DESIGN CULTURE(S)

Cumulus Conference Proceedings Roma 2021

Volume #2



Cumulus Association

Cumulus Conference
Proceedings Series
07/2021 Rome

Design Culture(s)
Cumulus Conference
Proceedings Roma 2021
Volume #2

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Layout and Graphic Design
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Concept for Cumulus
Conference Proceedings
Series was developed in
2018 by Jani Pulkka

Cumulus conference
Design Culture(s)
hosted by
Sapienza University of Rome, Italy
on June 8-11, 2021.
Conference website:
www.cumulusroma2020.org

Published by Cumulus
Cumulus the Global Association of
Art and Design Education and
Research. Aalto University, School
of Arts, Design and Architecture
PO BOX 31000, FI-00076 Aalto
www.cumulusassociation.org

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ISBN 978-952-64-9004-5 (PDF)
ISSN 2490-046X
Cumulus Conference Proceedings
Series, N°7

Cumulus Conference
Proceedings Series

Editor-in-Chief
Cumulus President
Mariana Amatullo

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Cumulus Conference
Proceedings Series

Cumulus the Global Association
of Art and Design Education and Research

Rome 2021

DESIGN CULTURE(S)

ROMA 2021

JUNE 08.09.10.11

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About the conference

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The theme

More than three years ago (it was 2018), when we presented our candidacy to host the Cumulus Conference in Sapienza, our first effort was to set up a Conference Theme. The duty was not simple since we wanted to avoid any naïve, fashionable or captivating topic. We were in search of a theme which is appropriate to the times, the context and moreover, to the Cumulus's community.

Our starting point was to consider what Cumulus meant and still means, not only for us, but within the worldwide design community. Looking back in the history of Cumulus, we found an interesting picture in its name: in fact, "cumulus" is the English name of a specific kind of clouds and comes from a Latin word that means "heap, pile, mass". Therefore, the word Cumulus is refereed, at the same time, to those big clouds that appear in the sky every time in different forms and always in constant change, as well as it is referred to a set of singular elements that make up a unit together. As a consequence, Cumulus efficiently describes the idea of a set of many singularities that meet, settle and become each time a new and different entity.

This picture helped us to set our goal: offering to such variegated, mutant, but nevertheless aggregated "cumulus", a conference theme where to recognize itself. This idea of big entity made of a huge number of singularities is connected to the idea of community, and then we had no doubt that this was the exact purpose of the founders of Cumulus when they decided its name.

Today the concept of community is increasingly complex, since it is crossing new social, technological, political and economic challenges and at the same time it is more global and multicultural than ever, more and more enriched by new hybrid languages and habits, due to the increasing flows of goods and people around the world. As a consequence, also a

Design Community, as Cumulus, is evolving as a wide-open field with many new practices and sometimes new principles.

In this regard, in order to figure out such complexity, we found a suitable answer in another word with Latin roots: the word "culture". Culture comes from the Latin word "colĕre" which means "cultivating the land to make grow" and, figuratively, also "taking care" of something, including knowledge, and therefore, "cultivation through education, improvement and refinement of the mind". This second meaning of "culture" is based on an insightful concept by the ancient Roman orator Cicero in his Tusculanae Disputationes: "cultura animi", which is the cultivation of the soul.

The resulting parallel between the culture of the land and the culture of the soul was fascinating and highly significant to us, since it is showing the challenge of growing something new, starting from the roots, from the soil, from the context and - as we know - depending on available soil, context and roots, we are growing different plants, obtaining different fruits and seeds, to plant again in a virtuous life-cycle. Thanks to this metaphor, we understood that diversity is a prime condition for the birth and the growth of culture, while it doesn't mean opposition but combination, arrangement and hybridization. Thanks to this metaphor, we got back to the initial concept of accumulation, and to the concept of Cumulus.

On another note, the Cambridge English Dictionary states that culture is also "the way of life, the customs and beliefs, of a particular group of people at a particular time". This could be an interesting stimulus but, when associating "Culture" with "Design", it was immediately clear that we cannot refer to one unique Culture, but we need to open to the concept of bio-diversity, where Design cannot be considered as the result of a single dominant, globalized, levelling thinking.

Finally, looking into design as an expression of Culture(s) and Culture(s) as the outcome of Design means to take into consideration not only what we are doing now, but what we are inheriting from the past and which should be granted for the benefit of future generations, so intertwining past and future, tangible and intangible, innovation and tradition.

Here is our conference theme: Design Culture(S)

Here, the suffix (S) is not only indicating the plural, the diversities, but it is also connected with the "saxon genitive", which is taking Design as subject, while connecting it to other different objects/meanings.

Following this concept, we found the ten keywords which we used to describe the tracks:

Artificial, Languages, Life, Making, Multiplicity, Proximity, Resilience, Revolution, Thinking and New Normal.

Each keyword was enriched with three additional keywords, to better explain the different directions and connotations, which are:

- Artificial is connected with Digital, Technology, Robotics
- Languages is connected with Aesthetics, Expression, Visual
- Life is connected with Nature, Biology, Human
- Making is connected with Process, Production, Post-Industry
- Multiplicity is connected with Gender, Pluralism, Diversity
- New Normal is connected with Health, Education, Work&Play
- Proximity is connected with Places, People, Economy
- Resilience is connected with Social Innovation, Circular Economy, Sustainability
- Revolution is connected with Critical Thinking, Interruption, Change
- Thinking is connected with Theory, History, Criticism

We obtained 40 wonderful words, full of possible meanings, ready to be interpreted and declined by the worldwide community of cumulus to figure out Design not as a singular specific voice but as a plural ecosystem of meanings.

After three years, during which our world is extremely changed, we can say that these words and this topic seems even more current and significant.

In the next pages of the Conference Proceedings, we are very enthusiast to offer a big picture of the biodiversity of Design Cultures and the multiverse of our Cumulus.

The experience

Cumulus Roma 2021 'Design Culture(S)' covered four days full of parallel sessions, working groups, poster sessions, exhibitions, social events, and more, but above all attending was a new form of experience than a conference.

While feeling the responsibility of filling a long void caused by the pandemic, we tried to re-design the whole experience to deliver a new form of conference which is keeping the in-presence through the online opportunities, so to bring you all to Rome and get the colors, the smell and the taste of the city, the architecture, the arts, the food, and the wine, always giving a cultural and a scientific perspective.

When facing the challenges, we wanted to deliver a new format to the whole Cumulus community, with the aim of innovating with technology, enhancing networking and the sociability of the experience, and keeping everyone on board to ensure the participation and democracy to our association from anywhere in the world, no matter of the time zone.

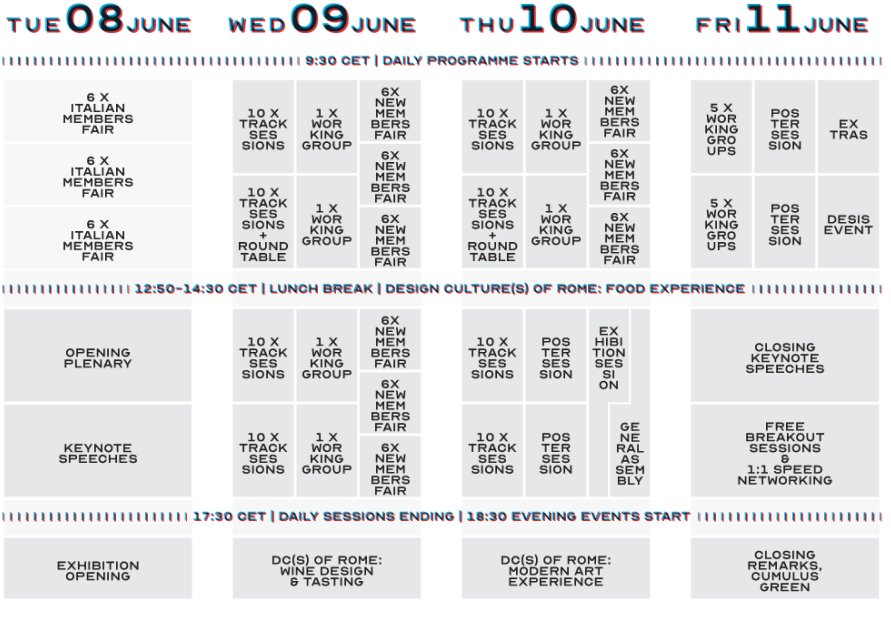
After four full days, we trust this conference at Sapienza University of Rome to be one of the longest Cumulus initiatives, counting with approximately 680 attendees, more than 350 papers and posters, 10 exhibitions, 10 tracks and 80 parallel sessions, 20 track keynotes and

four plenary keynotes, more than 50 schools exhibiting in the New Members Fair from everywhere in the world, and 18 schools participating in the Italian Members Fair.

Our aim was to develop a new form of hospitality to welcome and to make all of you feel at home in Rome but in a new virtual environment, while sharing design research and knowledge, along with the true spirit of Cumulus.

It is not enough to have a good project to gain good results, but it is necessary to get good responses. Your reaction was extraordinary, not only for the massive amount of registered participants, but for the involvement, the enthusiasm and not lastly the patience you have shown during the days of the conference. You joined in perfect Cumulus style from all over the world: from Oceania to the Americas, from Africa to Europe, to Asia, and you have actively followed the four days continuously, participating in a chat that often could not make your voices heard, but made us feel your presence very close.

Thank you for trusting us since the very beginning to the very end, while making this event possible. We will remember it for a long time for its extraordinary nature. We wish we will meet all together soon again without mask, and we will keep the memory of these days together among the best memories of this difficult period.



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LANGUAGES
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LIFE
NATURE
BIOLOGY
HUMAN

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Pepetto Di Bucchianico, D'Annunzio University of Chieti–Pescara
Emilia Duarte, IADE, Universidade Europeia, Portugal
Sabrina Lucibello, Sapienza University of Rome, Italy

MAKING
PROCESS
MANUFACTURING
POST-INDUSTRY

Mario Buono, University of Campania "Luigi Vanvitelli", Italy
Eujin Pei, Brunel University London, United Kingdom
Andreas Sicklinger, University of Bologna, Italy
Oscar Tomico, ELISAVA Barcelona School of Design and Engineering

MULTIPLICITY
GENDER
PLURALISM
DIVERSITY

Özlem Er, Istanbul Bilgi University, Turkey
Raffaella Fagnoni, Università Iuav di Venezia, Italy
Gianni Sinni, Università Iuav di Venezia, Italy
Pradyumna Vyas, National Institute of Design, India

NEW NORMAL

HEALTHCARE
EDUCATION
WORK / PLAY

José Allard, Pontificia Universidad Católica de Chile, Chile
Adam de Eyto, University of Limerick, Ireland
Philipp Heidkamp, Köln International School of Design, Germany
Michael Krohn, Zurich University of the Arts, Switzerland

PROXIMITY

PLACES
PEOPLE
ECONOMY

Sam Bucolo, Swinburne University of Technology, Australia
Frédéric Degouzon, L'École de design Nantes Atlantique, France
Claudia De Giorgi, Polytechnic University of Turin, Italy
Giuseppe Lotti, University of Firenze, Italy

RESILIENCE

SOCIAL INNOVATION
CIRCULAR ECONOMY
SUSTAINABILITY

Davide Fassi, Polytechnic University of Milan, Italy
Miaosen Gong, Jiangnan University, China
Nicola Morelli, Aalborg University, Denmark
Regina Aparecida Sanches, University of São Paulo
Maria Antonietta Sbordone, University of Campania "Luigi Vanvitelli"

REVOLUTION

CRITICAL THINKING
DISRUPTION
CHANGE

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Stefano Maffei, Polytechnic University of Milan, Italy
Betti Marenko, Central Saint Martins, University of the Arts London

THINKING

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HISTORY
CRITICS

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Keynote speakers

Roberto Marchesini



Roberto Marchesini is Director of the Center for the Study of Posthumanist Philosophy, as well as the School of Human-Animal Interactions, both based in Bologna, Italy. His studies focus on philosophical ethology, bioethics, zooanthropology, and posthumansism in an effort to better comprehend human-animal interactions. The cornerstone of his philosophical proposal is the unmasking of a perspective error that places humans at the center and at the measure of his predicates. One of his last books reinterprets the union between human beings and technology as a partnership that emerged from the phylogenetic set of the Sapiens species, highlighting the hybridizing and shaping potential of technology. From this perspective, every invention, every discovery, has an epiphanic effect; that is, it opens up a new dimension of the unexpected and of opportunities that change the boundaries and the perception of what we define human.

Salvatore Iaconesi and Oriana Persico



Salvatore Iaconesi is a robotic engineer, designer and artist; Oriana Persico is a cyber-ecologist, autobiographer and expert in digital inclusion. Living and working together since 2006 under the brand [AOS – Art is Open Source], they created artworks and performances of global interest united by the exploration and observation of contemporary technological human beings and societies – and their continuous mutation. Promoting a possibilistic vision of the world in which art is the glue between science, politics, anthropology and economics, they are the founders of Nuovo Abitare and HER, the two research centers they use to study the psychological and social implications of data and computation in human societies. Together they wrote Digital Urban Acupuncture (Springer, 2016), La Cura (Codice Editore, 2016), Read/Write Reality (FakePress Publishing, 2011), Romaeuropa FakeFactory (DeriveApprodi, 2010) e Angel_F: diario di vita di un'intelligenza artificiale (Castelvecchi, 2009).

Pier Luigi Capucci



Pier Luigi Capucci has been concerned since the ‘80s with the studies on communication, the new media and the new art forms, and with the relationships among arts, sciences and technologies. His theoretical activity is concerned with technologies of representation and communication, with technoscience-based art forms and with the media archaeology studies. He published more than 350 texts in books, magazines and conference papers in Italy and abroad. Founder of the first online magazine in Italy NetMagazine / MagNet; president of Noema, journal on the relationships between forms of expression, technologies, sciences and society; member of the International Advisory Board in many editions of Ars Electronica. Recently he founded art*science, a three-year research project on art and climate change and he serves as a consultant to the European Commission on the relationships between scientific disciplines and technologies (in particular Artificial Intelligence and Big Data) and humanities.

Chiara Luzzana



Chiara Luzzana is an Award-winning Sound Designer. She pairs a broad range of leadership in Sound Design, Music Composition, Sound Branding, Soundtrack and Audio Installation collaborating with companies and agencies all over the world. Noted among others for her project “The sound of city”, she explores and listens in awe to the artifacts of the urban environment, the products of the industrial cultures all around the world. Eclectic Artist, she wanted to break the rules imposed by notation, working only with noise. Former student at Berklee College, she investigated how the brain reacts to sounds, experimenting with everything from the neurobiology of musical cognition, to the construction of microphones and sound sculptures. Her projects and talks take us to a journey starting from listening to our life, up to listening to ourselves turning life into a “soundtrack”.

About Sapienza University of Rome

Faculty of Architecture and School of Industrial Design

The conference took place at Sapienza University of Rome, Faculty of Architecture. Sapienza University of Rome was founded in 1303 by Pope Boniface VIII and it is one of the oldest universities in the world. At the moment, Sapienza is hosting about 115,000 students and 4.000 professors and researchers, and it is a top performer in international university rankings, thanks to the 63 Departments organized in 11 Faculties driving high levels of excellence in several fields.

The Degrees of Design are part of the Faculty of Architecture, which was founded in 1920 and it happens to be the first modern Faculty of Architecture in Italy. At the core of its mission is the commitment to innovation, technology, urban living, while serving a fast changing society.

Its programs and curricula are divided between scientific research, studies in the humanities and experimentation with old and new technology. All this is leading to the education of the modern designer, which can be considered the synthesis of a scientist and a humanist who is both an artist and a technologist at the same time.

After the Degrees in Design, the Faculty is also offering programs in architecture, city planning, landscape, interior architecture and design management. Its high-calibre graduates are equipped with the skills which are necessary to design and to manage sustainable products, systems, services and environments, leading to innovation, technology, visual communication and design.

The Design Degrees in Sapienza are the following:

- A Bachelor Degree in Design;
- An International Master of Science in Product and Service Design (in English);
- A Master in Design and Visual and Multimedia Communication;
- An Interdisciplinary PhD Program in ‘Planning, Design, Technology of architecture’.


TUE
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JUNE
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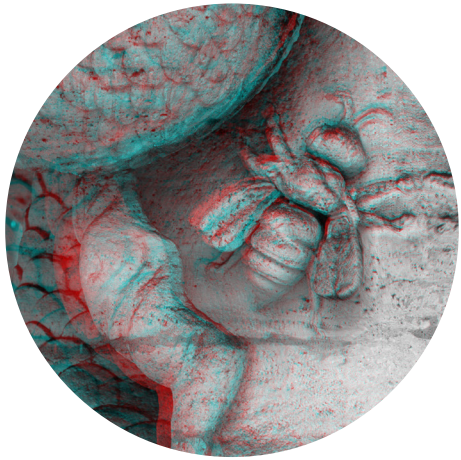
JUNE

DESIGN CULTURE(S)

EXHIBITION

ALL CONFERENCE TRACKS

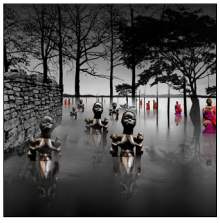


OVERVIEW

ONE EXHIBITION FOR EACH OF THE 10 TRACKS,
10 SCHOOLS, 10 PROJECTS



ARTIFICIAL
City of
Experiences
George Brown College

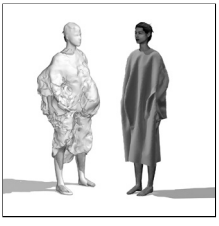


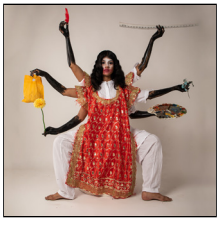
LANGUAGES
Post collaboration as a form of count-er-culture: The birth of new languages
University of Johannesburg

LIFE
Design for social problems in Mexico: living with disabilities
Autonomous Metropolitan University



MAKING
New Textile Topologies: Experiments at the intersection of surface, textile and form
The Swedish School of Textiles





MULTIPLICITY
Self-Acceptance to Self-Indulgence
Pearl Academy



NEW NORMAL
Expedition
2 Degrees
Zurich University of the Arts

PROXIMITY
Newcomers:
Design For
Immigrants
Pratt Institute's School of Design

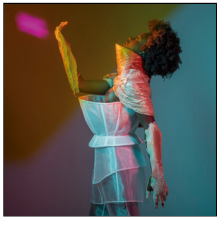


RESILIENCE
Designing for Resilience: Creating new possibilities for industrial cities
University of Monterrey





REVOLUTION
UFΘ Drift:
In Search
of Practice
ArtEZ University of the Arts Arnhem



THINKING
Design and awareness:
user meeting
ESDAP Catalunya

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

City of Experiences

Christian Pandolfi

George Brown College, Canada
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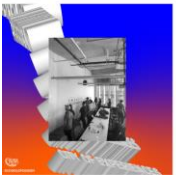
Abstract | The underlying goal for the City of experiences project is to continue questioning how cities are constructed and who they are constructed for. The popular discussion and ideas around the smart city and tech-utopias are not new, although maybe the technology used to drive them is. What is needed now, as a society, is to stop waiting for the acceleration of technology to determine how we will live, and instead be active in creating the necessary platforms for society to imagine what experiences they see in their lives as a driving force for design. The City of Experiences is a project that, through different experiments and engagements, will continue to explore this hypothesis. The work from this exhibition is situated in the Interaction Design and Development program at the School of Design at George Brown College.

KEYWORDS | URBANISM, EXPERIENCE DESIGN, PLACES, CITIES, PUBLIC SPACE, PROTOTYPES, FUTURES









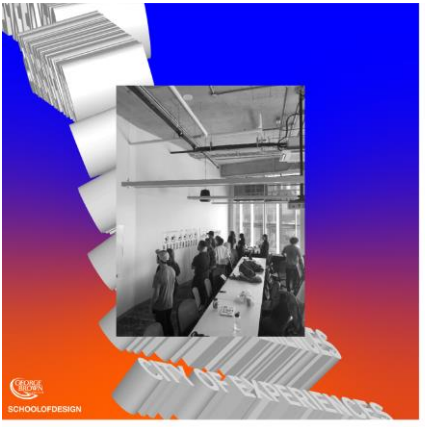









Imagine a city without buildings — a city designed around experiences.









Imagine a city without buildings — a city designed around experiences.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
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Post collaboration as a form of counter-culture: The birth of new languages

Dickson Adu-Agyei, Jody van Aswegen, Kgaugelo Lekalakala, Veronica Chipwanya

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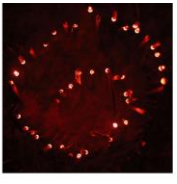
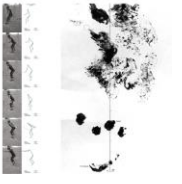
Abstract | The three projects exhibited all show the potential that lies in the collaborative approach to the design studio. Our collaboration with Makerere University in Uganda and Ardhi University in Tanzania allowed our students to engage with issues that are broader than their immediate environment. Moreover, the studio also encourages students to use critical visual studies (Dee, 2004) as a tool to express themselves freely, producing a series of projects that are counter-culture to the traditional ways of how architectural studios respond to spatial issues. These projects aim to bring out the untold narratives (Spiritual, Gender and Political issues) of the spaces we inhabit.

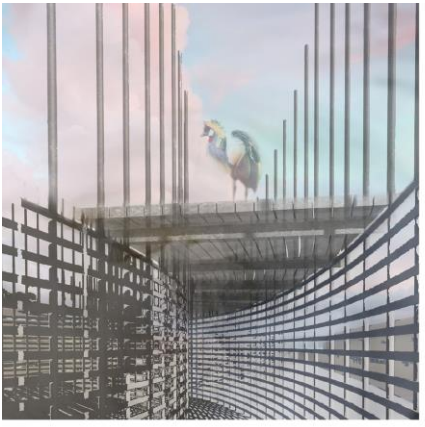
KEYWORDS | ONE, TWO, THREE, FOUR, FIVE









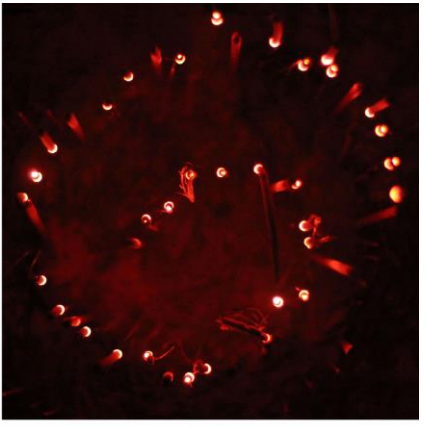
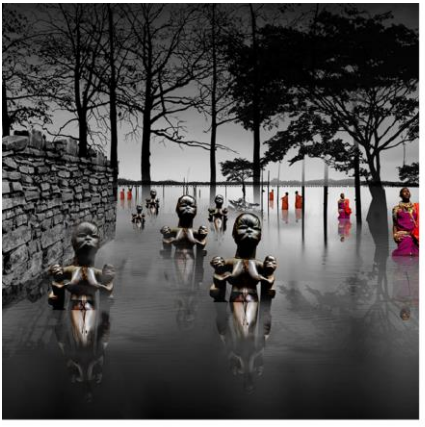
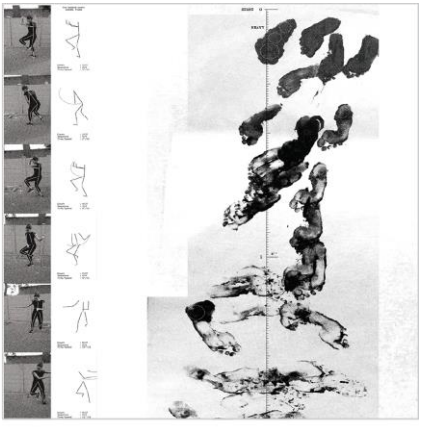






Figure 1. Jody van Aswegen | Kintu's Gate serves as a wastewater plant's bar screen trapping large masses of litter from the Nakivubo Channel, which flows through the informal settlements of the city of Kampala.
Figure 2. Jody van Aswegen | I reveal the spiritual dimension of the wetlands through a series of architectural installations serving as water purification gates strategically positioned within the wetland.
Figure 3. Jody van Aswegen | These interventions serve as sacred spaces as well as monuments to the sacredness of the wetlands, narrating the mythological Legend of Kintu for future generations.
Figure 4. Kgaugelo Lekalakala | She catches the 4 am taxi to school moving between transit spaces and passages/ That strip her of her innocence. "Xsxs- Xsxs, Mwxa'Mwxa, A o mphe marao, baby"/ From my so-called fathers and brothers. They do not see me. We are their artifacts./ Taught to ignore and reach your destinations.







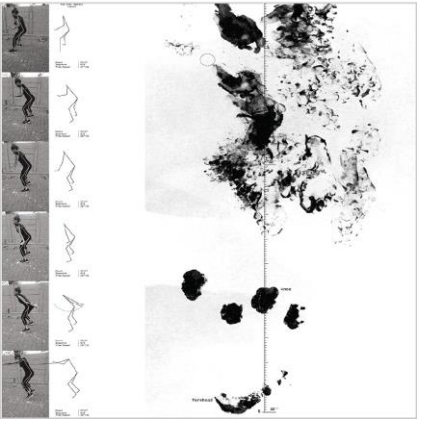


Figure 5. Kgaugelo Lekalakala | She moves silently, discreetly, to serve her home, before sunset. She does not set in space; she merely/ moves through it because it was not hers, to begin with.
Figure 6. Veronica Chipwanya | Occupy - A collection movement derived from Sukuma and Chagga Tribes of Tanzania. Symbolic of the intent to protest - using the body as an agent to occupy space. Firm Swing foot progression.
Figure 7. Veronica Chipwanya | Resist! - A collection movement derived from Sukuma and Chagga Tribes of Tanzania. Symbolic of resistance. Rigorous hand swings depicting confrontation, violence, and aggression.
Figure 8. Veronica Chipwanya | Flight and Scatter - A collection movement derived from Sukuma and Chagga Tribes of Tanzania. Symbolic of flight and scatter. Movement is abrupt, fast, calculated, gaining traction. The end is surrender (knees to ground, Forehead to ground).

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Design for social problems in Mexico: living with disabilities

Luis Yoshiaki Ando Ashijara, Haydeé Alejandra Jiménez Seade,
Jesus Eugenio Ricardez Sanchez, Ruth Alicia Fernandez Moreno, Areli Garcia Gonzalez

Autonomous Metropolitan University, Azcapotzalco, Mexico
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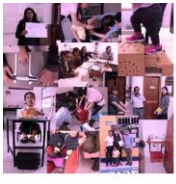
Abstract | The Ergonomics Laboratory of the CyAD (Sciences and Arts for Design) Division of the Metropolitan Autonomous University campus Azcapotzalco in Mexico City, is conformed of a group of research professors and students focused on designing, developing and producing comprehensive systems that improve the quality of life of people with disabilities. Play objects, orthotics, prostheses and technical aids for motor and sensory disabilities are included. It works in an interdisciplinary way, in academic projects that address real problems of society, through the application of ergonomic criteria, which apply to social inclusion through product design, which contemplate concepts of accessibility and social sustainability.

KEYWORDS | ONE, TWO, THREE, FOUR, FIVE















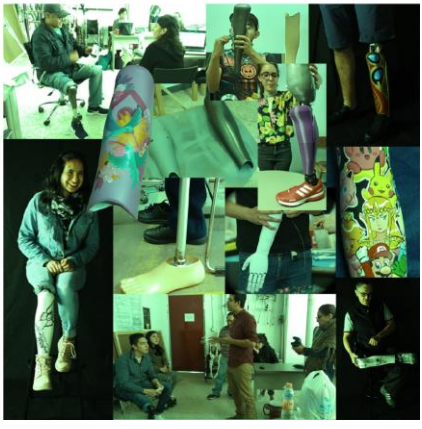



Figure 1. The research focused on developing aids for children with achondroplasia through experimental research and the application of product design and development processes.

Figure 2. The project has great relevance, since in Mexico there is still no comprehensive care for all people with achondroplasia, especially children.

Figure 3. Artistic intervention workshop of lower limb prosthesis housings, organized to sensitize and raise awareness in the community about the social divergence that is related to indifference towards people with disabilities.

Figure 4. It brought together academic peers and leading professionals within the field of illustration, research, awareness and product development for the improvement of the quality of life of people with disabilities.



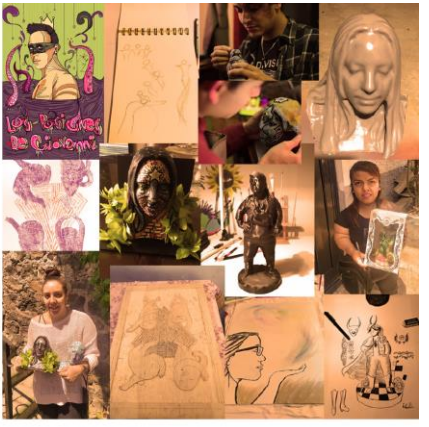






Figure 5. Workshop of illustration and artistic intervention of busts of people with disabilities, to raise awareness and sensitize about the social, labour, economic and educational discrimination suffered by people with functional diversity.

Figure 6. Through the workshop, awareness, sensitization and visualization of disability was achieved, as well as the discrimination suffered in different social spheres, the lack of educational, labour and economic equity.

Figure 7. The purpose of the awareness-raising activities is to promote the social inclusion of children and young people with disabilities among individuals of all ages.

Figure 8. A social benefit is provided through the design of recreational and educational materials that promote equality and the elimination of social barriers.

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New Textile Topologies: Experiments at the intersection of surface, textile and form

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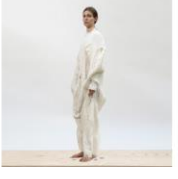
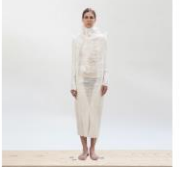
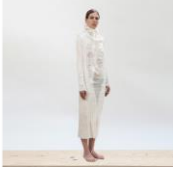
Abstract | This exhibit presents examples of work by Riikka Talman, Kathryn Walters, Holly McQuillan and Karin Peterson, all members of the collaborative platform 'Critical Textile Topologies'. Developed through experimental design research, the work of these four PhD students from the Swedish School of Textiles aims to propose alternative methods and systems in relation to textiles, surfaces and form. While these practitioners have independent research programs, their collaborative work produces cross-disciplinary multimorphic textile-form practices, resulting from a hybrid analogue/digital, 2D/3D approach, culminating in new, not previously exhibited work.

KEYWORDS | TEXTILE TOPOLOGIES, DIGITAL SYSTEMS, CRAFT, WEAVING, DRESS





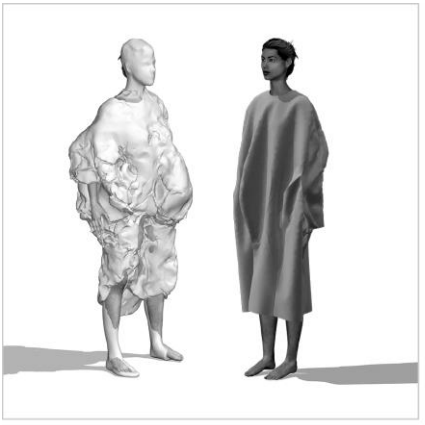








Figure 1. Clay sketch as stl.file imported and flattened as weave in Clo3D.

Figure 2. Stl.file materialized as a form for molding.

Figure 3. Map of bindings containing all information of and for multimorphic textile form being woven.

Figure 4. Released from the loom and separated through cutting, the multimorphic textile form is being shrunk on the form.



Figure 5-6. First example of multimorphic textile form. Partially shrunk on the form.

Figure 7-8. Second example of multimorphic textile form. Fully shrunk, no form.

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Self-Acceptance to Self-Indulgence

Drishti Gupta, Nekita Narang, Srishti Bajaj, Tanya Garg, Yoshita Jain

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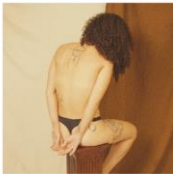
Abstract | "In an uncertain place, unknown depressed earth, where nothing grows in the damp shade. That is where they live. Where they grow from the inorganic, take root and spread until they become the other and the other becomes unknown" – Shalini Gupta Historically when politics becomes skewed the arts and self-expression are the first to suffer its impact. Modern India has never been very accepting of the unabashed self. And yet, amidst this climate of hate and polarization, a few young visual artists, have dared to break through the confines, despite its conservative family values and conservative society, and presented themselves; their ideas, naked for all to see, the embodiment of the self-indulgent gaze. The self-consumed gaze. An aversion to draw the viewer into a conversation. Almost cheeky, unconcerned with the gaze of the other. Self-indulgent explorations that appear to be caught unawares or are they posed to appear as such?

KEYWORDS | DISTORTION, SELF-INDULGENCE, SELF-EXPRESSION, GAZE, MULTIPLICITY











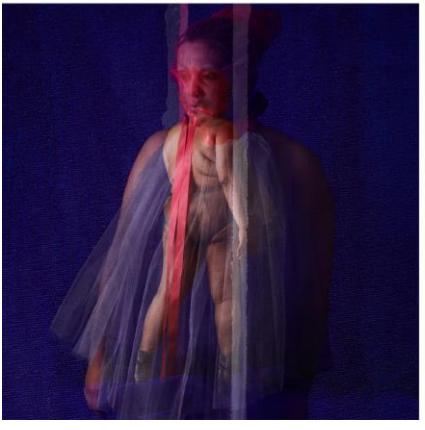




Figure 1. PINK SILENCE - Roadless.

Figure 2. PINK SILENCE - Mute.

Figure 3. UNTITLED - A spontaneous journey from the canvas to the lens.

Figure 4. UNTITLED - Connect the loose ends however you see them.









Figure 5. UNRAVELLING LAYERS - Sufism in poetry, prose and conversations.

Figure 6. STRANGER FACES - Images float on the internet, a new definition of infinity.

Figure 7. LADYLIKE - Women in a patriarchal society.

Figure 8. LADYLIKE - Female desire is taboo.

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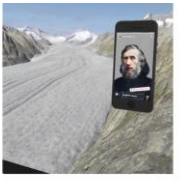
Expedition 2 Degrees

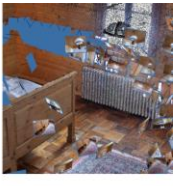
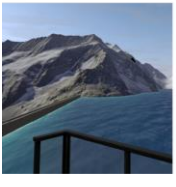
Niklaus Heeb, Christen Jonas, Noemi Chow,
Reto Spoerri, Andreas Linsbauer, Martin Hoelzle

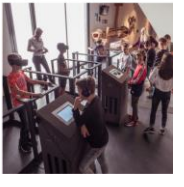
Zurich University of the Arts, University of Fribourg,
Institute of Geography University of Zurich, Switzerland
noemi.chow@zhdk.ch

Abstract | Experts have been warning: the Alpine glaciers will have almost completely disappeared by the end of this century. Global warming cannot be stopped, although by global efforts the temperature increase can still be limited to not exceed 2 degrees. But what are the consequences for nature and landscape and what will change for us humans? Equipped with 3D glasses, the expedition members set off to explore these abstract questions in an Alpine environment. The experience is intended to motivate reflection on individual decisions and efforts of the society, which in the end lead back to personal behavior. The project is originally aimed at school classes and includes a guided program in the classroom. Meanwhile, the project is on tour at various museums and events. www.expedition2grad.ch

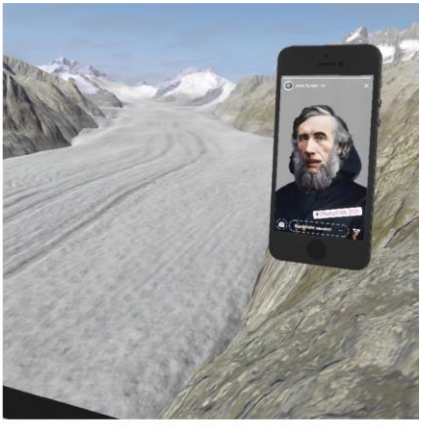
KEYWORDS | CLIMATE CHANGE, GLACIER, VR-EXPERIENCE, EDUCATION, MUSEUM

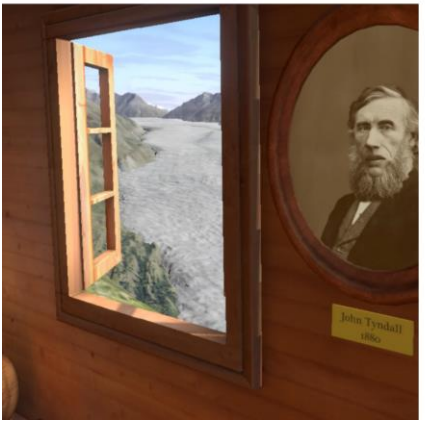









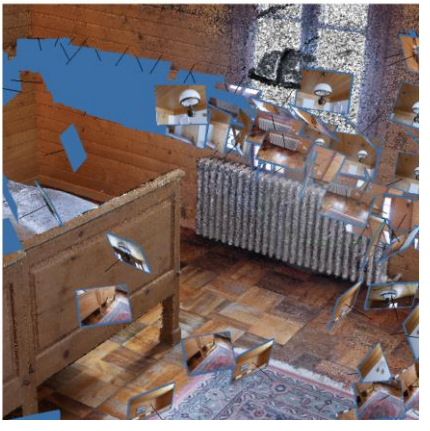


Figure 1. A virtual experience in a high mountains environment makes tangible a global temperature increase by 2 degrees.

Figure 2. John Tyndall, mountaineer and scientist, leads through time and space.

Figure 3. The expedition starts in the Hotel Belalp, where John Tyndall did research back in 1890.

Figure 4. The virtual environment in Tyndall's room was captured with photogrammetry.

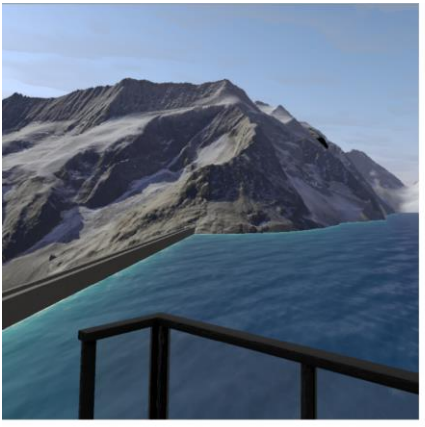








Figure 5. To create the virtual environment of the glacier area, the data of the latest scientific research was used, which includes the bedrock of the glaciers and potential lake occurrence in this area.

Figure 6. The VR installation also includes a climate quiz.

Figure 7. In the World Nature Forum in Naters pupils and students experience the installation.

Figure 8. Meanwhile, the project has been on tour at various museums and events such as the digital day in Zurich, Scientifica at University and ETH in Zurich, Youth Culture Festival in Basel. The tour is going on and further events are to come.

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Newcomers: Design for Immigrants

Constantin Boym, Alex Schweder, Josh Bird, Alex Thompson, Haiqi Yu, Harvey Feng, Alejandro Moyano, Oya Tekbulut, Shaya al Arfaj, Garrett Benisch

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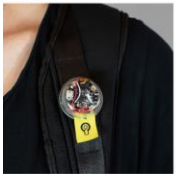
cboym@pratt.edu

Abstract | Newcomers was a graduate course offered at Pratt Institute's School of Design. For this course, students attempted to address the daily problems of people living without legal status in the United States of America. (Their number is estimated at 12 million.) Chair of Industrial Design Constantin Boym and Professor Alex Schweder conceived the project in collaboration with The New Sanctuary Coalition in New York. Through this collaboration, students were able to speak directly with activists for immigrants' rights and with people living in the United States without a legal status. A group of undocumented immigrants came to Pratt Institute as visiting critics to attend studio reviews.

KEYWORDS | PROXIMITY, PLACES, PEOPLE, ECONOMY, IMMIGRATION













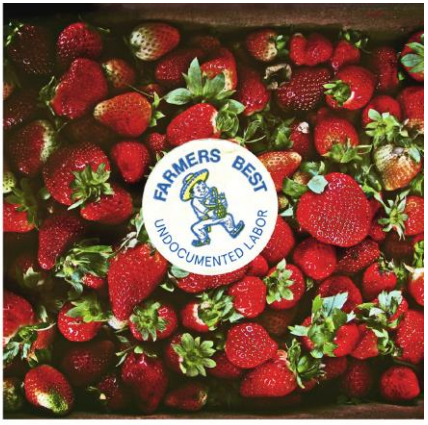







Figure 1. Josh Bird_Citizen Umbilical Clip. Umbilical clamps are routinely used with every birth. This one securely stamps the GPS coordinates of the birth while also sampling DNA in such a way that it can be used as evidence in court. American-born babies of immigrants thus qualify for the US citizenship.

Figure 2. Alex Thompson_Subversion Stickers. The Southern Poverty Law Center estimates that 60% of farm workers in the United States are undocumented. Appropriating the stickers that are ubiquitous in supermarket produce aisles, this work has developed a line of alternatively messaged stickers.

Figure 3. Haiqi Yu_Shareable Package. The cost of vegetable produce in USA will double without use of undocumented migrant labor. The packaging concept Share makes this statistic clearly visible, inviting everyone who buys produce to acknowledge immigrants' contribution.

Figure 4. Harvey Feng_Second Skin Gloves. These protective gloves for agricultural workers have an outer layer made from fabric that changes color when exposed to an active pesticide ingredient, Glyphosate. The danger is visualized in order to emphasize the need for extra protection.









Figure 5.Alejandro Moyano_Ami Cam. The affordable lapel-worn video cam is designed to be activated with the pull of a tab. This triggers a 2-minute stream of video recording, which would automatically upload to the user's social media, thus placing the evidence into public domain.

Figure 6. Oya Tekbulut_ICE Lollipop. This lollipop uses the likeness of ICE (Immigration and Customs Enforcement) badge to turn it on its head. Made with quintessential Mexican flavors, lime and cumin, this confectionary can help diffuse tense moments and, like political satire, make one laugh at a very serious topic.

Figure 7. Shaya al Arfaj_JustICE Water. Shaya al Arfaj imagined distributing information among undocumented immigrants through water bottles that could be placed in a common chain-link fence.

Figure 8. Garrett Benisch_ICE Planter. Garrett Benisch created an ICE Planter, designed for a non-native plant. Perched over the plant is a place where you can set an ice cube and to "melt ICE" it in order to irrigate the plant.

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Designing for Resilience: Creating new possibilities for industrial cities

Carlos Huerta Fernández, Ana Paula Garza Sepúlveda, Mariela Gómez Díaz, Isabel Escalante Sánchez, Mariana Urquidi Díaz, Ana Mehnert Stadeler, Carolina Villanueva Campoy, Daniela Cruz Morales, Samantha Lorena Cantú Ortegón, Ana Cecilia Alvarez Moreno, Ana María Peñúñuri García, Frida Fernanda Leal Parra, Luis Javier Laffitte Armesto, Gerardo Eugenio García Fuentevilla, Marcelo Hernández Paez, Ana Gabriela Lazo, Ana Patricia Garrido, Ana Paulina Pearl, Carolina Derbez, Yolisma Sedas, Linda Martinez

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Abstract | Known for its beautiful mountains and as the industrial capital of Mexico, Monterrey is also considered the most polluted city in Mexico. According to a 2017's article from The Guardian "Pant by numbers: the cities with the most dangerous air", Monterrey's air may have more than 3 times as many ultra-fine particles of less than 2.5 microns (PM2.5s) as WHO recommended levels (36 micrograms per cubic meter compared with 10µg/m3). As University, we highly encourage our students to propose and design solutions based on the needs of our community, and we look for professors that will give them the support to search for these solutions outside of their comfort zones, aiming for innovative and creative proposals. Most metropolitan areas in the world suffer from the consequences of its industrialization: not only smog but also flooding, light and sound pollution.

KEYWORDS | DESIGN, ARCHITECTURE, POLLUTION, RESILIENCE, NANOTECHNOLOGY



















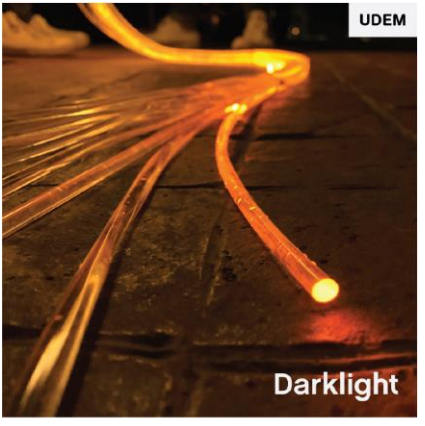





Figure 1. Darklight's proposal is to create a passive street lighting system, which uses the light wasted in the atmosphere, and take it to illuminate new spaces, creating new sources of light.

Figure 2. Tubular optical resin that redirects light captured from any type of lighting source. In the project's case, the refracting duct redirects light pollution gathered by the parabola.

Figure 3. Silent rivers' proposal is to create a translucent public corridor where citizens can go inside, that reduces exterior city noise and allows the user to isolate themselves from the city's chaos.

Figure 4. Flowair aims to provide clean air to the inhabitants of Monterrey's Metropolitan Area: the project consists of three complementary applications with an intelligent coating that neutralizes air pollution through nanotechnology.









Figure 5. Resilience Strategies' goal is to design an urban infrastructure, as a linear park in the ravine capable of controlling floods in its neighborhood while working as a public space and social integrator.

Figure 6. Pollumesh proposes to take advantage of the existing structures of the city's billboards to clean the polluting particles through an intelligent coating process in which sunlight and wind are involved.

Figure 7. Pollumesh is the marketing agency of tomorrow, that helps companies and brands to build a more meaningful relationship with their customers. The company's first product is a smog-eating billboard.

Figure 8. POLLUMESH - Ana María, Ana Cecilia and Frida joined their interdisciplinary knowledge to create a social innovation project and have been awarded with a US$ 100,000 seed capital grant from the Hult Prize.

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UFΘ Drift: In Search of Practice

Judith van den Boom, Fabrizio Cocchiarella

ArtEZ University of the Arts Arnhem, Netherlands,
Manchester School of Art, Manchester, United Kingdom
j.vandenboom@artez.nl

Abstract | A revolution doesn't start alone, it's a collaborative act with a wish to make a change physical, immersive and alive. Cumulus partners ArtEZ University of the Arts Arnhem (NL) led by Judith van den Boom and Manchester School of Art (UK) led by Fabrizio Cocchiarella present UFO Design Collaboratory. UFO is developed to hover between the institutes, facilitating a collaborative mode for radical intervention and methodologies for education and practice. UFO creates pathways for test-sites, making space to listen and establish connections —all to inspire an affiliation of perspective and methodology. Showcasing UFO 'Drift' and Brexit project 'State of Unsettlement'.

KEYWORDS | DESIGN, RESEARCH, ACTIVISM, COLLABORATION, FUTURES











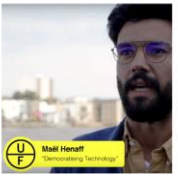









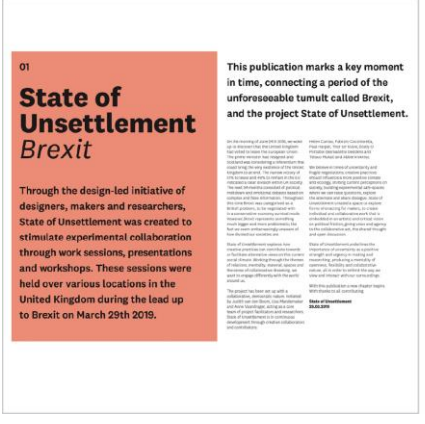

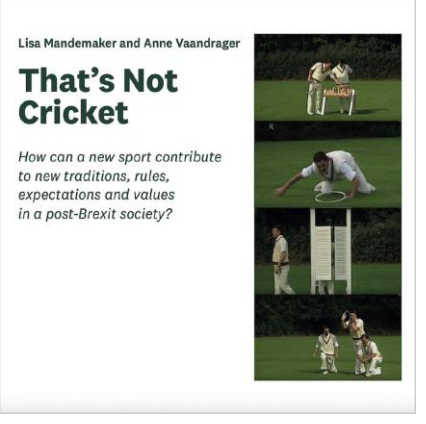

Figure 1. STATE OF UNSETTLEMENT - State of Unsettlement is a publication that contains a collection of eight research proposals by various students and researchers, all to facilitate alternative views on our current social climate.

Figure 2. State of Unsettlement wants to take the opportunity to transform possible futures and enact new pathways and perspectives in times of Brexit.

Figure 3. With this project, the Brexit research and the Drift, we aimed to research the role of the designer and its practice within a divided society.

Figure 4. UFΘ uses design as a critical agent and allow the discipline to establish itself as a tool for activism and vision, defying the standard, proposing a collective working.







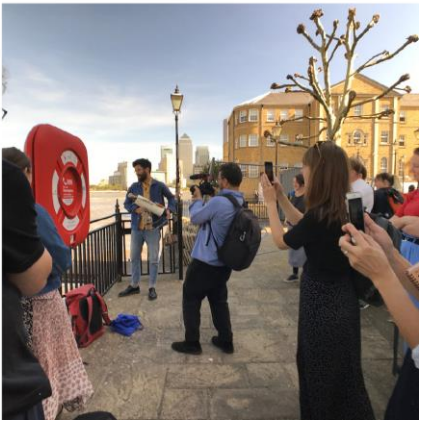

Figure 5. UFΘ DRIFT - The UFΘ Drift took place in September 2019 moving with a group of collaborators walking from Rotherhithe to Greenwich in London.

Figure 6. During the drift participants shared their research on the street, allowing the public to follow and engage and students exploring the practice in a nomadic context.

Figure 7. The various works developed by participants question and comment on the current precarious political, social landscape, in relation to the reinterpretation and imagination of the practice of design.

Figure 8. The Drift explored the conditions to re-think practice. Here designer Maël Hénaff is throwing his Sea Money Maker in the Thames.

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Design and awareness: user meeting

David Serra Navarro, Clara Gracia, Elena Nicolau, Mariona Andreu, Marta Forns, Georgina Soley, Laura Cabezudo

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dserra8@xtec.cat

Abstract | The social impact generated by the artistic discipline of Design is one of the pillars that support the DNA of the Studies Final Works of the ESDAP Catalunya. In its four specialities, graphic, interior, fashion and product, different proposals are developed to put the user and his community at the central point of reflection and analysis to: identify, propose and evaluate different tangible solutions for the individual and society. This selection of 8 SFW's mission is to show different projects with a common guiding thread: design as a tool for awareness, social transformation and awareness among users. Through different processes in which the designer-mediator is involved and in which the strategies and results of processes and artefacts that aim at empowerment, social innovation in specific groups, and resilience.

KEYWORDS | AWARENESS, SOCIAL TRANSFORMATION, RESILIENCE, MEDIATOR, COMMUNITY

















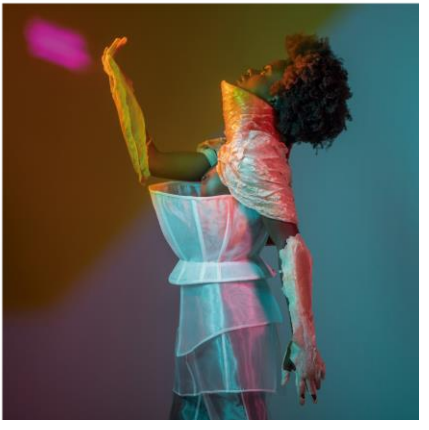


Figure 1. HERS - The main purpose of Hers is to create a coeducational tool (education based on equality and difference, and based on a gender perspective) in the shape of a card game with enigmas.

Figure 2. FURTHUR - The proposal of Furthur involves reusing unused clothing and offcuts as its main material, as well as military uniforms to peacefully and decidedly “declare war” on the fast fashion industry and to give the abandoned garments a fresh presence.

Figure 3-4. LIV - This project focuses on the female nipple. Its role, the reason why it is treated differently from the male nipple, its censorship, sexualisation and systematic stigmatization have recently been questioned and are now subjects of debate.









Figure 5. CONTES PER ANAR AMB COMPTE - Contes per anar en compte is an illustrated printed book that is intended to help separate children from their phone. The goal is to raise awareness of the troubles created by their addiction to mobile phones.

Figure 6. VICTIMS OF SILENCE - Victims of silence raises awareness about the presence and danger of asbestos, a hidden problem, which is in the air we are breathing and which is seriously injuring our health.

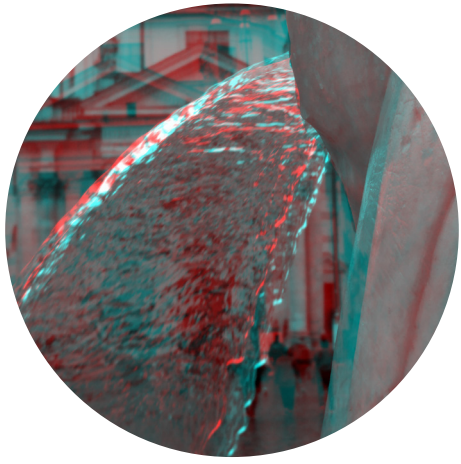
Figure 7. ELLXS - Ellxs has given voice to the collective of transvestites and transgender people. The project is a resource for raising awareness of gender identity discrimination and is intended to educate and normalize the situation.

Figure 8. COOPERA LLUÇANÈS - This project is a useful tool for the creation of new cooperative companies that includes an online platform, a network and an offline communication campaign. Its aim is helping to develop more competitive and sustainable business networks in the Lluçanès region (Catalonia).

DESIGN CULTURE(OF)

ARTIFICIAL

DIGITAL
TECHNOLOGY
ROBOTIC



TRACK CHAIRS

DESIGN CULTURE (OF) ARTIFICIAL
DIGITAL | TECHNOLOGY | ROBOTICS



João de Sá Bonelli,
PUC-Rio Department of Arts & Design, Brasile
“If Design is the Sciences of the Artificial, then how can Design theories and practices promote a better quality of life for us, humans?”

Mathias Funk,
Eindhoven University of Technology, Netherlands
“How must design deal with a slow culture shock of the artificial that smart objects manifest in personal or professional spaces? Which forms of business or political machines do we need to reject?”





Patrizia Marti,
University of Siena, Italy
“In the digital age, a new culture of design can flourish to value the complexity and uniqueness of being human, bringing aesthetics, creativity, sense making and value-oriented propositions at the forefront of technology development.”

Giuseppe Mincolelli,
University of Ferrara, Italy
“Data are a substantial part of our life, that we do not perceive and understand by nature. Design is called to empower humans, bridging this new phisical and cultural gap between us and our environment.”



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A participated parametric design experience on humanoid robotics

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[a]Università degli studi di Genova – dipartimento Architettura e Design
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Abstract | The project hereby presented illustrates the case study of a participated parametric design workshop, where the object is a hacked version of Poppy, an open source 3D printable humanoid robot developed by Matthieu Lapeyre. Poppy is used by a large community of researches whose focus is mainly on engineering and IT aspects of the platform development. Our activity, held in a larger dissemination event, was aimed instead at collecting data regarding users' perception of a companion robot, caregiver robot or evil robot. Our goal is to define aesthetic principles that influence users' appreciation and affection towards a humanoid robot. A parametric definition developed with Grasshopper 3D, easily editable thanks to a simple and intuitive interface, was used as a tool to involve users in a co-design activity which results are analyzed and presented in the following contribution.

KEYWORDS | HUMANOID ROBOTICS, PARAMETRIC DESIGN, PARTICIPATORY DESIGN, 3DPRINTING, OPEN SOURCE

1. Introduction

We are living in the era of bespoke products and personalization. This generic trend has evolved and become massive in most industries, supported by several technical developments in the world of design, such as the spread of open source tools for digital design, the development of rapid prototyping technologies and the emergence of the parametric approach in several areas of the world of the project (Manzini, 2015).

In particular, the practise of parametric design, described by the architect L. Moretti as "the relations between the dimensions dependent upon various parameters" (Bucci & Mulazzani, 2006), has spread from the architecture world to product design as new and more effective tools have been developed. Nowadays visual editors and programming tools are easier and easier to access, implement and learn; they allow designers to draw with algorithms, which can be defined as procedures that perform particular tasks through finite lists of well-defined instructions and inputs (Tedeschi, 2014).

If writing algorithms and designing with parametric tools remain prerogatives of the developer or the designer, these instruments can easily be used in participatory design experiences.

Participatory design has its roots in Scandinavian culture; the first co-design techniques have been developed there in the 1970s, but are taking upon themselves new meanings and definitions through the spreading of mass customisation in contemporary industry and the following growth of configuration tools designed to be used by end users who can thus make - usually small - design choices on the products that they are going to buy (Ciuccarelli, 2008).

Moreover, co-design techniques are very useful in the User-Centered Design process (Falcinelli, 2011). This essential practice of design is widely accepted and frequently used these days, especially in technological areas due to the fact that most likely a high-tech product, system or service will interact actively with users for which it is intended (Rizzo, 2009). Research in this field is even more important if we think of users that may not be used to interact with technological products, as in the case of elderly or people with disabilities. Speaking of interaction with technological products, it can be assumed that humanoid robots could provide the most complete experience in this respect. Therefore, it is of great importance to investigate people perception of those products, especially by weak users.

2. User Centred Robotic Design

The rapid technological growth that we are facing nowadays has highlighted issues about human-computer interaction, specifically with reference to the scope of robotics. Such dynamics open up new challenges for UX designers (Gamberini et al., 2012). While in the past the robotics scope was mainly involved in design industrial machines, in recent years we have witnessed an increasing number of social robots. The latter are able to interact, sometimes having complex relations, with human beings and other machines. They are able to learn from the environment in which they are located as from the interactions with users and to develop

a decision-making autonomy. The problems that arise within this context are still addressed without a multidisciplinary approach that would be necessary (Casiddu & Micheli, 2011).

Designing a social humanoid robot is not just the development of a consumer product as a household appliance and is not just the engineering of a body to a vocal assistance. Is a discipline that is located somewhere between the two previous ones: to create a physically tangible automaton, more or less human-like, able to act and react with a decision-making autonomy and capable to arouse complex emotions. This is not just about dealing with technical issues, but also taking into account the psychological side, considering the legal liability, evaluating social dynamics, economic viability and environmental impact. Therefore, it is necessary to place the individual at the center of the design process in order to directing research and activity to design an acceptable and accepted user experience of the interaction. Only then not just the shape but also the behaviour of social robots will be human-like and the technology will fit users' needs.

3. Poppy, a case study

The project hereby presented illustrates the case study of a participated parametric design workshop, where the object is a humanoid robot.

Our aim is to analyze the morphological aspects of humanoid robots and the users' perception regarding them. In order to do that, we planned an activity that would positively involve a wide audience in making design choices on a humanoid robot; in particular we worked on editing the 3D models of Poppy, which is fully available online on an open source platform developed by Matthieu Lapeyre in 2012, for his PhD thesis (Lapeyre et al., 2014).

Poppy is an 83 cm tall robot having 25 degrees of freedom and weighing 3.5 kg; it is fully 3D printable and hackable and it has a very active community surrounding the project, including universities, research institutions and private entities. Most of the research surrounding Poppy is focused on developing its engineering and IT aspects, but that was not our focus for this project. In fact, the mechanical and electronic parts remain the same, and the IT development has not been taken into consideration.

Instead, we re-designed the 3D model of Poppy's limbs using Grasshopper, a well-known visual programming language and environment that runs within the Rhinoceros 3D CAD application.

We used texture mapping to chart arms and legs and edit them using six different shapes with a varying design and degree of hollowness; in general, the editable parameters in our model were the following:

- colour of the head
- shape of the eyes projected on the incorporated screen
- chest, shoulder and hip colours
- type and density of the texture and colour of the upper arm
- type and density of the texture and colour of the forearm
- hand and foot colours

- type and density of the texture and colour of the thigh
- type and density of the texture and colour of the shin

As the joints of arms and legs remained the same of the original model designed by Lapeyre, we created a parametric system that allows to change every single limb of the robot without affecting its functionality and stability. In theory every user can now design his unique companion robot, according to his needs and tastes.

4. Method

In this section it is described our approach to the activity, the setting and the user experience.

The workshop took place during Rome Maker Faire 2019 for three days. The audience varied from families to technology amateurs and students. We used the tool of the survey to collect data about the visitors' age, gender and education level; this way we can paint a clear picture of the results we collected. At the end of the survey we would send the image of the designed robot to the participant's email. However, the survey took some time to be filled and many visitors, even though they found our activity engaging, decided not to complete it. In the end we collected 71 different designs for our robot; most of the participants were very young, between 5 and 12 years old.

The setting of our activity was very simple. We had a stand with a few tables where we placed some FDM printers, that we used to print in real time the pieces we needed to build our Poppy. While some of us worked on assembling and printing the robot, others were greeting the visitors and guiding them through the activity.

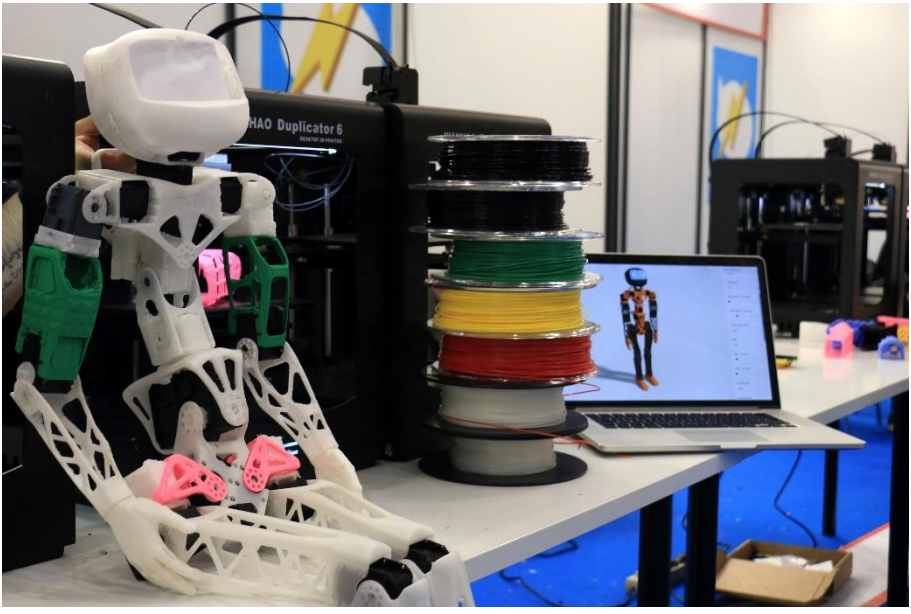

Figure 1. Set-up at Rome Maker Faire 2019.

Before starting to design their robot, participants were asked to choose between three different scenarios: they could design a caregiver robot, a toy robot for their kids to play with or an evil one. This choice would influence all the consequent ones and already represents an interesting term of comparison: we will discuss the results in detail in the following section.

The parametric model was easily editable thanks to the simple and intuitive interface of Shapediver, an online editor specifically designed to show files generated in Grasshopper. It was enough for users to drag some sliders in order to edit colours and geometry of the model, without needing any kind of skill in 3D modeling.

In order to give a physical feedback to users, the mostly often chosen geometries were 3D printed live during the workshop. This way, the experience had an analogic development, parallel to the digital one: due to the availability of a high number of 3D printed parts, it has been possible for users to understand the physical results of their choices.

5. Results and findings

In this section we will thoroughly discuss the analysis of our data sample; as mentioned before, we collected 71 different models and surveys.

Our population sample is quite peculiar, due to the specificity of the Faire in which our activity was held. Two thirds of the participants are male, and almost half of them are very young, between 5 and 12 years old. Only 30% of the participants hold a university degree of some kind, most of them in the area of design and engineering.

The companion robot was the most selected scenario, by 45% of the population; the caregiver robot was selected by another 30%, and the remaining 25% designed the evil robot.

We will now analyze every scenario.

5.1 SCENARIO #1 - Design a robot to give to your son as a present for Christmas



Figure 2. The chart shows the sample distribution of users in the first scenario grouped by age.

A first insight that we can highlight is that most of the users who chose this scenario were very young. We can argue that kids are fascinated by the idea to play and interact with a humanoid robot and are not influenced by adults' suspicions and distrusts towards artificial beings.

Regarding the face, 41% of the participants chose big rounded eyes for their project; they clearly aimed to paint a friendly and kind expression on Poppy's screen.

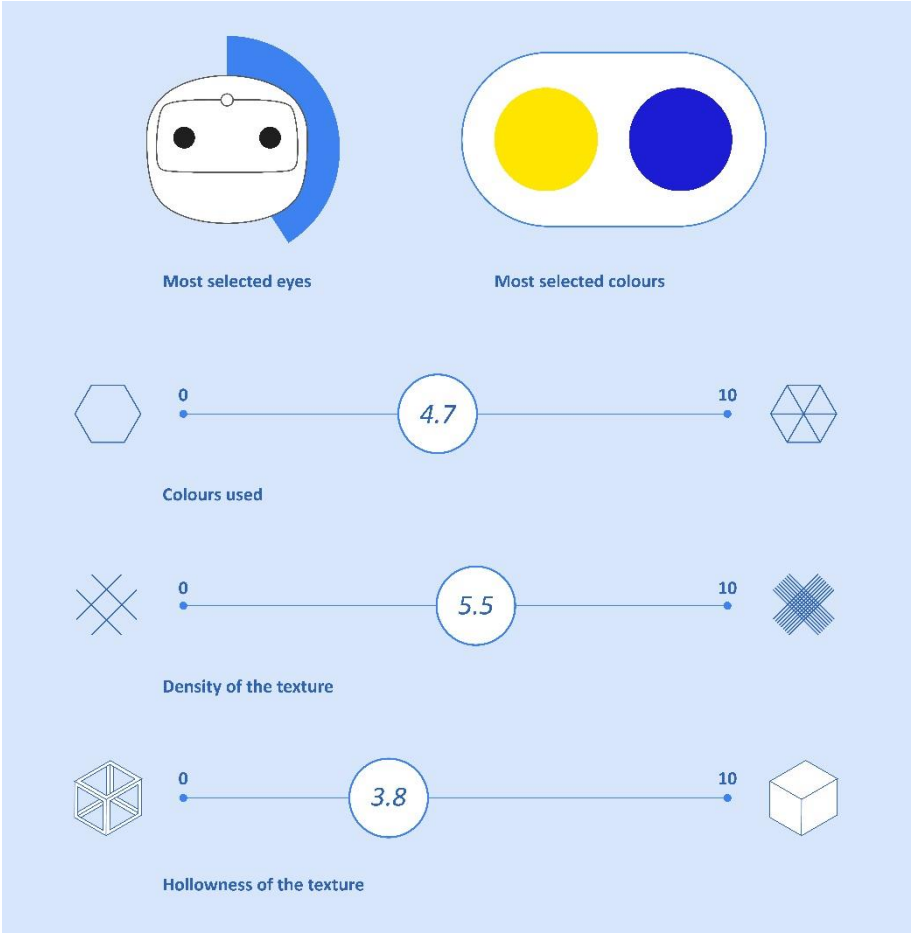

Figure 3. The visualization shows the users choices regarding the design of the robot for the first scenario.

An interesting reflection can be made on colour choice: kids have a tendency to use all the colours at their disposal, and this appears to be evident in our analysis. Even though there is a prominence of yellow and blue, our toy robots present an average of 4.7 colours used in the same model.

We also noticed a tendency that could be expected: girls make a higher use of pink in their design.



Figure 4. The picture presents the archetype of robot designed by users for the first scenario.

Young users were playing a lot with colours and shape of the texture but kept the density of it at an average level.

The chosen textures were mainly quite hollow, generating robots that appear to be lightweight but also sturdy and strong.

5.2 SCENARIO #2 - Design the robot that will take care of you when you will be old



Figure 5. The chart shows the sample distribution of users in the second scenario grouped by age.

This scenario shows a pike of appreciation by 36+ years old users. This may indicate an interest in the market of companion and caregiving robots by a population of adults that will in the future need assistance in their homes.

However, we also recall an interesting trend of kids wanting to design robots for their grandparents, which again shows that youngsters are not intimidated at all by artificial beings that may live with them.

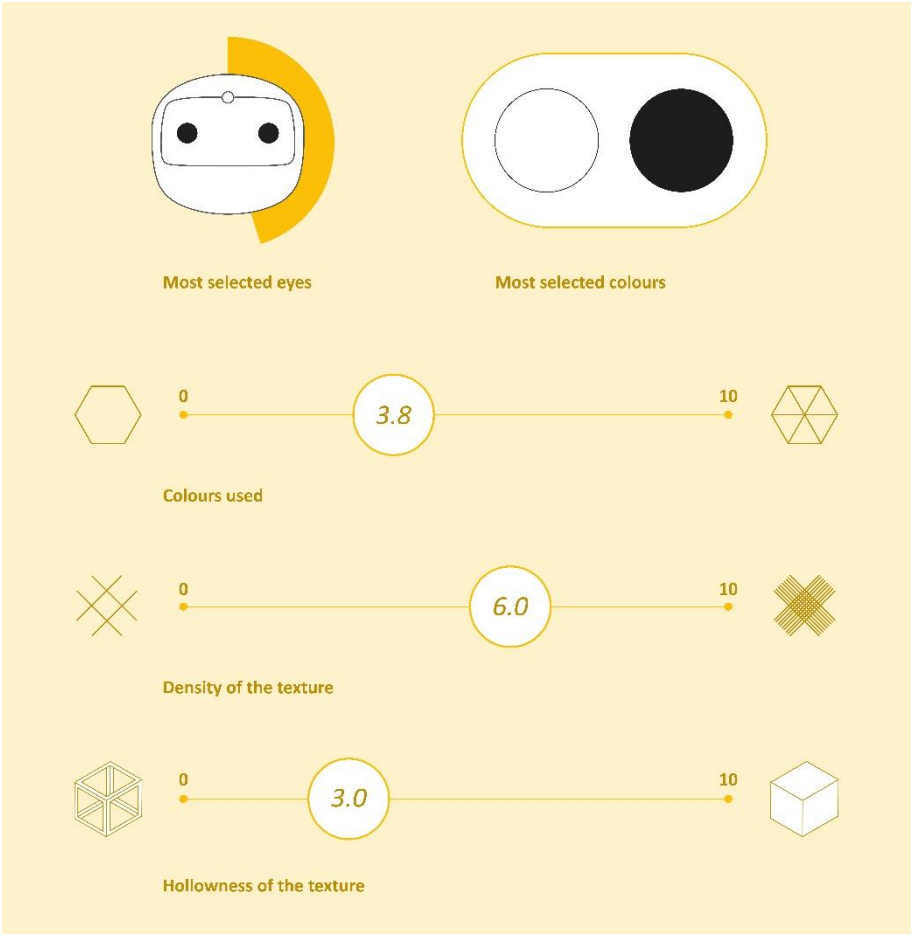

Figure 6. The visualization shows the users choices regarding the design of the robot for the second scenario.

The most selected eyes were again big and rounded, but there is a very different trend in colour choice. In fact, main selected colours in this case are white and black, with an average of less than 4 colours used in a design. This trend is in line with products on the market. Other colours often selected as accent for the design were mainly blue and yellow.

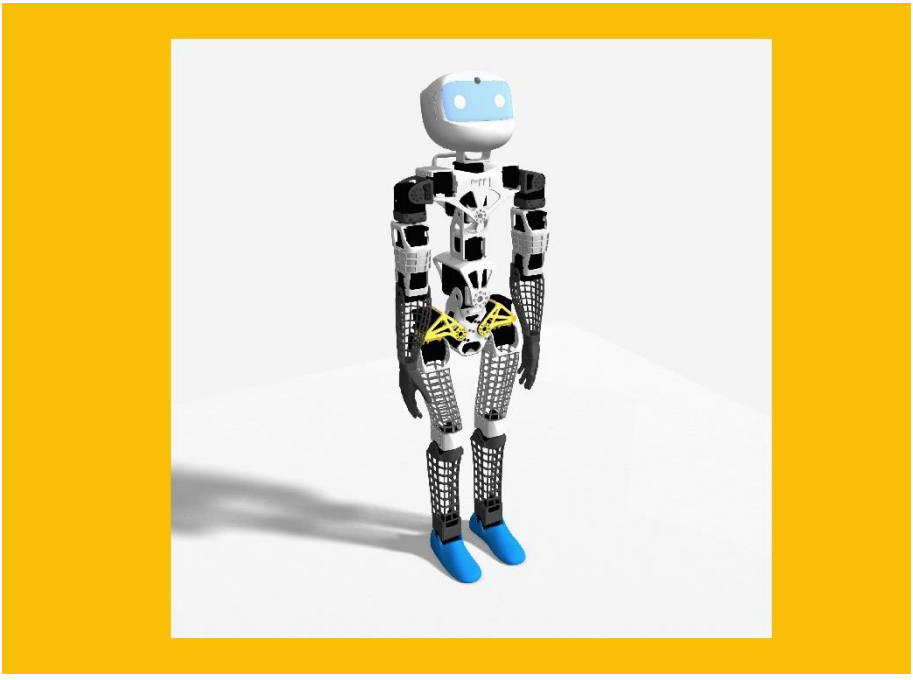

Figure 7. The picture presents the archetype of robot designed by users for the second scenario.

In this scenario we saw a slightly higher degree of density and complexity in the chosen textures, but the most interesting trend regards the hollowness of it: this is the scenario in which Poppy's limbs are lighter. This may indicate that users perceive caregiving robots as life companions who don't need to have a big and intimidating body, but rather a light and tiny structure, easily adaptable to confined environments such as private houses and hospitals.

5.3 SCENARIO #3 - Design the evil robot that is able to submit humanity

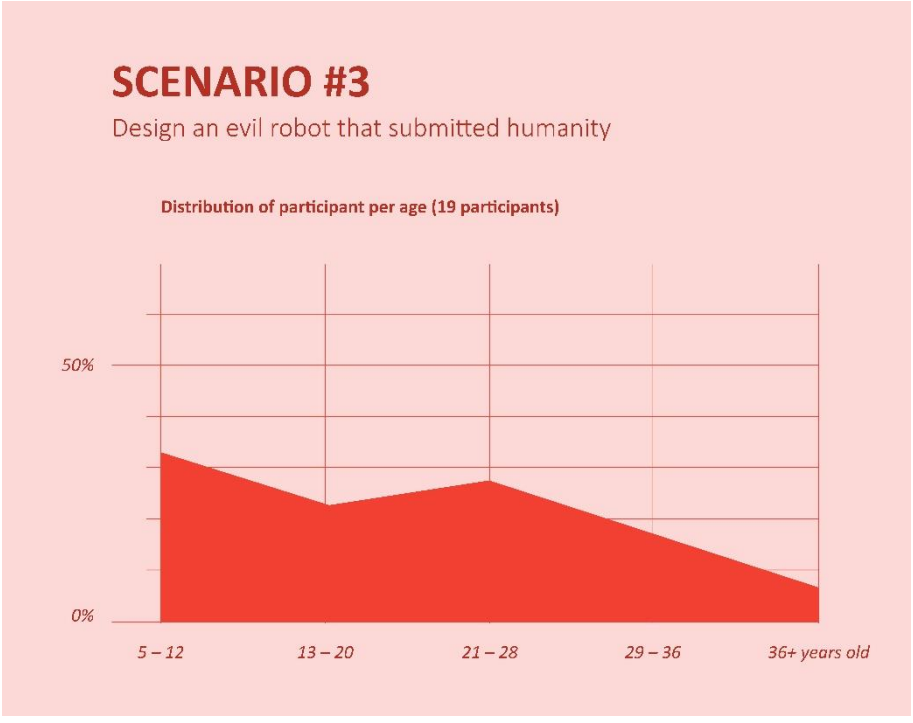

Figure 8. The chart shows the sample distribution of users in the third scenario grouped by age.

This scenario was the least selected; most of the participants that chose it were teenagers enjoying the idea of designing an evil character. Almost 60% of the designs present a stripe in substitution of the eyes; we believe that our users were recalling a recurrent iconographic choice made in movies.

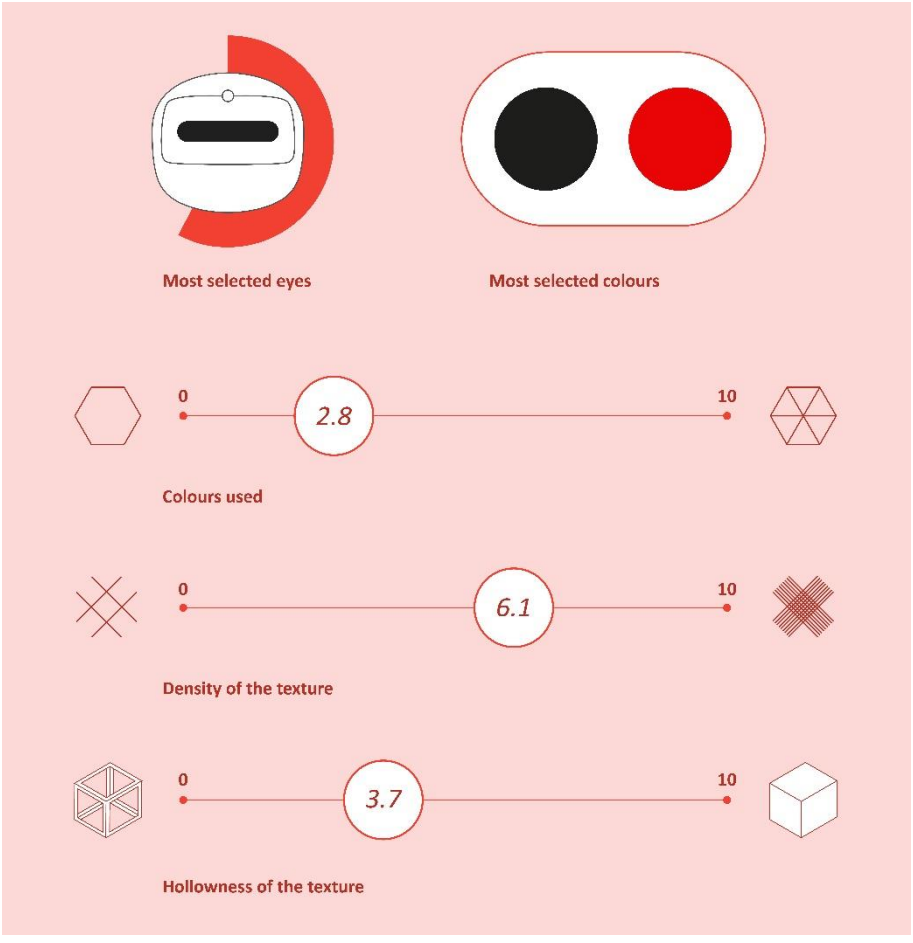

Figure 9. The visualization shows the users choices regarding the design of the robot for the third scenario.

Regarding colour choice, this is the scenario where the average of used colours in a design is smaller: only 2.8%. The most selected colours are black and red.

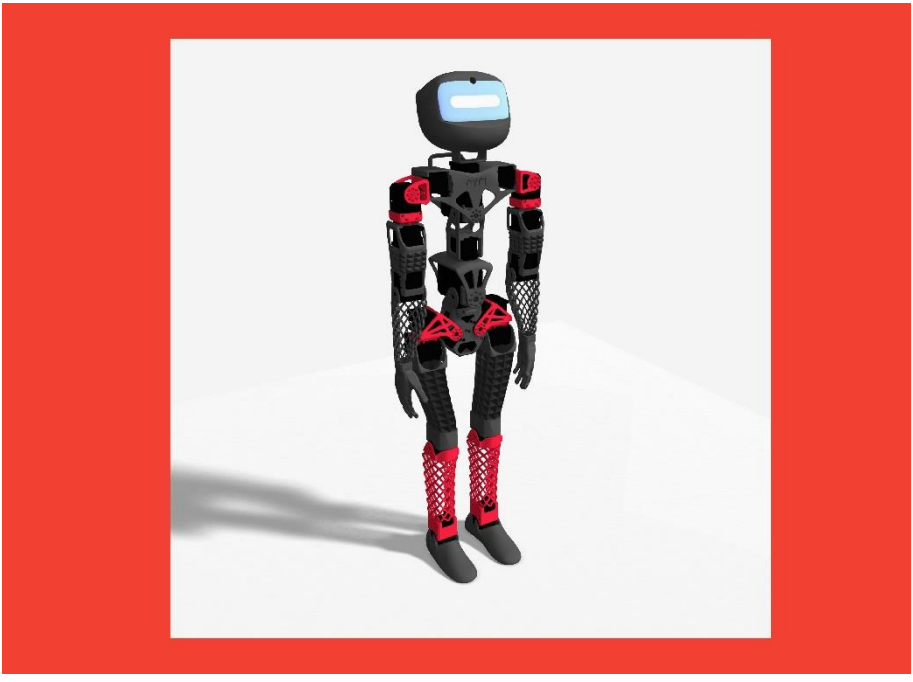

Figure 10. The picture presents the archetype of robot designed by users for the third scenario.

For what concerns the structure of the limbs, this scenario presents quite complex and dense textures, with a slight preference for the studded texture. Plus, this is the scenario with the less hollow structure.

In general, the evil robot appears to have a clear and well-defined iconography in the imagination of our participants, who surely recall movie and videogame characters when making design choices. Compared to the other scenarios, this is the one that mostly gave us results that we could easily expect to receive.

6. Conclusions

During the period of the faire, visitors have shown interest and involvement in our proposal; direct feedback confirmed that the public is fascinated and curious about the field of humanoid robotics and some of the people we talked to also declared that the possibility of having a companion personalized on their specific needs and tastes was very compelling to them.

We believe that the positive feedback also lies in the innovative method of data gathering and co-design that we experimented. The use of a simple digital platform to edit the project was supported by physical models of the robot and by functioning 3D printers. The participants thus had complete control and understanding of the design process, a situation that is not to be taken for granted in many participatory design experiences. Further developments of the project will hopefully take into account the possibility to program the robot to perform simple tasks, in order to give a complete formative experience to the users, especially the youngest.

In general, we have been able to confirm our hypothesis on people's perception of humanoid robots. In particular, we found that colours hold great importance in the perception of the goodness or evilness of a robot; most of the design choices were made, as expected, based on memories of popular archetypes seen in movies and videogames, especially with regard to facial expression and colour; lightness and small size seem to be important features for companion and caregiving robots, while sturdiness obviously make the user feel intimidated and inferior.

The data sample that we were able to collect has proven to be very useful for our analysis of Human - Robot Interaction patterns. Future experiences will be based on similar approaches, with the goal to find a faster way to collect information, in order not to lose data of participants that had few time at their disposal.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A systemic vision for the common good : |C|A|S|E| Goods Mobility in the fourth industrial revolution.

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Abstract | The design research is developed inside the urban mobility of the goods.
It is named |C|A|S|E| as the system takes as basic values and innovations the followings: the process innovation introduced by the 4° Industrial Revolution that allows inside mobility the interconnection of vehicles and surroundings (.C. Connected); the "rethinking" of vehicles as automated ones (.A. Autonomous); the value of spreading good practice of sharing (.S. Shared); the use of electrical sources of energy (.E. Renewable Energy).

The innovation proposed by the system as strategic participations are introduced by considering the new advanced logistic offered to the B2B and B2C as change opportunity.
Inside it all the elements are guardians of a primary value that is the economic growth of territory for the development of a civil economy that put importance to the design and recognize the ethic of work as elements of real innovation.

KEYWORDS | SYSTEMIC DESIGN, COMPLEXITY STRATEGY, DESIGN SYSTEM, ENHANCING URBAN SPACES, CREATIVE COMMUNITIES

1. The macro-system |C|A|S|E|: introduction

The design research is developed inside the urban mobility of the goods. It is named |C|A|S|E| as the system takes as basic values and innovations the followings:

- the process innovation introduced by the 4° Industrial Revolution that allows inside mobility the interconnection of vehicles and surroundings (.C. Connected);
- the "rethinking" of vehicles as automated ones (.A. Autonomous);
- the value of spreading good practice of sharing (.S. Shared);
- the use of electrical sources of energy (.E. Renewable Energy).

The macro system is developed on systemic interactions based on macro values objectives so it enhance and helps the growing of the collectivities. The scale to measure the kind of acting inside the collectivity is expressed by the double side reading formula: me>we>they. This value base of the research is very important because we think that the deep meaning of the design has to be oriented on the ethical order.

The innovation proposed by the system as strategic participations are introduced by considering the new advanced logistic offered to the B2B and B2C as change opportunity.

A co-robot in each scenario takes care of good relationship acting in the system, aiming to learn and teach how to preserve the life among time of the system itself.

In the macro system we are designing, the active community is at the centre of it and a new interpretation of sharing is given as development and common aid to civil and political economy that shelter both companies and customers/users (Figure 5).

The joining of a physical network with a digital one creates an elected community that shares values of social development. This new territory created enhances the design and distributions of new products for the future.

This system is designed to be able to continuously renew itself and is capable of including all the elements not excluding the weak in it.

Inside it all the elements are guardians of a primary value that is the economic growth of territory for the development of a civil economy that put importance to the design and recognize the ethic of work as elements of real innovation.

2. The macro-system |C|A|S|E|: the systemic approach.

To create the design concepts we defined which are the innovation strategic objectives, in three range of functionality, related to:

- User/Receiver;
- Logistic between B2B and B2C;
- Delivery between B2B and B2C.

This conceptual base allowed us to identify by main phases the concept proposals divided in the four interrelated scenarios |C|A|S|E|.

Each scenarios develops a system that has two different scale dimensions for products and service design, one related to the objects (/Polo A) and the other related to places (/Polo B):

- **.C. connected goods mobility** _ the **New Street Appliance** scenario becomes the system called **Promoting Radar** characterized by the slogan *'A continuous unveiling of possibilities*', declining the product / service concepts between two scale dimensions: the (Polo A / object) **access point** _ **Collector Totem** characterized by the slogan '*A lighthouse to rediscover the experience of places*' and the (Polo B / place) **mall** _ **Revealing Labyrinth** characterized by the slogan *'A lens to orientate yourself in a changing context*';
- **.A. autonomous goods mobility** _ the **New Way of Acting** scenario becomes the system called **Trails in Action** _ **facilitated significant purchases** characterized by the slogan *Tuned and on the go, from choice to delivery'*, declining the product / service concepts between two scale dimensions: the (Polo A / object) **helper robot** _ **Active Shade** / **listening and proactive shadow** characterized by the slogan *'The memory of worthwhile'* and the (Polo B / place) **vehicle robot** _ **Manta Flying Delivery** / **the flying drone solver of deliveries** characterized by the slogan' *Deliveries accomplished without domicile* ';
- **.S. shared goods mobility** _ the scenario **New Domestic Appliance** becomes the system called **Solidarity Colony** characterized by the slogan *'The domestic flow of things'*, declining the product / service concepts between two scale dimensions: the (Polo A / object) **domestic device** _ **Biorhythm of Purchases** characterized by the slogan *'From desire the purchase choice'* and the (Polo B / place) **domestic sharing** _ **The Library of Things** characterized by the slogan *'Shared Experience'*;
- **.E. electric goods mobility** _ the scenario **New Way for a Sustainable Growth** becomes the system called **Urban circuit for eco-deliveries** characterized by the slogan *'Sustainability in motion'*, declining the product / service concepts between two scale dimensions: the (Polo A / object) **Cargo-Bike and Cargo-Tram** _ **Eco-deliveries by Tram and Bike** characterized by the slogan *'Connect actual change actions'* and the (Polo B / place) **Cargo-Retail** __ **Market anywhere on demand** characterized by the slogan' *Vital strategies rooted inside the Territories*'.

3. The macro-system |C|A|S|E| : the first three interrelated system.

3.1 The system '**New Street Appliance _ Promoting Radar**' for the scenario |C| 'Connected goods mobility': scenario and main goals.

The system goal is to offer new purchasing experiences of goods capable of an enrichment of the user thanks to an offer of goods that represent a real possibility of choice and capable of the promotion of the local manufacturing companies.

The system is developed all around the user choices so that he has not only a passive role of buyer. The user is called to share the values of economic growth, as he is an active part of the system that discover and choose what is really valuable to him.

The purchasing experience proposed is declined in two different scales: from one side the discovery of a designed place the **Revealing Labyrinth /mall**, where the interaction takes place as a guided exploration of different purchasing zones; from the other side a designed object that has access point functions structured as a **Collector Totem /access point**. The Totem has compartments for the delivery and the return of goods but allows also a advantageous exchange thanks to the promotional compartments designed to enhances goods suitable for the specific user profile.

If the **Revealing Labyrinth /mall** concentrates more sales areas on it, and proposes a specific path for the user, the **Collector Totem /access point** is widely distributed in the places of a neighbourhood.

The system through the use of metadata acts like a radar that can promote local manufacturing companies of each specific district of the city allowing this micro-local companies a real B2C opportunities and support.

The most important phases for the system **New Street Appliance / Promoting Radar** scenario are:

- the **Promotion of companies** that is the main phase for both the **Revealing Labyrinth /mall** and the **Collector Totem /access point** (Figure 1), as it allows a visibility opportunity for the new and old local manufacturing companies;
- the **Management of big data as metadata**, to offer a personalized service with a wide option of choices responding to the user needs;
- the **Purchase facilitation**, to make easy the experience by adapting it to the needs of the user;
- the **B2C Company support**, the user can find inside the network of companies that apply to the system, a fertile pace of ethical purchase and conscious choices, helping the growth of the territorial economical identity.
- the **Delivery**, in a way that support the pickup service;

- the **Return** aimed to develop advantageous relationship that creates trust in the purchasing experience;
- the **Review**, and important phase for the relationship between the manufacturing company and user that allows the system to develop by granting an high standard of experience.

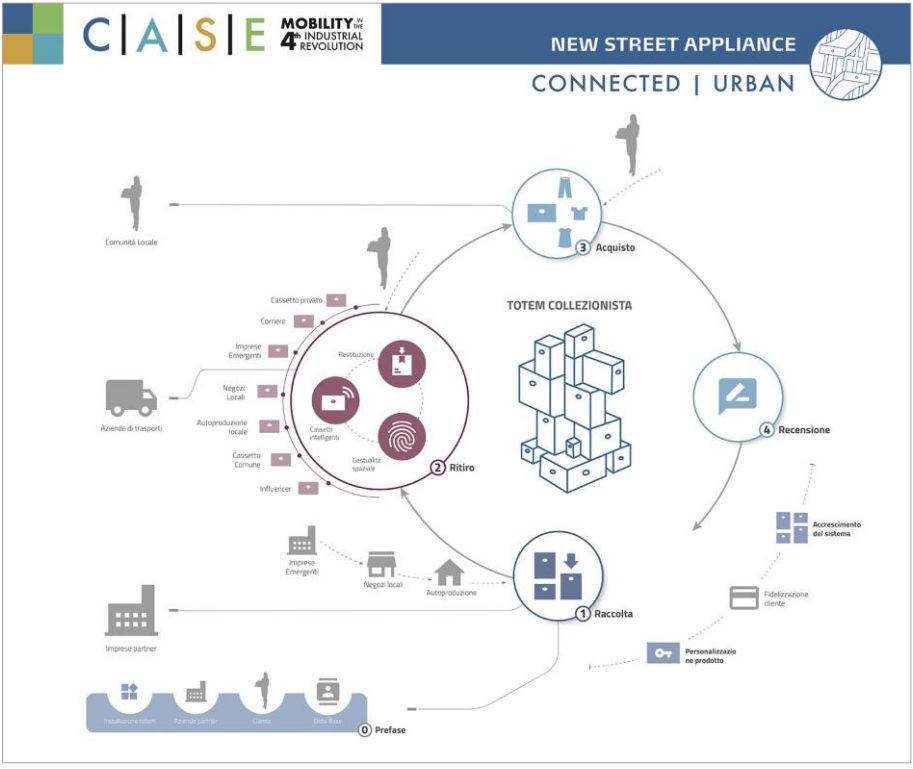

*Figure 01: '**New Street Appliance**' system _ Pole A / object '**access point _ Collector Totem**' _ Map: main phases and link to others systems poles.*

3.2 The system '**New Way of Acting /Trials in action**' for the scenario |A| "Autonomous goods mobility": scenario and main goals.

In this system we are going to define, the needs and desires of the people are in the centre to help the consumption of significant goods.

The union between automated interactive devices with IoT logic and services to facilitate the **Promotion**, **Selection** and **Delivery** of the goods phases, helps the creations of a new way of acting and competing in the human needs complexity and in the consumption related to them, with the aiming of creating an increase in the offers useful for the economical development of the local district companies, and in response to that rate of unexpected events that are part of everyday life.

This system acts like a **Shadow** that knows the user and gives to him advices. It moves like a **Manta** that 'dance' sinuously in a network of relationship creating new fluxes and connecting people, goods and companies (Figure 2).

In the intervention dimension aimed at the Person (scale dimension Polo A / object), the system proposes the concept of a personal assistant '**robot helper _ Active Shade**', whose symbolic node is (shown on the map as) the 'image of a *'Gift package from which an anthropomorphic shadow departs*' which is outlined on the characteristics of the user to give him a shopping experience based on a choice between possible goods offered to be tested periodically as possible proposal according to his profile. Only those that are really appreciated will be purchased. The connection with the '**New Street Appliance / Promoting Radar**' (Polo A / object) **access point _ Collector Totem** is of relevance.

The concept intent of the product service **Active Shade** / **listening and proactive Shadow** is expressed by the value phrase: *'From the desire the purchase choice'* (Figure 3).

In the intervention dimension aimed at the territories, (scale dimension Polo B / place), the system proposes the concept of a co-robot **vehicle robot _ Manta flying delivery** / **the flying drone solver in deliveries**, whose symbolic node is (shown on the map as) the image of a *'Manta in flight*', a biomorphic flying drone that evokes the animal's agility in moving between water and sky and the possibility thanks to its dancing performance to interact empathically with the user, tracing the recipient and performing therefore deliveries where, following unforeseen circumstances, a new address is more useful to the user. The connection with the '**New Street Appliance / Promoting Radar**' (Polo A / object) **access Point _ collector Totem** is of relevance.

The concept intent of the product / service **Manta flying delivery** / **the flying drone solver in deliveries** is expressed by the value phrase: *'Deliveries accomplished without domicile' (Figure 00)*.

The value scenario identifies the '**New Way of Acting**' system as *'facilitated significant purchases'*, and is overall described by a synthesis of the two poles, whose symbolic node is

the image of a composition of '**Trails in action**' a dimension of the human acting where 'the world' is depicted between the' Sky _ with the Flights' and the 'Earth _ with the Shadows'. The dialog of the two creates a new way of accessing the goods to experience real knowledge and only if the consequent is considered valid confirm the purchase.

The slogan that identifies the Values (quality and action) of this system is: '*Materialising a good that can be owned before the real purchase*' (Figure 4).

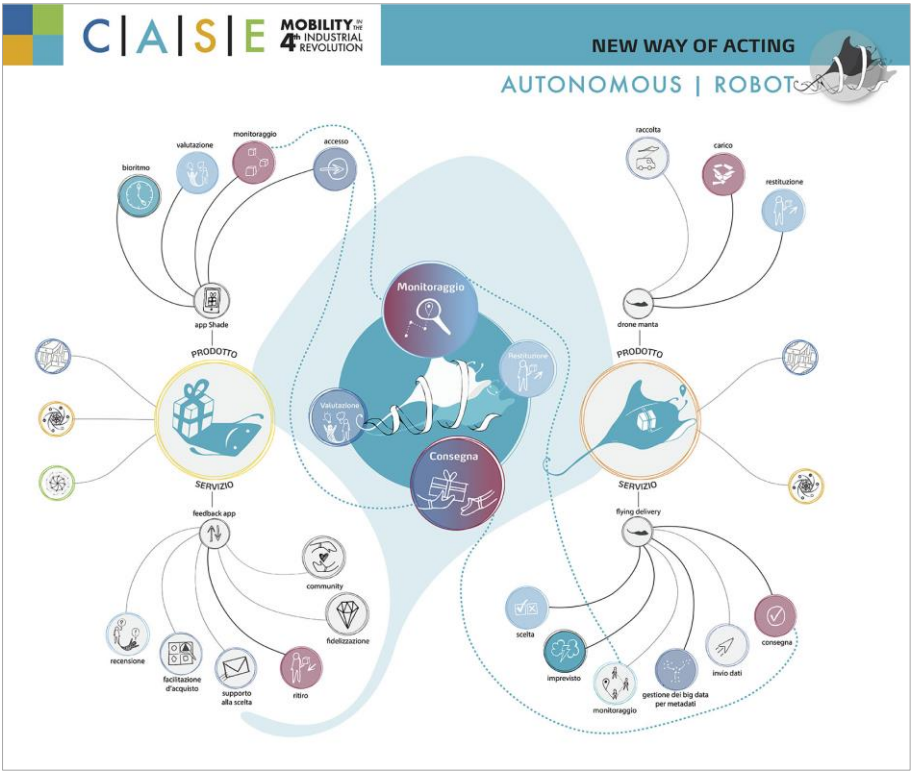

*Figure 02: The system '**New Way of Acting**' for the scenario |A| 'Autonomous goods mobility' _ System Map: main phases for each of its poles and link to others systems.*

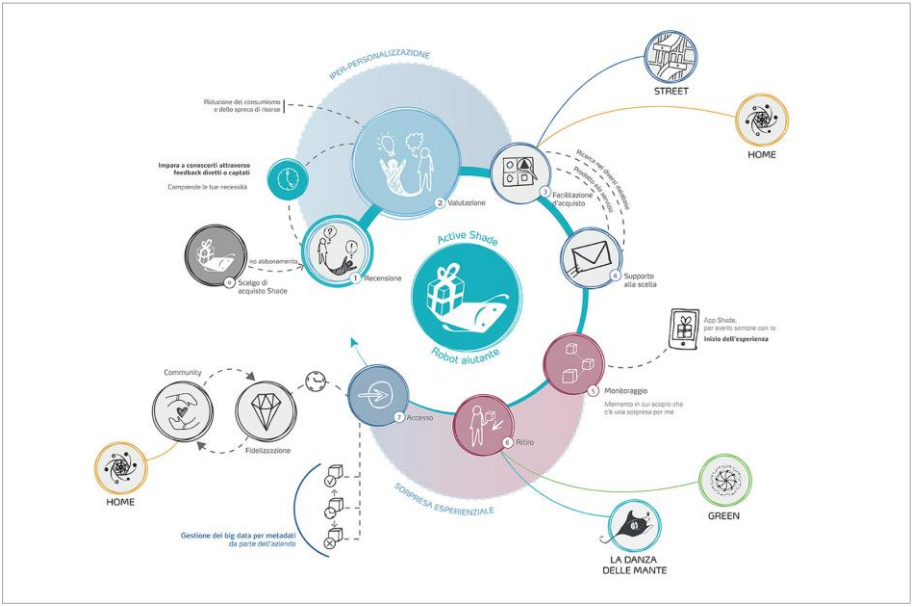

*Figure 03: '**New Way of Acting**' system _ Pole A / object '**helper robot _ Active Shade**' _ Map: main phases and link to others systems poles.*

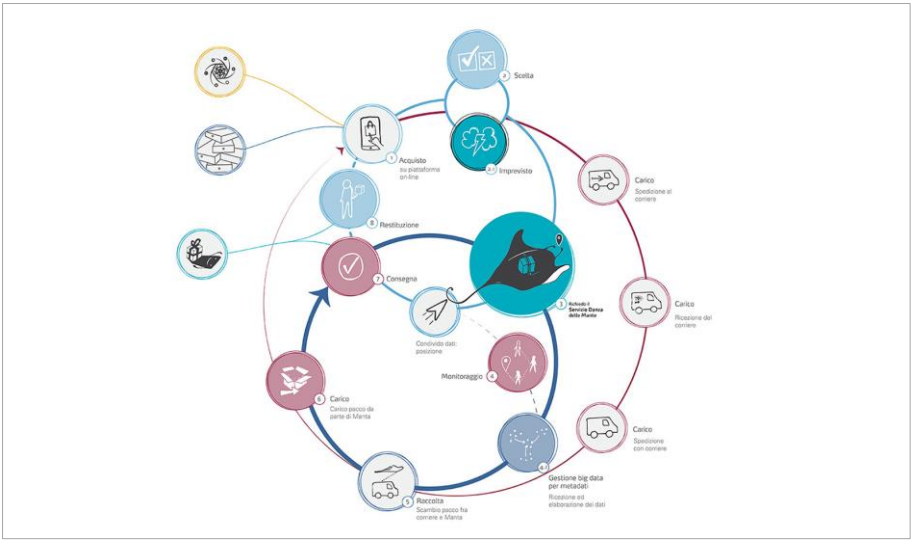

*Figure 04 _ '**New Way of Acing**' system _ Pole B / place '**vehicle robot _Manta Flying Delivery** ' _ Map: main phases and link to others systems poles.*

3.3 The system "**New Domestic Appliance**" for the scenario |S| "Shared goods mobility": scenario and goals.

In short, a scenario is outlined for the '**Solidarity Colony**' system, in which the pivotal stages of innovation - primarily of purchasing management with an extension to the sharing and exchange of things (from possession of objects to use of their services - through a subscription service), together with facilitating actions in the delivery /collection and in prolonged use practices (maintenance, repair, reuse), are (Figure 6, Figure 7, Figure 8):

- The **Management of big data as metadata** allows the classification of objects, matching needs and the offer inside the community of the '**Solidarity Colony**'. This match is made by the subscription to the '**The Library of Things'** where there are also small companies and craftsman as members.
  The participation to the system is aided by the '**Biorhythm of Purchases'**, a domestic device with IoT technologies that filters the availability of the goods using the user's defined parameters and the requests of that period, regulating the sharing/borrowing or purchasing of the goods. The '**Solidarity Colony**' is a community capable of requesting a specific manufacturing of goods by certifying their purchase (Design on Demand, Design for Sharing of goods and services).
- **Review and Monitoring**. The reviews of goods and the monitoring on all the stages of the service are the base for a good quality and developing of the system. The user is a active part of the system when he not also provide a review but he also gives information on way of use and good practice because he helps other users and promotes the available goods. The manufacturing company is an active part too when it provides maintenance and restoration of the goods and provides information about the production methods and material used (values of sustainability and ethics). The '**Solidarity Colony**' is a community capable of testing new products for the manufacturing company and can became a testimonial for the companies' products.
- **Goods correlation** and **choice support**. The '**Solidarity Colony**' system modulates the supply of goods in circulation on the basis of data, which over time constitute a real capital with which to respond to the scheduled needs of its subscribers and with which request and promote new products on the basis of what is vital in the community itself. Users and companies exchange goods in a fluid way: everyone has access to a great variety of things, much wider than it would be in their private sphere. The solidarity and community spirit of the system circulates objects and skills, transmits security and changes the way of seeing things: from simple objects (*objectum* 'that goes against') to sharing opportunities and useful purchases. The owner and the consumer leave room for a wider dimension, of user and supporter.



*Figure 05: The system '**New Domestic Appliance**' for the scenario |S| 'Shared goods mobility' _ Visual Map: main concept and link to others systems.*

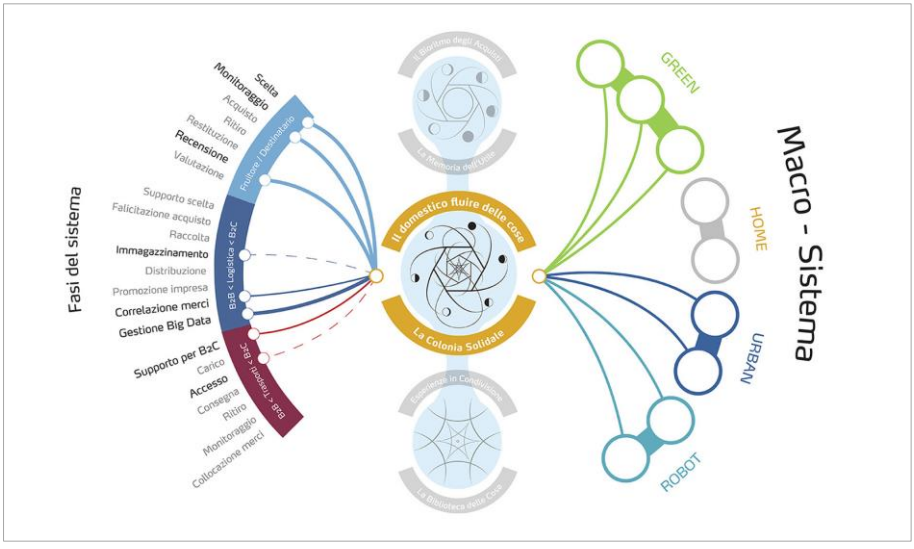

*Figure 06: The system '**New Domestic Appliance**' for the scenario |S| 'Shared goods mobility' _ Map: diagram main phases and link to others systems.*

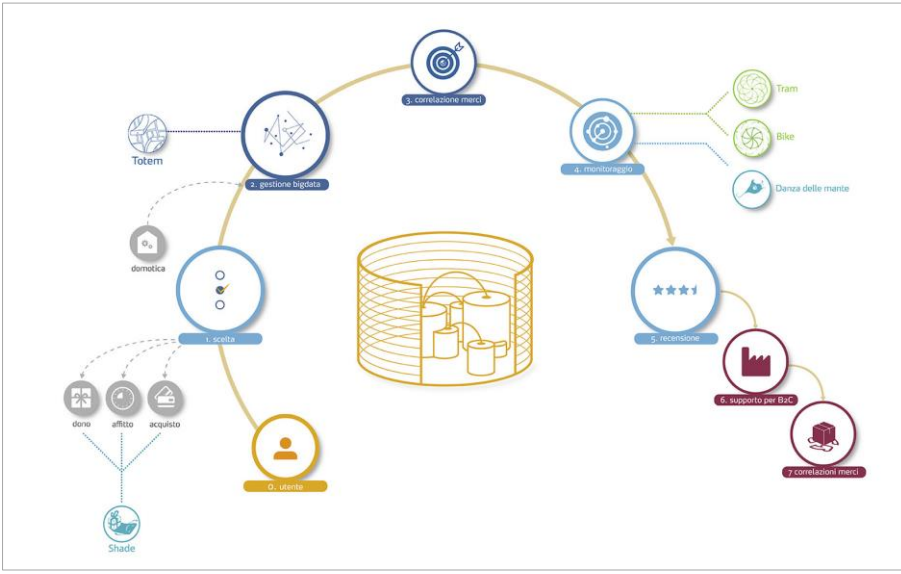

*Figure 07: '**New Domestic Appliance**' system _ Pole A / object '**domestic device _ Biorhythm of Purchases**' _ Map: main phases and link to others systems poles.*

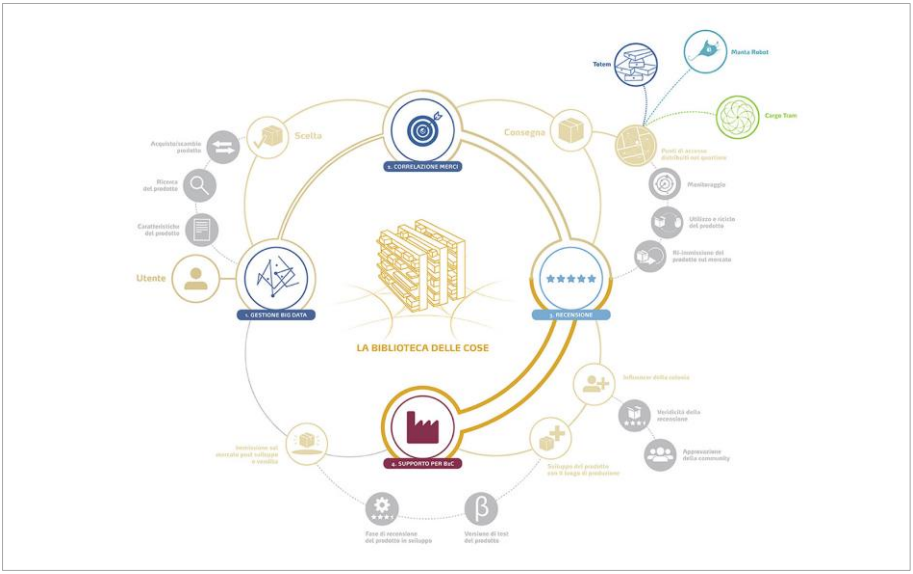

*Figure 08: '**New Domestic Appliance**' system _ Pole B / place '**domestic sharing _ The Library of Things**' _ Map: main phases and link to others systems poles.*

4. The macro-system |C|A|S|E| : the last of the four interrelated systems.

4.1 The system '**New Way for a Sustainable Growth**' for the scenario |E| 'Electric goods mobility': focus on scenario.

The system is characterized by synergy of different transport solutions: Cargo Bike, Cargo Tram, Cargo Retail. All this solutions contribute at the goods delivery and create new functionality for the system. They are all green powered and will moves through the city by existing paths (Figure 9).

These vehicles are designed to be modular, complementary and integrated and will be assisted by static elements (goods interchange stations, pick-up boxes).

The system goals are to enhance local identity and strengthen the social relationship. To achieve this, the system wants to be a supporter of the *good environmental practice* by becoming an *Itinerant exhibitor* of them.

The goods on sale will respect the environmental sustainability and will be promoted by the possibility for the user to be aware of their manufacturing origins. To avoid the waste of perishable goods they'll be reallocated when next to their expiry dates. The system can also be used to collect old goods at end of life stages.

The system we are designing has at his core the enhancement of local manufacturing companies by creating an organic exchange characterized by active relations inside all the elements of the system.

The interconnection of the different services available wants to create a 'on the go sustainability' for the development of a flexible system capable of understanding and adapting to the changes.

4.2 The system '**New Way for a Sustainable Growth**' for the scenario |E| 'Electric goods mobility': main goals.

In short, a scenario is outlined for the '**New Way for a Sustainable Growth**' system - new ways of conceiving the '**Cargo-Bike and Cargo-Tram**' and '**Cargo-Retail**' -, in which the key phases of innovation mainly focused on goods delivery with extension to the sale, together with support actions and testimony of eco-sustainable practices, are:

- **Delivery / Pick Up**. This functions are fulfilled by special closed structures offered by the cargo Tram for the collection of goods and door do door delivery made through cargo Bike;
- **Collection**. All the poles of the system (Cargo bike/ tram /retail) offer a collection point for packaging and recyclable waste;

- **Correlation of goods** and **Promotion of business**. These phases are ensured by the selections of goods that respects eco-friendly and civil economy requirements. These products are made available to the consumer thanks to the moving market offered by the **Cargo-Tram** and thanks to the downstairs market offered also on request by the **Cargo-Retail**;
- **Review**. This phase is dedicated to the relationship with the customers/users. Thanks to the IoT technologies the system can evolve by continuously granting a high quality and performance offered.



*Figure 09 _ The system '**New Way for a Sustainable Growth**' for the scenario |E| 'Electric goods mobility' _ Visual Map: main concept and link to others systems.*

4.3 The system '**New Way for a Sustainable Growth**' for the scenario |E| 'Electric goods mobility': main results related to **user / receiver.**

The '**Choice**, **Monitoring**, **Pick Up**, **Evaluation** and **Review**' phases emerged from the area of functions dedicated to the "**User** / **Receiver**".

The Pole A1 '**Cargo-Bike / Connecting actions of effective change**' assumes a systematic delivery of goods destined to a client that wants to be informed in order to take conscious choices. To achieve this the product/service concept is focused in the following phases of the system (Figure 10):

- **Choice**: the concept wants to be an itinerant showcase of different high quality goods of the local manufacturing companies, especially for commodities, short life products and refillable package products;
- **Pick Up**: the concept allows a new formula of booking neighbourhood delivery with the possibility of giving back the packaging of the purchased goods. The concept has a designed pulled module for a proper collection and storage of this items.

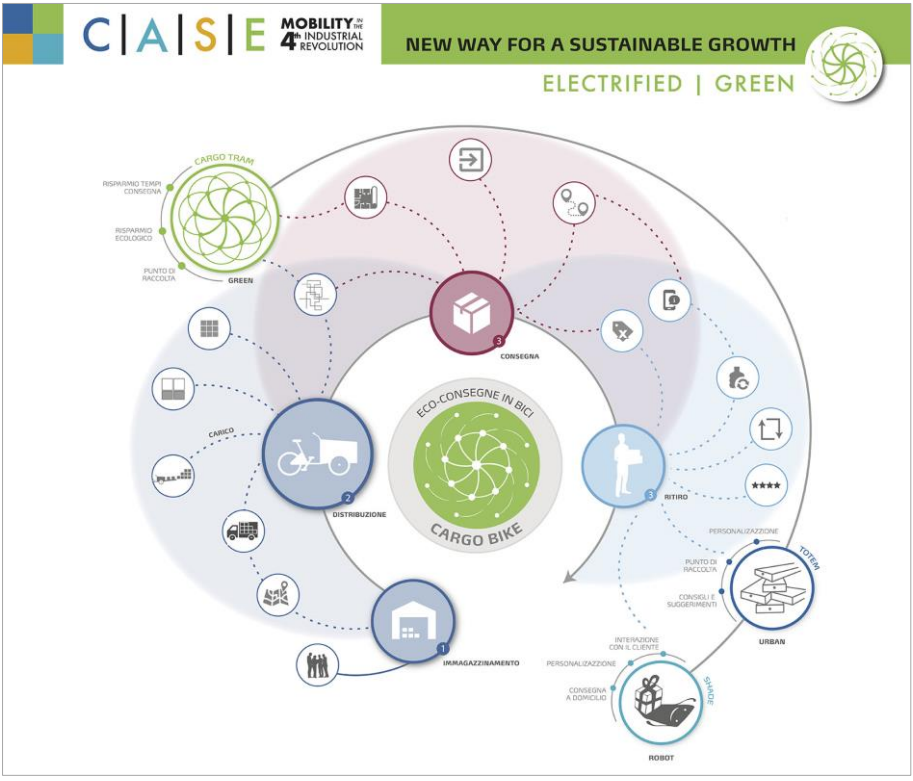

*Figure 10: System '**New Way for a Sustainable Growth**' for the scenario |E| 'Electric goods mobility'_ Pole A1 '**Cargo-Bike / Connecting actions of effective change**' _ Map : main phases and link to others systems poles.*

The Pole A2 '**Cargo-Tram/ Connecting actions of effective change**' assumes for the following phases:

- **Pick Up**: A connection with the system '**New Street Appliance / Promoting Radar**' (Polo A / object) **Access Point _ Collector Totem** allows the presence on the tram docks of controlled access Storage units for the picking up of the purchased goods. This access points that works all day long are distributed along the Tram railways circuit and the user can choose freely the preferred dock for the picking up of his purchase (Figure 11).

The **product concept** is: a Tram dock equipped with a Pick Up Units area for the customers, an Exchange area for the modules containers accessible by the Cargo-Bike for the door to door delivery and by the Cargo-Retail for the itinerant showcase modules.

The **service concept** is: a web application for the access to the storage units by a secure code sent to the user. A personal card will be also available to easily access to the units interface to improve the user experience.

The storage unit became a place where the user cannot only pick up the goods but also storage items to be shared connecting with the system '**New Domestic Appliance / Solidarity Colony**' (Polo B / place) '**domestic sharing _ The Library of Things**'.

- **Evaluation** and **Review**: The system operates in order to enhancing the valuations stage and wants to collect advices for a real involvement and continuous upgrade of the delivery and purchase offer. Also the goods will be monitored directly by the user that is informed about quality and supply chain of the products sold by the Cargo Tram and Cargo Retail that are both part of a travelling market. Evaluation and Reviews are verified and made public.

The Cargo-Tram is provided of a 'Stock Exchange List' that can be consulted online and offline on the Tram vehicle and on the Dock/storage units. This **service concept** makes public the real satisfaction and quality of the delivery service and of the purchased goods.

The Pole B '**Cargo-Retail / Vital strategies rooted inside territories**' assumes the following phases:

- **Monitoring**: By the design of a mobile application the user can localize the Cargo-Retail, checking its path, visualize the estimated time of arrival to the next stop and where it is. With the connection to the system '**New Domestic Appliance / Solidarity Colony**' (Polo B / place) '**domestic sharing _ The Library of Things**' the user can request/book as group of users a specific neighbourhood sale.
- **Choice**: Inside the same concept mobile application is available a virtual showcase where all the available goods are shown provided of all the related

information. By his personal profile the user can access to a special selection of goods, see all the ones available and can create a list of his favourite products. These products can be purchased by using the Cargo-Retail or can request a delivery on the storage units provided by the Cargo-Tram or can ask for a neighbourhood delivery by the Cargo-Bike.

This formula, connected to the System '**New Domestic Appliance / Solidarity Colony**' (Polo A / object) '**domestic sharing _ Biorhythm of purchases**' can increase/preserve local manufacturing small series of products because it can ensure not only the purchase but also a distribution network that helps the delivery and pick up.



*Figure 11: System '**New Way for a Sustainable Growth**' for the scenario |E| 'Electric goods mobility'_ Pole A2 '**Cargo-Tram / Connecting actions of effective change**' _ Diagram : concept main phases.*

5. The macro-system |C|A|S|E| : designing a system needs to be systemic and complex.

In the system setting it is necessary to operate with systemic and therefore process logics in order to guarantee vitality in maintaining quality ('manifest of shared values' as a profound sense of working for economic growth that is an improvement in the quality of life and in compliance with logics of environmental sustainability) and actions ('rules of the game' or ways of operating respectfully and enabling) in the design intervention of products and services whose role is to be an activator node of good relational practices so that the technological innovation they bring can emerge as fertile for further creative processes of change of reality.

The system in mimesis with living organisms is endowed with further self-regulation processes aimed at achieving macro-values and economic growth, aware that the value of goods must guarantee the prosperity of civilization, or through the material culture of which they are brought, to be a vehicle of democracy and aggregation for the new polis.

The material culture in turn operates with principles of complexity, and therefore logical promoters that apparently can be excluded (the requests of the user / consumer, those of the B2B and B2C Transport, those of the B2B and B2C logistics) but which if put in dialogue or if designed as a single system, on the contrary, they are interrelated and from the experience of use they articulate a real coexistence and growth.

In the macro-system | C | A | S | E | we have declined the complexities through experiential practices aimed at a continuous reflection on that triad me-we-them which we cannot as a human condition regardless of as it simultaneously needs a strengthening of the peculiarities of the individual, the recognition of belonging to a group of peers, and of the leakage as an opening to the differences of what is other. The community dimension as the competence to think about oneself in all three possibilities.

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Acknowledgements: |C|A|S|E| Goods Mobility is a research activity developed with Systems Design students of the 1° year of MA degree in Systems Design ISIAROMADESIGN of both addresses: Services & Products Design, and Communication, in twelve weeks from March to May 2017.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Activist Activated: Efficacies of AR Political Poster Design

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Abstract | The social awareness poster is an artifact (or an artful-fact) of a singular cultural and political moment. These art objects become the graphic legacies of human history. In retrospect, they are visual souvenirs, functioning to highlight the zeitgeists, passions, and hopes of past generations. These objects of persuasion evolve alongside technological advances just as new methods of digital storytelling shape the formal qualities of communication design. As the politically fraught present endures calcifying party binaries and civic apathy, is there an opportunity for social awareness posters to activate a viewer? This paper investigates augmented reality (AR) as a mechanism for re-engagement. The magic and delight of an augmented poster can inspire both physical and intellectual re-engagement, combating "compassion fade," or the tendency for societal concern to decrease in the face of inundating depictions of tragedy. With AR posters, the space of activation expands beyond 2.5 seconds of 1 static spectatorship, into an inclusive and performative experience in which viewers are invited to participate. A viewer is asked to activate, engage, play with, and share the message. This whimsy invites delight, allowing messages to slip past erected barriers of pessimism and apathy.

Redefining the bounds of activist poster design is particularly necessary in the current political climate. Engaging an apathetic populace requires a venture into those spaces contemporary civilians occupy. More than just brick and mortar, these spaces are digital, liminal. As screens interface and mediate our identities, becoming so called third "eyes," so too should contemporary political posters exist: between the real and the projected—the phantasmagoric.

This is where the most effective engagement can occur, high in potential for the activist designer: the AR-augmented political posters occupy a digital and physical ecology. During the 2011 Egyptian revolution, for example, Twitter hashtags were used as both graffiti—spray painted on the walls of the city-in-revolt, a physical record in Cairo—and as portals to online forums (Twitter, Facebook), which then called for action in the streets (a positive feedback loop) of gathering activists to campaign and spread ideas on foot (their hashtags literally

meant “tweet the streets”). This was a culturally and time-specific development of new practices in activist communication which combined new media (social media) with the classic repertoire of street level agitation. Just because Twitter or Facebook or cellphones were in everyone’s pockets is not why Egyptians used them, however; but rather, these tools are a reflection of the specific culture of these new political movements (artefacts of a 21st century corporate phenomenology) and of their “popular” character and majoritarian ambitions.
For sustained political engagement and healthy discourse, a combination of physical-digital tactics seems most effective. Political posters that activate a viewer with AR connect the digital to the body, through the use of an augmented eye. Interaction becomes the key, shifting viewers out of dogmatic and stymied positionings. This paper will look at commercial AR campaigns as well as international physical-digital political activism.

KEYWORDS | AR, POLITICAL DESIGN, ACTIVISM, POSTER DESIGN, DIGITAL AND PHYSICAL ECOLOGIES

1. Introduction

The social awareness poster is an artifact (or an artful-fact) of a singular cultural and political moment. These art objects become the graphic legacies of human history. In retrospect, they are visual souvenirs, functioning to highlight the zeitgeists, passions, and hopes of past generations.

As a political artefact, the social awareness poster is an art form that persuades. The infamous 1977 Milton Glaser “I <3 NY” poster, for example, was created to increase tourism for the state of New York.[i] The simple design is a monotype rebus featuring a red heart symbol, all locked up in a gridded square: “I (heart) NY.” Now in the Museum of Modern Art’s permanent collection, the poster did so well for the New York State Department of Economic Development that New York City adopted it as it’s branding. Years later, in 2001, Glaser reworked the original design. The designer added a small, charred blemish to the bottom left corner of the heart and new text (“MORE THAN EVER”) below the original rebus. “This was my reaction to the events of September 11, 2001,” describes Glaser. “The only subtlety is the wound, which is located on the lower "west side" of the heart. The shaded portion represented the very area in lower Manhattan where the once proud World Trade Center Twin Towers stood until a pair of hijacked passenger jets slammed into them. Showing a wounded heart is important. To attain healing, the first thing one must do is to acknowledge that there is pain.”[ii] Glaser’s original design may be one of the most well-known designs in the United States, as well as one of the most plagiarized, as you’d be hard-pressed to walk through Times Square and not see the design printed on t-shirts, tote bags, and souvenir mugs.[iii] [iv] The power of this updated piece, then, is in its homage to its 1977 self. The 2001 design asks a viewer to participate in remembering the narrative of a

collective past: to recall what the heart in the 1977 design looked like, unblemished. Using symbolic powers of graphic metonymy, Glaser also persuasively reminds viewers what New York City looked like, pre-September 11th.

This poster is both an artful-fact of collective trauma as well as a rallying cry for solidarity in the face of terrorism. It's effectiveness relies on a kind of interactivity. Although the viewer is prompted to engage sans high-tech interface, the efficacy of Glaser's design prompts the question of how new technologies could augment the medium of political poster design. This article outlines the genre's formal qualities as well as surveys the history of iconic designs. Methodologically, bringing phenomenological theory to bear on the history of street art and poster design will provide a compelling lense through which the design of protest posters can be examined. Finally, this article will examine the landscape of experiential design and digital ecologies (UX and IU) and their application to the poster design in the 21st century, unpacking how new developments in interactive technologies augment the power of the social-political poster.

The political poster is a powerful means of fostering interaction and engagement. Combating civic apathy is important for democracy to function; the social awareness poster can energize citizens to participate in democratic life. As the politically fraught present endures in the United States, with calcifying party binaries and civic apathy, the political-poster-as-art-object has the opportunity to upgrade its tactics of persuasion, maximizing those magical moments of interactivity with new and interactive technologies.

2. Historic Review

Socio-political poster design has always held a mirror up to history. Back in 1972, Andy Warhol was commissioned to create a poster for Democratic presidential candidate, George McGovern. What Warhol actually made didn't depict McGovern at all. Instead, the "Vote McGovern" poster showed the sickly, snake-green skinned, diabolically orange-eyed incumbent candidate Richard Nixon. Just like in Warhol's *Marilyn Monroe* or *Mao* silkscreens, Warhol sourced a popular, media-approved portrait of Nixon to use as his base. Warhol's color alterations, however, completely transform the visage into a disturbing commentary on Nixon's unsavory character. Visually confronted by the prospect of the alternative, one could only be compelled to do what the poster insisted—"Vote McGovern."[v] Design Director and founder of Thirst, Rick Valicenti, writes in Graphis' *2020 Poster Annual,* "throughout time, posters stand as enduring reflections of the moment they were designed." Despite predictions that printed materials would perish in the digital age, the printed political poster has not disappeared. Elizabeth Resnick, curator of such comprehensive poster exhibitions as *Art of the Poster* (1999), *The Graphic Imperative: International Posters of Peace, Social Justice and The Environment* (2005), and *Graphic Advocacy: International Posters for the Digital Age: 2001–2012* (2012), states that "the

poster in all its forms has persisted as a vehicle for the public dissemination of ideas, information and opinion."

From the 2008 presidential campaign of Barack Obama to the Women's March of 2017, printed social awareness posters have been actively used. One such design, the 2008 "HOPE" poster by designer and street artist Shephard Fairey, is as emblematic as Warhol's *Vote McGovern*. The piece, which features a highly stylized version of presidential candidate Barack Obama's upward-turned face is rendered in three distinct and high chroma colors on a light stone-colored foundation: light blue, dark blue, and red. The cool palette of the historically Democratic Left casts its hue on the left side of Obama's face while the right side's vibrant red is of the Republican Right. That said, Fairey does a clever job extending the colors of the polarized parties into the opposite side of Obama's visage. Red lines outline the left ear and jawline, for example, as well as help delineate the left brow, eye, nostril, lips and neck. The dark blue does the same work on the right. Through the metaphor of color, there is a sense that the binary between Republican and Democrat is not so divided, and in fact one needs the other in order to define a larger whole.

Referencing the abstraction of certain printmaking processes, Fairey uses a color block in dark blue to key the image. This dark blue contains most of the structural elements of the design and thus serving as a "key" for the placement of the other two colors. In this way, Fairey delineates the man in the portrait as inherently blue, Democratic, but hints at a less polarized future with the inclusivity of red on both sides (and vice versa). This could allude to Obama's potential to alleviate feelings of political amity and alienation, feelings that had increased since 2004.[vi]

Beyond party representation, the use of color plays an even more significant role in this piece. According to the National Portrait Gallery's exhibit featuring the work, the design "forged an unprecedented and powerful icon for Obama's historic campaign."[vii] This work symbolizes the first African-American president's career in the Oval Office, in colors that transcend skin tone. These simple, yet powerful, design choices created a piece that became the rallying cry for what political future could look like.

Aesthetically, the posters of Shephard Fairey do not stray far from such iconic designs as 1924 Russian Constructivist poster *Books (Please)! In All Branches of Knowledge* by Alexander Rodchenko, or J. Howard Miller's *We Can Do It!* from the early 1930s. Both utilize dynamic diagonal lines and intense, yet simple, color palettes. They also rely on a heavy stroke weight to control the movement of a viewer's eye. If there is a palette for politics, these posters have it: reds, blacks, creams, and blues. In political poster design, an artist relies on symbolism that is abundant in the culture with whom they wish to communicate. For example, Alfred Leete's WWI image of the British war hero Lord Kitchener wagging his guilt-inducing finger at potential 1914 recruits is reused by both Dmitry Moor and James Montgomery Flagg in a USSR propaganda piece and the infamous "Uncle Sam Wants You!" work, respectively. These posters, in turn, do not look so different from the 19th century Parisian lithographic and illustrative advertisements by Henri de Toulouse-Lautrec, Jules

Chéret, Alphonse Mucha, etc; work that gave birth to the modern poster. Through these examples, it is easy to track how symbolic visual language bold typography has persisted through the ages of political poster design. The visual legacy of the printed poster is long and rich. There is little doubt that the medium, as Elizabeth Resnik predicted, will persist.

3. Phenomenological Artefacts

Bernard Canniffe, Chair of Graphic Design at Iowa State University, describes how "every day we are reminded that politicians are either incapable or unwilling to meet...global challenges," and that "the design profession and design education must work together to address and resolve this imbalance or else we are designing ourselves into an uncertain and fragile future." "Design conformity and the superficiality of design is as strong today as they were in 1971. We have to stand up for what we believe in, and protest what we know to be wrong."[viii] To understand how this works, it is helpful to turn to phenomenology as a theory of how we engage with our visual environment.

The political poster acts as a social responder, engaging with and from a specific moment in time. Poster and propaganda design are the artefacts of a corporate phenomenology, the products of a self-revealing reality. Martin Heidegger describes Phenomenology as "the process of letting things manifest themselves." Unpacking the term, Heidegger emphasizes an inner relationship between the root "phenomenon" and "logos," where "phenomenon" means a "kind of showing" and "Logos" means a "letting be seen."[ix] This theory enables people to see clearly something that is right before their eyes but obscured; things that are so taken for granted that they are muted by abstract observation. The first aim of phenomenology is to reawaken a sense of wonder about one's environment. Shepherd Fairy describes the goal of his work as attempting "to stimulate curiosity and bring people to question both the sticker and their relationship with their surroundings."

The political poster functions within this space in two senses. First, the power of the medium's instant, visual language can provoke a certain type of looking. According to Steven Heller, former art director of the New York Times and author of *Design Literacy* and *Art Against War*, the value of a poster is that it provides "the opportunity to see things more iconically." This is the rapid digestion of messages, of form and color and type, that activate the eye and revitalize the viewer's perception and attention to detail.

In the second sense, the very physical location, installation site, or material application of the poster motivates a "letting be seen" experience within the viewer. The political poster can stimulate curiosity and bring people to question both the print and the relationship the artwork has with its surroundings. This then prompts a viewer to also begin to "let be seen" the environment and ecology of images and messages they, themselves inhabit.

So, to use Fairey's "HOPE" poster as an example of the phenomenology of engaging with the political poster, the use of color, referencing both mainstream political parties, discloses not

only the possibility of a political candidate who might overcome both political and racial divisions but the strong *desire* for such a candidate. The very concrete placement of these posters, on a street level, discloses that one participates in a shared desire, energizing and encouraging political participation in a public and shared space. To better understand this context, in the next section we turn to the formal genre of street art.

4. Street Art

Shepherd Fairey has been "manufacturing quality dissent since 1989."[x] The abstracted and vector-simplified pieces, such as Andre the Giant or the OBEY type lockup, are designed and installed on the streets in order to "make you look and question."[xi] It is no coincidence that the venn diagram of social advocacy designers overlaps with that of street artists. Political activism has always been a kind of disruption: the moment that formal architectures or sanctioned messages are ruptured, fractured, silenced, or remixed with the use of rebellious posters, stickers, signage, and graffiti. Street artists like Banksy, Shepherd Fairey, Hanksy, and Grapus create a dialogue between political structures and the voice of the individual.

5. Experiential Design for Engagement

Increasingly, Americans possess feelings of cultural and political polarization between strict party lines. According to recent socio-political scholarship, this polarization has led to mutual feelings of alienation and enmity.[xii] Political gridlock has been present for three close elections in the United States: 2000, 2004 and 2016. Coinciding with toxic partisanship is also an over-saturation of visual imagery. According to *Eye on Design* op-ed writer Lilly Smith, US citizens are today "bombarded by political pundits, email blasts, polls and pollsters, and targeted TV and online ads," She goes on to argue that "distilling what each candidate's policies and motives are so we can confidently check that box come November, can be difficult if not downright confusing."[xiii] "Today, Twitter has more than three hundred million users, and two out of three Americans own smartphones," wrote Jill Lepore in a recent article in *The New Yorker*.[xiv] *The New Yorker* also reported that TikTok, the popular short-video app where users repurpose reality into ironic, bite-size content, has over 500 million users.[xv] So, in the age of social media instant-streams, how does the poster exist in a world where we look down at a screen for information instead of up?

Experiential design, specifically new participatory technologies such as augmented reality (AR), can be a mechanism for *re*-engaging the apathetic, the uninterested, or the burned-out. Augmented Reality is the increasingly popular technological technique of viewing the world through a device (like an iPhone camera, or the Microsoft HoloLens), which overlays additional, digital information, images, text, etc. on top of the "real" world view. Additional examples come in the form of Snapchat filters, TikTok meme filters, or the addictive VR scavenger hunt game, Pokémon Go! All of these are augmented reality. Interactive posters,

paradigmatically ones that utilize AR, could shake apathy and politicization within our technological and political milieu of the 21st century.

There is an opportunity, with the affordances of new technology, to re-engage with the needs and desires of people who are today over-saturated with visual imagery. Design must not just get someone's attention, but also maintain it long enough for the message to sink in. With the digital and physical ecology of an augmented yet physical poster, a user's phone habits are exploited to make information retrieval a less isolated, more public and participatory endeavor (in the same way that Pokémon Go transformed phone games into a massive, participatory exercise). The magic and delight of augmented posters can inspire both physical and intellectual agency, combating "compassion fade," or the tendency for societal concern to decrease in the face of depictions of tragedy.[xvi] Compassion fade is a documented issue, initially published in the Journal of Judgment and Decision Making, by Ezra M. Markowitz in 2013. Compassion fade occurs when: "compassion shown towards victims often decreases as the number of individuals in need of aid increases, identifiability of the victims decreases, and the proportion of victims helped shrinks. Such "compassion fade" may hamper individual-level and collective responses to pressing large-scale crises." These findings suggest that compassion fade may challenge our collective ability and willingness to confront the major environmental problems we face, including things such as political corruption. Instead, what we do is moderate—thinking, well, I am really commitment to the cause, I liked all my friend's articles they shared about impeachment, etc.—this only further indicates, though, that compassion fade may present a significant psychological barrier to building broad public support for addressing these problems.

With AR posters, however, the space of activation expands beyond 2.5 seconds of static spectatorship to an inclusive and performative experience, in which viewers are invited to participate. Messages can thus slip past barriers of pessimism and apathy, shifting a person out of stymied positions.

The lens of the camera is our third eye, through which we immortalize our vacations, our puppies, our outfits of the day, our selfies. As Sontag writes in *On Photography*, "the photographic enterprise [is] the very creation of a duplicate world, of a reality in the second degree, narrower but more dramatic than the one perceived by natural vision."[xvii] When we use both ours and our third eye we enter the space of augmented surreality, and I propose that this space is rife with wonder, and ripe for activism.

AR works so well because humans have acclimated to viewing the "real" through the "mediated" lens of a camera and taking it as truth. Basically, since Niepce and Talbot and Daguerre invented photography, people believed what the lens portrayed.

Our eyes connect to the lens' eye, but without losing the body in pure spectatorship because we are forced to compare the discrepancy in the multiple visions. AR offers, then, not only offers the opportunity for play and whimsy, physical interactions and delights that engage

and erode the barriers of “compassion-faded” pessimism and apathy, but also asks us to look critically, to take note, to stay in the experience another second longer.

Interactive posters, paradigmatically ones that utilize AR, could shake apathy and politicization within our technological and political milieu of the 21st century.

6. Digital and Physical Ecologies

This is where the most effective engagement can occur, high in potential for the activist designer: the AR-augmented political posters occupy a digital *and* physical ecology.

A great example of this is captured in Paolo Gerbaudo’s recent book *Tweets and the streets: Social media and contemporary activism*, wherein he writes about the Egyptian protests of 2011. During the revolution, Twitter hashtags were used as both graffiti—spray painted on the walls of the city-in-revolt, a physical record in Cairo—and as portals to online forums (Twitter, Facebook), which then called for action in the streets (a positive feedback loop) of gathering activists to campaign and spread ideas on foot (their hashtags literally meant “tweet the streets”). This was a culturally and time-specific development of new practices in activist communication which combined new media (social media) with the classic repertoire of street level agitation. Gerbaudo also argues that this shift away from networking, the function hashtags have typically had, to one of “aggregation,” specifically political agitation, is not simply a consequence of new technical tools. Just because Twitter or Facebook or cellphones were in everyone’s pockets is not why Egyptians used them, but rather because these tools are a reflection of the specific culture of these new political movements (artefacts of a 21st century corporate phenomenology) and of their “popular” character and majoritarian ambitions.

It wasn’t just digital, it wasn’t just printed, this was a new choreography of the phantasmagoric and the real.

This 2011 graffiti from Cairo is incomplete, then. As is, it is a pun on Gil Scott-Heron’s famous song-title ‘The Revolution Will Not be Televised,’ with the last verse concluding ‘it will be live.’ What the sentiment of this graffiti condemns is exclusively online forms of engagement that are “often derided as insincere, low-cost, or trivial,” aka slacktivism. In Facebook nomenclature: “Liking” the revolution.

Augmented Reality, on the other hand remains grounded in a tradition of print, it “reads” and depends upon printed material, but requires engagement throughout. The above should actually say: “the revolution will be interactive, all media, and it will consume us.”

Another great example is street artist Escif, a native of Valencia, Spain, who has worked for over two decades to execute graffiti interventions, and recently deployed an AR interventions at the last year with this Kiki Smith sculpture. He says, “I like the way that augmented reality gives the chance to add some new shapes to reality, as graffiti does,

without any authorization needed," he explains. "Although technology can be a big limitation for expression, it also gives us some new tools for freedom."

While AR is a trendy technology with which to engage, right now, it is already emerging in numerous industries, including healthcare, education, advertising, navigation, and so many more. And, of course, it will continue to do so as it becomes more accessible. In recent years, AR has changed from a hobby for the tech-savvy into big business. And as the trend with almost all technology, democratization to the layman isn't far off. At that point, it will fall into the hands of revolutionaries. After all, activist poster design and street art have long been a way to interrupt our surroundings with the unexpected.

7. Applications

Advertising has made sure to capitalize on the connection between AR poster design and audience activation. Facebook, for example, has incorporated AR technology into its set of tools with which brands engage users. According to Adweek, Facebook's approach to AR allows users to "try on" products for the purposes of e-commerce.[xviii] This capitalizes on a growing interest with AR within the marketing landscape. According to eMarketer forecasts, 68.7 million people will use AR at least once a month in 2019, and that number could grow to 77.7 million by 2020.[xix]

One aggressively strategic example of this was implemented by Burger King in 2019. Capitalizing on pre-existing ad campaigns from its main competition, the Burger King app could be pointed at a McDonald's advert to "burn" it, revealing a free Whopper voucher underneath. The feature became a viral sensation, recently winning a Cannes Lion.[xx]

The London-based graphic design studio, Omse, also used AR in a 2020 poster exhibition to promote the design and release of its newly minted typeface, Gattica. Called *Agenda 2020,* the exhibit explored "the graphic possibilities enabled by emerging technology—from variable fonts to augmented reality," and showcased augmented poster designs filled with typography.[xxi] The explorations of expanded space and time asked viewers to question the future of static design elements, such as letterforms. In a move not too dissimilar from Facebooks AR marketing, Omse used AR to allow attendees to see their new typeface design alive and out in the world, like a living type specimen book. Taking a more speculative approach, another pop-up poster exhibit called *Walkie Talkie* in Vienna, also leveraged AR to call attention to forms of communication in liminal spaces.[xxii] The exhibit housed AR poster designs that prompted a gallery-goer to ask how AR fostered a new medium of communication. What these exhibition examples have in common is how AR makes it possible to immerse an audience in a different world, one in which the laws of physics can be turned upside down. These strange new spaces prompt the question: what are the opportunities and challenges for AR in storytelling, art production, and communication?

A final example of contemporary applications, one that shifts the most dramatically away from the realm of marketing, placing AR poster design within the space of civic activation is the collaborative and multi-platform design project called “Ongoing Matter (2019–2020) by Anne H. Berry and Sarah Edmands Martin. A traveling, multi-platform collection of new poster designs, the AR poster exhibit activates static posters in order to mobilize political engagement with the *Report On The Investigation Into Russian Interference In The 2016 Presidential Election*, or as it is more colloquially known, *The Mueller Report*. The goal of the work is, ultimately, to make *The Mueller Report* more accessible to a wider audience, and subsequently facilitate increased engagement with its findings. Consisting of a series of between twenty and thirty posters, the designs illuminate the major threats to democracy as cited in *The Mueller Report*. The collection is currently traveling around the United States, accompanying a digital platform showcasing the artwork.

8. Conclusion

Inheriting the spirit of activist street art, AR poster designs re-engage with the needs and desires of a culture over saturated with visual imagery. A combination of physical-digital tactics, like in AR, could be most effective for sustained political engagement and that healthy discourse.

These objects of persuasion evolve alongside technological advances to shape the formal qualities of communication design. As the politically fraught present endures calcifying party binaries and civic apathy, is there an opportunity for social awareness posters to activate a viewer? The magic and delight of an augmented poster can inspire both physical and intellectual re-engagement, combating “compassion fade.” A viewer is asked to activate, engage, play with, and share the message. This whimsy invites delight, allowing messages to slip past erected barriers of pessimism and apathy.

Redefining the bounds of activist poster design is particularly necessary in the current political climate. As discussed via commercial AR campaigns as well as pieces of physical-digital political activism, the AR poster has the opportunity to engage an apathetic populace specifically because its format requires a venture into those spaces contemporary civilians occupy. For sustained political engagement and healthy discourse, a combination of physical-digital tactics seems most effective. Political posters that activate a viewer with AR connect the digital to the body, through the use of an augmented eye. Interaction becomes the key, shifting viewers out of dogmatic and stymied positionings and into a more wondrous space.

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Author 1 add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE] [_DCs Author Bio and Acknowledgements]

Author 2 add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE]

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Art, Design, and Mathematics: Software programming as artifice in the creative process

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Abstract | This article seeks to address the creative qualities of programming in an artistic context. When questioning the limitations of graphical interfaces, we can reflect on the contribution of Programming as a resource to go deeper into a creative process in the context of digital media, robotics, interactivity, generativity and other possibilities. A exploratory research study was conducted through interviews with laboratory coordinators from educational institutions in Rio de Janeiro, who have been exploring the possibilities between Art and Technology for at least a decade. Among the main findings that mark the creative process are experimentation and multidisciplinarity. Distaste for Mathematics appears as the main barrier to the insertion of Programming in an artistic context.

KEYWORDS | MEDIA ART, DIGITAL ART, DESIGN, ART, PROGRAMMING

1. Introduction

1.1 Creative Coding: Art and Technique

A fundamental part in the transformation of an increasingly technological society (Figure 1), Programming allows describing and executing tasks on computers, its use is widespread for functional and deterministic purposes.

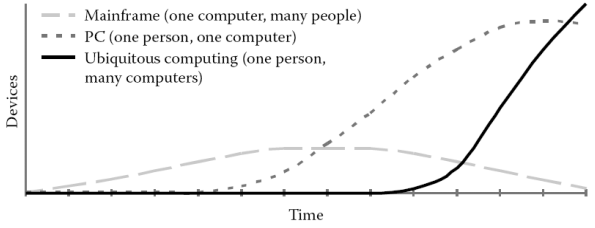

Figure 1. The three modern computing eras (source: Krumm, 2010) illustrates how computers are becoming smaller and more present in our lives.

The use of Programming in an artistic context proposes another purpose. Creative Coding "is not a tool; it is a new way of expressing yourself." (Maeda, 2004, p. 113), in the work that possibly coined the term, in the book "Creative Code". By placing artistic expression at the center of Creative Coding, Maeda distinguishes it from traditional programming.

By writing codes, enabling the creation of one's own tools, it is possible to expand and democratize the design practice, "Conferring (re)designability to technology expands Design. It brings forth a culture that is increasingly understood as co-constitutive and driven by design practice" (Krippendorff, 2000, p.90).

Since the late 1960s, artists and scientists have sought to break the creative limits that emerged with the arrival of computers. According to Oakim (2018), the first visual experiments were generated through a computer by mathematician Frieder Nake, arousing curiosity in the artistic and academic community.

The exploratory proposal of this article analyzes how Programming fits into the creative process and what challenges are encountered in the learning process. Four researchers were interviewed in search of the creative qualities found in the dichotomy between art and technology, concepts that were not always distant from each other:

> "We know, for example, that the Greek word *téchne*, from which technology derives, refers to any and all productive practices and even included artistic production. The Greeks made no distinctions of principle between art and technique, and this assumption went through much of the history of Western culture, until at least the Renaissance (Dufrenne, 1980, p. 165). For a man like Leonardo da Vinci, painting a canvas, studying human anatomy or Euclidean geometry and designing the technical scheme of a machine constituted a single intellectual activity" (Machado, 2001, p.24)

1.2 Interfaces and hidden codes

With the popularization of graphical interfaces in the 1980s, artists moved away from coding, but with the emergence of open-source culture, the community created its own tools that facilitate the learning of coding in an artistic context, such as Processing[1], enabling creative coders to go beyond the limitations of closed source software and its interfaces.

When observing the transformations caused by computers in the practice of Design, Kripperndorff (2000) analyzes the emergence of these graphical interfaces:

> "Personal computers led to the following paradigm: interfaces. Similarities to languages, interactivity, internalized experiences and the possibility of self-teaching made the interfaces not explainable in psychological, ergonomic and semiotic terms, making the language of functionalism, consumer preferences and aesthetic appeals obsolete. Interfaces are processes, they decomposed the artifacts into interactive sequences." (Krippendorff, 2000, p.89)

The techniques used in Creative Coding require different levels of knowledge, when relating to Programming, each problem becomes a possibility to broaden the understanding of how the software (read Black Box) works. Flusser (2011) analyzes the Black Box phenomenon in the context of the camera, here it can be understood as any element whose functioning is obscure, as such the interfaces:

> "Once acquired, the camera will turn out to be a curious toy. Although it rests on complex scientific theories and sophisticated techniques, it is very easy to manipulate. The device proposes a structurally complex game, but functionally simple. A game that is the opposite to chess, which is structurally simple, but functionally complex: it is easy to learn its rules, but difficult to play well. Anyone who has the "latest model" camera can shoot "well" without knowing what is going on inside the camera. Black box." (Flusser, 2011, p.78)

Being in front of an image editing software distributed by the major software manufacturers, despite allowing a varied range of results, does not contribute to the understanding of how the technique used in the software can be remodeled to enable a new creative bias, these software solutions are made available "closed", the codes are not accessible, protected by the interests of intellectual property.

The work of Gilbert Simondon was also considered, a French philosopher who developed a system of thinking about invention and technical objects. Simondon "does not only aim at the technical dimension of human life, it defines life within the technical dimension" (Camelozi, 2015, p. 446). If we connect the technological obscurity denounced by Flusser

[1] Processing, ambient for Creative Coders, created in 2001. Retrieved January 23, 2020, from https://processing.org/

and his ability to question the automation of consumption of these devices (interfaces), we find in Simondon's work a way to decompose technical objects into layers:

1. External layer: appearance, how the object manifests itself socially.
2. Intermediate layer: utilization, compatibility between the object, the medium and the operator.
3. Internal layer: functional core, intrinsic compatibility that the object is capable of producing, making natural resources (energy) compatible with the objective.

Therefore, when questioning closed source tools and their interfaces, we can reflect on the contribution of Programming as a resource to go deeper into the creative process, in the context of digital media, robotics, interactivity, generativity and other possibilities.

2. Method

An exploratory research was conducted through interviews with laboratory coordinators from educational institutions in Rio de Janeiro, who have been exploring the possibilities between Art and Technology for at least a decade. The interviews were conducted through a semi-structured script containing 17 questions, oral recording procedures were adopted and later transcribed. Discourse analysis (Vergara, 2010) was used to present the different views of the interviewees.

The four interviewees (Table 1) authorized their nominations, they can be classified as qualified informants according to their academic trajectory, representativeness in the national and international scene, and historical contribution in Art and Technology. The beginning of Computer Graphics and Digital Art in Brazil is intertwined with the heterogeneous trajectory of these researchers.

Table 1. Interviewees organized by order of interview.

Name	Academic Title	Laboratory
João Bonelli	PhD in Design at the Pontifical Catholic University of Rio de Janeiro	LIFE: Laboratory of Physical and Experimental Interfaces
Carlos Nóbrega	Postdoc in Art and Technology at the University of Brasilia	NANO: Nucleus of Art and New Organisms
Rejane Spitz	Postdoc in Electronic Art at the University of California	LAE: Laboratory of Electronic Art
Luiz Velho	PhD in Computer Science from the University of Toronto	VISGRAF: Vision and Graphic Laboratory

The first three interviewees went through the entire script, offered valuable contributions and indicated the way to investigate Mathematics as a challenge for inserting Programming into the artistic context, an aspect discussed more specifically with the fourth interviewee, Luiz Velho.

3. Interviews

3.1 About the Interviewees

The interviewees' academic trajectories were represented by a timeline (Figure 2) built from the facts highlighted in the interviews and the academic milestones listed in Lattes Platform (Virtual Resume System).

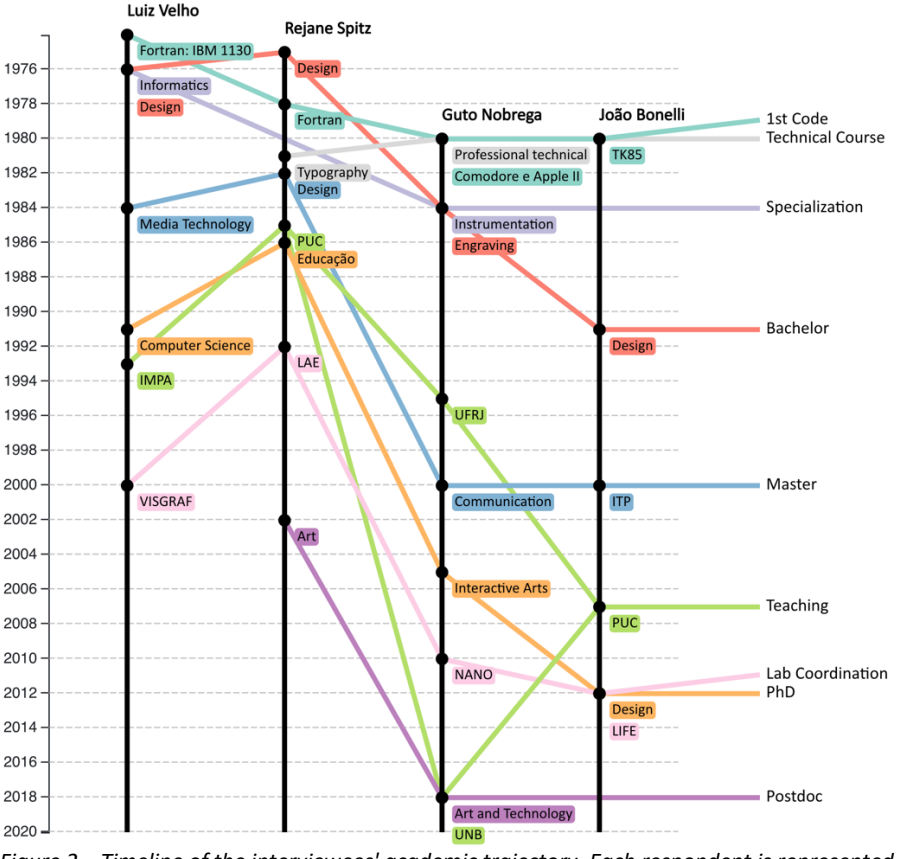

Figure 2. Timeline of the interviewees' academic trajectory. Each respondent is represented by the vertical line, points highlight the milestones of their trajectories. The landmarks were grouped by lines that cross the chart on the horizontal axis, identified on the right side of the chart.

Respondents were asked "when was your first contact with Programming?". The answers varied between childhood and the beginning of graduation, where two of the interviewees reported handling punched cards with Fortran language.

3.2 Creative process

The following question was asked: "how do you observe the creative process?". For Spitz (2019), creativity is related to the need for survival, “actions that are caused by curiosity”:

> “Creative processes are the result of an individual effort caused by curiosity. Anything is a creative process, as long as someone is looking to know, create or build. I think the creative process is being given a lot of value, it is being highly valued. (...) Creativity is caused by the need for survival. You have to be creative to survive, regardless of anything. Survival depends on curiosity that leads to creative processes. We are creative in absolutely everything, in the way of reproducing, feeding, dreaming, swimming and all these were human creations for survival.” (Spitz, 2019)

Bonelli (2019) observes the creative process through experimentation:

> “It is the process of doing something, reflecting on what you did, evaluating, and then doing something else based on these reflections, evaluating and doing something and something else (...) It is not planning and having something in the end, as if in the first day of the project you knew exactly where you were going to go, but doing several experiments and seeing your work evolve after each experiment, until you reach the final result. Constantly re-evaluating your results and objectives. We propose seeing the Design process not as a straight line from A to B, but as a spiral, circular shape, where you arrive at the center, which is your goal, through development and experimentation.” (Bonelli, 2019)

Drawing is in the base of Nóbrega's creative process (2019):

> “Usually, people consider the best drawing the one that most effectively represents the thing being observed. The problem is: what is representation, what does it mean to represent something more effectively, because of visual similarity or because it brings information about that thing? You can have extremely simple, delicate drawings that differ from classic drawings, and that are extremely powerful in describing the sensations produced by the thing in question. Great masters, for example, sometimes take a line, a dash, and it takes us directly to their time, 500 years ago, 200 years ago, and you will feel as if you have been transported by that image. So, what is the potency of that image? The idea is to use drawing as a tool for discovering and modulating your own identity, at that moment and in that space.” (Nóbrega, 2019)

According to Nóbrega (2019), among the various aspects that imply the creative process, there is “awareness of an altered state” in a validated reality, one of the 3 realities defined by Ascott (2000). Nóbrega (2019) describes validated reality as:

> “Consensus reality, which has a number of issues that are consensual, i.e., it exists because there is a belief, like believing I am here talking to you, and if that belief fails, we stop talking. Reality is not something given a priori, if you start thinking about it, a very wide range of possibilities opens up. So for me, this is the matter in the creative process. The difficulty in creativity is just when you limit the speculative and exploratory aspect of the situation. Of course you master certain aspects, it is important, you will not be making contributions in areas you are not deeply experienced. Within this limit, you try to expand as much as possible with variables, which can bring some freshness to that.” (Nóbrega, 2019)

3.3 Programming and creative process

Then the following questions asked "How do interviewees see the role of Programming in the creative process?". Nóbrega (2019) analyzes Programming as Art by itself:

> “I believe programming is expanded when it occurs within a certain system; it is connected, and it connects the system with the whole. It becomes participatory, and several projection mechanisms start to act there, I imagine. You are programming, you are creating something that will be alive there. I think you can think of it as a process of invention. Gilbert Simondon says it is only possible to invent something because there is synergy between your mental state and the thing being created, that is, there is a coupling, a kind of resonance. When you think about it, you are there generating that object in a mental process, you test it and take a series of actions that promote the life of that object, even without it physically existing. So I think that this synergy, probably, should happen in programming because even with the little experience I have, what fascinates me the most is the ability to change a variable and have an extremely complex modification in the work. (...) This is inherent to Art, to the creative process, and it is important that in programming it can be incorporated to a certain extent. I think it’s like the ace in the hole, how you handle the stiffness of programming so it opens up and brings life to the system.” (Nóbrega, 2019)

From another perspective, Bonelli (2019) sees Programming as a tool capable of creating other tools:

> “It is like a pencil, a hammer or a handsaw. It is something that will help you get a result, reach a certain result, that will empower you. It is a very powerful tool, because you can build a million things with programming, including a handsaw or hammer, or you can program a robot to saw wood.” (Bonelli, 2019)

Spitz (2019) sees Programming as knowledge, a resource that, like any other piece of knowledge, is part of the creative process:

> “Any knowledge is a resource for survival. It's the only thing you carry, and knowledge cannot be shared, information can be shared, data, but knowledge is individual, is indivisible. Knowledge is contained in a given being, what he/she has learned from his/her experience, and from data and information.” (Spitz, 2019)

3.4 Teaching programming in the artistic context

Then, the interviewees were asked "How do you see programming teaching in an artistic context?". Bonelli (2019) points out the differences between teaching traditional programming and teaching programming in an artistic context:

> “We realized that in the IT department, teaching is much more based on questions of logic. They already start giving object-oriented programming right from the start. This needs a lot of abstraction from students, so that they can understand what is happening "right away". We adopt the Processing principle, a programming environment for designers, and we start teaching programming through drawings. When learning with Processing, you start by making an ellipse, a square, choosing the fill color, dealing with the coordinates on the screen. You write, you play, you do something, and not only get results very fast, you also work with a language that designers are very fluent with. Shapes and colors every designer understands.” (Bonelli, 2019)

Spitz (2019) notes that there is a willingness to join Design and Programming:

> “Teachers who work a little with programming will tell you that now the new designer has to know how to program and so on. It is not what is happening, we have very little notion of programming for someone to think that we will solve the programming problems of the world. It is a programming layer at the base of Design, it is what we are doing today, whether this is going to change or not is another question.” (Spitz, 2019)

Spitz (2019) mentions that in the 1980s there was a movement that believed it was not necessary to know how to program, after all, everything was moving towards becoming friendly, in terms of interfaces that allowed quick learning and fast results. This in fact happened, but she notes that programming is becoming more friendly as well. Spitz (2019) and Nóbrega (2019) consider the arrival of Arduino as a decisive element that promoted transformation in this sense. For Nóbrega (2019), Arduino allowed people “to leave programming focused on image and go to programming focused on physical things ”.

Nóbrega (2019) indicates that “there has been a very expressive growth, over the last few years, in terms of opening up to this universe of “hacks”, of a maker culture, that you can do things”. Access “spread via this open source culture”.

3.5 Challenge of teaching programming in the artistic context

When asked about "What are the challenges for teaching Programming in an artistic context?", Bonelli (2019) says:

> “The biggest challenge is hate for Mathematics. In our education system, students get to the university filled with rage at their teachers who tortured them. Those teachers lacked motivation, were not compensated properly, were not talented, taught Mathematics based on threats, on the blackboard. When we talk about sine and

> cosine, they ask to leave. The first thing we need to do is to deconstruct, because students reach 18 years old with their ideas shaped." (Bonelli, 2019)

Based on this reflection, there was a need to investigate the relationship between Mathematics, Programming and Art. For this, interview with Velho (2019) was carried out, where he explains the relationship between Mathematics and Programming: "The scientific basis of computing and programming is Mathematics, if you take Mathematics, this idea of algorithm, you take Newton's method, which is a classic in Mathematics, a program, an algorithm of how you are going to do something". And he points out the importance of multidisciplinary work:

> "It is not possible to work only with mathematicians or experts, it needs to be a complete multidisciplinary group. (...) Today, society is going back to the era of Renaissance, because after Renaissance, we started to have specialization, where each one mind their own business and that's it. But it wasn't like that before. It was a holistic thing. We are going back to the time of Leonardo Da Vinci, who did Art, Science, Engineering etc. The future will be like that, for that people need to change their attitudes. You can't build a multidisciplinary team with people who consider themselves traditional artists and don't want to understand how things are working." (Velho, 2019)

The importance of collaboration between disciplines is also mentioned by Spitz (2019) in the same question:

> "The only way to make things happen is to have subjects in which Informatics, Design and Art students work collaboratively. If universities were not so compartmentalized... We have some subjects given by computing professors, but it is not the same thing. A class has to have students from Informatics, Design and Arts working on collaborative projects, half-half, 50/50, not 49 and 51." (Spitz, 2019)

In this place of exchange, where subjects gets mixed and need to speak the same language, the need to understand the outlier, in this case, Mathematics, is evident. Velho (2019) talks about the contributions of Mathematics:

> "We are at a very special moment in humankind. Mathematics is the engine of innovation, and people still haven't realized that. With the internet and the evolution of media, the third industrial revolution is happening in our society, but it is not mechanical, it is intelligent, it is mathematical intelligence. The three most important things today: biomathematics, artificial intelligence and the media. And Mathematics is behind this." (Velho, 2019)

When reflecting on the challenges of learning and teaching Mathematics, Velho (2019) says:

> "Mathematics is very simple, it has two aspects: essence is the concept, and the operational aspect is the accounts. The accounts can be laborious and sometimes even complicated, but when you know the concept and you are going to do it, it is easy. It is very specialized. But the central idea of Mathematics is simple. (...) People are what makes the difference." (Velho, 2019)

4. Analysis

A curious finding, but yet inconclusive, is the early contact with programming shared by the interviewees. Even for those with higher artistic inclination, an early contact with computers and programming suggests a familiarization with the necessary techniques to dialogue with emerging technologies and, therefore, a distinguished nature during a professional, artistic and academic trajectory. Today, more and more schools are providing programming for children all over the world. These courses use tools such as Scratch[2] to teach programming logic through the creation of games, interactive stories or parametric drawings. Plans such as UNESCO's (2019) technology literacy help future generations acquire knowledge to dialogue with technological transformation in a non-passive way.

The perception of a creative process was associated with the practice of each one, whether through drawing, experimentation or multidisciplinarity. Collaboration between disciplines was recognized as a key element for innovation. Based on Simondon's ideas of invention (2008), Design, as any other discipline, goes as far as Design can go, by collaborating with other disciplines, as a result of an "amplifying dialectics", it produces "functional surplus-value" (*plus-value fonctionnelle*): This explains, therefore, why technical inventions have "superabundant functions" (*fonctions surabondantes*), because it gives an amplifying leap regarding the potential of separate objects.

Choosing between multidisciplinary training, where Programming teaching would be inserted in other courses, versus specialist training, encountered an equalizing proposal: the collaboration between courses mediated by projects, where students from different courses can share and develop their skills.

The main barrier for the insertion of Programming in an artistic context appears to be the hate for mathematics. The feeling that "students accumulate negative experiences in their learning path" (Bonelli, 2019) can be observed in the percentage of students with adequate learning in Mathematics, where there is a "considerable growth over the period of the initial years of elementary school and very low levels in the final years and high school, with stagnation/downward trend in recent years." (Todos Pela Educação, 2019, p. 24)

According to an evaluation carried out with 600,000 students from 79 countries, the challenge of stimulating the pleasant learning of Mathematics is a worldwide challenge:

> "76% of students attained Level 2 or higher in Mathematics. At a minimum, these students can interpret and recognize, without direct instructions, how a (simple) situation can be represented mathematically (e.g. comparing the total distance across two alternative routes, or converting prices into a different currency). However, in 24 countries and economies, more than 50% of students scored below this level of proficiency." (OECD, 2019, p. 15)

[2] Scratch, environment for teaching programming logic for children, created in 2015. Retrieved January 23, 2020, from https://scratch.mit.edu/

As seen in the interviews, the human element, i.e., teachers and students is yet, another decisive factor in teaching Mathematics. The Profissão Professor report (Todos pela Educação, 2018) carried out a quantitative survey of 2,160 basic education teachers from all over Brazil. Although the decisive factor for choosing a profession is the pleasure of teaching, half of the interviewed teachers answered that they would not indicate the profession to a young person, because of the "devaluation of the teacher, poor remuneration and difficulties in the routine" (Todos pela Educação, 2018, p. 15).

5. Final considerations

While graphical interfaces became more practical and more popular, so did Programming. Languages and tools were developed to facilitate learning and promote artistic expression through code.

Programming was observed as inserted in the creative process so that it solves the technical problems to make the project viable. It is marked by an experimental process, where unexpected discoveries are concatenated in the project.

The hate for Mathematics appears as a barrier to the insertion of Programming in an artistic context, where quantitative research in the Brazilian context has shown that the challenge extends itself to a precarious education system, and the main aspect of concern is the teacher. As a suggestion for other research, it might be interesting to investigate whether the same happens in other countries.

The 4 interviewees already had contact with Computers and Programming before or during the graduation in the areas of Art, Design and Mathematics, suggesting that they were more familiar and ready for the technological transformation along their learning path. It would be worth researching whether the teaching of Creative Code for young people collaborates with positive experiences in learning Mathematics.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Artificial Creativity – Hybridizing the Artificial and the Human

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Abstract | This paper focuses on the creative practices used in the field of design that integrate artificial computerized systems. It refers to the double faceted nature of design as generating both form and function. Following philosopher Luciano Floridi's analysis of human-technology-nature relationships, this paper points to different typologies of "creativity" that are now possible through the capabilities of technology that take part in the design process. It addresses creative processes grounded in machines that operate autonomously as well as through hybrid processes that combine human and machine operations. Suggesting that new emerging forms of computational creativity in design mark the transition from human to post-human design, this paper argues that the computerization and "scientification" of creativity maintain values of unpredictability, newness, and originality inherent in aesthetic creativity. Yet, it will argue, applying different parameters on creative computerised systems entails social and political values that should be analysed.

KEYWORDS | COMPUTATIONAL CREATIVITY, AUTONOMY, POST HUMAN DESIGN, HYBRIDITY, IN-BETWEENESS

1. Introduction

Creativity is perceived as one of the central buzzwords of the present era. Contemporary culture is based on rhetoric that presents creativity and innovation (a coupling concept), as preferred values. It is considered a primary condition to cope with states of instability and transience that characterize the current reality. Creativity is strongly connected to neo-liberal concepts that foster the production of an unceasing supply of commodities in order to maximize profits. It is presented as an engine for growth and as a condition for economic resilience and is a leading principle in the branding of countries and institutions, as well as individuals. Nowadays, technological developments are considered the key stimulators of creativity.

Although many definitions for the concept of creativity have been formulated over the years, no consensus has been established in relation to any of them (Robinson, 2008). The divergent definitions are often attributed to different authors and are cited in relation to their specific context. Furthermore, these definitions apply to the various aspects of this term: “Some definitions are formulated in terms of a product, such as an invention or discovery; others, in terms of a process, a kind of person, or a set of conditions" (Torrence, 1971, p. 552). Yet, in spite of the differences in definitions, they all address the concepts of “novelty” (Cropley, 2011).

From the perspective of modern thought, it is possible to stress two main approaches to creativity. The first is grounded in Kant's philosophy, which realizes creativity as embodied in the act of "the genius." According to this concept, creativity is an innate trait that cannot be obtained by learning and therefore it is not a product of rational and structured thought. As such, it cannot undergo processes of methodization or imitation. From the mid-twentieth century, [1] a structured scientific practice to explore creativity has been developed mainly in the fields of psychology and learning (Martiniano, 2016). Since the 1990s, the “scientification“ of the creative process has expanded into many other fields and has become a major factor in the natural sciences and other areas of the social sciences: sociology (Elisondo,2016; Reuter, 2015; Reimeris, 2016); psychology (Mehta and Dahl, 2019; Kaufman & Sternberg, 2019); economy (Howkins, 2001, 2014) as well as in the fields of art (Ingold, 2010; Kaufman & Paul , 2017; Elliot, 2017) and design (Julier & Moor, 2009; Darbellay, Moody & Lubart, 2017). Consequently, new definitions of creativity have been introduced that conditioned the existence of the creative processes in structured knowledge and discipline. Creativity is thus seen as an acquired and imitative feature that is often associated with problem-solving practices in existing situations rather than the creation of something new (Martiniano, 2016, p. 163). The “scientification” of creativity also communicates a broader trend of imposing research methodologies and practices from engineering and computer science into the life sciences. This was the result of the ability to

[1] The "scientification” of the creative process can be traced back to the 19th century, with the first attempt to explore creativity with scientific tools in Galton's study of the “genius”, as early as 1869. (Eysenck, 1993).

encode them with scientific tools, life-processes, and materials, and to modify them in processes that can be recognized as creative.

This paper will focus on the creative practices used in the field of design that integrate artificial computerized systems. It will refer to the double faceted nature of design as generating both form and function. Following philosopher Luciano Floridi's analysis of human-technology-nature relationships, this paper will point to different typologies of creativity that are now possible through the capabilities of technology that take part in the design process. It will address creative processes grounded in machines that operate autonomously as well as through hybrid processes that combine human and machine operations. Suggesting that new emerging forms of computational creativity in design mark the transition from human to post-human design, this paper argues that the computerization and "scientification" of creativity maintain values of unpredictability, newness, and originality inherent in aesthetic creativity (Bodem, 1995). Yet, it will argue, applying different parameters on creative computerised systems entails social and political values that should be analysed.

2. Man, machine and creativity

In the new complex techno-human ecology in which designers act today, the clear distinction between humans and machines that has characterized modern Western thought in the past, is becoming increasingly blurred: Computer systems and the logic of code are embedded in the most essential characteristics of human existence, while automated machines are acquiring traits of living systems. Thanks to new developments in the field of computer science as well as in the natural sciences, the new algorithm-based machines are no longer characterized only as computational apparatus of a significant logical nature, but they also take part in areas that were previously considered unique to human beings, especially in the creative field.[2] Therefore, the binary distinction between a thinking human-being who learns and creates, and the executive machine that optimizes and improves human activity through embedded automation systems is being undermined. The matrix of control of humans over machine and the dichotomous division between nature and culture is being replaced, as claimed by Bruno Latour in his Acor-Network Theory (ANT) (Latour, 1996), by the perception that human beings and 'things' are not necessarily autonomous entities distinct from each other.

Undermining human autonomy while recognizing the ability of non-human entities to generate creative processes was manifested in various contexts during the twentieth century. For example, Freud rejected the concept of human autonomy in light of his claim that the subject is controlled by the *ego*, the *id* and the *super-ego* (Freud, 1991). Piaget argued that creativity is a product of an adaptive process in which mental structures interact with the environment (Piaget, 1972), while Charles Pearce showed how the concept of reasoning as a compulsory condition for mental processes, can take place in machines as

[2] These machine's creativity is implemented both with respect to information – through the use of algorithms, and on material phenomena – through identification of the material's 'code' and the ability to modify it.

well (Pierce, v2, p. 56). However, acknowledgment of the machine's creative capabilities is a result of the developments in computer science, especially those relating to computerized learning capabilities and drawing conclusions through artificial intelligence applications.

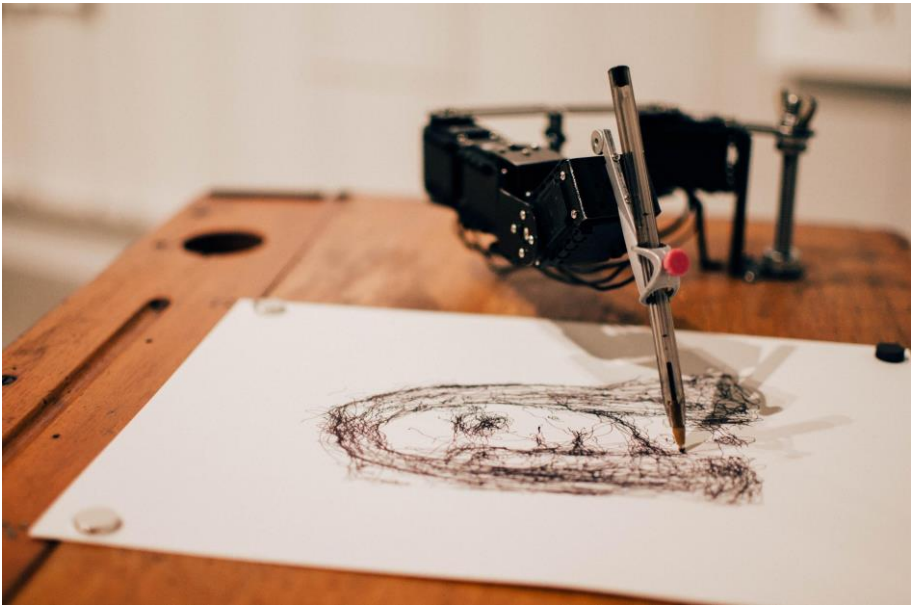

Figure 1. Patrick Tresset, Human Study #1 5RNP, Trace Exhibition, 2018, New Media Gallery, New Westminster, Canada. Photo: NMG

Autonomous robots challenging the most epitomic representations of artistic creativity – drawing and painting, have been developed as part of the exploration of computer creative capabilities: Artist robots have included Aaron, created by Harold Cohen back in the 1980s, The Painting Fool, developed by Simon Colton (2001), Paul conceived by Patrick Tresset (2011), and the AiDA robotic painter, devised in collaboration with Oxford University and introduced to the public in 2019. Additional applications were developed in various creative fields, such as systems in the field of music, capable of taking part in real-time jazz improvisations along with human musicians; an algorithm that wrote a musical piece similar to Bach's,[3] a sequel to Harry Potter,[4] and poems written autonomously by artificial intelligence programs. In the various fields of design, many generative platforms have been created using AI such as the WIX web design, Tailor Brands for building brands, Spacemaker

[3] See: The BachBot Challenge https://bachbot.com/#/?_k=ta71ou Retrieved February 9, 2020

[4] "Harry Potter and the Portrait of What Looked Like a Large Pile of Ash" https://botnik.org/content/harry-potter.html Retrieved February 9, 2020

for urban planning, Finch for planning floorplans, as well as new emerging GAN (Generative Adversarial Networks) platforms[5] about which, considering their outputs, it is difficult to discern that they were not created by man.



Figure 2. Dragan Ilić, Roboaction(s) A1 K1 Courtesy: Dragan Ilic and GV Art London

The introduction of creative abilities into machines can, on the one hand, lead to dystopian perceptions based on fear of the takeover by computational systems of human creative tasks in a way that will leave no space for human designers. On the other hand, it suggests that creative capabilities in machines can provide an opportunity to redefine creativity in new ways that are possible only through the inclusion of machines. Dragan Ilić's work, "Roboaction(s)A1 K1", metaphorically demonstrates these two perceptions regarding the inclusion of machines in creative processes. Using an advanced robot, Ilić creates monumental drawings on canvas while his body is rotating at a speed along a vertical and horizontal axis connected to the robot's arm.[6] By using an elaborate brain-computer interface (BCI) system he controls the robot with his brain. Although he controls the creative process by manipulating the movement of the robotic arm, the traditional relationship

[5] Demonstrations of creative use of GAN: https://towardsdatascience.com/14-deep-learning-uses-that-blasted-me-away-2019-206a5271d98 Retrieved February 9, 2020

[6] http://www.draganilic.org/work/?y=2017 Retrieved February 9, 2020 Retrieved February 9, 2020

between man and the machine as the executing factor is reversed. Here the robot uses man as his paintbrush, and thus leads the creative process. Therefore, it undermines the binary distinction between the thinking, learning and creative human being and the executive machine that optimizes and improves human activity through the automation systems embedded within. Yet, within this human-robot hybrid, man enjoys new possibilities granted to him by the machine. This work offers a new way of thinking about creativity as a human-machine collaborative act.

3. Computational Creativity and the Possibility for Post-Anthropocentric Creativity

Common human discourse on computational creativity systems analyses the ways such systems are capable of performing creatively on a human level or even going beyond it. In addition, it aspires to a better understanding of human creativity and attempts to formulate an algorithmic perspective of creative behaviours in humans.[7] In order to better understand the potential of computational creativity within the design discipline, the contextualization of the changing relationships between man and technology is necessary.

In his article "Technology's in-betweeness," philosopher Luciano Floridi offers a view that challenges the anthropocentric approach to technology. He proposes to classify technologies by three categories of order that describe their relationships with their users (Floridi, 2013). These categories differ from each other in the different relations that they incorporate between the feature of “in-betweeness” that refers to the interacting user, and the concept of “affordance” which refers to the enabling factor of the interaction. The first two categories have lain at the basis of the relationships between man and the world surrounding him throughout human history. First-order technologies are the most basic: They stand between the user and the world of natural phenomena. Although they can be complex in themselves, and sometimes even rely on other technologies, even nonhuman beings can apply them. Second-order technologies are the most common and include technologies used by people, but they always involve other technologies. Third-order technologies, in contrast, are technologies that refer to other technologies as users. They exclude the human subject from the chain of interactions and hence become autonomous. Yet, despite the clear distinctions between the three order technologies, different technologies can be attributed to each of them with regard to the context of their performance.

Following Floridi’s analysis, I would like to propose three different typologies in order to understand the potential of machine's creativity and to examine the ways these forms of creativity are being applied in the design field. As in Floridi’s model, I will refer to the classification of creative modes as contextual.

[7] https://en.wikipedia.org/wiki/Computational_creativity Retrieved February 9, 2020



Figure 3. Abundance, Lead Designer: Alisa Andrasek Curation: Bruno Juricic, Code And Design: Madalin Gheorghe, Structure: Arup Engineering, Fabrication: Ai Build. Cloud Pergola: The Croatian Pavilion At The 2018 Venice Biennale, Image Credit: Luke Hayes

man- [machine-word] - The first typology is based on computerised generative processes that are not necessarily creative in nature. Creativity takes place in the human-machine encounter and cannot exist without it. In this case, the machine contributes to the design of objects that exceed human intuition. The ability of the machine to produce aesthetic forms that go beyond the realms of intuition derives from the complexity of the operations that the machine can perform. The works of Swiss architect Michael Hansmeyer who creates forms generated by an algorithmic code based on a subdivision principle is an example of this kind of contribution. The many iterations performed in the design processes give rise to shapes that the computer can generate that cannot be imagined by humans and cannot be manufactured without computerised tools.[8] Another example is Alisa Andrasek's project "Abundance": a robotically extruded microstructure in the form of lightweight lattice, generated by applying Perlin noise through the voxel cloud. Here again, computerised algorithms overcome human limitations: "Since the pattern recognition in such a cloudy noisy structure exceeds human cognition and the designer's capacity to search, there was a clear need for machine learning assistance for the design process."[9] Additional algorithms

[8] http://www.michael-hansmeyer.com/ Retrieved February 9, 2020

[9] https://www.alisaandrasek.com/projects/abundance Retrieved February 9, 2020

were required in order to overcome the high resolution printing process which was based on an adaptive feature, making this printing feasible.
Creativity in this context is made possible by technologies that extend the range of possibilities through which phenomena in the techno-natural world can be accessed by creative humans and become objects of design: The creative process is based on human decisions but cannot emerge without partnership with the machine.

machine- [man-machine] - The second typology refers to the creative ability of machines using artificial intelligence applications, trained by humans and run according to tasks they are assigned to perform. They operate autonomously without human intervention in ways that can be perceived in human contexts as creative. Most of the platforms used in these contexts are based on neural networks and supervised machine learning. To enable the creative process, objects in various media formats and genres are fed into the computer database. By learning the properties of groups of objects, the system acquires the ability to identify repeating patterns that form the ground of new objects that have had no previous existence in the past.[10] Another manifestation of this typology is a creative platform that manages to emulate mechanisms of creativity without being limited to a predefined field of creative action. These platforms are "trained to imitate a set of human designers by observing their design state sequences without inducing problem-specific modelling bias or extra information about the problem." (Raina, McComb, & Cagan, 2019, p. 1)
It can be claimed that this kind of creativity, does not produce anything "truly new and creative" that goes beyond what has been previously structured and familiarized. In Fredric Jameson terms, it can be considered as "pastiche" - an expression of a culture based on the imitation of existing patterns. Yet this kind of computational creativity can generate outputs in intricacy, scale and variety that introduce new possibilities for design.

machine- [machine] The third typology is characterised by machine autonomy, independent of human supervision and with no clear definitions of the creative process.[11] Such creativity is generated within and between computerized systems, applying logic that does not necessarily resemble human creative processes.[12]

[10] An example of such a process is the project "The Next Rembrandt", in which an AI system has autonomously painted a portrait which has never been painted before but resembles Rembrandt's original paintings with great proximity. https://www.nextrembrandt.com/ Retrieved February 9, 2020

[11] A broadly cited example of an autonomous design process is the design of the partition for an Airbus aircraft that offered an efficient and cost-effective solution, perceived by designers as an "out of the box" solution, not resembling human design precedents. See: https://www.autodesk.com/redshift/bionic-design/ Retrieved February 9, 2020

[12] There is frequent use of the term "black-box" in relation to the opacity of many of the AI systems whose operations cannot be traced by developers. Recently, different applications have been written in order to follow the system operation' logics.

The “new generation” of autonomous creative applications capable of creating new objects or behaviours, which can be employed in the field of design, are characterised by mechanisms of emergence, growth and evolution, inspired by biological processes. Unlike supervised deep learning which is applied on modelling of what we know by training on an existing data set, autonomous creative computation is focused on generating solutions for what does not yet exist. The unpredictable nature of this creative modelling arises from the stochasticity embedded in computational operators like mutation, recombination (cross-over), and selection, defining some of these computational models. Rather than on a single, continuously refined solution, these models are based on a population of solutions. Therefore, they can afford to try out novel ideas and discover creative solutions which cannot be conceived without the complexity and diversity of the computational processes (Cohen-Or & Zhang, 2016).
Although experiments in creative modelling via evolutionary design have already taken place in architecture and urban planning in the last decades of the twentieth century (Balling, Taber, Brown, & Day, 1999), implementing autonomous systems excluding human involvement is still in its first stages of development. We are at the beginning of a process whereby machines will have to apply proactive autonomous design practices in order to survive and optimize their operations. The massive implementation of IoT systems and autonomous agents, and the need to ensure their resilience and ability to adjust to new evolving conditions will be accomplished to a large extent with algorithms written by algorithms, leaving human agency redundant. Therefore, it stands to reason that future creative design will not only perform with no direct human intervention, but will be the outcome of machines communicating with each other.

3. Creativity, noise, and the concept of “in-betweeness”.

A source of reference to creative and autonomic systems is the concept of autopoiesis (self-creation), which was coined by biologists Maturana and Varela, relating to the question: What is life? They defined living systems as 'self-producing' mechanisms which maintain their particular form despite material inflow and outflow, through self-regulation and self-reference (Varela, Maturana, & Uribe, 1974). An autopoietic system, according to this definition, can grow itself out of itself, and can regenerate through self-organizing processes. Sociologist and philosopher Niklas Luhman, in adopting the concept of autopoietic systems for sociology, argued that for a system to maintain its autonomy, it should have the ability to partially overcome external noise. (Luhmann, 2000)
In her book *How We Became Posthuman*, cultural theorist Katherine Hayles shows how both, cybernetics and information theory, which developed in the 1940s and 1950s, embraced the modern values of creativity, individuation and creation of the new (Hayles, 1999). She indicates that paradoxically, in Shannon Weaver's theory of information, it is the noise which is perceived as unexpected and random and thus enhances the value of the information (Wiener, 1954). By disrupting the tendency toward homogenization and the

entropy of knowledge, it prevents the condition in which routine information causes the system to atrophy, and to envisage predictable patterns. In cultural contexts, a literary work can be seen as rich in information while clichés are cultural forms with diluted information (Hughes, 2005, pp. 371-72).

In order for information to be effective, as artist and culture researcher Hito Steyerl claims, there is also the need to clean up irrelevant noise. Therefore, creativity is stimulated not only by the existence of the noise, but also by the ways it is decoded. Steyerl makes the analogy between the process of distinguishing noise from information, to social formation as described by philosopher Jacques Rancière: “to distinguish between noise and speech to divide a crowd between citizens and rabble. If someone didn't want to take someone else seriously, or to limit their rights and status, one pretends that their speech is just a noise…” (Steyerl, 2014). Since design is fundamentally social, we should follow Steyerl’s question "What is the political and social algorithm through which noise is cleared from the information," and explore the ways these processes occur in computational design creative processes.

One of the most significant definitions in the field of computational creativity is that of computer scientists Colton and Wiggins, who define this concept as follows:

> “The philosophy, science and engineering of computational systems which, by taking on particular responsibilities, exhibit behaviours that unbiased observers would deem to be creative.” (Colton, 2012, p. 21)

Referring to the concept of computational creativity, Colton and Wiggins address the need to analyse this term on a meta level. The notion of responsibility, which they regard as a fundamental characteristic of the creative process, lies notably in the evaluation practices and quantification criteria which are applied to the system’s creative behaviour. This is done in order to empower and refine the system’s autonomous creative abilities through a learning process which can also be optimized. Therefore, while the creative process in its “aesthetic” dimensions is characterized by unique qualitative virtues, within computational creativity, quantitative breadth such as efficiency, speed, level of appropriateness and minimal exploitation of resources as manifestations of optimization, are also becoming part of this process.

In their article, “Data Mining and Machine Learning in Computational Creativity,” Toivonen and Gross explore the potential for a new affinity between autonomous computerized creativity and other factors. They argue that, in order to achieve creative autonomy and originality in systems, it is necessary to attribute both self-determinism and adaptability to them. The system’s creative capabilities rely on its autonomy to evaluate the creative process. In order to avoid repeating patterns and formulas, they propose using data mining and machine learning methods. They argue that the motivation for changing the evaluation criteria of the system comes naturally from outside the system through feedback of its action or through reliance on another creative system which could also be human. Therefore, they argue, creative autonomy is strongly related to social interactions (Toivonen & Gross, 2015).

At this point, referring to machine-to-machine creativity, I would like to return to Floridi's concept of in-betweeness. Following his assertion that technologies are always in-between, he points out the special new condition of third order technologies: Since those technologies interact with other technologies, "all the in-betweeness becomes internal, no longer ours but technologies" (Floridi, 2013, p. 114). Although, "[s]uch a process of 'internalisation' is a source of concern about ICTs ending up controlling human life, these technologies can still generate new externality and therefore still preserved the "technological in-betweeness" (that gives the context to their use). In this way they can create a new space outside the loop". This is "a space made possible by the loop, that relies on the loop to continue to exist and to flourish, but that is not to be confused with the space inside the loop" (Floridi, 2013, p. 115). Such a space, as he claims, could be cyberspace." He argues that "out of the loop spaces" are not new in human history, but new technologies have generated immense change in the scale and pace with which the whole of human society is now migrating into them.

The social dimensions of such processes take place, among others, with the integration of feedback systems in which human beings are involved, and therefore become a component in the design process. This has a special significance, for example, when human consciousness, which becomes a new "affordance" in Floridi's terms, in the context of complex feedback systems, evolves to be the object of optimization through the use of vectors of behavioural control by systems of artificial intelligence which play a role in the design process.[13] These processes are based on new forms of in-betweeness within complex networks operating in the framework of the design practice and may bear many social and political implications.[14] They incorporate human beings and machines, as well as other agents which are relevant for the creative process.[15] Therefore, conducting an autonomous computational design process with no human intervention or intention can be still connected to human activities as a parameter in the design process or through its resulting product.

[13] See for example the way Michael Hansmeir and Alisa Andersek use feedback processes in their designs constructing a model of the relation between abstract geometric properties and the human perception.

[14] The use of such feedback systems has also had a strong influence on the cultural and political space, as we have witnessed, for example, in Cambridge Analytica's involvement in the US election campaign and the UK referendum on Brexit.

[15] The use of the term "actants" follows the use of this term as defined by Latour's Actor Network Theory (ANT).

3. Concluding Thoughts

Bruno Latour proposed to understand technology through the idea of the fold. In technical action, time, space, and types of "actants" are folded together and take part in a process of shaping one another. Technology, he claims, is not simply used by humans but helps to constitute them as they both operate as part of a network. In such a network, the degree of autonomy shifts between the different actants that operate within it. Therefore, human perception, scale, and passion are no longer the first measures of value (Latour, 2002).
As explained, computer-generated creative platforms have been developed to adapt to the characteristics of the information space and to the new possibilities that they present. In addition to imitating human creative models, non-supervised creative platforms, as well as biologically based models (emergence / genetic / evolutionary) have been developed and are being further developed. These mark a transition from the adherence to human intent and conceptual construction, to the unknown, bizarre, mysterious and unpredictable. They enable processes that go beyond human intuition in many facets of design creativity: from the ability to imagine shapes and speculate scenarios, through problem solving, and the ability to connect objects from different ontological realities. They function within complex and information-intensive systems that humans cannot comprehend. With the total departure from the binary separation between man and machine, a new paradigm of human-machine creativity can be explored where the borders between the proactive actant and emerging/evolving automated processes cannot always be distinguished.
In the current state of affairs, creativity has ceased to be considered an exclusive human virtue. Yet, as the ecology in which creativity can take place is constantly changing, the concept of creativity in the new “in-betweeness” and “affordances” provided by the use of computerised networked systems, gains social and political attributes. In this case, the image of the single author who derives its legitimacy from the romantic concept of a "creative genius" is being challenged not only through deconstructionist and post-structuralist theories, giving rise to anonymous, collective collaborative practices, but also through a complex data space hybridized with actants of different forms and origins. Therefore, thinking about computational creativity demands a great deal of awareness of the various platforms and infrastructures that make it possible to implement creative processes within the data scape and to the way they perform: the kind of algorithms in use and to their limits; the types of trained databases being exercised and the politics behind them and the domains in which they operate. In this respect, special attention should be given to the ways parameters such as pertinence, identity, noise and optimization, are generated and to the value systems they embody.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Artificial Intelligence is a Character? Exploring design scenarios to build interface behaviours.

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Abstract | The paper aims to illustrate the qualitative results of the first phase of the scenario research about voice interfaces, examining whether it is possible to design them as if they were a theatrical or cinematographic character. The research field intersects interaction design with character design, intended as the narrative construction of a character, and theatrical performances. The experimentation takes advantage of theatre workshops that aims to show, and understand, which are the main characteristics of a vocal interface and how to design them according to a performance approach. The paper ends illustrating how design can address actual opportunities and criticalities about emerging technologies, following a relations-based approach.

KEYWORDS | INTERACTION DESIGN, VOICE USER INTERFACES, CHARACTER DESIGN, SCENARIO, THEATRE WORKSHOP

1. Introduction, from voice to personality

In recent years, there has been a widespread diffusion of devices that integrate vocal interfaces closely connected to artificial intelligence. Although these issues were already debated in the scientific community during the early 1990s, only in the last decade this topic experienced greater insight from many disciplines, including interaction design. The renewed attention is linked to the massive diffusion in the daily life of two products-functions: voice assistants (SIRI, Google Assistant, Alexa, Cortana); smart speakers (Amazon Echo, Google Home) that had a surge in sales. The scenario also includes extremely complex products, such as robots, voice assistants on board of cars with different degrees of automation and web pages applications. Therefore, the research field appears to be very broad and even in the scientific literature names of the vocal interfaces are connoted with different nuances. They are defined as Vocal Agent (VA), more often as Vocal Assistant, Conversational Agent (CA), Intelligent Assistant (IA), Virtual Assistant (VA). Robotic scientists, for example, imagined them to help fill the gaps in human social relations to generate friends and companions (Richardson, 2015). If the set that contains all the definitions is called Natural User Interfaces (Dasgupta, 2018), much is being discussed not only on the functions of the interfaces but, above all, on aspects such as: the emotions they should communicate, the characteristic traits of the personality, the ability to stimulate virtuous behaviours. The concept of naturalness is still debated in the scientific community, but the dialogue makes interaction easier because voice interfaces currently allow a great tolerance in the understanding of the input messages, without forcing the user to be strict encode and learn standard messages to be given in a dialogic fashion (Dale, 2016). Moreover, the voice is not only perceived as human-like, but human traits are also associated with the behaviours of the system (Nass, Steuer & Tauber 1994). People tend to infer more a human creator behind the computer, hearing a voice than reading the same text (Schroeder & Epley, 2016). Even if users are perfectly aware of the presence of an artificial intelligence, they believe that voice-human has real needs and desires (Short, 2017), human emotions or traits (Brave & Nass, 2007), feeling even more comfortable when VA asked invasive questions (Yu, Nguyen, Prakkamakul & Salehi, 2019). People create a mental image of the voice, including personal traits, attitudes, background information and even physical characteristics (Cohen, Giangola & Balogh, 2004). Starting from this statement, VAs are usually designed to include emotion appraisal (Castellano et al., 2013), generation and expression capabilities (Tsiuorti et al., 2016), to produce empathy (Lunardo & Bressolles, 2016). Other attributes usually associated with VA are: empathetic (Fung et al., 2016), affective (Oker et al., 2015), emotive (Maldonado & Nass, 2007). All these efforts are made to foster communicative and emotional aspects, but the core concept follows the design of a human-like interface, defining it as emotional intelligence, that is grounded in parameters like: believability (Ranjbartabar & Richards, 2016), the illusion of life (Bates, 1994), collaboration (Cassell, Sullivan, Churchill & Prevost, 2000), trust (Cheepen, 1988), sensitivity (Dibitonto, Leszczynska, Tazzi & Medaglia, 2018), capable of conversing (Clark et al., 2019). However, one of the most debated topics is how to give to VA a recognisable personality to simulate a

real human-like dialogue; many scholars apply the same personality model both to the human and the machine side, because the base construct is to create a match between human personality and the machine one. But, at present, the VA wide spreading generated an unusual loop in which scholars are still analysing commercial VUI to find if there is a clearly designed personality, which categories of user can easily accept, adopt and engage a stable relation with that kind of VUI. While personality is well described by Corr and Matthews (2009) as "the set of habitual behaviours, cognitive and emotional patterns that evolve from biological and environmental factors", then the first split concerns the subdivision between the personality traits theory and the personality types one. Personality trait theory considers characteristics of people as part of a larger continuum and its approach is described into the Big Five theory; personality types theory, instead, describes characteristics of people as discrete categories. Big Five theory (McCrae & John, 1992) specifies the general affective behaviour by the five following traits: Openness, Conscientiousness, Extraversion, Agreeableness, Neuroticism. Type theory has its roots in personality scales, such as the Myers-Briggs Type Indicator (1962), which posits 16 personality types deriving from a set of four fundamental dichotomies, for example, extroversion vs introversion. It is worth noting that in the analysed studies, scholars do not use the two approaches as separate, but often mix them by adding other parameters, see for example Heudin (2017), such as mood (Morris, 2012) and emotion (Campos et al., 1994).

2. Analysing and designing personalities of VA

The literature review presented in these first two sections aims to show how interaction design considered the aspects of voice interfaces design, especially the humanization aspects, including users' inferences. The analysis includes design and psychology references as the research field is multidisciplinary, but broadens the field also considering character design. Garcia, Lopez, and Donis (2018) analysed 3661 online surveys to assess the VA personality; their goal was to evaluate VA and identify people desired VA personality. They found that: attributes most frequently associated with VAs were practical, informed, up-to-date, well-mannered, logical and helpful; the least associated were cheerful, sweet, sentimental and masculine. On the other hand, Ehrenbrink, Osman, and Möller (2017) found the personality profile of testers and their preference for Siri, Google's Now and Cortana, based on attractiveness and psychological state reactance. The results show how the group of testers who preferred Siri was the largest and matched the average personality profile. The Google Now group was preferred by extravert, the group that preferred Cortana was more neurotic, less agreeable and less extroverted. Doyle, Edwards, Dumbleton, Clark, and Cowan (2019) present a study in which two VAs are compared with human interaction. They found eight key dimensions to categorise participants' perceptions, for this study is essential to quote at least three of them: conversational interactivity, partner identity & role, vocal qualities. MA, Yang and Fung (2019) used the Big Five model to understand whether VAs personality affects how people perceive intelligence of Vas; their testers observed VAs

endowed with personalities more intelligent than the robotic one. There are still a few examples of how to design the personality of a VA. Spencer, Poggi and Gheerawo (2018) designed, through participatory design workshops, four personalities based on Jung (1954), Person and Mark (2001) archetypes. They define four main features: purpose and story, person, tone of voice, language. Lee, Lee and Lee (2017) show the results of workshops with groups of two users that play the human role and the VA role, using the Wizard of Oz approach. They found that if the VA role was acted in a cheerful and friend like users were funnier and more satisfied, even if the time to complete the tasks were longer. On the other hand, groups with introvert played VA had the best performance with a minimum level of communication. Ghosh and Pherwani (2015) observed the behaviour of assistants in real life. They collected data about communication styles, attitudes, language and nonverbal cues, strategies to face the boss mood. Then they selected nine personality attributes to generate three hypothetical personalities. This work is significant, but, according to the authors, is focused on the assumption that a VA could be only an assistant and must act mimicking those behaviours. Heudin (2015) designed an emotional metabolism that can manage personalities, moods and emotions into a multi-personality conversational agent. He experimented 12 personalities, some of them referring to characters of cinema. He claims and demonstrates that multi-personality agents work better than mono-dimensional ones preserving coherence. Finally, Braun, Mainz, Chadowitz, Pfleging and Alt (2019) propose to match the personalities of users and VA using Big Five models and experiment them into a real-world driving study. They designed four assistant personalities (friend, admirer, aunt, and butler) and their results show "higher likability and trust for assistants that correctly match the user's personality while we observed lower likability, trust, satisfaction, and usefulness for incorrectly matched personalities". The interesting part of this work is the use of a voice pre-recorded by an actress. In the literature review, the authors found some work about the characterization of the interfaces, starting, for example, from the work of gender analysis by Schnobelen (2016); Luria (2018) suggests three guidelines to design personal robots: reciprocity, affirmation and independence. These come from a review of 15 sidekick characters from popular books and movies. Literature analysis shows that there is still a little corpus of studies about the designing of the personality of interfaces in general. The authors also found that is not clear how to design the behaviours of a voice according to the users and the context, finally even if it is true that people consider VA as human-like there is still a design space to project an AI character giving to machines their characterization. According to these brand-new studies and previous experimentations, the authors want to explore the characterization of the interface and the concept of performing interfaces which is recently be claimed by Aylett, Cowan and Clark (2019), underling the differences between personality and characters. Therefore, considering personality aspects is now part of the design process but as Vas are considered human-like can they be considered as characters? Which elements besides personality are needed to design VA in this way?

3. Methodology and Workshop structure

The experimentation makes use of designed theatre workshops that aimed of showing and understanding the main features of a vocal interface and creating a grounded common language background between performers and designers. The workshops involved three professional actors, they currently work for theatre shows and film productions, they also recorded voice over for films. The elements of discrimination to choose them were: their experience in shows where the contact with the audience was much closer, for example in contexts without a stage and barriers between actor and audience; their work as teachers. We assumed that the closeness and direct interaction with the audience, greatly influences the character and generates sudden changes during the performance, then teachers of acting methods have experience in explaining all the facets of the theme. The three workshops with the individual actors lasted about three hours each, they took place at the authors' department, both the authors took written notes during the workshop. We chose not to record audio and video, except for brief moments related to performance examples, in order to avoid that the actors could perceive the workshop as a set. The first phase focused on the voice assistants currently available on the market; the goal was to: verify the actors' knowledge of the interfaces; acquire familiarization with them; investigate their use; test the other devices they were not aware of; collect their perceptions on the voice assistants asking them which were the main perceived parameters and if they found the features of a character designed as such. The second phase concerned a critical analysis, in which the actors were asked to comment on three vocal interfaces chosen among the many present in the cinema (Samantha in Her, HAl9000 in 2001: A Space Odyssey, the episode White Christmas taken from the Black Mirror Series). The aim was a deeper understanding of how a cinematographic interpretation of an AI was designed and realized and to trigger a dialogue on character building. The third phase mixed elements typical of the semi-structured interview and the performance. The actors were asked to explain not only the main factors that allow to characterize a character during the performance, but also the developing method itself across different steps. This framework could also be useful not only in the preliminary phase, as in this paper, but it could be also used for concept generation and validation. In fact, the general goal is to better understand how performing a character is different from considering personality as seen in literature, in order to obtain other parameters to integrate into the design process.

4. Results

During the first phase all the actors confirmed that they know at least one of the vocal assistants, but they do not own them as speakers. One uses Siri on iPhone weekly, one Google Assistant daily, one Google Assistant only in particular situations (i.e. driving). The actor using Siri started to do it after a random event. During the rehearsals, Siri started talking without anyone wanting to do it. From that moment, Siri was used as a character on

stage as a disturbing and surreal element. All actors previously seen Alexa at work, none of them ever interacted or listened to Cortana's voice. In order to demonstrate how the four VAs work, the actors could freely talk to the assistants for few minutes. Then actors asked to the VAs to tell a fairy tale and sing a song. This choice allowed the actors to listen to two possible uses of the voice closer to their context. For all four cases the actors were asked to evaluate the vocal assistants according to the criteria of verisimilitude, and the parameters associated with the voice that were more evident to them. The comparison with the parameters is based on the literature and includes tone, timbre, pitch, rhythm, intonation, accent, prosodic elements. The three actors recognized as plausible Siri and Alexa, praising the quality of Alexa's voice, while judging the sound quality of Google Assistant and Cortana as still “too raw” and “robotic old school”. Judgements about the characteristics of the voice were: "always UP", "always ready and enthusiastic", "ringing". It should also be pointed out that one actor emphasized that all these characteristics reinforced negative stereotypes related to female gender. The three female voices were also defined as the mirror of current technology. According to the actors, it seems that the voice that represents the intelligence of the machines has that particular timbre. The reaction in front of the fairy tales and songs of all three actors was of "amazement", "makes you smile", "could be used as a pastime". Vocal assistants told: a text about punctuation (Google Assistant); the little mermaid (Alexa, NB with sounds and accompanying effects); the fox and the grape (Cortana); Siri avoided answering. By repeating the experiment, some of the VA can change behaviours, Cortana sometimes answers similarly to Siri and Google Assistant, telling their own story. The actors highlighted that this might contribute to the construction of VA back-story. The songs, instead, have been an element of debate, especially about Cortana (Italian anthem) and Alexa (Il canto dell'addio). The actors expected that VA would use a tone modulation effect, called vocoder, and that they could not keep up with the rhythm of the song. But voices and rhythm were not distorted, so actors assumed that a speaker recorded the songs ad hoc. Google Assistant's voice, instead, collides with the actors' expectations because it sings nonsense lyrics; while Siri refuse to sing and after some insistence provides a spoken version of the song “Nel blu dipinto di Blu”. The songs provided more elements on the analysis of the parameters of the voices, i.e. the rhythm, the cadence and the tails of the vowels. The rhythm is perceived by the actors as "broken", "not fluid", especially when the period becomes very long. In their opinion this depends on a cadence that is not yet fully characterized, but above all on the vowels cut in the length at the end of the words. If, in fact, the addition of some pauses and hesitations, such as "ehm", recalled probable human behaviour, one actor pointed out that the word can be pronounced more or less quickly, but very rarely is cut off sharply. The question at the end of the first part concerned the perception of a designed character in VAs. In this case all the three disagreed, pointing out the total lack of acting and of typical aspects of the character, defining the interfaces as "generalist", "average", "not at all prone to make the interlocutor emotional", "distant, though always cheerful and available". When asked to compare their comments to the personality classifications found in literature, actors agreed on their utility, but they pointed out that personality is not "rock-hard", it has to be declined in every single line and actions;

so, it is not possible to apply personality just to a question-answer, but it needs more connotation as a whole character. They underlined that a character needs more psychological elements – personality is just one of them –, physiological and sociological features in a complex way. The second phase was dedicated to the analysis of three videos that clearly show the interactions with artificial intelligence. The beginning of this phase was dedicated to watching some part of films in English and Italian language. The first sentence that all the actors uttered was almost identical "this is acting", "we are talking about something else", "it is not comparable". The actors underlined the strong interpretation highlighting the unbridgeable difference between actor and speaker. Although some subjects of actor and speaker courses of study are similar, actors are called to work with their whole body "in a holistic way", while speakers can work only on aspects of voice. Explaining better those concepts, actors focused both on the vocal emission through the body and its movements, and on the psychological aspects. They performed some lines showing how that interpretation could be generated by focusing on the invisible body of the actor, for example "even if you can't see the body of Scarlett Johansson (Samantha's voice in the film Her), you can perceive her posture, her gestures, you can hear her breathing". Two of the actors narrate, in fact, that in order to emit sounds in the theatre it is necessary to involve the whole body, that is used according to postures, movements and gestures to limit, amplify or modify the sounds, even stage costumes are taken as a cue to characterize the vocal emission. In the theatre, the psychology of the character is explored in an extremely detailed way and the indications are often metaphorical, "that sound must be yellow". Sentences that seem to recall Kandinsky's theories and that, however, could generate a common background language starting from design elements. All the actors agreed on another determinant factor of the acting: it can return the change in the psychology of the character. "You can understand what Hal9000 is becoming paying attention to how the interpretation is changing, the rhythm, the sound, how it plays between the mellifluous and reassuring register and the attitude of the one who hold your life in its hands". The voice reacts to the narrative, to the evolution of the characters during the whole time. One actor, commenting on the scene of Black Mirror, dwells on the fact that it is the man who tries to imitate, to impersonate the role of the machine, as if the machine now had a predetermined archetype. The third phase focused on two questions: how an actor builds the character to be performed on stage and how, once on stage, he modulates and manages everything he has studied. The answers were very different, many methods and schools of acting were mentioned and often the answers remained on a high level, the same about the voice parameters. Three phases emerge: study and construction of the character by themselves, adaptation of the character during the rehearsals with the director and the other actors, live performance. During the first one the answers have common traits when quoting the questions towards the character. This is a technique widely used in writing (Seger, 1990), whether it is dedicated to novels, films or theatre performances. It is an approach that can also be found in character design and concerns the exploration and research of the character, starting first with the written text analysis and then adding levels of depth on all possible aspects of the character's life and story. When a detail is not present in the text, the

actors reconstruct it. This serves to build the internal motivation, "the engine", the goal that will become increasingly evident on stage. The reconstructed elements will help the actor in shaping the character. On the basis of the text and the questions to the character, the actors declare to build "a scheme", "a grid" that includes all the elements, from the dominant emotions to the recursive gesture (e.g. of the hands) constructing a recognizable grammar of the body, from the parameters related to the voice to the relationship they will have with the other actors. The second example has been defined "the jazz grid" and is linked to the other two phases of rehearsal and live performance. The actor builds the character on a "reactive grid", with possible responses to other events. As in jazz improvisation, the interpretation becomes relational. The grid then responds to the input provided at that moment by the other actors, by the audience, by the context and by the environment whether real (in the street or in houses), or on stage. A clear distinction emerges between these two environments. Although the actors on stage claim to perceive very well how the audience is reacting, in situations without barriers the actor enters a direct relationship with the nearby audience and modulates the parameters of the grid by virtue of the audience's attitude. In these cases, they say that the range of variation of the parameters is much wider to better adapt, provoke, seek empathy with the audience.

5. Conclusions

The actors' vision was very much concerned with qualitative aspects of performance. Aspects not found in the literature and divergent ones appear in all three phases of the workshop, from the use of the whole body acting to generate the voice, to the need to build the psychological aspects of the character, starting from his relations and his story that evolves during the use. The lack of characterization of VA is highlighted, as a homologation on many aspects. Furthermore, some purely vocal aspects must be implemented, such as the final resonance of the vowels and a design of some distinctive features such as rhythm and cadence. It is difficult from the analysis of these workshops to draw precise variations in order to obtain immediate results applicable to the existing vocal interfaces. According to actors the project is missing, although the vocal instrument is at an advanced state of realization and their producers are exploring innovations such as emotional intelligence, which may not fill the aspects of emotional reaction. The three workshops, on the contrary, allowed the authors to glimpse what could be a road still little explored regarding the question: what is the character of technology, of artificial intelligence? Cinema and visual arts provided many answers designed to stimulate reflection, trigger discussion and provoke, but by now the technological tool is already present in our homes and in our habits. Personality aspects can be considered a starting point but, as actors pointed out, using only personality the risk is to obtain a homogenisation of the interfaces' behaviours. To create real emotional conversational VA, the next step should be the construction of a complex character able to react during the dialogue, according to the situation and the context. The contribution of design in this field can therefore be very methodological, if it integrates not

only actors for performance but also copywriters, psychologists and social science experts in a wider way.

6. Future Works

The presented work is part of a research project that will end with the design of an interface for a self-driven vehicle. The next step will therefore concern the definition of some possible characters that AI will be able to interpret in a well-defined context, the script writing and interpretation of the actors and the subsequent post-production actions that are still open questions.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Becoming Janus: The Subversive Potential of Face Recognition Technologies

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Abstract | The human desire to "know the face" and to decipher its diverse characteristics and manifestations has long inspired technologies of vision. In recent years, it increasingly stimulates scientists and engineers in efforts to automate vision: to create machines that can not only generate images, but also analyse their contents. Consequently, "machine-to-machine seeing" (Paglen 2016) is dramatically transforming multiple spheres of human life as it also removes humans from decision making. Protesting against the growing threats of such technologies to society, artists, designers and activists straddle the lines between machine readability and human recognition in a call to resist what they refer to as total surveillance. This paper explores such efforts to reinvent and subvert facial recognition technologies. It delves into the differences between identity, identification, and social acceptability, paying particular attention to the way these differences are manifested at the conjuncture of visibility, machine readability, and human recognition.

KEYWORDS | FACIAL RECOGNITION TECHNOLOGIES, SURVEILLANCE, CRITICAL DESIGN, BIOMETRICS, IDENTITY

1. Introduction

When you invent the ship, you also invent the shipwreck; when you invent the plane, you also invent the plane crash – Paul Virilio

In Roman religion, the god Janus was considered the animistic spirit of doorways (*januae*) and archways (*jani*). Some traditions regard Janus as the god of *all* beginnings: the beginnings of the day, month, and year were sacred to him. Janus was represented with his face turned simultaneously backward and forward, seeing into both past and future.

In modern times, Janus is the name given to the facial recognition initiative of the Intelligence Advanced Research Projects Activity (IARPA), a US government body that funds innovative research aimed at giving the US intelligence community a competitive edge. Its goal is to enable "dramatic improvements in unconstrained face recognition. . . to develop novel representations to encode the shape, texture, and dynamics of a face for the purpose of improving face recognition performance from video and still images, and then allowing higher performance search and retrieval" (IARPA 2013). In an age when facial recognition technologies (FRTs) are becoming omnipresent, the duality captured in the project's name is revealing, if not alarming.

The IARPA Janus Project is but one instance of so-called "soft surveillance" (Hudson 2013). Airlines now have facial scanning instead of passports for boarding; fast food restaurants use it at their front counters; and Apple uses it to unlock its iPhones as well as its Apple Pay app. Soft surveillance gains compliance by persuasion, rather than coercion, yet still denies the individual any meaningful choice (Ball 2009). The situation is aggravated, however, in non-democratic countries. In China, for example, ordinary citizens use facial recognition to pay the subway fares and sort the garbage, while the government uses it to actively monitor them. These examples demonstrate the rise of FRT and raise concerns regarding threats to freedom and privacy in democratic and non-democratic countries alike.

This paper examines the costs of the digital stabilization of identity that follows biometric analysis, the tension between digital identity and individuals' power to shape their own, and efforts by theorists, artists, designers, and activists to resist the quick adoption of these technologies and call to regulate them. Select examples from their work invite us to imagine a future that undermines the rigidity of today's political and corporate digital hegemony and propose alternative narratives to current uses of FRT.

2. Know Thy Face

Faces are considered the most personal and distinctive feature used to identify and recognize others: they are information as well as expression devices. Recently, with the dramatic increase in the adoption of face recognition, detection, and analysis technologies that rely on powerful software platforms, serious legal, public advocacy and philosophical concerns have arisen**.** Unregulated, prone to human error and systematic bias and above all poorly understood, FRT is rapidly rolled out in fields as diverse as military intelligence, policing, and consumer culture. An advanced recognition system has to be in place in order for a face to function as a gateway to unlocking devices, enabling services and payments, and crossing borders. FRT does not operate only as a static database focused on ad-hoc individual identification, but is increasingly used in real-time, nonspecific dragnets, or "face surveillance".

A recent significant FRT breakthrough is the emerging field of automated facial emotion measurement and expression recognition, designed to infer feelings. Most emotion recognition systems are based on research conducted by psychologist Paul Ekman in the 1960s. Following Ekman's concept of a shared vocabulary of human facial configurations that are tied to emotion, stating that many of which are universal, subsequent studies have assumed a consistent, species-wide map connecting certain expressions to certain emotions.

More recently, artificial intelligence (AI) and machine learning (ML) have been applied to "understand" the context of human behaviour by analysing facial expressions and gestures. Moreover, their deployment responds to this "understanding" in ways that can support human life, health, wellbeing, and recreation – but also marketing, prison and mall security, and state surveillance. Both emotion and facial recognition systems rely on capturing facial features and reactions, but are "trained" on datasets that are often flawed. Indeed, whereas data on the human face has quickly become a commodity, laws and regulations lag behind and in their absence, the use of recognition technology poses complex ethical dilemmas regarding transparency, algorithmic governance, fairness and accountability – and ultimately, data privacy and human rights in general.

Biometric identification systems that aim to "authenticate" individuals usually do so by digitally scanning physical traits. Face recognition is one such example, and so are iris scans and fingerprint matching (Pugliese 2010). Relying on these technologies for authentication requires considerable caution once our society accepts what is extracted via computational means as biological "truth." Kelly Gates (2011) argues that digital biometric identification technologies are designed "to fulfill certain perceived social necessities and political-economic demands of large-scale, late capitalist societies – societies characterized by a predominance of mediated forms of social organization and vastly asymmetrical distributions of wealth" (p. 16). For Gates, the premise of automated facial expression analysis is "to make human affective behaviors more calculable, to open them up to precise

measurement and classification, thereby making them more amenable to forms of intervention, manipulation and control" (p. 22).

In a similar vein, in *When Biometrics Fail*, Shoshana A. Magnet (2011) sheds light on the role that state institutions and the military play in driving technological development and criticizes the close relationship between surveillance and marketing. She asserts that human bodies are not biometrifiable, and that biometric science presupposes the human body to be a "stable, unchanging repository of personal information from which we can collect data about identity" (p. 2). Her argument is part of a long tradition that believes that any such formalization process involves a reduction in complexity (Goriunova 2019). Magnet is concerned with the kind of society we will become once we deploy these technologies, where a form of representation comes to be understood as a techno-scientific truth.

Given the dependence of biometric technology on both machine vision and ML and taking into consideration the threats they pose to human rights and basic freedoms, FRTs' shortcomings and their abuse by states and militaries should be made public knowledge. Activists, scholars, artists and designers shed light on the fallacies and uncertainties of FRTs as well as their overreliance on paradigms that are reductionist, insufficient, and inaccurate at best, and prone to abuse at worst (see Bjørnsten 2017; Buolamwini 2018).

This multidisciplinary effort is becoming increasingly urgent given the additional layer of abstraction that attaches itself to biometric analysis, with the rise of seeing machines that are both ubiquitous and increasingly autonomous. In fact, most images today are produced by machines for machines to see, process, and label. As a result, most images produced today are exclusively machine-readable, never seen nor intended to be seen by humans. This machine visibility that is invisible to humans has two major consequences: (1) We do not know where, why, by whom, and for what reasons these datasets are culled; and (2) Citizens and computer scientists often do not—and cannot—understand the workings of the machines. Due to the blackboxed nature of the algorithms involved, even those in charge of their operation are only partly aware of their decision-making and inference processes. We hear more and more voices of criticism warning from the implications of the swift rolling out of seeing machines and the automation and black-boxing of the process that govern them (Shah 2019, Devlin 2020) and autonomous systems. The time has come to reconsider and renegotiate what just recently became the dominant paradigms in our society.

3. The Blind Spots of the Panoptic Machine

Given the growing concerns with the consequences of constant observability and the degree in which machines intervene in everyday lifegiven the asymmetric power of these systems. We should advocate for new rights, such as the "right to be unseen" not only for data collected and presented *about* humans, but also *for* human beings. We see more artists-activists such as Adam Harvey (2019), who advocates in his artworks and writings against

facial recognition becoming "the focal point of an emerging authoritarian logic". Another bold example is Zach Blas' resistance to what he considers the violence of biometrics. Blas perceives this technology as a mode of abstraction that has an explicit and unavoidable collusion with global surveillance and the prison-industrial complex (Browne, 2017). Both Blas and Harvey devise tactics and techniques to make faces unrecognizable, or unidentifiable. Their works raise questions pertaining to human creativity and freedom: How can one evade the machinic gaze? Can one possess more than one face? Should we disentangle the link between one's face and identity, and the way they are captured and represented by humans and machines? How can we escape the abstraction of biometric analysis and effectively resist the machinic attempt to reduce our multifacetedness to a single face?

Social psychologist and techno-philosopher Shoshana Zuboff offers a disturbing picture of how tech giants mine users' information to predict and shape their behaviour. She coined the term "surveillance capitalism" to refer to the combined market and government trend that undermines self-determination, autonomy, and decision rights "for the sake of an unobstructed flow of behavioural data to feed markets that are about us and not for us" (Naughton 2019). This inevitably leads to a condition she calls "glass life", where every movement and action is documented. In order to escape the machinic gaze, we humans have to hack the system, to thwart facial recognition software. Zuboff (2019a) warns against a no-exit situation in which walls are made of glass and lauds artists and activists who dedicate their genius to the prospects of human invisibility.

Adam Harvey is among the best-known artists active in the counter-surveillance field. For over ten years, he has been experimenting in attempts to fight total surveillance, but also to create "the future I want to see: people wearing stylish clothes that block surveillance and enhance privacy" (Mali 2013). Harvey's first works include *CamoFlash* (2008-2010), a wearable set of LEDs that trigger when detecting camera flashes, turning the paparazzi's tools against them. Most relevant to this paper, they also include *CV Dazzle* (2010 and ongoing), an experiment with makeup and hairstyles meant to confuse facial recognition systems. *CV Dazzle* explores how fashion can be used as camouflage and works by altering the expected dark and light areas of a face (or object) to exploit the vulnerabilities of a specific computer vision algorithm. Inspired by dazzle navy ship camouflage, invented during World War I, it is motivated by the need to reclaim privacy in a world of increased visual surveillance and data collection.

By introducing low-cost DIY methods for deceiving computer vision algorithms, Harvey challenges the face's machine-readability. Nevertheless, he is aware that the result is very much visible to human observers. "Computer vision poses new challenges that otherwise do not exist in human observation: it is low-cost, scalable, passive, remote, networked, and *superhuman* in its capabilities to recognize and understand faces, emotions, social relationships, health indicators, identity, socio-economic status (by analysing clothing), and even intent" (Harvey 2019a, my italics). This could mean that we humans must improve our

capacities and become either more or less machine-like in order to trick and possibly overcome the machines.

In a more recent project, *Hyperface* (2013–2017), Harvey exhibits a playful approach to tricking computer vision by creating patterns of false faces for computers to "see." It proposes a new kind of camouflage that aims to reduce the confidence-score of facial recognition by presenting faces that distract computer vision algorithms. *HyperFace* recognizes that concealing a face from facial detection algorithms is both a technical and an aesthetic challenge. Here, Harvey does not seek anonymity as in *CV Dazzle*, but rather to trick computer vision in a different way. In *HyperFace* he creates a mechanism that offers a higher confidence score for a "false" face by exploiting a common algorithmic preference for the highest confidence facial region.

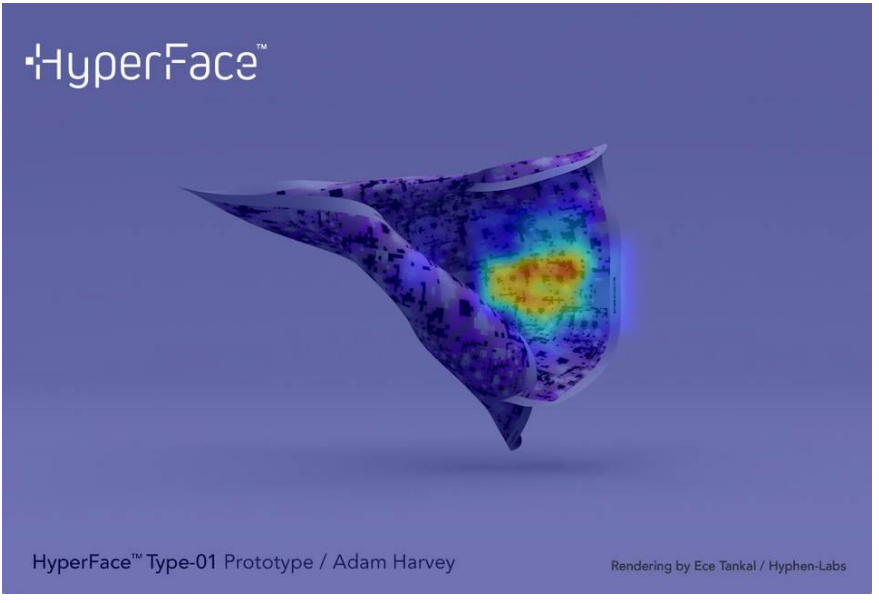

Figure 1. HyperFace Prototype by Adam Harvey / ahprojects.com. Rendering by Ece Tankal / hyphen-labs.com. 2017

Playing with face properties and visibility has also led other artists, designers and creative technologists to initiate projects that could be easily labelled "speculative" or "critical design." By calling attention to the different ways that machines and humans "see" and "interpret the world, such works convey how art and design can be applied to raise awareness to pressing socio-technological issues and bring forth a new agenda. One example is a project that straddles the line between social acceptability and machine recognizability:

Wearable Face Projector (2017) – a group project by students from the University of Arts Utrecht. They devised a small device worn on one's forehead, with a beamer on its front that projects a different appearance on the wearer's face. The projection blurs facial features and covers them with alternative faces, creating alternative visibility, one that "protects you from privacy violations" as the project description goes (Liu 2020).

Another example, more evocative of Harvey's *CV Dazzle*, is the brainchild of Grigory Bakunov ("Bobuk"), director of technology distribution at Russian tech giant Yandex. Bakunov uses an anti-facial recognition algorithm to conceal people's identities (Zavyolova 2017). Like Harvey, Bakunov uses make-up and coloration as camouflage – not from other humans, but from machines. He draws human attention to himself with the colourful patterns on his face, but they are designated to evade the machinic gaze.

Throughout history, humans invented technologies for hiding and concealing one's identity, the recent technological progress requires more wit and sophistication in finding ways to tweak, play, expand the possibilities "to hide within technology or turn it against itself. The recent protests in Hong Kong and the ban against masks (The Time 2019) show how in this Janus world of machine visibility, not only do officers of the law seek impunity through anonymity but outlaws seek survival by the very same measures. During the past year, at the height of the COVID-19 pandemic, we have learned about efforts by both governments and corporations to improve facial recognition performance given the universal use of masks (Johnson 2020). Will we be able to find new ways to inoculate ourselves against total surveillance that seems bound to outlive the virus?

The choice to conceal or expose one's face immediately highlights the differences between what is perceptible to the human eye and what is readable to the machine. In an age when AI systems still need to be "trained" by humans, or at least with data provided by humans, who will train humans to realize the far-reaching consequences of omnipresent cameras and autonomous vision machines?

Some artists, designers and activists take a different approach and go beyond thwarting FRT. Protesting against surveillance, they attempt to protect civil liberties by some form of sabotage or "facial weaponization[1]". as Zach Blas advocates in his works. Berlin-based art group *Peng! Collective* has called for mayhem in the system by blurring the binaries upon which the FRT database are premised. Such a project, if successful and deployed on a larger scale, may impede "the machines and their masters" as Zuboff refers to them. In September 2018, *Peng! Collective* launched *Mask.ID*, a computer program to manipulate passport photos, creating a realistic photomontage of two different photos (naturally belonging to two different faces) and "smuggling" them into passports to avoid recognition. Theoretically, the two people depicted can now travel using the same document, because the human eye

1 In his writings, works and workshops, Blas challenges the asymmetrical power relationships embedded in surveillance capitalism and promotes a different kind of visibility devoid of gender or recognizable face

recognizes both faces in the photo. In an exhibition, Peng! presented a manipulated biometric passport accepted by the Bundesdruckerei (the German federal printing service) that identifies two people: Federica Mogherini (EU Commissioner for Foreign Affairs and Security) and an artist belonging to the collective.

This goes beyond sabotaging the database. Peng! started a campaign calling on citizens to "flood government databases with misinformation" (Peng 2019) and disrupt mass surveillance. The passport, then, embodies the transformative potential of a call to civic action. A contemporary activist rendition of the Janus face, one passport that serves two different individuals is more than an artist's provocation. *Mask.ID* articulates a very serious idea: the option to hold a double (or multiple) identity or to share one's identity with someone else. It calls for alternative uses of technology that enable fluidity, resisting the stabilizing logic of one fixed identity.

This proposition can be tested in other fields using technologies other than FRT. Think for example about sharing a credit score, holding a shared voting identity, sharing grades in school, or citizen scores within the Chinese Social Credit System (Kobie 2019). How could the authorities deal with such a situation? Could such initiatives pave the way to undermining the normative logic of the existing machinic-hegemonic order? Is it at all possible to introduce new values such as flexibility, fluidity, or multiplicity in a world constituted by the binary logic?

4. Masks and Pirates

Two design projects propose masks that harness rather than merely subvert technology, defying the logic of outlaws and law enforcement to afford both individual privacy and interpersonal interaction**.** Dutch designer Jip van Leeuwenstein created *Surveillance Exclusion* (2016) – a curved lens-like mask that obfuscates its wearer's face to fool face-recognition cameras, but not other people. Appearing like a lens, this mask thwarts FRT's ability to recognize its wearer, but it is still possible for people to interact with the people around the wearer thanks to its transparency (van Leeuwenstein 2020).

Aposema (2017) by Adi Meyer, Sirou Peng and Silvia Rueda, is a project conceptualized during their studies in the Interactive Architecture Lab at University College London. Technically, it is a responsive facial prosthesis made of silicone that promotes a new relationship with and through technology – *a* device that enables a new form of expressive communication. *Aposema* facilitates a more meaningful interaction by two-way transfer of information via the mask. Built using soft robotic prosthetics, biometric sensors and an augmented reality digital

layer, this prototype is meant to create a more sophisticated system for creating information 'inputs' and 'outputs', respectively, enabling and enhancing interpersonal understanding. The designers were interested in possibilities that the mask offers as a means of dynamic

body alteration, which may change its wearer's social identity. In proposing a new way for communication, one that both reveals and conceals, and offers a more expressive form of communication and interaction between humans and machines, *Aposema* signals a possibility to carve a new, path to self-discovery by means of emotional recognition. In that, it makes an important conceptual step beyond the authoritarian logic of biometric technology.

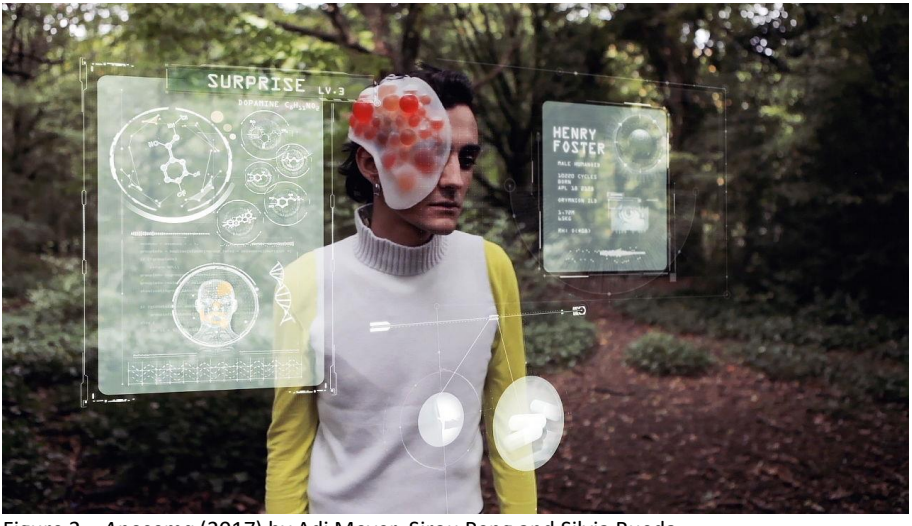

Figure 2. *Aposema* (2017) by Adi Meyer, Sirou Peng and Silvia Rueda.

As explained earlier, the logic that governs biometric technology runs counter the notion that the human body cannot be reduced to a single identity with clear and stable markers. Recently, an in-depth review of over 1,000 studies on the use of facial expressions to convey emotion showed that facial expressions actually provided scant information about a person's feelings (Barret 2019). In other words, facial movements are an imprecise gauge of a person's feelings, behaviours, or intentions. There is a growing concern that the speedy rolling out of FRTs and their enthusiastic adoption by corporations and governments neglect philosophical questions concerning the nature of visual perception that have animated theoretical debates about both AI and visual media technologies. As Gates (2011) writes, "*if* machines can see, they must necessarily embody particular ways of seeing, rather than possessing a universal, disembodied, objective form of vision, outside of any particular vantage point or subject position" (author's italic).

This concern echoes findings about algorithmic bias and Magnet's cautions against biometric failures and the fear of science encroaching upon people's rights by profiling them based on race, gender, and ethnicity. Further research may develop and validate AI's ability to recognize more subtle muscle movements and contextual cues. Hopefully, it would yield a

more nuanced and more inclusive science, but it will not resolve a philosophical question that is essentially human. It is therefore vital in the meantime to develop alternatives to the hegemonic order —that is, alternatives to the relentless progression (certainly not progress) of surveillance capitalism and to the direction in which technology seems to be headed. Rather than contribute to the cops-and-robbers narrative, perhaps we can develop different pathways that allow digital technologies to serve new masters – privacy, freedom and the individual and social good.

*

French philosopher Paul Virilio's theory of accidents suggests that every technology has faults that plague it from its very beginning: "Every technology carries its own negativity, which is invented at the same time as technical progress" (Virilio 1999). The invention of the ship was also the invention of the shipwreck, but also of the law governing seafaring and, I would add, of the pirate as well. What will it take to develop a negative to the existing technological paradigm? Can we turn our face away from the (recent) past to envision a different future, a life that is not made of glass and a face that is not a document? Can we rid ourselves of the rigidity of a fixed identity and strive toward the liberties that can be gained by becoming more like Janus the deity, celebrating duality and fluidity, plurality and change?

The design projects and artworks reviewed here call for a new approach to FRT and for new possibilities for this field. We should encourage and promote additional projects that present new possibilities and directions for facial recognition technology, in hope that it is in our power to transform it, or at least resist its invasion of our privacy. Projects in this vein can and should be attempted for us to build a brave new world where a self-determined multifaceted identity, human and fluid, is enabled.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Between digital and physical. Envisioning and prototyping smart material systems and artifacts from data-informed scenarios.

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Abstract | Acknowledging the roles and potentials of data as activators of design processes within the domains of speculative design and prototyping, the authors are running a study fostering collaboration between the fields of smart materials, digital fabrication, interactive artifacts, and speculative design. This paper discusses the possibilities offered when data meets digital fabrication technologies for the construction of smart material systems. Integrating smart components and flexible electronics, novel materials with responsive behaviours can detect, process, and manifest data. Such nature and features make a speculative design approach key for contextualizing these materials in a social, environmental and ethical future dimension to define their purposeful applications. Situated in this cross-disciplinary design area, this paper describes the grounding theoretical framework for the setup of a 2-day hackathon where interactive materials possibilities and implications were addressed and unpacked. Finally, the paper discusses potentials, limitations, and future possible scalability of the experiments and models presented.

KEYWORDS | SMART MATERIALS, DATA, DIGITAL FABRICATION, INTERACTIVE ARTIFACTS, SPECULATIVE DESIGN

1. Introduction

It is nowadays acknowledged the paramount role that data plays in our lives, and as designers, in different ways and for different purposes, we also massively rely on data. For example, they allow us to build data-informed scenarios where to unpack phenomena and understand their features for extrapolating useful insights and suggestions. Given this premise, a team of design researchers from multiple design fields have started a joint research about how envisioning and prototyping can be informed by a conscious and sharp use of information as data, following a Research-through-Design paradigm (Frayling, 1993; Koskinen et al., 2011). Here, by *data* we refer to those related to existing imaginary as films, television programs, home videos, video games, streaming contents and other media that can be accessed because available online. As designers, we look at such relevant and valuable information because they can be seen as clusters of knowledge with the potential to play a key role in igniting and harbouring scenarios, elaborated in narratives and imaginaries (more or less wide and shared). Those data are often difficult to be retrieved, accessed, or identified as relevant because they are dispersed in the vastness of the online material.

Building on this, we launched InData (www.indata.polimi.it), a project aimed at investigating the role and potentialities of data as activators in the design process identifying speculative design and prototyping as its application fields. This project was born with the scope of enabling designers to better imagine possible futures, exploiting the collective knowledge coming from online open databases. The main practical output of the project is a Scraping Tool (Varisco et al., 2019) that plays an important role as a data collector and organiser, allowing access to knowledge that would otherwise be more distributed, or worse inaccessible. Within this project, we conducted several experimental activities, led by the research question: How envisioning and prototyping can be informed by data?

Here we discuss the possibilities offered by the encounter of data and digital manufacturing technologies for the construction of smart material systems in a perspective of envisioning and prototyping. Speculating about possibilities is indeed an empowering way of disclosing and discussing alternatives, considering both utopian and dystopian perspectives (Auger, 2013; Tharp & Tharp, 2019). Acknowledging that data and data-informed scenarios can be fundamental triggers when properly embedded in speculative design and prototyping, the experimental part of our study consisted of a hands-on activity, in the format of a design Hackathon to correlate the fields of smart materials, digital fabrication, and interactive artifacts.

In the following we discuss the benefits and implications coming from starting the construction of smart material systems from data-informed scenarios, presenting the outcome of a Hackathon where these premises were experimented.

2. Theoretical background

2.1 Interactive and smart materiality

The artifacts we use in our everyday life are becoming increasingly embedded with smartness, as the quality of an object to adapt to circumstances, reacting to different stimuli. Over the years we built complex and interactive systems that bridge together people, processes, data, things, and environments in a networked and responsive way (Evans, 2011, 2012). In doing so, data and information became central for crafting growingly seamless and integrated experiences (Castells, 2000, 2004; Giaccardi, 2015). To respond to this tendency, considering the urgency of connectivity, we should deepen the reasoning on which materials can be used to implement and support smartness.

The expression "smart materials" identifies materials with changeable properties responding to external inputs (Ritter, 2006). Smart behaviours can be transferred to materials by integrating micro-controllers, sensors and actuators into materials so that they can detect, process, and manifest data in very promising ways (Razzaque et al., 2013; Brownell, 2014; Vallgårda et al., 2017; Rognoli & Parisi, 2021). Furthermore, different technologies and materials with smart properties can be combined to create *Smart Material Composites* (Barati et al., 2018) and *Hybrid Material Systems* (Parisi & Ferraro, 2021).

The application of such materials unfolds many opportunities both from an aesthetic and functional perspective: enhancing multi-sensory experiences; monitoring and supporting body activities; making invisible data tangible and information more accessible. One of the main challenges regarding the implementation of smart and interactive materials is sustainability, e.g., using organic and biodegradable materials (Lazaro Vasquez & Vega, 2019; Ferrara et al., 2019; Parisi & Shetty, 2020; Kretzer & Mostafavi, 2021). The use of biopolymers from renewable resources emerges as an opportunity to exploit and test.

Therefore, the choice to work precisely on the transformation of bio-based materials into smart bio-based materials is a crucial critical aspect. From a side such materials have not reached a stabilized imaginary; from the other side the possibility to self-produce them in custom shapes, thicknesses, and haptic characteristics, offers great spaces for experimentation and application yet unexplored.

2.2 Speculative design

A speculative design approach is key in contextualizing these materials in a social, environmental and ethical dimension for defining their purposeful applications, by enhancing their potential in translating and delivering information. In fact, such hybrid materials are often materialized in the form of prototypes and experimental demonstrators, due to technological limitations in the case of scaled productions, scarce availability of fully embeddable components in some applications, and a lack of connection with the functional and emotional dimension to which they refer.

With a speculative approach, designers try to envision opportunities without the current limitations of technology, culture, and politics in mind, and seek to satisfy the emotional and intellectual needs of people. Everyday problems often take the shape of complex matters of investigation as *wicked problems* (Buchanan, 1992). Bridging the real and the fictitious into possible or alternative scenarios nurtures exploratory processes where opportunities and possibilities are investigated. These solutions act as a "catalyst for collectively redefining our relationship to reality" (Dunne & Raby, 2013, p. 2). Speculating about the not-yet existing technologies and objects, through the use of scenarios or tangible artifacts (diegetic prototypes), is opening new frontiers for exploration and inquiry – critical inquiry and creative exploration. In this way, design practitioners can focus on the new methods and applications through which they can envision a not-yet-existing artifacts and applications. Designers should take a look into the future to face the upcoming challenges. In the area of experimenting with interactive artifacts, intelligent materials, digital fabrication, and speculative design are performing a paramount key role in enabling designers to better imagine the future and to suspend disbelief about change (Sterling, 2005).

2.3 Digital fabrication as activators of new possible scenarios

The connecting element between speculative design and new possible application conception of bio-based materials is offered by the enabling nature of digital manufacturing technologies (DMT). These technologies, indeed, are increasingly accessible and pervasive, also thanks to the worldwide spread of places such as Fab Labs and makerspaces.
In the last ten years, this led to a change in reachability and exploitation of DMT. The ongoing growth of the maker culture through DMT filled the gap from "having idea" to "making idea" (Dormer, 1997). Nowadays, the importance of experimental practices is not being questioned: throughout design practices the use of makerspaces and fabrication workshops is being actively adopted worldwide, especially in high-education contexts (Carulli et al., 2017). The opportunities offered by making processes not only affect the prototyping phase but can also become a driver of design innovation. Above all, making practices could be identified as the first trigger for enhancing speculation in several fields, not only in Design.

DMT and making processes can lay the groundwork of design concepts that integrate design practices with engineering, art and science. Examples of this approach are "Design Taxonomy" by Ginsberg (2014) that visualized, through 3D-printed shells, a future scenario where vehicles mutate and evolve subjected to biological rules, and "Conus" of Vtol.cc Art Collective, a project that applied the study of a mathematical model to develop an installation that analyses a geometric pattern on shells and transforms them into control signals for the synthesis of sound and images. These artifacts represent singular cases of a wide nebula of conceptual trials and tests distributed in the centre of the *Krebs Cycle of Creativity* (Oxman, 2016), where the creativity drivers are entangled (Brockman, 2011). Consequently, providing the DMT – and more generally the context and knowledge of a university makerspace – the real turning point is channelling the speculative dimension of

design that integrates bio-based materials, sensors, and actuators. A point that should be leveraged when attempting to apply an evolution of the experimental model already present in design schools.

3. Hackathon as a cross-disciplinary practice for envisioning and prototyping

As a demonstration of this cross-disciplinary design space, we present the case study of the 2-day hackathon "DATA < > MATERIALS - Design between Envisioning and Prototyping" involving 19 students from the different courses of the School of Design of the Politecnico di Milano (BSc and MSc). The hackathon relies on a research-through-design approach (Page et al., 2016) thus overcoming the limitations that occur when students have different backgrounds. Such an experimental approach represents a practical way to design where the students are able to first experiment and later quickly verify and iterate ideas extracting the necessary knowledge from the iteration itself through hands-on activities. Experimenting directly by building up ideas in quick prototypes gives the opportunity to fail and iterate quickly, thanks to DMT. When approaching intangible contexts such as future scenarios, the iteration of conceptual ideas in a tangible form is a key element to actualize intrinsic and critical elements. We took advantage of the practical and hands-on design activity as a final step for the InData project research (Varisco et al. 2019; Mariani et al., 2019). We used previously created data-informed future scenarios as a starting point for the student for the creation of concepts. The scenarios served as situational paradigms for the design and as a nourishment for the students' critical thinking on perspectives of future development and related ethical implications. In the following we present the setting and activities of the hackathon, critically discussing its outcomes and how the theoretical and practical framework nurtured the participants' knowledge.

3.1 Research methodology

Aiming to understand how data-informed scenarios and digital fabrication prototyping can empower designers in-training in envisioning smart material systems, the research follows a through-design approach (Koskinen et al., 2011). For grasping the benefits and also the implications of exploring bio-based interactive and smart materials from future scenarios and an array of sensors, we applied a mixed method approach, triangulating the results obtained. We monitored the hackathon conducting rapid ethnography (Millen, 2000) with participant observation. Moreover, we asked participants to provide us contextual feedback, explain which processes they were following and why. Further evidence was collected through online questionnaires and informal interviews. Also, we evaluated the experiment through the analysis of the outcomes in the form of the tangible artifacts. The purpose was comparing our initial expectations and hypothesis with the perceptions, thoughts, and experiences of those who partook in the design activity.

3.2 An experimental design method for the cross-disciplinary practice

For setting up the Hackathon, we defined a design method and structured the activities, preparing contents and a supporting toolkit for students. The method derived from the theoretical framework of the project, entangled as a systemic synergy of various outputs and knowledge from our individual research areas. It is a holistic design method involving future scenarios informed by data (Rosson & Carroll, 2009), bio-polymers do-it-yourself making (Rognoli et al., 2015), smart components programming and integration, and digital fabrication (e.g., laser cutting). In this method, three layers are mutually informed to provide design consistency to the designed artifacts: quality, shape, and behaviours (Fig. 1).

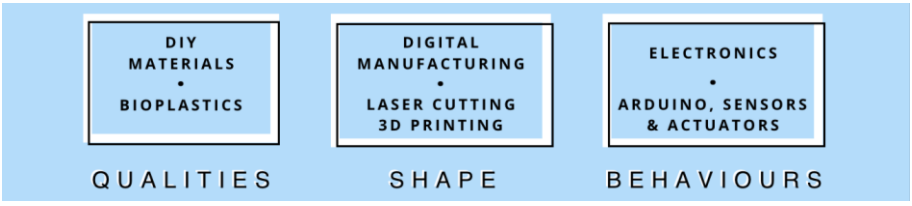

Figure 1. The three grounding layers of the method, and the related supporting technologies.

We involved a heterogeneous, multidisciplinary group of 19 students with various design backgrounds and previous knowledge on the hackathon's subjects. The brief was the creation of tangible artifacts as outcomes of the application of the method which involved different tools and elements as supporting material for the quick design process: data informed future scenarios, experimenting with bio plastics and digital manufacturing, and sensor and actuators embedding (Fig. 2).

Students were asked to create a concept of a tangible artifact that would set and act in a possible future – a diegetic prototypes – made in bio plastic, with embedded technology, supported by a kit containing a scenario, a board with sensor and Arduino code, recipes for bioplastics, and materials inspiration cards. Additionally, we provided ingredients for cooking bio plastics, and different tools such as moulds and laser cut frames.

Reference future scenarios with the additional support of a Scraping Tool developed by the authors (Varisco et al., 2019; Mariani et al., 2019) were provided as the starting point for students' creative process. Moving far from the present moment, the act of setting an idea, a concept, a provocatory element in the future allows designers to avoid constraints and boost imagination with a focus on critical elements and ethical involvement.

Moreover, aiming to materialize and iterating the conceptual ideas with hands-on activities, students learnt to create bioplastics with quick and easy recipes that enabled them to give shapes and material qualities to their ideas. The attribution of material qualities to bioplastic making was supported by introductory lectures, tutorials, and material inspiration cards that provided background knowledge and insights for embedding qualities of the material

through different textures, thicknesses, densities, and so on. Students could take advantage of digital fabrication supports and electronics to be embedded in the biomaterials to give them behaviours and bring actions to life.

The first day of the hackathon was dedicated to the learning and experimenting with biomaterials and electronics that, starting from the data-driven scenarios provided, enabled the participant to explore possibilities and constraints of the creation and use of biomaterials and electronics extracting insights and iterating the design concepts. During the second day, students built the final prototypes.

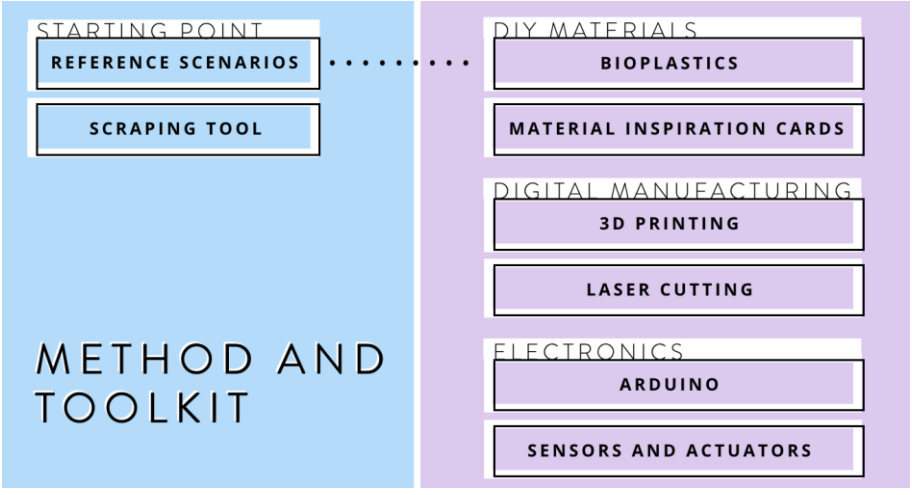

Figure 2. Overview of the Hackathon method and toolkit.

3.3 Elements of the toolkit

Reference scenarios. We provided participants with scenarios that were previously built relying on the knowledge base that later on informed the InData project itself. Starting from information derived from sci-fi, the scenarios are based on envisioning technological evolutions including not only technical, cultural and visual hints but also opening to social and ethical implications (Fig. 3): (1) Perfect Humanity, (2) Pervasive Monitor (3) Automatic Intelligence, (4) Alternatives (Varisco et al., 2017). This formalization of scenarios follows the same principles of the use of the InData Scraping Tool (Varisco et al., 2019), which has also been provided to students participating in the Hackathon as an additional instrument for refining and advancing the given scenarios.



Figure 3. The four scenarios used as a starting point.

These scenarios depict different futures with various extents of pervasiveness and ubiquity of information and technology, showing various degrees of access and use in societal context:

1. *Perfect Humanity*. Advanced technologies and access to high quantities of information enable us to enhance our potential, making us "perfect" but increasing social inequalities.
2. *Pervasive Monito*r. Measuring actions and people in relation to their data enables the hyper tailoring of services, while also raising perturbations on self-

perception, perception of others, and technocratic monitoring of society with political implications.

3. *Automatic Intelligence.* In completing everyday tasks and making decisions, we will rely on machines and robots capable of doing everything on behalf of people. In this setting, people become less and less aware of the actions performed by non-human actors.
4. *Alternatives*. The pervasive connectedness will delete the distances, altering the perception of time and space, and reducing the differences between reality and virtuality. This not only changes our reality but also allows people to become someone else through their avatars and digital representations.

We created a format containing all the scenarios, with mood boards, reference movies titles, and a list of keywords to use to expand the knowledge using the Scraping Tool.

Bioplastic recipes and tutorials. For "cooking" bioplastics, we selected a set of predefined recipes (Fig. 4). Participants could create new recipes changing ingredients' proportions and adding fillers (as powders and pigments), exploring different properties of bioplastics, such as mechanical (elasticity, stiffness), optical (transparency, translucency, opaqueness), and physical (texture). Participants were equipped with laser cut wooden frames of various dimensions to be used for experimenting with first samples of bio plastics. Laser graved textured plastic sheets were also provided for this activity and participants had a half day for testing given recipes. Then they started to design their own frames, textures, and even recipes.



Figure 4. Experimentation with bioplastic recipes.

Fab Lab environment. Access to DMT such as laser cutting, 3D printers, and vinyl cutters allowed to shrink the time usually spent in the production and assembly of study models and prototypes, allowing to run several cycles of error tests until the ideal result is achieved. Without this type of infrastructure available, the duration of the hackathon would have had to be significantly revised.

Material inspiration cards. A set of 24 inspirational cards showing examples of interactive and smart materials was provided (Fig. 5). Each card shows an example through pictures and textual information, a short text describing how it functions and performs, and a graphical schematic representation of its components, inputs, and outputs (Parisi & Rognoli, 2021).



Figure 5. Participants using the material inspiration cards.

Arduino, sensors and actuators. A kit with an Arduino board, sensors, and actuators was provided for the embodiment of the technology in materials and designed artifacts. Based on the evaluation of the complexity and time that has to be employed for the realization of the artifact, we limited the selection to three sensors – sound, touch, and proximity– and three actuators – LEDs, vibration, and buzzers. Moreover, estimating possible uses, we provided basic codes (Fig. 6).



Figure 6. Arduino coding and experience prototyping.

3.3 Results

The activity resulted in four concepts of speculative interactive artifacts manifested by realizing a set of responsive material-based diegetic prototypes able to react to inputs and delivering information according to predetermined design scenarios. At the end of the hackathon, students presented their concepts making an open presentation to the

community of designers, where the working prototype was shown and discussed. Here the four concepts are described.



Figure 7. Prototype of Secluder.

Secluder. Based on a society where virtual reality takes over and people live isolated in a parallel world (*Alternatives* scenario), the concept presents a visor-shaped device programmed to respond to noise overstimulation in public crowded environments by recreating a relaxing world of lights and colours regulated by chromotherapy, using sound sensors and LEDs as actuators (Fig. 7). The translucency and the use of colours and gradients recreate a relaxed immersive environment. The light-emitting behaviour and the material qualities are intrinsically dependent, while the texture enhances the interaction between the light and the material.

h.ID.e. The team contextualized the concept in a near future scenario where facial recognition takes over and governments have access to all data and control any action (*Perfect Humanity* scenario). In such a scenario, they imagine a part of the population that does not accept giving away their identity for security. h.ID.e is a DIY wearable device to circumvent facial recognition technologies in the form of a mask hiding facial expressions and preventing facial recognition thanks to the material texture and embedded lights activated via touch sensor (Fig. 8). The team exploited the potential of DIY bioplastics for generating uneven surfaces, applying a foamy-effect increasing the number of irregularities on the surface

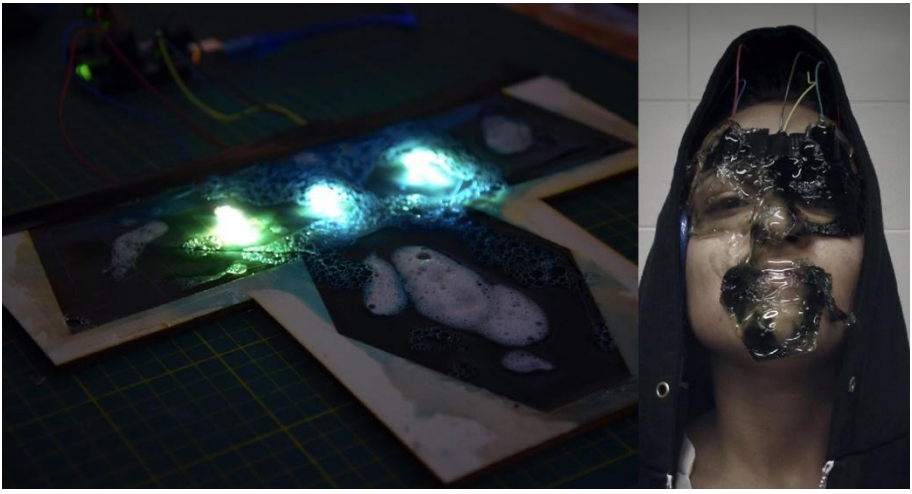

Figure 8. Prototype of h.ID.e.



Fig. 9. Prototype of Breasty.

Breasty. This device is conceived as a companion simulating human skin by touch and appearance (Fig. 9). The team worked on transferring the colour, translucency, and texture of human skin on a flexible bioplastic skin. The device detects the user's touch through a touch sensor situated on one side; it simulates the user's touch, vibrating through a servo-motor situated on the other side. Users can interact with the sensing part of the object; in

return, the responding part will generate the motion that AI elaborated they need (*Automatic Intelligence* scenario).

Zhuan. In the scenario, health and exercise become essential in people's everyday life, and they are often monitored or assisted by technology (*Pervasive Monitor* scenario). The concept is a wearable device designed in modules that detect physiological data and it provides light and colour feedback to make users more aware when training (Fig. 10). The team envisioned other opportunities to implement in the future in relation to IoT and communication with other devices for better program and time management. The device modules consist of two bioplastic layers with translucent and soft qualities, integrating electronics in between.

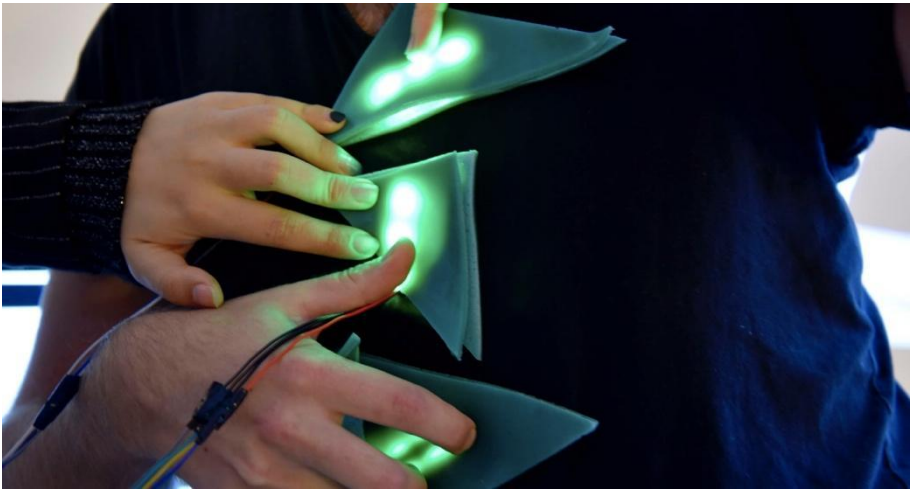

Figure 10. Prototype of Zhuan.

4. Discussion and conclusions

In this paper we presented the theoretical background and results of the hackathon. The method described is flexible enough to be extended or transferred to other fields and aims, and possibly to be scaled out in larger experimental actions. In this regard, we can trace a distinction between the methodology per se and how it was applied. Fundamental elements are data-informed scenarios and their use as triggers for both contextualization and inspiration. The playground in which this methodology was applied is that of smart materials, where scenarios contributed to envisioning the combination of materiality and technology, eventually delivering tangible demonstrators of interactive solutions. However, while in this hackathon the role of biomaterials was a central element, in further activities where the emphasis on this topic is limited, they can serve as a source of inspiration, ideas

stimulation, or materialization of tangible demonstrators. The setup showed the versatility of the methodology, and its possible applicability/adaptability to other hackathons and experiences intended for speculating on times to come while relying on current expectations regarding the future, including societal, cultural, moral, ethical perspectives and implications. The methodology and its tools may be used in activities involving other disciplines or sectors than design or cross-disciplinary teams. Examples are sociology, research and innovation, media studies. In case of this extension to other fields, however, we recognise the possible need to adapt the tools in order to make them accessible and usable by non-designers, as to say researchers and practitioners from other disciplines.

The results confirm that the theoretical and practical framework of the research project can contribute to build knowledge, impacting on the projects' development. Stimulated by the set of future scenarios, participants developed unconventional and future-oriented ideas of interactive products or materials. The development of the future-oriented design ideas was a reflective process during which the designers were analysing potential societal issues and related ethical implications of the future world. The set of the future scenarios suggested different worlds with alternative social, political, cultural, and scientific constructions, with related implications. Such scenarios also embed several technological solutions that belong to those contexts, serving as the practical activators of the abovementioned implications. Building on this reasoning, the participants were able to explore the fictional worlds that paved the way for better understanding the potential of technologies. In our case experiment, one of the main topics was bioplastics, hence ruminations regarded their possible evolutions and applications, their social impact and ethical implications. The future scenarios and the hands-on activities encouraged the adoption of a reflective approach while facing future-oriented constructions and related idea generations.

All the participants capitalized on the opportunity to use digital fabrication, especially laser-cut applied to wood to obtain custom frames, and laser-engraving applied to plastic surfaces to add designed textured and form to the materials (Fig. 11). The combination of DIY bioplastics as an easily customizable material, and digital fabrication as a rapid prototyping technique supported participants in obtaining personalized tangible interfaces with meaningful user experiences. Finally, the potential of the bioplastic to embed technologies or serve as a layer with the purpose of containing electronics was exploited.

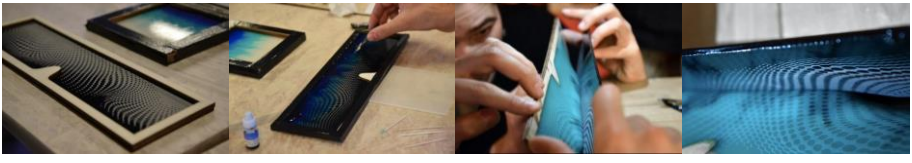

Figure 11. Custom shapes and textures are obtained by moulds laser-cutting and -engraving.

Although we suggested subsequent steps to facilitate unskilled participants, the method encourages a non-linear use of the toolkit's elements, prioritizing a holistic and flexible approach. Despite the positive feedback collected during the hackathon and in the evaluation questionnaires, some unexpected behaviours were observed, which are food for thought for future actions. In particular, the wide range of interpretative and implementation possibilities offered to students actually shifted the focus from the final output to the process. The experimental dimension is particularly persuasive for design students. As soon as they had the opportunity to confront themselves directly on bioplastics, they partially detached from the final goal of the activity, focusing on basic, extensive experimentation. Probably, the lack of integration of in-depth studies on self-produced materials in design courses was one of the reasons for the deep-rooted curiosity found in the creation of materials.

At the same time, there is the awareness that the acquisition of a process allows its replicability: participants mastered to manage the basic knowledge, potential and limits of bio-based materials, understanding some unconventional application potential of digital manufacturing technologies. In doing so, they learnt that integrating electronic components into a prototype presents unexpected complexities. In this case, thanks to the multidisciplinary structure of the experimentation, participants have been able to expand their knowledge in areas that are not usually tackled together. Therefore, experimentation combined with design practices has once again proved to be an effective and fast learning method.

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Acknowledgements: The InData project has been funded by the Department of Design of Politecnico di Milano, and the InData Scraping Tool has been developed by DeepGlance according to the authors' directions. This project includes to various extents the researches of its authors; researches often funded by third-parties. The work of Laura Varisco has been partially funded by TIM S.p.A., Service Innovation Department, Joint Open Lab S-Cube, Milano, Italy (PhD Scholarship). The work of Stefano Parisi has been funded by Fondazione F.lli Confalonieri (PhD Scholarship). We thank Polifactory, the official makerspace and fablab of the Politecnico di Milano, for hosting the hackathon. We thank Markus Holzbach, professor at the Offenbach University of Art and Design, for his inspiring opening lecture. We thank all the students who participated in the hackathon.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Consensual (Design) Fictions: co-creating iterative use cases to define technology conceptualization

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Abstract | Design Fiction has become the basic tool with which a team of European institutions has addressed the definition of use cases for the project of a future social network called HELIOS. This article aims to showcase this experience of technological conceptualization that has used a co-creation process of speculative figurations as a methodological resource. The underlying HELIOS project-funded by the EU through the H2020 program [http://helios-social.eu]- is a proposal for a decentralized social platform. It proposes an alternative to existing networks because of its context awareness and its connectivity based on trust and transparency. Key findings of this practice-based research show a proto-toolkit on how collaborative fictional narratives are useful in innovation processes. Moreover, it presents a procedure to deal with the complexity of not-yet-existing technologies and socio-technical scenarios. The article highlights some challenges to add ethical, political, and environmental concerns to the technology development process itself.

KEYWORDS | CO-CREATION, TECHNOLOGY, SPECULATIVE DESIGN, INNOVATION

1. Introduction

Every disruptive innovation process requires a leap into the unknown. The first stage of the design process (the conceptual development) deals with fictional devices and situations. It addresses expectations, desires, and preconceptions of what society, especially the relationships between humans and technology, will be.

To succeed, any new product or service needs to consider established cultural and material entanglement. This means creating a stable actor-network (Latour, 1996; Callon, 1998): a set of narratives and a collection of technical requirements that are work and are perceived as desirable and useful both for social institutions and individuals.

HELIOS, the use case presented in this article, is a technology that does not exist yet. Its mission is to build a social network platform on which social media applications can be built. The vision of HELIOS is to empower meaningful relationships by increasing trustworthiness. For this, between 2019 and 2022, the European Commission's H2020 program, is funding a consortium of 15 European institutions (companies, start-ups, and universities) to bring this technology from the realm of fiction (a concept) towards reality (a tested and functioning technology). The Barcelona based Art and Design University Escola Massana [https://www.escolamassana.cat/en] is one of the consortium members. Massana's responsibility, through its critical design research team Port 0, is to lead the first phase of conceptualization of the tool to propose a speculative co-design process based on the definition of fictional use cases (Jacobson, 2003).

As a first step Port 0 proposes the capacity of fiction and speculative design to conceptualize a contextual and technological future in which the potential of the product is imaginatively visible. The main characteristics are functionalities and requirements. This critical approach aims to surface the ethical, political, or environmental risks involved.

A creative (academic) team, as part of a technological (private companies and tech universities and research groups) consortium, provides insight into (post-) human centered values and experience that relate to the underlying product (Buchanan, 2004). This initial phase of the design is an open process in which the participation of all project's partners is required. Fiction narratives become catalysts for a collective empathy that conveys the complexity of the innovation process.

We can summarize the general objectives of Port 0 process in these three aspects:

1. Test the ability of fiction and speculative design to conceptualize and surface future technological performance.
2. Provide a (post-) human-centered perspective for the design of communication platforms.
3. Favor co-creation and manage the participation of all the agents involved in the process.

There are different ways an emerging object can be instituted. In the following sections we will share a particular method that helped a group from 15 different public and private institutions to reach, through fiction-led co-creation, a common definition of a new technology: how it could be, how could it work and how it could be used.

2. Conceptualization context

2.1 Technology design and development in the context of a consortium with several companies and technical universities

During the early stages of technological innovation process fiction emerges related to how the object will be executed in relation to building, producing, using, and explaining the technology. In this sense, prototypes, sketches, and renders produced during the conceptualization stage remain in the world of imagination.

2.2 The role of an arts and design school

In order to present the results of this action-research (Stringer, 2013), we focus on a creative and critical view from the perspective of arts and design, specifically (not limited to) the first stages of the technology design. For this, the approach considers practices from speculative, critical and fiction design, future studies, sociology of science and technology studies and post-human philosophy. This ensures an abstract and open perspective to preferable futures located at the intersection between possible and plausible futures.

These socio-technical projections have been articulated through a (Post-) Human Centered Design practice, particularly by means of scenario building through the iterative co-creation of use cases to inform the technology development teams of (so far fictional) technical requirements and services of this future technology in different contexts.

The findings of this practice-based research allowed us to develop a methodology exploring how collaborative fictional narratives act as a catalyst (from individual imagination to collective empathy) to deal with the complexity of innovative processes and particularly to not-yet-existing technologies and socio-technical scenarios while highlighting ethical, political, and environmental concerns to the technology development process itself. Port 0 conducted this research.

2.3 Particular design needs

As briefly stated above, HELIOS seeks to support the creation of social networks that empower meaningful relationships. To do so, it is focused on two key objectives: (1) to reduce fake content based on creating human trust circles, and (2) to automatically

recognise social contexts while connecting people with similar interests and concerns, through intelligent objects, smart environments, and premium content. The development of this technology implies different institutions from different European countries, working in the fields of computer science research, technology development companies, business and communication, applied technical research and arts and design.

The 'creative team' of the project collaborated in the definition of the functionalities, services and uses of the platform to create a framework and a set of guidelines to be technically implemented by the engineering team. This collaboration is part of the STARTS (Science + Technology + Arts) concept [https://www.starts.eu/]. For this, Port 0 gathered all necessary socio-technical requirements for the design and implementation of the overall platform. This included identifying specific aspects that lead to the empowerment of meaningful relationships. The goal is to assess the concept of Trust within social media in order to develop a basis for a platform that follows a 'Trust by Design' paradigm.

With this in mind, Massana had to design a process to challenge the ideas of the technical partners through provocative instantiations of what the social network HELIOS could potentially be.

2.4 State of the art

2.4.1 Speculative Design as a conceptual and critical space

Designing a technology is not only about developing an object, product or service, but creating what Science and Technology Studies (STS) define as a stable actor-network (Callon, 1998; Latour, 1996). The execution of a particular connected artifact has to do with its own technical operation, but also with its ability to satisfy a certain range of needs, dialogue with a set of social expectations, and to with the institutional interests. This enables engaging different kinds of users and proposes satisfactory interactions between the human and non-human actors. Taking this into account, the initial steps of a technology design must consider an actor-network in which the object itself will be embedded.

At the beginning of the design practice by Port 0, it was essential to recognise the agency of non-human beings from a post-human perspective (Barad, 2003; Braidotti 2016). This philosophical gesture assists the need to displace the human as the center and measure of everything and recognise other species and ecosystems as ontologically equal, while, at the same time, blurring the boundaries between what is considered as cultural or artificial, and what's considered natural or technological (Haraway, 2006).

This post-anthropocentric perspective is an essential viewpoint when designing mechanisms for social, political or environmental intervention. In this respect, Critical Design (Malpass, 2017) identifies possible problems or concerns related to objects, products and services within a non-market-oriented perspective. Inscribed within this area, Speculative Design (Dunne & Raby, 2013) and Design Fiction (Bleecker, 2009) are ways of exploring different

approaches to making things, probing the material conclusions of our imagination and removing the usual constraints when designing for massive market commercialization. Inspiration, creative provocation, raising questions, persuasion and innovation are key layers of this kind of practice (Tharp & Tharp, 2019).

Those disciplines consider the future not as something already fixed, but a space to conquer. When talking about times to come, the classical Stuart Candy's (Candy 2010) future cone is useful in the sense that it provides a series of coordinates considering what is projected, probable, preferable, plausible, and possible.

In order to explore those not-yet-existing realities, Fiction and Speculative Design can help to explore different visions of what HELIOS might be in terms of perception and use, also by incorporating practices and meanings related to the social network. In this sense, this approach is limitless in terms of imagination, therefore the process can furthermore assist in problematizing possible consequences of the implementation of this not-yet-existing technology. The freedom of not having to create something useful, sellable, or even desirable for consumption helps to imagine unexpected possibilities, pushes the boundaries, and helps provoke debate with the technological development team of HELIOS.

2.4.2 Human Centered Design

To frame the concept, especially at the very beginning several authors were taken into consideration to focus on ethical, political, and environmental concerns. This helped the team to build a post-anthropocentric and post-humanist vision of HELIOS.

The philosophical and sociological references were useful to understand the context and link the technology with it, while speculative, critical and fiction design were useful to imagine and problematize HELIOS potentialities. Another design framework that helped to articulate and present complex scenarios, users and, in general, industrial, and socio-technical possible contexts was Human Centered Design (Buchanan, 2004). Based on a series of methods, Human Centered Design situates the core of the design practice in the needs of people instead of aesthetics, technology, or markets to inform the development stage of the project.

Human Centered Design is a wide field with very different methods. It takes into account that, at this stage, the technical team needs be involved in a choice based on the use cases method (Jacobson, 2003), a methodological tool for further definition of computational architecture, technical requirements and use-experience of the platform. Use cases are not exclusively what the platform can do, but narrative examples of some of its possible functionalities and relations with people, objects, business, and environments.

2.4.3 Participatory Design

Finally, taking into account the complexity of the project, it was decided to include the input of the whole consortium in the concept design. To do so we used collaborative and participatory design (Kensing & Bloomberg, 1998; Arias et at, 2000) methods in order to

iterate the proposal several times. The HELIOS concept, therefore, would evolve from a very speculative coordinates to a more desirable, feasible and testable one.

To do this we had to understand what the project leaders perceive as what HELIOS is, and more precisely, what the features and functionalities are. Once the basis was settled, we started a divergence-convergence process. This was necessary to open the partner's imagination while making evident potential ethical, political and environmental concerns related to HELIOS.

3. Design process

Once the wider concept of HELIOS was established, the project partners were invited to further discuss the outcome. More precisely, the stages of this design process were:

- Understand HELIOS core concerns: specifically, the main features and functionalities;
- Use Speculative Design and Design Fiction to open potential uses, functionalities, requirements, and services of the HELIOS platform;
- Use critical thinking and critical design perspective to make evident potential ethical, political, and environmental concerns related to HELIOS;
- Open the definition of HELIOS concept to the 15 consortium partners;
- Use Human Centered Design to create a set of use cases that will work as a briefing that must be checked from the technological team before proceeding to its implementation;
- Definition of the final user-centered design requirements.

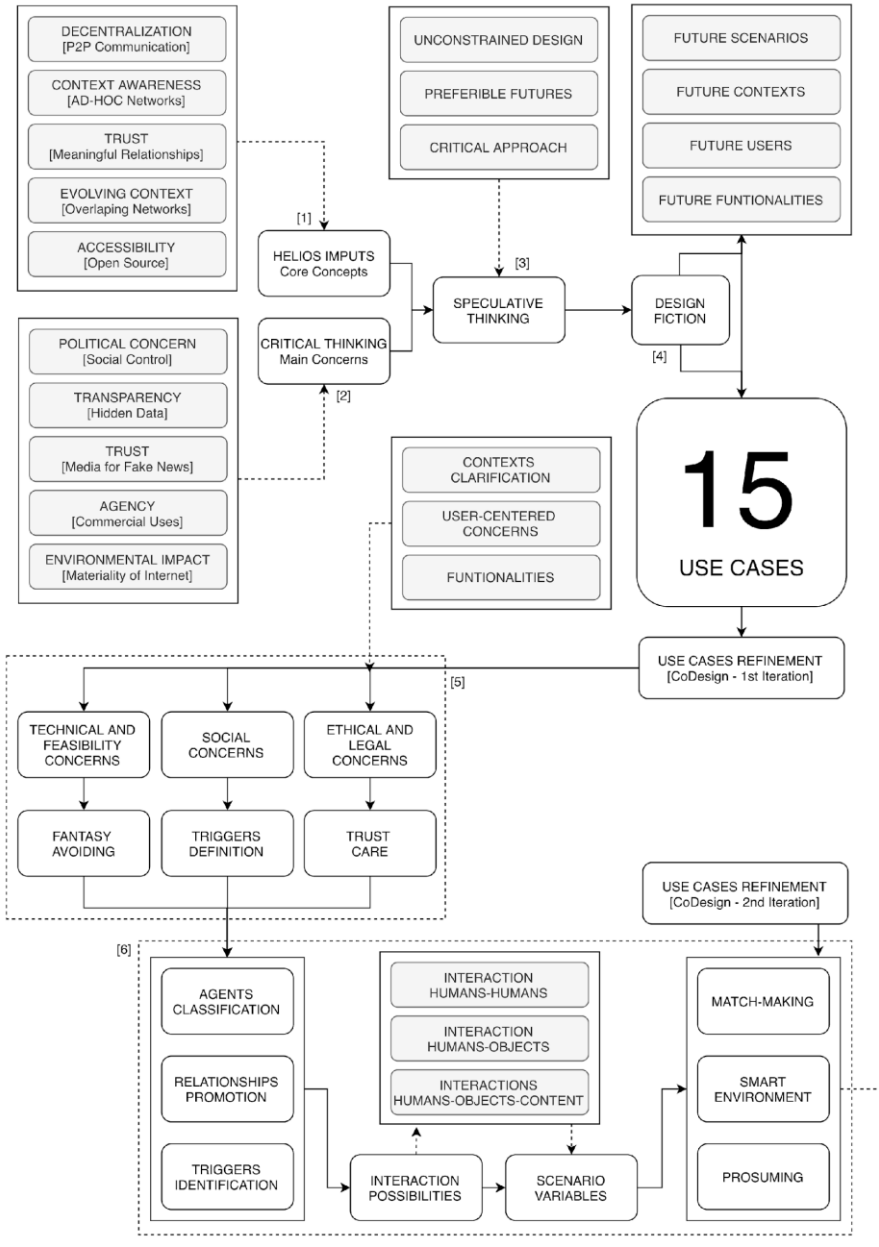
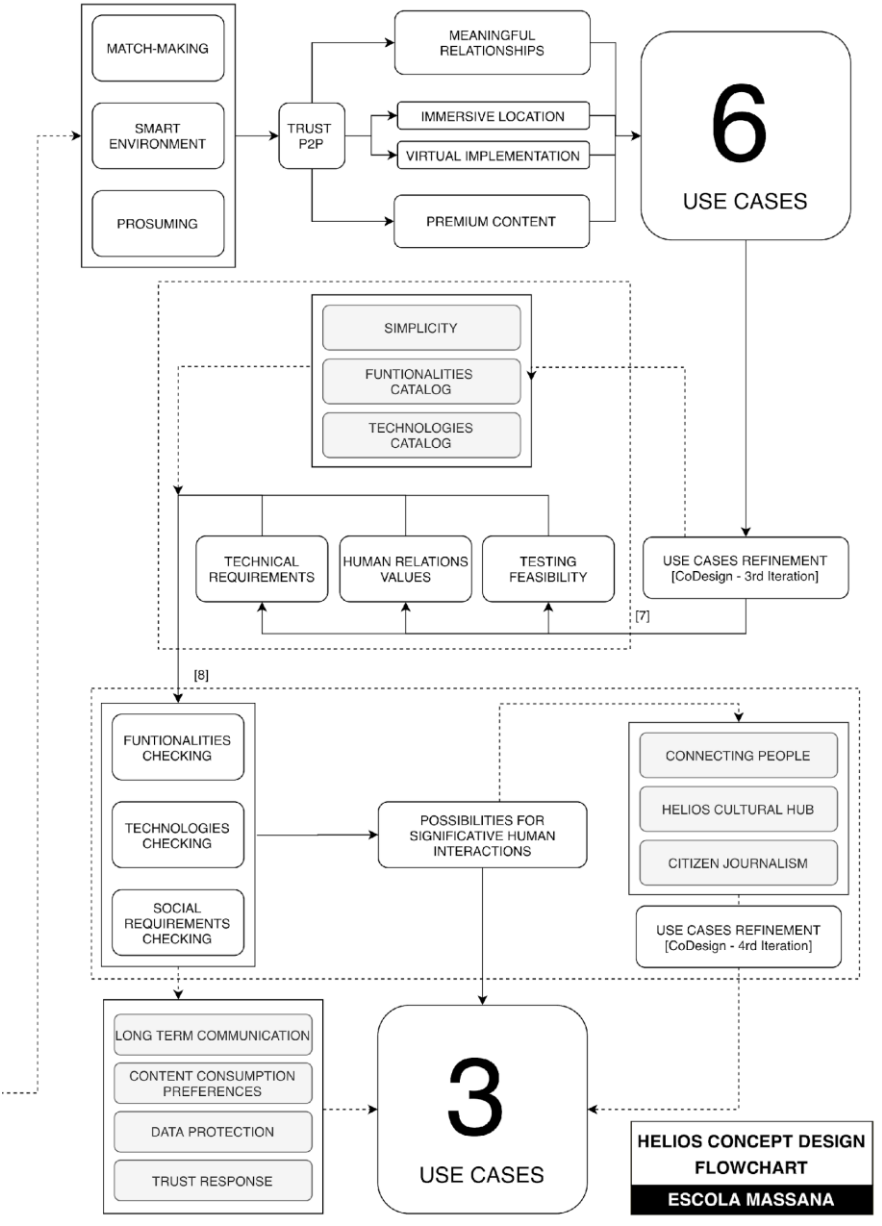


Figure 1. HELIOS Concept Design Flowchart


MATCH-MAKING
SMART ENVIRONMENT
PROSUMING
TRUST P2P
MEANINGFUL RELATIONSHIPS
IMMERSIVE LOCATION
VIRTUAL IMPLEMENTATION
PREMIUM CONTENT
6
USE CASES
SIMPLICITY
FUNTIONALITIES CATALOG
TECHNOLOGIES CATALOG
TECHNICAL REQUIREMENTS
HUMAN RELATIONS VALUES
TESTING FEASIBILITY
USE CASES REFINEMENT [CoDesign - 3rd Iteration]
[7]
[8]
FUNTIONALITIES CHECKING
TECHNOLOGIES CHECKING
SOCIAL REQUIREMENTS CHECKING
POSSIBILITIES FOR SIGNIFICATIVE HUMAN INTERACTIONS
CONNECTING PEOPLE
HELIOS CULTURAL HUB
CITIZEN JOURNALISM
USE CASES REFINEMENT [CoDesign - 4rd Iteration]
LONG TERM COMMUNICATION
CONTENT CONSUMPTION PREFERENCES
DATA PROTECTION
TRUST RESPONSE
3
USE CASES
HELIOS CONCEPT DESIGN FLOWCHART
ESCOLA MASSANA

The HELIOS concept design has been developed with a group of students and professors from Escola Massana, working together as the transdisciplinary research team Port 0.

Port 0 started studying the HELIOS project proposal to understand what HELIOS was conceptually meant to be. For this, basic inputs on the general concept of the technology were studied (#1 in the HELIOS Concept Design Flowchart). Once this was understood, the research team reflected ethical aspects of HELIOS, such as potential political concerns, transparency, trust, agency, and environmental impact (#2 in the HELIOS Concept Design Flowchart).

With the core concepts of HELIOS apprehended, the speculative thinking point of view was useful to approach the general concepts without constraints and limitations (#3 in the HELIOS Concept Design Flowchart) with the goal of materializing future scenarios, contexts, uses and functionalities through a practice of Design Fiction (#4 in the HELIOS Concept Design Flowchart). To present and crystalize the possible vision of what HELIOS could be, use cases methods were used. Because the co-design process required to iterate the conceptual prototypes several times by adding consortium partner's feedback, it was decided to start with 15 different use cases (this number was the result of the initial student's brainstorming activities). The high level of speculation of this first round of use cases shed light on some possible, probable, and preferable scenarios and functionalities to show different scopes of possibilities.

The 15 use cases were presented online to the consortium for refinement. This was followed by adjustments regarding context clarification, user-centered concerns and functionalities in general terms. Moreover, the Consortium asked to refine technical and feasibility concerns, social concerns, ethical and legal concerns, triggers definition and trust. Furthermore, focus was placed on fantasy avoiding, which means avoid impossible use cases, trying to situate the imagination on the realms of preferable, between the plausible and the possible (#5 in the HELIOS Concept Design Flowchart).

After gathering all consortium feedback, the 15 use cases were redefined with a renewed focus on inter-human interaction, humans-objects communication, and humans-objects-content. Based on the analysis of a new pack of use cases, groups were created and emerged three meta categories related to the central aim or main use of HELIOS in the following contexts:

- Matchmaking (connecting people);
- Smart environment (where the interaction is basically with the environment);
- Prosuming (where users use HELIOS to create, communicate and potentially; market content and services on the platform) (#6 in the HELIOS Concept Design Flowchart).

The definition of these three categories was key to achieve a better definition of preferable HELIOS requirements and services. Based on these categories and a series of key features of the social network like trust, P2P, meaningful relationships, immersive location, virtual

implementation, and premium content, six new use cases were created, leaving aside some unnecessary features. This third iteration was discussed in person with the consortium partners. In the meeting, the consortium identified the need to build simpler, function-oriented use cases while creating a technologies catalogue. Besides, the Consortium discussed technical requirements, human relations values, and testing feasibility (#7 in the HELIOS Concept Design Flowchart). Those requirements were considered to do the last use cases refinement.

The last and fourth iteration of the co-design concept process, ended up with a set of functionalities, technologies, and social requirements. That way, it was possible to provide a framework that might help to create significant human interactions by three different scenarios and functions. Three final use cases were created, focusing on three different areas:

- Connecting People (where different individuals or groups can connect based on common interests or needs).

  'Connecting People' offers the opportunity to engage with new people, practice new activities or gain knowledge about a certain topic. It is used by people with common interests such as businesspeople, retirees, students, co-workers, singles, etc. In order to connect to other people, each user should activate a set of permissions that will share -depending on what they want to do- personal data like age, gender, studies, real-time location or hobbies with other users.
  Helios network could be activated through a (1) user request or established by a (2) smart environment where people practice similar activities (pet-walking, going to a playground, professional co-working, or going to a market, for example). Once the software identifies a potential meaningful, safe, and trustworthy link, it displays an option for the connection that users can accept.

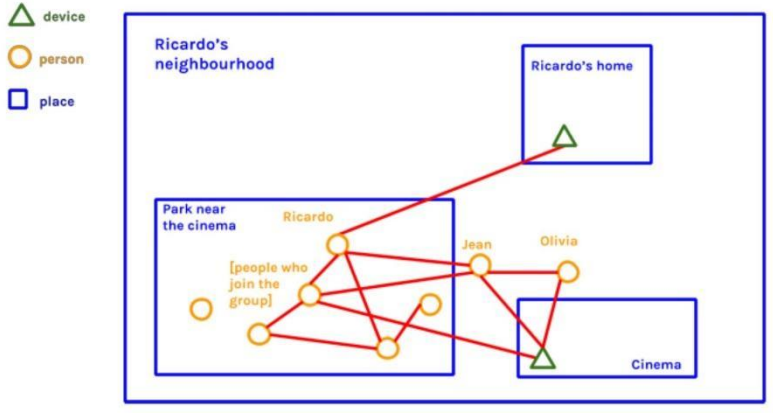


Figure 2. HELIOS Connecting People Use Case

- HELIOS Cultural Hub (where HELIOS works as a social network that links people based on attendance to cultural events).

  'Helios Cultural Hub' works as a social network that links people based on attendance to cultural events. It matches people visiting cultural centers, such as museums, libraries, or galleries, encouraging them to meet each other. It modifies the actual cultural experiences, so they become shared spaces of communication and open-source knowledge and makes connections between users that last beyond the event.
  In that way, libraries and museums become hubs for Helios to engage its matchmaking function. This would be triggered by site-specific beacons whenever users enter those spaces (when they cross a geo-fence). Also, users can agree to receive data and contextually based media about the exhibition or event, that besides provides an augmented and immersive experience of the place. There is also an interactive map of the city where Helios keeps feeding data about cultural places and events updates.

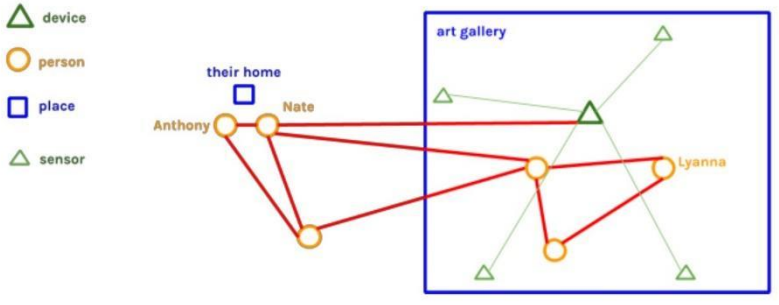


Figure 3. HELIOS Cultural Hub Use Case

- Citizen Journalism (where HELIOS sets a context-aware platform for those who can offer contributions to the description/broadcasting of a particular event) (#8 in the HELIOS Concept Design Flowchart).

  Through 'Helios Citizen Journalism' it is possible to publish data (text, image, video) and to access the collected information. There is a content storage/archive where the data is collected and shared. There is also a "Trust Score" and a "Quality Score" of the content, based on previous publications of the user, to avoid fake news.

  The platform can be used as a media broadcasting hub, with "premium content" (pay-per-view) and can integrate a rewarding system for amateur and professional

contributions. Part of Helios contextual network is already established from former editions of the same event. Within the network, users can chat, share content, and make video-calls.

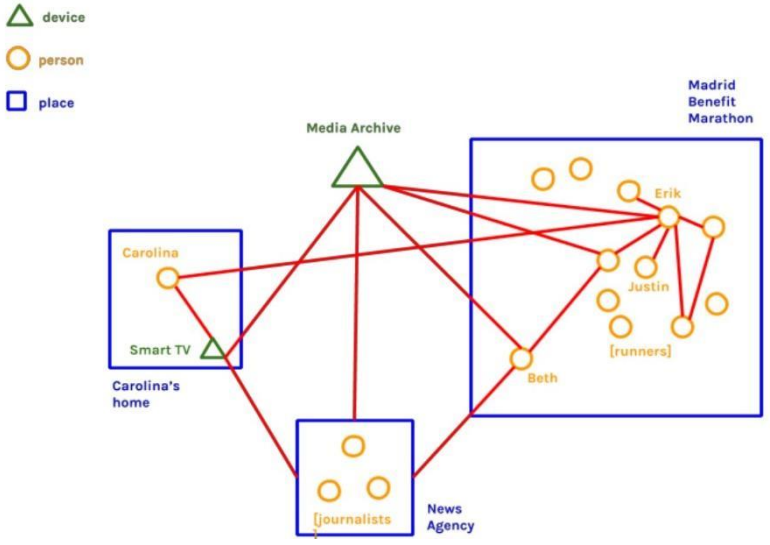


Figure 4. HELIOS Citizen Journalism Use Case

4. Challenges

In learning and experimental environments, Design Fiction and Speculative Design are used to provoke debate, help open the imagination or create objects and services in a coherent manner within a diegetic world. As a methodological process, fictions promoted by design are aimed to visualize concepts, functionalities, or performances of use not easy to be perceived from a standard approach.

Within the framework of HELIOS, these design methods had this same objective plus one: to create an imaginary consensus to clarify the rest of the development process. For this, the use cases lead the journey from the unknown to a consensual known-to-come. The used cases were specifically designed to be an abstract reference and a source of inspiration for the rest of the team to develop business plans, interfaces and, most important, the technical requirements. These requirements were meant to be a list of what engineering teams had to develop.

Through the different iterations of this use cases co-creation process, there were taken into account needs, expectations and limitations expressed by the different partners of the

consortium. Based on those, three usage scenarios were adjusted as a witness of the future social network agreed projection.

The expectation at this moment was that use cases' co-design process should have stopped. Nevertheless, contrary to what was planned, they became a source of further debate and controversy. The use cases became something they were not intended to be: a design guide, in two directions. On the one hand, use cases are being used for the definition of tasks that technical teams have to develop. On the other hand, they are being interpreted as the script to be strictly used for the testing and piloting of the project. This provoked a new debate on the meaning of HELIOS and has affected the agility of the development process.

This happens often in social research related to design conceptualization and (post-) human centered design which are difficult to guide. Based on this experience, one of the key learnings of this process is the need of designing a knowledge transfer protocol for (post-) human-centered and speculative design processes in technological development. This implies to better define objectives in industrial innovation and to clarify the role of Design Fiction within the whole process including the moments where it can be helpful according to the objectives of the projects and method capacities.

5. Conclusions

The key findings of this practice-based research illustrate a proto-toolkit on how collaborative fictional narratives are useful to deal with the complexity of not-yet-existing technologies and socio-technical scenarios. We highlighted the main challenges to add ethical, political and environmental concerns to the technology development process itself and prevent some of the risks.

Based on this experience, we tested and proved the utility of Speculative, Critical and Design Fiction Methods as an innovation tool in technology to deal with uncertainty in the early stages of development design processes. In this sense, the trans-disciplinary scope of co-design when dealing with the heterogeneity of stakeholders was useful, and collaborative narration was useful to progressive narrowing the speculative scope after the iterative process of co-design.

The design process has surfaced the tensions between the productive objectives of the corporate partners and the search for innovation of academic entities. The iterative sequence of case studies shows a progressive reduction of the idealistic look and an increase in realism in the ideation of technology.

Finally, this experience shows how art and design schools can help foster imagination of technology development projects, opening new possibilities and helping to clarify and synthesize new products and services. In this regard, the need of human-centered design in R+D processes has been proved.

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Acknowledgements: Thanks to all our colleagues and institutions participating in the HELIOS project, and to all the students of the Escola Massana who have collaborated in the creative sessions.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design of robotic for superhuman tasks

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Abstract | Over the last years, thanks to the latest technological advances, the interaction between user-operator and machine in the industrial context has changed. The presence of collaborative robotic solutions leads to the innovation of production processes and the identification of types of human-robot interaction physical-cognitive, sensory, social and emotional aimed at enhancing human capital.
The paper, through examples of robotic solutions, illustrates critical-analytical processes with a human-oriented approach, aimed at assessing the production performances related to product quality and operator safety in relation to new collaborative systems that follow the evolution of the industry.
In this context, design configures interactive and collaborative working methods in order to optimize the production process by investing in knowledge, rethinking workplaces from a Human Centered Artificial Intelligence (Human Ai) perspective, highlighting both the possibility for human to carry out activities and the possibility for machines to enhance human abilities (Superhuman Capabilities).

KEYWORDS | ARTIFICIAL INTELLIGENCE, HUMAN ROBOT COLLABORATION, SUPERHUMAN CAPABILITIES, MANUFACTURING INDUSTRY

1. Introduction

The new interaction scenario between operators and intelligent machines wants to promote new ways of interactive and collaborative work in order to optimize the production process by investing in knowledge, re-organizing the workplaces from a Human Centered perspective, interacting with technologies and implementing design, production and evaluation methods in terms of predictability, reliability, sustainability and usability.
From the analysis of industrial contexts, the greater collaboration between the production operator and the robotic system allows the increase in productivity and the improvement of working conditions by reducing health risks, thus promoting participation through shorter working methods. The presence of robotic systems leads to concrete development of the advanced manufacturing system through the definition of relevant technological trajectories for the improvement of production performance, product quality and production operators' safety in relation to the presence of new collaborative systems that follow the evolution of the industry, characterized by the synergy between robotic and human skills (Krüger et al., 2009).
The significant character is given by the introduction of evaluation methods of Human Robot Collaboration application and by the implementation of industrial automation process with the use of advanced technologies in the process of "Fabbrica Intelligente", considering the robot system's comfort use of fundamental importance and the safety for the production operator in human-robot collaboration applications. The integration of artificial intelligence in the industrial robotic sector has the purpose of improving the robot collaborative solutions and "intelligent" workspace optimizing the human-robot interaction. The application of Artificial Intelligence to human-robot interaction system within production process is evolving the concept of work by investing in new skills aimed at smart, sustainable and inclusive growth to improve autonomy in automation processes and respond to new market demands.

2. Theoretical-methodological framework

Examples of robotic solutions illustrate the critical-analytical process starting from the usability, accessibility and reliability assessments of the collaborative systems with particular attention to the safety of the production operator in carrying out work activities in synergy with the robotic systems and the possible implication improvement of production processes. From the analysis in literature of the current collaborative systems and the methods currently available for ergonomic assessments, evaluation methods are highlighted to support the current regulatory system, in reference to collaborative applications. Robotic systems are developed from the identification of system skills, in particular the ability of human-robot interaction, currently among the relevant factors in production contexts.
In particular, the discussion focuses on the design methodology centered on the user of Human Centered Design and on the analysis and design methods for the definition of

parameters and usability principles such as effectiveness, efficiency and use satisfaction, in order to improve the human-robot interaction. These criteria verify, on one hand, the system's quality characteristics, with reference to the present functionalities and their reliability and effectiveness, on the other, the analysis of the interaction, the learning ease and use of the system itself. The performance analysis of the "intelligent" workstations is carried out through the recognition of the current production lines on the basis of the ergonomic principles that determine the well-being in the industrial environment in order to define and improve the requirements and principles of usability of the system in the application of human-robot collaboration (Maurice et al., 2017). The Human Centered Design (HCD) creative approach is centered on people through a process based on human beings' ability to develop ideas that have both emotional and functional feedback.

The HCD methodology is characterized in fact by three focal moments: inspiration, ideation and implementation. In the inspiration phase, the operator-user is observed during the work activity to understand their needs, identify their priority problems and possible intervention opportunities. In the ideation phase it is understood, interpreted and given a meaning at the moment of inspiration to develop possible solutions. However, in the implementation phase, the solutions are translated into the real context, trying to better understand the communication methods and maximize their impact. The three moments described above are aimed at enhancing and powering up the empathy of users-operators in the workplace and developing innovative solutions in today's industrial contexts allowing the increasing of productivity.

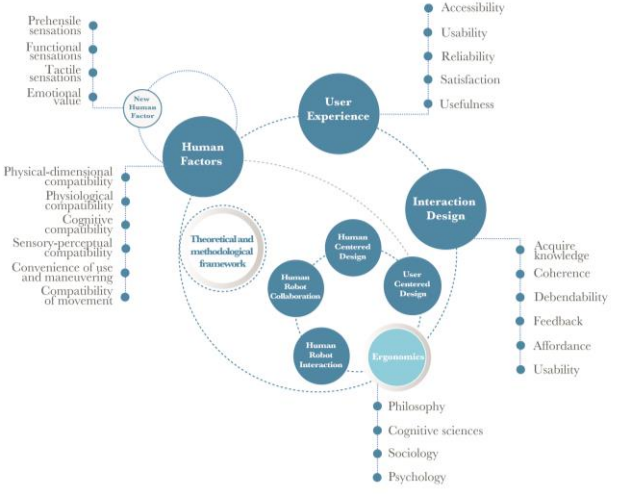

Figure 1. Scheme of the theoretical methodological framework.

2.1 The evaluation of collaborative robotic system

The evaluation of human-robot interaction is a strongly debated subject and prefigures a greater development technological plan. Evaluate collaborative systems, very often confined to automated operations within industrials installation, it is an issue that involves the robotic production industries, the cobot designers, the institutions that certify the suitability and safety of systems and finally the users-operators that interact directly with the cobots.
In this phase is fundamental to introduce the concept of usability, the ISO 9241-11:2018 defines, indeed, the usability as:

> "the extent to which a product can be used by specific users to achieve specific goals with effectiveness, efficiency and satisfaction in a specific context of use; the effectiveness as a measure in relation to accuracy with which users achieve results and satisfaction as comfort and aptitude for using the product."

Usability can therefore be expressed through three subcategories: effectiveness, efficiency, and user satisfaction (Weiss et al., 2009). The User Centered Design (UCD) strategy puts the user-operator needs and limits at the center of each phase of the process, providing a very precise development cycle regulated by ISO 13407 Human-Centered Design Process and based on the analysis of users-operators in order to implement systems that meet their needs. The User Centered Design strategy is based on users' empathy in developing innovative solutions and designing experiences. The development cycle of the UCD consist of four phases: specification of the context of use, specification of the requirements, creation of project solutions, and valuation of the projects. The specification of the context of use consist in identifying the user-operators who interface with the robot and defining the conditions of use. The specification of the requirements is based on the identification of the business requirements and the user-operator goals that must be satisfied.
The creation of project solutions defines the process' phases starting from an approximate concept to arrive to a complete project. Finally, the evaluation of the projects consists of carrying out usability tests with user-operators in order to test the efficiency of the project; and also:

> "Testing users with real users is the fundamental usability methods and in some cases is irreplaceable, as it provides direct information on how people use computers and what are the concrete interface problems in the test phase." (Nielsen, 1993)

The Human Robot Collaboration methodology changes the projects criteria of collaborative workstations and foreshadows a significant improvement in future production methods. HRC aims to identify the cells that could benefit most from collaborative robotics and to analyze the cells in which collaborative systems have a more auspicious application.
The Human Robot Collaboration methodology refers to the ISO 10218-2 of 2011 and the ISO/TS 15066 of 2016 technical specification which defines the collaborative methods and strength related limits of the robots. The HRC is mainly based on the data collection of the performance parameters deriving from the analysis of the ergonomic factors and the position of the user-operator compared to the robotic system in the production line as well as the analysis of times and the logistics system in order to improve performance in carrying out task in a collaborative perspective.

Through the Key Performance Indicators (KPI) it is possible to evaluate the complexity of the technology and the importance of Human Robot Collaboration applications, and to have an overview of the production cells. The parameters arise from the ergonomics of the users, from the operators' workstations and the interaction spaces, from the line transportation with particular attention to safety and any critical issues, the analysis of the time cycles implemented to carry out the tasks, and finally from the logistics (Zanella et al., 2017).
The considered Key Performance Indicator analyze: the shortest cycle times to process the largest number of products in a defined time, the cycles completed by the collaborative system in a given period of time, the service life of the cobot during the performance of a set task, the time expressed as percentage that the collaborative robotic system takes to execute the program, and finally, the waiting time in which the robot is stalled during the execution of the tasks. Therefore, it is necessary to monitor the Key Performance Indicators over time and compare the cobot's performance during the execution of the various tasks. In this regard it is possible to detect plausible problems and investigate its causes directly from the robotic cell. The KPIs analysis offers the possibility to evaluate the activities carried out by the collaborative system, the methods of interaction between the user and the robot, the exchange information between the man, the machine and the interface.
The goal is to optimize the performance of the collaborative cell by making continuous changes and monitoring the KPIs for long periods by investigating in times and activities. The improvement process of the robotic cells is constantly evolving in order to insert robotic systems in the other phases of the process to increase the productivity and quality of the finished products.

3. Regulatory framework

The reference regulatory framework are placed in the field of robotics and in detail it analyzes the Technical Specification ISO/TS 15066 *Robots and robotic devices - Collaborative robots* which defines the guidelines and safety requirements of the collaborative methods, the ISO 12100 for the assessment of risks arising from human-robot interaction and ISO 10218 for robotic production systems.
In 2016, the ISO 10218/TS 15066 technical specification was born to meet the new needs that emerged from the inclusion of collaborative robotic system within industrial production contexts, the specification provides lists to be respected for risk control and prevention in use of cobots. The technical specification regulates the robotic operating cells according to the different applications without the addition of protective perimeter cages and integrating safety measures on various levels, creating invisible barriers with borders that must not be crossed by the user-operator or, otherwise, the robotic system will slow down until it would shut down. The 2016 ISO/TS 15066 technical specification of *Robot and robotic devices - Collaborative robots* defines the criteria for assessing the risks generated by the use of collaborative robots and the safety levels that can work alongside operators without danger. The *Safety monitored stop* connect the robotic systems with the work environments, and in fact it defines the executive phase of the robot that mainly works alone and occasionally interacts with the user-operator. The user can cross the robot workspace, but it is necessary

to go beyond the safety perimeter to stop the robotic system and perform manual operations. This mode can also be implemented by uncooperative robots.
The *Speed and separation monitoring* regulates the minimum distance to be respected by the operator. The user-operator must respect a certain safety distance and through the use of scanners and vision systems guarantees instantaneous detection, otherwise, the robot will reduce its speed of action until it would stop. It is therefore specified that to make the robotic system more collaborative it is necessary integrate additional sensor and additional safety tools to improve the presence management of the operator within the work environment in order to avoid contact.
The *Hand guiding* is mainly used to program the movements of the robotic system. The user-operator gets in touch with the cobot to guide the robotic arm and, at reduced speed, plans the desired trajectory through the kinesthetic learning modes. The manual guidance of robotic systems is used for programming semi-automatic movements in safe conditions, therefore it is necessary to have special sensors to protect the user.
The *Power and force limiting* regulates the operation of collaborative robots through the permitted force and torque levels. Cobots are capable of perceiving the force's abnormal levels, identifying excessive loads, blocking and at the end, dissipating forces in the event of an impact. The robotic systems are monitored thanks to high resolution encoders positioned in the joints that detect the forces and carry out a self-learning process, in this case the robot can stop after the collision or change the direction of movement to reduce the possible impact energy (Vicentini, 2017).

4. Collaborative robotic technologies

There are robotic systems that have been identified, aimed at intelligent, sustainable and inclusive growth, for the innovation of products and manufacturing processes through the application of advanced solutions and technologies for human-robot collaboration within production processes, capable to respond to new market demands. The reference cobots consider the comfort of use and the user-production operator' safety in human-robot collaboration applications of fundamental importance. In 2004 manufacturer of industrial cobots Kuka introduced its first collaborative robot LBR3 to the market, a very lightweight model with a computerized control system. Instead, the Universal Robots company, in 2008 produced the UR5 model of major importance in the indusial automation field; The CTO and co-founder of Universal Robots Esben Østergaard in this regard states:

> “We have been the pioneers of collaborative robotics ever since the term was invented. If it is true that security is essential, today it is nothing but the cost of entering the cobot market. We believe that being collaborative is as important as being economically accessible, so as to reduce barriers to automation and let the robots be accessible to manufacturers who would never thought they could use them.”

The company Rethink Robotics was revolutionary that, between 2012 and 2015, have produced the small Baxter collaborative system and the Sawyer system capable of carrying out high precision and rapid operations. In 2015 Fanuc, the largest cobot manufacturer in the world, has launched its first collaborative robot CR-35iA safe, reliable and capable of lifting up to 35 Kg.
The flagship project of ABB company turns out to be the YuMi robotic system, a small cobot that performs complicated manipulation activities mainly in the assembly stages through the support of the two arms called dual arm. In the ABB product range there is also the YuMi Single Arm model, a cobot equipped with a single robotic arm with an innovative Omnicore monular control system capable of performing assembly operations quickly and with great precision.
The KMR iiwa system from KUKA Mobile Robotics (KMR) consist of the union between a mobile and flexible platform and the lightweight robot LBR iiwa. The KMR iiwa system is an autonomous robotic platform, and to command it a single control system is sufficient. The mobile robot is independent and suitable to be used for changing tools on industrial machines, to power supply machines and automation of laboratories. The KMR iiwa is a sensitive, autonomous navigation system for which no protective fences are required, instead the security system is guaranteed by a laser scanner positioned on the mobile platform and seven force/torque sensors positioned on each axis of the articulated joints on the robot. Thanks to the Simultaneous Localization And Mapping (SLAM) method, the platform locates its position in real time on a map of its workspace generated with data from backup laser scanners and wheel sensors.
FANUC America Corp. has robots that work closely with workers and learn how to work besides moving from one place to another. FANUC mobile robots automatically recalibrate their movements, in fact saving programming times. The CR-35iA robot is capable of lifting up to 35 kg alongside a human operator in safety, increasing productivity and flexibility of the working environment. The robot is characterized by protective rubber casing that protect the operator during the work phases. The CR-35iA robot is the answer to market needs that requires ever safer workspace aimed at human-robot interaction.
The collaborative robot Motoman HC10 of the YASKAWA Europe GmbH company, thanks to a sophisticated force/torque sensor on each axis, is equipped with an efficient safety system when it comes into contact with the operator, allowing a flexible interaction between the surrounding environment and the robotic arm. It should be noted how the robot is compatible with the models of the Motoman range and offers advantages on hardware and controls; they are also reliable and have low interference profiles. Another flagship project of the Yaskawa company is the Motomini with a 500g playload, equipped with a compact YRC1000micro (220V) control system, an innovative Smart Pendant with full touch system. In addition to two cameras, the Nextage Robot by Kawada Technologies consist of a head, a torso, two 6-axis arms with a movable base and a valid safety system where the robotic system's elbows never move towards the outside of the work environment, all thanks to the axial structure, so even if both of its arms are moving, the robot is not in danger of colliding with the user.

The Nextage is equipped with 15 operating axes that use low power 80 watt motors to move, allowing the robot to detect a man nearby, further safety sensors can be installed and when it is essential, this will allow Nextage to stop what it is working on.
The UR3e model by Universal Robot has a playload of 3 kg and a radius of 500mm, is smaller and lighter than previous models and is capable of easily carrying out assembly programs and precision work thanks to the 360° rotation on all joints. The UR3e model also features two adjustable safety functions and a new integrated force/torque sensor which increases the sensitivity of the collaborative robot. UR3e is able to retrace a small surface with precise and coordinated movements. The UR3e design is modular, allowing you to replace the joints in 30 minutes to minimize the times, costs and stalling phases of the robot.
The K.L.A.IN. robotics, on the other hand, offers the 3D-CPS Fast robot for the bin-picking sector, designed in collaboration with the ISS Research & Development group of Politecnico di Milano, characterized by a guide system for gripping mechanical components randomly positioned. What distinguishes the robot is the system scan speed and a safe and non-invasive IR lighting component for the operator.





Figure 2. Left. YuMi collaborative robot, ABB Robotics. 2015.

Figure 3. Right. UR3e collaborative robot, Universal Robots. 2018.

5. The collaborative robotic and artificial intelligence

In this context, design configures interactive and collaborative working methods by rethinking workplaces from a Human Centered Artificial Intelligence (Human Ai) perspective, offering "artificial machines" the possibility to enhance human capabilities by making them superhuman. Humans are equipped with the ability of self-control, morality, memory and recognition of emotions, in the same way robotic systems, through the use of artificial intelligence, are able to implement human capabilities by ensuring a knowledge of morality higher than that of the average man. In fact, "artificial machines", thanks to their superhuman speed and vast databases, have the ability to help or replace humans when it

comes to making complex decisions. Moral decision making requires the maturation of emotional responses by the reasoner such as empathy, which are properly attuned to the environments and objects with which they relate. It is these responses that allow us to register the true meaning of situations, such as the need to act urgently in situations that warrant the fear of an impending dangerous situation (Savulescu & Maslen, 2015). Thus, relationships and communications are established between natural and artificial worlds without intermediation using multisensory approaches made of gestures, images, sounds, narratives - where robots are able to communicate with each other and with humans, using the same language, verbal or gestural - to understand the fundamental conditions and the necessary decisions to be made or not (Capece, 2019).

In the era of artificial intelligence, the human-machine combination will be increasingly capable of implementing production technologies by enhancing the human factor, improving efficiency, the quality of industrial products and satisfying the demands of a flexible market with short production times.

The Omron company has invested heavily in the production of intelligent robots and integrated and interactive industrial automation system ensuring excellent performance in terms of effectiveness, efficiency and flexibility. The Forpheus robot is a collaborative robot with artificial intelligence designed to train ping-pong players; the interactive system is a representation of Omron's integrated technologies: motion control, artificial intelligence, machine learning and robotics based on open standards. The Forpheus cobot is equipped with multiple movements, greater prediction and detection of human behavior, detection and personalized training of ping-pong players focused on artificial intelligence. Omron has also introduced a new solution for control and preventive maintenance. The Sysmac AI Controller is the first device equipped with artificial intelligence for the automation of industrial machines. The control system analyzes and uses data through Edge devices to improve the durability of the manufacturing plants and prevent any problems or malfunctions in real time.

Another robotic system to mention is Homberger's Doosan Robotics, the compact Mecademic cobot with Solomon 3D vision system. Doosan Robotics is innovative thanks to the integration of Solomon Accupick3D and Mecademic Meca500, an application for recognition, categorization, and pick & place activities. Thanks to the artificial intelligence integrated in Solomon Accupick3D it is possible to carry out the pick & place activity, then identify transparent objects and manage the picking operation from different angles. The cobots, as happens for the human being, store actions through daily experience allowing them to move even in uncertain and unknown environments in order to implement their functions and abilities.





Figure 4. Left. Forpheus robot collaborative with artificial intelligence, Omron Corporation. 2019.

Figure 5. Right. Doosan Robotics collaborative robot with artificial intelligence, Homberger. 2019.

The robotic systems are equipped with Machine Learning capabilities and, without prior programming, they are able to access big data, cloud connection and cyber security, transforming large amounts of data into added value for businesses. According to Machine Learning, collaborative robotic systems are able to learn automatically from experiences through algorithms, in fact cobots analyze the examples to extrapolate meaningful relationship between them. Collaborative robotics associated with artificial intelligence aims to optimize processes with high variance by investing in advanced interactivity, improving decision-making skills and ensuring the possibility of adaptation and self-learning, to make activities less and less repetitive and reduce waste produced by traditional work activities.

6. Conclusions

Collaborative robots represent an expanding trend in industrial robotics, they outline the meeting between human and machine, and the sharing of their respective capabilities and potential. The operator is entrusted with activities of cognitive value related to intelligence and ability to solve problems, while the user-operator is entrusted with repetitive and heavy loads. New interactive and collaborative ways of working are outlined in order to optimize the production process by investing in knowledge, highlighting on one hand the possibility of man to complete the activities, and on the other the possibility of machines to enhance man's capabilities (Arcangeli, 2018). The way to implement human skills is to develop a consciousness in robots to achieve moral thinking; therefore, to achieve this goal, a high level cognitive development that involves processes such as: self-reflection, a sense of trust,

the mental imagination, and the subjectivity, is essential. With this approach the principles of biology and physics can be useful together with current applications of neural networks to improve efficiency and performance (Sossella & Caligiuri, 2019). Artificial intelligence makes possible the learning process by robotic systems through interaction and experience with users within the working contexts, in this regard the cobots are able to adapt their behavior based on the surrounding environment and to cope with unexpected situations.
The task of Artificial Intelligence in industrial contexts is to improve the autonomy of automation processes; through the use of digital technologies, the concept of work evolves to create new skills aimed at enhancing human skills. Collaborative robotic systems with the aid of artificial intelligence will not only be the subject of industrial contexts but will become support instruments in daily life and in domestic environments for assistance and rehabilitation.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design, space management and work tools: enhancing human work in transition to Industry 4.0.

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Abstract | Industry 4.0 is a process that has a major impact on production methods and the organization of industrial work systems. With the spread of enabling technologies, workers begin to engage in new types of relationships with intelligent machines. In particular, collaborative robotics (cobots) is identified as an interesting case study to initiate a "human-machine hybrid" design process. Through research based on interviews, questionnaires and field observations, this study aims to define the three main challenges in the design of cobots, assuming the need to reaffirm the importance of a human-centred approach in the smart factory of the future.

KEYWORDS | | INDUSTRY 4.0, HUMAN-MACHINE INTERACTION, COLLABORATIVE ROBOTICS

1. Industry 4.0: cooperation between machines, production department and workers

Industry 4.0 represents a major transformation process which involves a technological leap both in the use of computer science and in the field of industrial automation (Beltrametti et al., 2017). This technological evolution is exponentially increasing the possibility of being able to create systems characterized by high automation, where the human component is of fundamental importance (Celaschi, 2017).

In fact, the application of new technologies in corporate environments does not have effects on production processes only, but also on the way of working, on operators' skills and on business organization. The use of these innovations necessitates the operator developing new skills, such as the ability to be able to work in a team, to be able to solve complex problems and to adapt to working methods which are different from the standard, managing multiple machines at the same time and moving between different production workplaces:

> "these are low-hierarchy organizations, with a pronounced team spirit, with multiple skills and capable of opening themself up to new solutions and new forms of work" (Carvelli & Sapelli, 2018, p.20).

Companies are faced with a profound paradigm shift characterized by a high interconnection and cooperation between machines, production departments and workers. Operators who interact with new technological tools, learn new ways of using and controlling the machines as well as different space management. In fact, the introduction of new enabling technologies will inspire new approaches by operators towards their work tools and new organization and arrangement of lines and machines (Fantoni, 2018).

2. Collaborative robotics

The research project "*PReST: Processi, Relazioni, Spazio e Tempo: valorizzare il lavoro umano nella transizione all'Industria 4.0"*, conducted by Iuav University of Venice and Ca' Foscari University of Venice, analyzed and identified the organizational innovations capable of enhancing human work in the industry 4.0 transition in the Veneto region. In particular, the issues concerning organization of work and production processes were studied in depth, with particular interest in human-machine interaction. Part of the research focused on collaborative robotics which represents an interesting case study, as it constitutes one of the fundamental elements of Industry 4.0 in terms of flexibility, adaptability and reconfigurability of production. Collaborative robots are part of an "evolutionary" growth of machines (Magone & Mazali, 2016) that are totally transforming the relationships between machine and user with greater attention to the needs of operators.

This generates new health, productivity and safety conditions in the workplace. From the study and analysis of the current state of cobots (Vicentini, 2017) in companies and their

use, reflections emerged on these products and consequently on their design methods. Cobots are automated systems for direct physical interaction (Colgate & Peshkin, 1999) capable of performing a variety of functions to assist the operator. In practice

> “this means that the cobot takes on repetitive and precision tasks as well as the heavy lifting, while a person brings the brains and dexterity to the operation. Cobots, in this way, are literally extending the workers’ physical capabilities.” (Daugherty & Wilson, 2018).

Today collaborative robotics is one of the main development processes of Industry 4.0. To develop it further, it is necessary to involve employees, since the human component represents a necessary and indispensable element for the proper functioning of the company production system. In this context, in which the man-machine relationship is increasingly important and in which a worker interacts with multiple machines, design plays a central role. A process of change is taking place and it is necessary to effectively understand the main transformations in 4.0 development processes and in particular in the process of "man-machine hybrid". (Campagna et al., 2017).

3. The operator as a central element in the design process

Collaborative robots are used to provide automation elements in manual applications with the intention of supporting the operator in order to increase his capacity, depriving him of a series of tasks more suited to machine execution. For example, when it comes to handling very flexible objects and materials with an imprecise shape, the manual abilities and competences of the worker are indispensable. On the other hand, when it comes to handling more rigid elements, the robot can be an "incomparable co-worker" (Vicentini, 2017, p.6).

So, the worker, in the production process is a figure characterized by a high level of importance, because of being equipped with considerable cognitive skills. For this reason, the worker is entrusted with tasks that bring a greater value than those performed by cobots, which are used more in the execution of high-risk operations for users.

Therefore, in order to oversee a complete and efficient design of cobots and all those machines that create an interaction with the human being, it is appropriate to avail of a user-oriented approach (Mincolelli, 2017). The focus is no longer on the automated robot, the machine or the interface, but first of all, it is the operator who must be analyzed to identify the possible ways of interaction that he can adopt in order to collaborate with the machine. Therefore, once the context of use has been defined, the design team must analyze the needs of the operators, in order to create a design proposal capable of satisfying a series of requirements to increase the simplicity and speed of use with the work tool.

4. Research methodology

The research team began an investigation, and a first draft of methodology was done in order to decide on the various research activities. Then a series of interviews took place with various stakeholders, including researchers, trade unionists and company managers, in order to identify which opinions they had regarding Industry 4.0 processes. The goal was to establish a concrete and complete definition of innovations, not only from a theoretical point of view, but effectively researching the main changes in everyday routine and those which occur in individual 4.0 operators. Companies were identified on the basis of specific criteria, in order to carry out internal investigation and observation. Before starting the fieldwork research phase, the research methods were agreed and defined, which were based on 40 interviews with employees, department heads and owners of 4 companies.

Anonymous questionnaires were delivered and non-participant observation was conducted on site in production departments, taking photos and making videos of the work environments, which were useful for qualitative data collection.

The research used a general inductive approach (Thomas, 2006) in order to present findings based on summaries of the data collected through interviews, questionnaires and observations. The analysis of the qualitative data focused on the identification of some "design challenges" that may emerge in the design of cobots to be introduced within 4.0 companies.

This methodology revealed how the operator orientates himself in the use of these new technologies and clarified whether if he favours the new interoperability with machines or not. This approach has proved to be crucial in order to analyze how the worker moves in his work environment and how he relates to new enabling technologies. It was therefore possible to define how all this can impact on the redefinition of the duties of his role and what the possible repercussions are on his psychophysical state.

5. Olmat and Telwin: two case studies compared

From the analysis done, two companies were identified with different characteristics in terms of number of employees and manufacturing technologies in use today. The two case studies are interesting to verify current changes in the way machines and workspaces are designed, specifically through analysis of the differences between traditional industrial robotics and collaborative robotics from the design point of view.

In the case of Olmat, a small metal-working company that produces foundry cores, a traditional industrial robot is used in the painting and palletizing phase. The only collaborative actions between the operator and the machine are identified in the activation and shutdown of the robot by the use of a special display. The man-machine relationship is reduced to these operations and to a remote control of the work, which is performed by an

interface on the machine. The robot's working space is delimited by a well-defined area to maintain operators' safety and consequently the man-machine relationship is very limited, given that if the operator crosses the robot's working area, the latter will automatically shuts down for safety reasons.



Figure 1. Example of traditional industrial robot

In the case of Telwin, a medium-sized company that produces welders, cutting systems, battery chargers and starters, the production line has a quality control and painting management area where a small collaborative robot operates. The main function of this cobot is to spread the resin over the electrical components, thus making them waterproof

and resistant. Interaction with these machines involves a programming officer and others who actively manage machine operation. In the company the employee, in addition to starting and shutting down the machine, performs loading and unloading of electrical components, cooperating with the cobot and actively checking to ensure the work is carried out correctly.

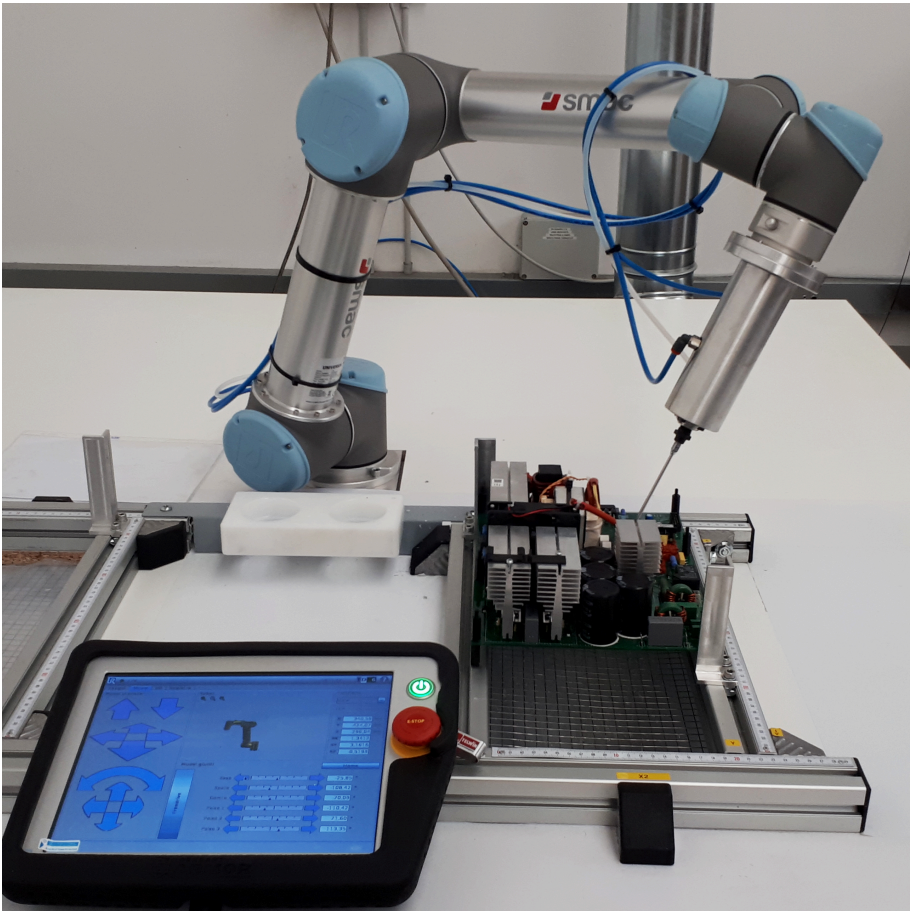

Figure 1. Example of cobot

The analysis and interviews done with employees and company managers revealed that the most efficient electronic components are produced by the combination of cobot and operators and not 100% automated. This interaction allows greater control of production and participation stimulates employees to perform better in terms of both quality and productivity. Consequently work areas take on a different layout: the cobot has no

protective barriers and can interact with the user, generating an overlap of the two operating areas.

6. Design challenges: workspaces, physical appearance, human-machine interfaces

The analysis of the case studies identifies some areas of activity in which design can play a primary role, assuming three “design challenges” for the near future within companies in which the relationships between cobots and operators in the same environments will gradually become more complex: workspaces, physical appearance (Follett, 2014) and human-machine interfaces.

6.1 Workspaces

Human-machine interactions increase workers' tasks and create new methods of using the work tool. In addition, these new relationships involve a different use of workspaces, where the operator, based on the level of collaboration, can share his workspace with the area's cobot (Rhonzin et al., 2019). Specifically, collaborative solutions are designed to generate direct physical interactions with the operator within a shared space. In other words, a space in which the worker and the cobot perform specific tasks together and at the same time. For example, the worker and the cobot can perform different operations without ever meeting or making contact. But if there is a direct exchange of objects or an assisted manipulation of some components, there is a direct cooperation between the human and the automated component (Vicentini, 2017). So, in this case, the space becomes shared: the manual workstations of the operators overlap with the cobot work area, producing more common areas. In fact, in many cases the introduction of new machines involves an important change in the plant layout, especially in terms of space flexibility.

In particular, the introduction of robots in production areas generally brings the operator closer to the robotic system, producing more efficient spaces and unlimited work flows. These collaborative solutions that cooperate with the operator must be monitored and supervised for safety reasons. The cobots are equipped with sophisticated safety devices, such as displays and anti-collision systems, capable of constantly monitoring what happens in their area of operation, coordinating their movements with those of operators, thus resulting in control over their actions and forces used. During the design phase, the designer and all the players involved in the process must try to remove or limit accidental contacts that could be created between the cobot and the operator during the work operations as much as possible.

To do this, it is essential to analyze the cobot’s movements when it is operative and its position with respect to the worker in order to carry out an accurate risk analysis. Since cobots are specifically designed to work with the operator without the use of protection

barriers, it is essential to program these machines in order to regulate their speed in the vicinity of an operator and to insert special locking systems that allow the cobot to be stopped at the minimum contact with the worker and to optimize the operating spaces.

6.2 Physical appearance

A further important aspect to consider for the design of these machines is represented by the construction of shells, which are not only used to protect the internal technology of the cobots but also to confer anthropomorphic shapes (Fornari, 2012).

In fact, for the design and construction of machines that must cooperate with the human being by sharing the same workstation, the design team must be able to design efficient robots, not only from a functional and safety point of view, but also by identifying forms to make operators more comfortable. This is an aspect not to be overlooked, as the intent to give robots human features is not done for simple aesthetic reasons, but to create an interaction that can be as natural as possible, to facilitate and prepare the operator from a psychological point of view into accepting the idea of having an industrial machine at his side more easily. In addition, this helps the operator to perform the tasks with more ease, lowering the level of frustration, the risk of making mistakes and also preventing accidents.

Therefore, the design of cobots and their shapes must start from an analysis of users and all their needs, in order to create design solutions that facilitate operators and their work in a variety of settings.

6.3 Human-machine interfaces

Human-machine interfaces (HMI) play a fundamental role in interacting with cobots, since they are used to make complex systems more understandable and easier to use, acting as a filter between the machine and the user (Aranburu, 2018). In fact, through the interface, the operator can communicate with the robotic system in order to perform a series of actions, including turning on, turning off, controlling and monitoring the machinery. In the design of human-machine interfaces for interaction with cobots, it is necessary to consider all the human variables of the users who approach these devices, through considerable collaboration between all the players involved in the design process: the designer, the ergonomist, the perception psychologist, the engineer. In particular, since it is an interaction process between different types of users, the first aspects that the design team must consider is usability and user experience (Pfeiffer et al., 2016). So, first of all it is essential to analyze the various needs and the cultural and technical background of the user, to establish which functions must be assigned to the machine and which ones to the operator.

In this context, the operator who uses the interface should have the possibility to take actions intuitively and quickly, through a clear and evident arrangement of symbols and messages. For example, if the user has to perform daily interface operations with the device

very quickly, the arrangement and schematization of the signals and messages must be clear and effective.

From this perspective the visual arrangement of symbols and buttons should be coherent, clear and at the same time not too schematic, to avoid generating cognitive chaos, and to make the approach to the machine as intuitive and natural as possible.

7. Conclusions

The analysis carried out highlights the importance of the "dialogue" between the machine and the operator within the new paradigm of the digitized factory. The case studies demonstrate how human-machine interaction, and the design of production spaces are changing in relation to the use of a traditional industrial robot or a cobot. In the near future, collaborative robots will increasingly join traditional industrial robots, allowing a higher level of cooperation with the operator. By taking advantage of direct physical interaction, the operator will be able to spontaneously and safely interact with the machine, with the possibility of bidirectional communication regulated by design.
Considering the important role of design in enhancing the relationship between humans and cobots, today it's possible to identify at least three major "design challenges", which can be summarized in workspaces, physical appearance and human-machine interfaces.
In the near future, these areas of studies will become fundamental to define reliable guidelines for the design and development of collaborative robots in industrial sector, in order to augment and enhance human capabilities.

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Acknowledgements: We would like to thank the companies Olmat and Telwin for collaborating in our research and for helping us to acquire useful data and information in order to elaborate this paper. The direct comparison with these industrial realities that are facing this process of transformation has been of fundamental importance to understand limits and opportunities of this developing approach.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designers' Skills for Social Robotics

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Abstract | The discussion about Social Robotics reflects the way we perceive our present and how we envision the future. Social Robots differ in form and function from their factory cousins based on the context they operate in. Social Robots today tackle loneliness among the elderly, aid patients with developmental and degenerative diseases, help perform household tasks and more. The common denominator among all these roles is intensive contact with humans. This contact draws Robotics out of its technical foundations to seek inputs from other disciplines like Social Sciences, Psychology and Design. The potential of the Social Robotics market leads us to investigate the role Industrial Design could play in it, the skills designers will need to cultivate to participate and the strategies for Industrial Design education to ensure the preparedness of new designers for the field of Social Robotics.

KEYWORDS | SOCIAL ROBOTICS, INDUSTRIAL DESIGN, EDUCATION, HUMAN-ROBOT INTERACTION

1. Introduction

The Neglect of Industrial Design (Ughanwa, 1991) champions the irreplaceability of industrial designers in product creation. Ughanwa argues that for products to gain a competitive edge in the international market, the design of products cannot be left to the Engineers. Ughanwa's industrial designer is not a specialist, but someone who can unify a technological capability with the fulfilment of a desire or need of the user.

In the next decade, Borja de Mozota (2002) reports on Design Management in Europe's top Small and Medium Enterprises (SMEs). The study finds Management employs Design primarily for product differentiation through aesthetic and ergonomic interventions. While the role of Industrial Design begins to be perceived as a major contributor to a market advantage (Drew & West, 2002; Raulik et al., 2008; Europe Economics for DG Internal Market & Services, 2016), the profession is still not considered crucial. In many cases, Design is seen as a sub-field of either Marketing or Engineering. Design is not perceived as a mover in improving product quality or production and most product innovation is driven by marketing, leaving R&D or Design-driven product innovation at a lower priority. The study also analyses what skills managers look for in Design candidates. Imagination and the ability to synthesise and visualize ideas rank much higher than the ability to understand user needs or think laterally. This reflects some of the stereotyping of the designer as more of an aestheticist.

With the advent of Design Thinking around the 2010s, Design as a discipline matured enough to begin influencing other disciplines such as management (Kolko, 2015). Recognising the role of Industrial Design, companies began building in-house multidisciplinary design teams that collaborate with the different departments to create more advanced products (Burton, 2019). Corporations like Apple and Philips that have well-established design teams, helped start the trend of acquiring Design capabilities. Tech players like Facebook, Google and IBM are joined by consulting companies like Accenture, PwC, Mckinsey and Deloitte in acquiring design firms (Maeda, 2016). With the rise of digital products, the focus shifted from products to experiences (Design Council, 2018; Burton, 2019). Consequently, industrial designers now find themselves filling jobs in Design management and User Experience Design (UX) and the profession is adapting to meet the needs of the future.

In the new decade, the growth of Industry 4.0 and the Domestic Appliances market create new opportunities for industrial designers in the technological sector. One of these growing markets is Robotics. While industrial robots used in automated production lines have a well-established foothold in the market, Social and Assistive Robots occupy a considerably small market share. Complex human-robot interactions with these robots demand more thought into their application and usability. As a result, roboticists will need the aid of professionals trained to understand and address user needs- Industrial Designers.

2. Service and Social Robotics

The earliest mentions of Social Robots, in the present context, occur in the 1970s by when the idea of the robot had already been popularised considerably through science fiction literature and film. In a 1978 Interface Age edition dedicated to the theme of robots, F.W Chesson discusses the evolution of robots and lays out the physical and technical requirements for a possible Social Robot tasked with supervision. The article discusses the use of sensors, Artificial Intelligence, and features such as obstacle avoidance that are still relevant to robotics. In the forty years since robots have overcome numerous technological hurdles to make their presence in human lives not just possible but essential.

Broadly, a robot is a programmed physical entity that perceives and acts autonomously within a physical environment which has an influence on its behaviour meaning it manipulates not only information but also physical things (Kaplan, 2005). The International Federation of Robotics (IFR) defines two main services offered by robots: (a) servicing humans (personal safeguarding, entertainment etc.) and (b) task performance and equipment servicing. A Service Robot is thus "A robot which operates semi or fully autonomously to perform services useful to the wellbeing of humans and equipment, excluding manufacturing operations." (Hegel, 2009). Similarly, the International Standards Organisation (ISO) defines "Service Robots" as robots that "perform useful tasks for humans, which aid in physical tasks such as helping people move around".

Professional, personal, and domestic Service Robots in 2019 had a combined market share of 17.2 billion USD with logistics and floor cleaning robots making big gains (International Federation of Robotics, 2019). The overall demand for Service Robots is boosted by socio-economic changes (medical, cleaning, entertainment robots) and industry strategies (collaborative, logistics, maintenance robots). As Service Robots grow more ubiquitous, they will have to evolve to adapt and interact more holistically with humans.

In contrast to Service Robots, Social Robots are designed to communicate with people. Chatbots are also designed for that purpose, but a social robot is physically embodied (Korn et al. 2018). Social Robots are explicitly developed for the interaction of humans and robots to support a human-like interaction (Hegel 2009). Bartneck and Forlizzi (2004) define a Social Robot as an autonomous or semi-autonomous robot that interacts with humans by following the behavioural norms expected by the people with whom the robot is intended to interact. If robots are to make this leap, Robotics must grow out of its technological roots.

3. Social Robotics as a Multidisciplinary Field

Roboticists are conventionally engineers with competencies in Electronics, Mechanical or Computer Engineering. These roboticists may also specialize in fields such as Artificial Intelligence, Machine Learning or Computer Vision which significantly augment robot

capabilities. Complementing these individuals are, often, professionals from the fields of Psychology and Sociology, called on to help create the “Human” element of the robot.

Multidisciplinary cooperation in robotics began to gain importance in the mid-90s and early 2000s when events and conferences brought different interest areas, in the field of robotics, together. “The IEEE International Conference on Robot and Human Interactive Communication (RoMan)” that started in 1992 and conducted annually to this day was one of the first such events. Initially, this conference was mainly attended by experts in robotics from technical fields but in recent years the conference has attracted more multidisciplinary researchers. In 2000, the IEEE / Robotics Society of Japan created an international conference on humanoid robots that put the spotlight on robot behaviour and anthropomorphic robots and in 2001 the United States National Science Foundation and the Defence Advanced Research Projects Agency (DARPA) sponsored the first seminar on Human-Robot Interaction (HRI) (Burke et al., 2004).

Such events brought together a highly specialized and multidisciplinary group of researchers who worked in fields associated with HRI and allowed roboticists to interact with experts from various sectors like Psychology, Sociology, Cognitive Sciences, Communication Sciences and Human-Computer Interaction. We can, hence, consider these events pivotal in the establishment of Social Robotics.

Social Robotics has also been advanced by robotics competitions. Two early competitions in the field were the “Association for the Advancement of Artificial Intelligence (AAAI) Competition and Exhibition” and the “Robocup Search and Rescue” (Kitano et al., 1999). The challenges involved the development of robots capable of rapidly analysing their surroundings under extreme conditions and completing their search and rescue task. The rich Human-Robot interactions in these challenges led participants to focus on resolving HRI problems.

In recent years, these competitions have expanded on the original scope resulting in the birth of events dedicated to Assistive Robots. The HRI challenges in this domain include physically supporting the user safely and designing effective social interactions through cognitive and emotional approaches, often through natural interactions like gestures and speech.

These conferences, seminars and competitions highlighted the need to establish inclusive interdisciplinary interactions, to create a common working vocabulary for this field, diversify the areas of application based on the interests of each discipline and organise fieldwork for HRI experts to validate and test concepts. These events also created great opportunities for technology transfer between disciplines and helped identify new opportunities for such technology in society.

The development of robotic assistants in the socio-cultural context poses many challenges. Besides technological limitations (sensor accuracy, actuator response speed, processing capabilities etc.), participation and synergy between the technical and non-technical teams

involved in the project are also issues since the success of the robot is not only determined by technical efficiency but also by its effectiveness (Šabanović et al., 2009). Depending on the context of the application, it is also possible to involve other professionals, for instance, doctors, patients, and caregivers in the case of assistive robots or teachers, students, and parents for educational robots. The design of socially interactive robots can thus be seen as a catalyst of knowledge that can lead to the creation of a "Hybrid Science" (Caporael 2000).

The research covered in this paper is aimed at understanding the present and future roles of Designers in this multidisciplinary field of Social Robotics.

4. Statistical study of Robotics teams today

The first part of the research consisted of the statistical analysis of the role of designers in current Social Robotics companies. It was carried out by web scouting using keywords associated with the design and production of robots. Web scouting resulted in an initial list of 42 companies. This initial list was reduced, excluding industrial robot companies, maintaining companies working on Social Robots. A second reduction resulted from inadequate data found on company websites or insufficient data on the role of team members, their education backgrounds, or their professional profiles. Some of this data was drawn from the interviews we conducted and some from cross-checking team listings with profiles on professional social networks. Another point to be noted is our inclusion of profiles requested for job openings in addition to the composition of existing teams.

Our final sample comprised of 22 representative companies in the field of Social Robotics. They consisted of 1 large, 6 medium, 9 small and 6 micro enterprises. A considerable number of them were spinoffs from research institutes and universities. We analysed employee roles associated with robot development avoiding administrative and marketing roles. We also analysed the educational background of the employees.

Professional roles were classified into 11 categories:

- 3D: 3D Modelling, Animation, Character Design
- AI: Artificial Intelligence, Motion Analysis, Computer Vision, Speech Technology, Sensing
- BM: Biomedical, Human Behaviour, Assistive Technologies
- EL: Electrical and Electronics Engineering
- GR: 2D Graphics, Communication, Web Design
- ME: Mechanical Engineering
- RO: Robotics, Materials, Mechatronics, Energy/Autonomy management
- SW: System Software, IT architecture, Firmware Development
- TA: Assembly, Testing, Maintenance
- UI: UI/UX Design, Interaction Design, Web Interface, Games
- OT: Other roles

The different educational backgrounds were classified into 9 categories:

- BM: Biomedical Engineering, Physical Therapy
- CS: Computer Science, Software Development, Software Engineering
- DE: Graphic or Industrial Design
- EL: Electronics or Electrical Engineering
- JT: Junior Technician, Trainee
- MA: Mathematics, Statistics
- ME: Mechanical engineering
- RO: Robotics or Mechatronics Engineering
- ND: Undefined

From the analysis of data of the selected companies, we obtained 138 professional profiles for comparison. From these, we were able to identify 31 different combinations between job roles and educational background (see Figure 1).

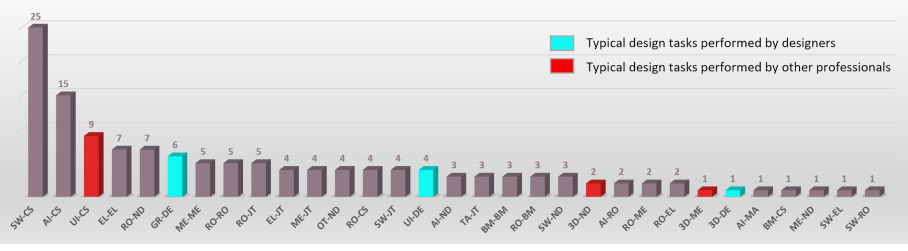

Figure 1. Comparison of job profiles and educational backgrounds in professionals engaged in the Social Robotics industry

From the graphical analysis, it is evident, at 29% of the total dataset, that software developers with the relevant educational background comprise a significant part of robotics teams. In total, if we consider all software development, including Artificial Intelligence (AI) and other machine intelligence specializations, software developers/engineers occupy around 40% of the total dataset. In the classification we distinguish between the two groups, to highlight the demand for specialists in machine intelligence in addition to developers needed to program functional aspects of robots.

The second most significant participation is from professionals that characterize the sector-Roboticists. Under this banner, we include profiles such as 'Robotic Engineer' and 'Robotic Technician', professionals who specialise in mechatronics. This role occupies 20% of the dataset and professionals in these roles come from many different educational backgrounds.

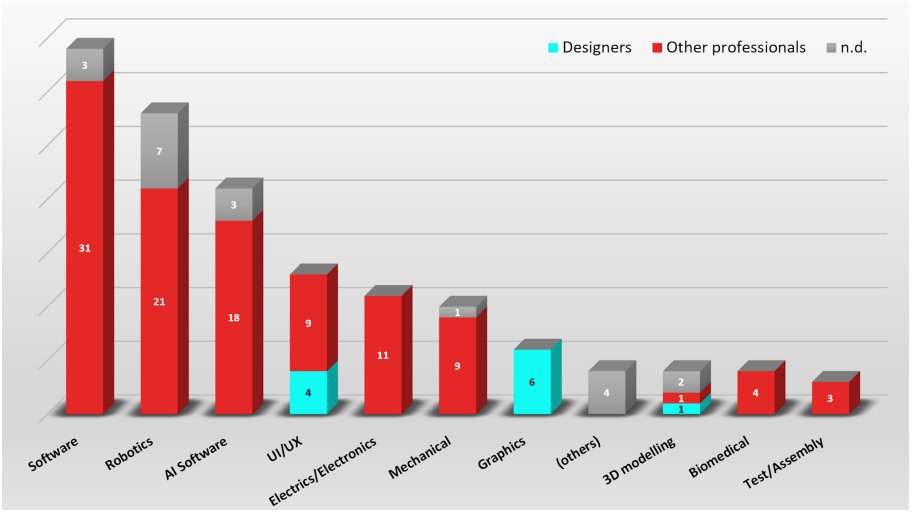

Figure 2. The proportion of Designers engaged in different profiles in the Social Robotics Industry

The next most significant role is that of User Interface/ User Experience designers (UI/UX), a design specific role. They comprise of around 7% of the team but what is noteworthy is that a greater proportion of these specialize in, or come from an educational background in, software development rather than Design. Only 36% of UI/UX roles in our dataset are occupied by designers.

Altogether, considering the most typical design roles (2D/3D design and UI/UX), which comprise 17% of the total, we note that of these roles 52% of the positions are occupied by non-designers, generally software developers. The only sector where designers are exclusively employed is in 2D graphics, web, and communication design.

The overall picture, though not exhaustive, seems to confirm the fact that, even considering only social robotics companies, which by definition must pay particular attention to the relationship between people and machines, the designer is still mostly required to perform graphic and communication tasks. In the sample, of 8 companies with UI/UX positions only 2 employed designers while the others employed computer scientists. One possible reason for the lack of designers in the industry could be that many small robotics companies are spin-offs from technical institutions and are more focused on functional performance.

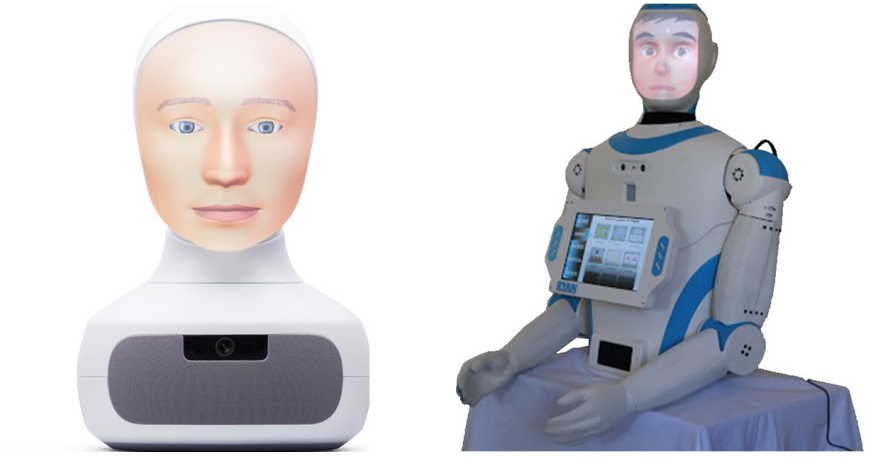

Figure 3. Furhat Robotics (Sweden), a small enterprise that produced Furhat (left), involves designers in UI/UX while DreamFace Technologies (USA), a micro-enterprise that developed Ryan (right), has engineers managing UI/UX (Image sources: Furhat Robotics, DreamFace Technologies)

These findings seem to demonstrate that the participation of designers in the Social Robotics industry is not high. To investigate the reasons for this we conducted interviews with professionals in the sector.

5. Expert Interviews

This section of the research was aimed at gathering information from the industry experts on the present situation of design in Social Robotics to synthesize strategies for Design Education in the future. Five interviews of individuals from robotics companies and research institutes, primarily those that deal with Social or Assistive Robotics were conducted: Dr Maria Rosanna Fossati (Researcher, IIT Genova), Mauro Puttolu (Sales Manager, Jampaa), Will Jackson (Director, Engineered Arts), Dr Manuele Bonaccorsi (CEO, Co-Robotics) and Alexandre Colle (PhD candidate, Edinburgh Centre of Robotics and Co-founder of Konpanion). Of the organisations of our interviewees, 2 had in house designers and the other 3 either collaborated with designers on projects or outsourced design tasks. The organizations are based in Italy and the UK.

5.1 What can designers do?

According to Fossati, a designer can play several roles in the Robotics industry. The most common role is that of an aestheticist who intervenes, often in the final phases of the project, to work on the embodiment of the robot. This and the role of the graphic designer

help give the robot a competitive edge in the market. However, this shouldn't be the primary role of a designer who can also participate as a facilitator between the product development team and end-users to better understand the needs that must be addressed by the product and the end-users' comfort with the final product beyond functionality. Designers can contribute to robotics through research as well. In literature, Valoten (2005) explains of the existence of these roles based on the evolution of Finnish Industrial Design. The role of the designer as an aestheticist comes from the early days of Design where artists were brought in to create new forms for products. Design Research came with the advent of ergonomics when aspects of the design process were being codified as a scientific methodology and not merely an artistic expression. Designers as facilitators arose in the 1980s with the rise of Design Management and with the rise of the branding era in conjunction with the technological boom, industrial designers became involved in providing User Experiences. Another interviewee Mauro Puttolu feels that this task of improving the User Experience along with Problem Setting are the most important roles designers can play in Robotics. However, his company has seldom worked with industrial designers. It is not uncommon for companies to outsource their design tasks. Hiring a design agency can bring in fresh perspectives, but often, this approach looks at design as value addition and not as an integral part of product development. Instead, in-house design teams require less time to familiarise themselves with the company's needs as they have a more intimate knowledge of the company's project, resources, capabilities and market objectives. Will Jackson's Engineered Arts is one such company and as one of the in-house designers he says, "Robotics is an integration challenge - the mechanical parts must fit with the external appearance and the software interface must be easy and accessible to use".

5.2 Design in a multidisciplinary approach to Robotics

The collaboration between different fields such as engineering, informatics, natural sciences, cognitive sciences, design, arts, medicine, and education shows how different research methods and work practices are as necessary as they are problematic. Work involving different backgrounds and approaches can often lead to misunderstandings. Confusion over terminology is probably the most common cause for confusion. The meaning of a term may vary depending on the discipline (Šabanović et al., 2007). Fossati notes how the disciplines each have their own language, vocabulary, work practices and toolbox. This makes it hard for the different fields to dialogue, let alone collaborate operationally.

Despite this observation, most of our interviewees agree that the solution to resolve such differences is multidisciplinary collaboration. Jackson identifies the conflict between a designer's idea and engineered reality as the result of hiring designers with no practical experience and urges designers to experiment and understand feasible production methods and material properties. Manuele Bonaccorsi offers a different perspective saying it is important for engineers to work with other disciplines. He makes a case for interdisciplinary courses at universities where designers come in contact with technology and engineers get to collaborate with designers to broaden their understanding of the application of

technology. This approach will better equip students from both disciplines for professional projects, which are increasingly multidisciplinary. Alexandre Colle, concurs, saying designers and engineers cannot work without each other while developing products. Design, according to Colle, is a holistic discipline where you must consider the needs of users, the environment and the market. Colle stresses that designers must engage more with engineers and advocate the potential of design thinking in robotics. For Colle, multidisciplinary education brings together not only Design and Engineering but also Psychology, Business and other fields that create new opportunities for meaningful outcomes where technology is not an end but a means.

6. Conclusions

Our conclusions on the skills an Industrial Designer should possess to integrate into a Social Robotics development team are based on desktop research on the development of social robotics, studying market forecasts in this sector, analysing robotics team compositions and the educational backgrounds of team members. In addition, expert opinions were sought through interviews. Our conclusions also include our experiences developing Social Robots in multidisciplinary teams (Bonarini et al., 2016) and the courses we teach in this field (Bonarini & Romero, 2013).

6.1 General Skills

Industrial designers' core skills, as developed in professional courses, will continue to be indispensable in Robotics and designers must be highly competent in using these skills. Industrial designers will have to bank on their ability to identify problems from comprehensive assessments of user-needs conducted through interviews and research. Designers will always be relied on to be creative and solve problems radically. This said industrial designers must be extremely capable at representing ideas through 2D sketches as well as 3D models both physical and digital. Models must not only convey the aesthetic appearance of products but must take due consideration of the production processes involved. To this end, industrial designers must be knowledgeable in the existing industrial methods, materials, and their properties. It is highly recommended that during the iterative prototyping process designers experiment with the materials and processes to improve their understanding of the practical feasibility of their ideas.

6.2 Technical Skills

Robotics development and arguably all product design is inherently tied to engineering. Thus, designers must educate themselves in Mechanics, Physics, Computer Science and Electronics to be able to communicate effectively with engineers in the field of robotics. We do not intend for designers to become experts in these fields but to have sufficient working knowledge of the principles and become familiar with the language used by these fields. A

multidisciplinary approach to problem-solving requires designers to be prepared to work alongside professionals from other fields. Thus, industrial designers must seek experience on collaborative projects, working with engineers, to better integrate into robot development teams. In robotics, designers must be able to produce functional prototypes to demonstrate interactions and basic functionalities. To achieve this, they must be capable of developing electronic circuits employing sensors and actuators or of programming interactive displays. This requires them to extend their knowledge of prototyping to include electronics and informatics. Fortunately, development platforms for electronics firmware and software tools to develop web services and mobile applications, have made this easier today by abstracting many of the complexities. Nevertheless, Designers must be prepared to learn to use new software and we strongly advise gaining some proficiency in computer programming since coding is now an integral part of a broad spectrum of software tools. The rising demand for UI/UX design makes these skills an indispensable part of an Industrial Designer's toolkit.

6.3 Social Science Skills

Improving User Experiences is heavily influenced by the understanding of human factors. These are studied in detail in psychology, sociology, medicine and design. Referring to research and consulting experts in these areas must be part of the methodology used by industrial designers to create better Human-Robot Interaction. From the perspective of product design, it is evident that the experience of using an object is multisensorial. In robotics, this is even more important considering there are not only affordances from the embodiment to consider but also responses and feedback that must be designed as part of the robots' behaviour.

There is a great role of context and culture to the success of a project and designers must always be perceptive of the user's expectations and concerns. This calls on designers to contribute as researchers by staying informed of current trends, market opportunities, technological advancements and scientific breakthroughs in different fields that can lead to new innovations.

6.4 Soft Skills

The multidisciplinary nature of Design positions industrial designers as mediators in the workplace. Visual representation skills that are part of a designer's foundation has great potential to be utilised to communicate information more effectively between disciplines and departments. Industrial designers must improve their communication skills to dialogue with professionals from different backgrounds as well as to advocate for the integration of design in the development process. For human resources, this ability of designers to collaborate and cross-pollinate across disciplines would be invaluable. Part of the communication skills required is the ability to listen and discuss. Designers must then be able to extrapolate and synthesise the gathered information into new ideas. Lateral thinking is

essential for Industrial Designers to aid in solving technological problems with creative ideas.

Thus, we posit, for Social Robotics still in its nascent stages of market maturity, there is much an Industrial Designer can contribute towards creating new paradigms in robotics and providing inputs that could give Robotics companies a market advantage.

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Acknowledgements: The authors would like to thank all the interviewees- Dr Maria Rosanna Fossati, Mauro Puttolu, Will Jackson, Dr Manuele Bonaccorsi and Alexandre Colle for their invaluable input, the organisers of Cumulus for adapting the conference under tough circumstances, and Università Iuav di Venezia for its support.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing for the future by understanding evolving culture based on advancing technology and the changing behaviors that accompany it.

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Abstract | This paper will investigate how Design, Culture and Technology have grown in tandem throughout history, how they help us investigate and record the present, and how together, they can inform our future.

1) The Cyclic Correlation between Design, Culture and Technology : Innovation in "technology" ie, not only computers, but the application of scientific knowledge in industry, has influenced the course of Design since our ancestors learnt how to carve bones, rocks and moved to ivory, stone, metal and so on. Our earliest centres of culture, such as the Gobekli Tepe, developed in tandem with Technology and Design (Curry, 2008; Bewan, 2018). Throughout history, the five waves of technological revolution (Industrial Revolution, Age of Steam, Age of Electricity, Age of Mass Production, Age of Information) have been accompanied by social change (Moody and Nogrady, 2010). Design serves as a medium to voice opinions, shape culture and visualise the future. Design can voice the abstract better than words, allowing it to transcend cultural and language barriers. Such expression allows for an alternative discourse that challenges established centres of power, existing norms and helps us expand the collective imagination (Chandrachud, 2019).

2) Design and the Future: In the 21st century, the influence of technology is felt acutely. It has transformed daily life, it has reduced distance, time, geography; increased accessibility to information and resources and it has consequently transformed our habits and therefore, the content we produce (Brewer, 2018). As technology leaps into increasingly esoteric complexities, Design can help us make sense of our rapidly changing world (Dubberly & Pangaro, n.d.; "Making Sense of Today's Tech World," 2018). Design can also make the changes of the future and their benefits and challenges visible to the masses so that we may all weigh in to how technology is going to shape the human condition. We need to cater to and predict the changes technology will bring and design for them. This section will examine design practices today and how they will be redundant or relevant in the future. This section will also attempt to understand the sociocultural changes brought about by technology that influence society and behaviour and therefore, Design

In the purview of this understanding, this paper will outline design as it stands today, including how changing culture impacts designers, design practices and their users/audience, and will speculate the role of design in the immediate and to some extent, the distant future.

KEYWORDS | DESIGN, TECHNOLOGY, CULTURE, FUTURE, BEHAVIOUR

1. THE CYCLIC CORRELATION BETWEEN DESIGN, CULTURE AND TECHNOLOGY

Our earliest centres of culture developed in tandem with Technology and Design (Curry, 2008; Bewan, 2018). Our improved understanding of stone, allowed us to create structures like the Gobekli Tepe, a religious, cultural hub, with carvings to represent interpretations. It has been postulated that these large gatherings pushed us to cultivate grain thereby heralding the advent of agriculture that transformed society and culture (Turchin, 2013). Innovation in "technology" ie the application of scientific knowledge in industry, has influenced the course of Design since our ancestors learnt how to carve bones, rocks and moved to ivory, stone, metal and so on. Throughout history, the five waves of technological revolution (Industrial Revolution, Age of Steam, Age of Electricity, Age of Mass Production, Age of Information) have been accompanied by social change (Moody and Nogrady, 2010).

We see multiple examples of artistic representations flourishing with scientific progress. In the Harappan civilisation, we see evidence of design in the immaculate sewage systems and town planning. The advent of the camera forced artists to redefine what constituted "art". Artists broke away from realism and we saw impressionism, expressionism, cubism etc. Besides artists and designers using technology, like computers and cameras, to create work, we also see technology facilitating the way work is being shared and experienced. AR/VR is being used in museums and galleries to transform the experience of visitors. (Ricci, 2018; Katz, 2018). In 2017, Snapchat launched an AR feature where Jeff Koon's AR Balloon Dog was "vandalised" by a group of artists. As technology opens up new arenas to art, we are called to question new perspectives like should AR experiences be subject to the rules of physical space? As the AR experience gets monetised and advertising in this space grows, we would need a fresh set of norms to govern the virtual world (Matney, 2017; Pantelić and Velimirović, 2017)

Design can voice the abstract better than words, allowing it to transcend cultural and language barriers. Such expression allows for alternative discourse that challenges established centres of power, existing norms and helps us expand our collective imagination (Chandrachud, 2019). Chittaprosad Bhattacharya's illustrations recorded the misery and the role of colonial rule and global capitalism during the Bengal famine of 1943. His work, Hungry Bengal, was so powerful that almost all copies of it were destroyed or confiscated by the British administration (Chandrachud, 2019). Homegrown collectives in India are coming together to offer alternate discourse and express challenging ideas, creating awareness about transgender women, feminism, identity and oppression ("Aravani Art Project", n.d.; "Kadak", n.d.; Dharmadhikari, 2017).
More famously, Banksy gained international recognition for his work challenging assumptions and questions authority. Following his example of quick graffiti through stencils, teens in Daara kickstarted the Syrian chapter of the Arab Spring. (Chandrachud, 2019)

Given how the arts have been employed as a tool to express dissent, to voice public opinion, to challenge authority, to protest and to start revolutions, they need to be looked at as a powerful tool for change. These movements are gaining momentum through technology, social media and digital imagery and we see Art, Design and Technology shaping culture across the globe.

2. DESIGNING THE FUTURE

In the 21st century, the influence of technology is felt acutely. It has transformed daily life, it has reduced distance, time, geography; increased accessibility to information and resources and consequently transformed our habits and the content we produce (Brewer, 2018). As technology leaps into increasingly esoteric complexities, Design can help us make sense of our rapidly changing world (Dubberly & Pangaro, n.d.; "Making Sense of Today's Tech World," 2018).
Design can also make the changes of the future and their benefits and challenges visible to the masses so that we may all weigh in to how technology is going to shape the human condition. We need to predict the changes technology will bring and design for them.

The ramifications of technology on the human condition and culture are mired in contradictions such that attempts to marshal it into positive and negative are challenging. This section will examine design practices today and how they will be redundant or relevant in the future and attempt to understand the sociocultural changes brought about by technology that influence society and behaviour and therefore, Design.

1. Technology, People and Society

1.1 Hyperreality

Hyperreality is a condition in technologically advanced postmodern societies where the distinction between reality and fiction is blurred. Facts and figures, ie, reality, loses its weight against the influx of digital narrative that renders the spectacle being presented, like news or elections, more real than actual events. This means that public perception is not based on actually but its distorted portrayal.
In India, the 2019 Balakot airstrike served to solidify narrative and woo voters as opposed to long term diplomatic solutions. As of January 2019, social media, news channels, journalists and political leaders offer multiple, contending narratives such that ground reality is often irrelevant. Landmark news events one day are replaced by new distractions the next. Illustrations, cartoons, films, social media serve often serve as instruments of propaganda. This confused sense of reality manifests itself in dichotomies like the worship of a "Bharat Mata" (India as Goddess and Mother) and the high rates of gruesome crimes against women (Kamatham, 2019).
This is not particular to India alone. We have reached an age where symbols have replaced

facts. In the United States, Donald Trump's showman, reality TV star persona and the name "trump", often put in the forefront a powerful businessman, completely eclipsing whether he is a responsible leader (Albrecht, 2018).

1.2 Social Cooling

Edward Snowden revealed that the National Security Agency (NSA) collects data from internet companies such as Google, Apple, Facebook, Microsoft and others (Sottek and Kopfstein, 2013). With increasing online surveillance, our actions are monitored, measured, bought and sold. Studying an individual's internet usage, social media activity, purchases, financial information, hobbies allow systems to predict the individual's age, income, beliefs, friends etc and some systems, and countries are using this information to assign people a "Social Score". (Schep, n.d.).

Social Cooling is a long term phenomenon that occurs in a reputation based economy which results in a culture of conformity characterised by self censorship, an aversion to risk taking, and rigid social structures (Schep, n.d.)

This kind of surveillance and persuasion can be used by authorities to pressure citizens into obeying expectations. Invasive and authoritative models of governance have historically limited the scope for healthy discussion, debate and creativity. (Williams, 2018)

1.3 Identity Formation

A capitalist society necessitates the rapid assumption and shedding of identities for consumption. The media and the internet cause this process of rapid consumption to accelerate through a culture of fragmented replication, reproduction and reinforcement of listicles, clickbait, memes etc. The images we see are often "quotational work" that appropriate information from various sources. Identification in this scenario is harder and our attention spans shorter. This frenzy of information sharing is linked to identity formation and those of us with weak egos fall into this pattern with relative ease. The identities we form through such consumption can often lack depth and are often fragile (Peretti, n.d.).

1.4 Accountability and Negative Behaviour

Initially the term "troll" was used to describe people who were part of an internet subculture based on playful needling. Initially harmless, we saw the emergence of far right, extremist groups out of this pool of internet 'trolls' on '4chan' somewhere between 2008 to 2012. Some of the early internet 'trolls', include Andrew Anglin, publisher of The Daily Stormer, who achieved international attention when in 2016, he declared "Hail Trump" in a speech at Washington, D.C., and received Nazi salutes from his audience. As compared to pamphlets, radio, newsletters, and personal interaction, Anglin's reach via the internet is staggering (O'Brien, 2017). The pace of sharing information is sped up further with 'likes' and 'shares', where people engage with an individual piece of text or image and not the larger context. Engaging with content, even to criticise it, gives information momentum so a

lot of damage is done inadvertently through flattening of the context via technological affordances that amplify harmful behaviour. (Phillips, 2019)

Design Exhortation -

Much of the negative behaviour we see online, by individuals and by organisations, stems from the way designers and business owners strategise. Dark Patterns are interactions designed to mislead users. This is not sloppy design but stems from ill intent. With more of the world getting online, designers are increasingly responsible for how people experience the web. UX designer Harry Brignull, has been cataloging dark patterns since 2010 on DarkPatterns.org. Examples of these include 'Privacy Zuckering' where users are tricked into publicly sharing more information about themselves than intended. (Brignull, n.d.,)

Should designers perhaps, like lawyers and doctors, require legal licenses to practice? While this damages the democratic nature of the profession, it may help hold designers accountable. We could begin with ethics becoming a part of the design curriculum but more pressingly, designers need to start openly discussing their social responsibilities.

2. Technology, Accessibility and Knowledge sharing

Design packages new technology everyday, constantly improving the experience. Not only that, design can improve accessibility for a wide range of audience. Simple things like not using only colour to convey critical information, for example at traffic signals, have the potential to improve daily living.

Today the internet shapes us and everything around us. Initially a highly decentralised platform to discover new connections, interests and to share information, today a handful of companies control how we see and share information. Surveillance has emerged as the new business model for internet companies. Initially the Internet was the great equaliser, created with the vision of a truly equal, connected platform, free of the pressures of society. Without the expense of television, radio, newspapers, the internet made communication almost costless. It offered the possibility of an equal society (Kesvani, n.d.).

The internet has however failed this initial promise. Digital literacy is now essential to being employable and there is a gap being created. In under developed countries, women are 33% less likely than men to use the internet and in low and middle income countries, this gap is 26% . Reasons for this include cost, cultural factors, privacy concerns and time constraints (Leusse and Plou, n.d.).

It would however be remiss not to acknowledge the potential online learning has in providing equality in education and opportunity. Progress in this sphere has however been limited due to lack of incentive for commercial institutions and the possible threat to job security of academicians (Klain, 2015).

We also find technology facilitating the relationship between creators and their audience as they engage directly through the internet, making Art and information more accessible. We also see this in how the arts are engaging more audience through technology in public spaces (Ricci, 2018; Katz, 2018).

Design Exhortation-

As of June 30, 2019, the United States saw 1204 website accessibility lawsuits filed in federal courts since January with a projected total of 2408 by the year end (Shaw, 2020). This is despite the States being and a world leader where designers have easy access to the Web Content Accessibility Guidelines with most citizens having internet access.
The World Wide Web Consortium (W3C) makes many simple design suggestions (such as optimal colour contrast ratios, keyboard navigation support etc) and implementing commonly used assistive technologies (like speech recognition tools, screen magnifiers etc) (Henry and McGee, n.d.). It is also important to understand that when content and objects are designed to support disability, they also become more accessible for regularly abled persons. Everyone is disabled sometimes, whether through a temporary injury or being limited by multitasking (such as one arm being occupied with carrying a toddler or carrying a phone in one hand).
Designing for accessibility however, does not only mean reaching people with disabilities but also people with different cultural backgrounds and those in remote regions. For example, understanding that some writing systems like Japanese and Korean may require vertical text support. In Japan check marks may need to be converted to circles, which is their symbol for correct ("INTERNATIONALIZATION", n.d).

3. Technology and Bias

The algorithms used to predict information through gathered data are not always accurate, and can perpetuate biases. The term “Mathwashing” describes the phenomenon of using “*math terms (algorithm, model, etc.) to paper over a more subjective reality*" (Wood, 2016). According to Olga Russakovsky, assistant professor in the Department of Computer Science at Princeton University, bias in AI has three root causes - i) Bias in the data being collected ie, overrepresentation of some categories and less of others. ii) The algorithms themselves as they tend to amplify bias in systems. iii) Human Bias ie, prejudices of the people collecting data (Smith, 2020).

Design Exhortation-

The automotive design and development industry is dominated by men and as a result in the 1960s, crash tests were done with dummies modelled after the average male and seat-belts were designed for them, making cars 47% more unsafe for women, particularly pregnant women. 2011 was the first time a female crash test dummy was used. Now with self driving cars, if voice recognition does not recognise every race and gender as human, it can have dangerous consequences (Reiley, 2016). Organisations and Designers must understand the potential of how dire the consequences of bias in technology can be. Furthermore, design and development teams must be diverse.

4. Technology and Ethics

Smartphones use the same neural pathways as drugs and gambling to hook people. (Andrew-Gee, 2018). There is an urgent requirement to regulate and monitor the

development and application of technology. While there are government and private bodies working on this and there are various guidelines for how and where ethics should be applied in technology, what is crucially missing is public participation (Brown, 2015). Till the larger public is involved, governments will not have enough incentive to ensure a humane approach to technological development and application. For the larger public to get involved, just disseminating information may not be enough. People often do not rely on information to form opinions but on assumptions and on opinions of others, very often loud political groups (Baron, 2019).

For educating the creators, liberal arts, study of ethics and philosophy should perhaps be a formal part of curriculum. Self driving cars for example are already grappling with the dilemma of pedestrian life vs passenger. Education should aim to holistically develop human potential and advancement in technology should aim to make life better, not merely more convenient.

Design Exhortation-

Most decisions that influence design, ie, the technical and commercial aspects are planned long before designers get involved. Designers are systems thinkers and communicators and need to design more than just screens. They need to design policy. Ethical implications should come as a precursor to technological application, wherein ethics assist the design and development of technology and do not manifest after the technology is implemented.

Independent developers are working on innovations to change the infrastructure of the web through decentralised web apps such as Graphite docs, an encrypted alternative to Google Docs. Right now these applications are not as intuitive or polished as their counterparts but should designers get involved, they could be.

Designers can also create awareness and disseminate information to educate the general public and initiate dialogue. In the wave of recent protests in India against the contentious “Citizenship Amendment Act”, Indian designers are chronicling the movement and educating the general public by offering easily consumable information that challenges the state sponsored narrative, and are creating a movement of political consciousness (Raghav, 2020*).*

5. Technology and Opportunity

We examined how technological literacy and bias are creating gaps thereby unfairly stifling opportunities for some. We now consider whether AI will make life more comfortable or reduce work opportunities creating a widespread job crisis. On one hand we have seen jobs becoming redundant such as travel agencies, elevator operators etc but we have also seen creation of new jobs like app developers, social media managers, data scientists and others.

Daugherty and Jim Wilson, of Accenture Research have bifurcated jobs into trainers and explainers wherein the former train AI systems and the latter function as liaisons between machines and human supervisors. AI can potentially emerge as a tool to assist better

performance by people and assist with unfilled jobs such as the shortage of truck drivers in the US where automation may offer better productivity and lifestyles ("AI and the Future of Work", n.d.).

However, not everyone sees AI as a positive tool to augment jobs. The Forrester report (Future of Work) predicts job losses of 29% by 2030 with only 13% job creation to compensate. To prepare for this scenario, the report makes recommendations in government policy, economic planning, business planning, leadership planning and individual planning ("Future of Work", n.d.).

Design Exhortation-

Brands like Airbnb and Uber do not offer any new products at all but just good design. There are multiple companies offering the same service and technology. Design is the key differentiator. Consumers today do not have the patience to decode and understand how something works. It has to be intuitive. Design and technology will work together, abolishing constraints of effort, mechanics, space and time.

Design is about a holistic experience and to create such an experience, Designers will need to understand the function and context, ie, culture, which includes aesthetics, material, narrative, language and the interaction.

We can expect to see tools to make these challenges easier and integrate design, software and hardware knowledge. AI could potentially help designers impartially evaluate the quality and impact of their work. We will also have access to more information yet as Big Data and personalised experiences continue to grow in importance. We will also see greater diversity as more women and people from different cultural and ethnic backgrounds join design teams. This will be essential to understanding context.

6. Technology and Sustainability

In recent years innovation has turned to sustainability as we tackle depleting natural resources, pollution, disasters, energy and water shortage. With mounting public pressure and actions being taken through regulations and policy makers, organisations will now need to tackle economic sustainability, societal sustainability, and environmental sustainability. There is evidence that the sixth wave of innovation is in Sustainability (Silva and Serio, 2016).

Design Exhortation-

Everything that is designed is created that way to be consumed, generally at the cost of our environment, culture, society and well being. Most personal electronics are packed with environmentally hazardous chemicals and minerals like mercury, lead, nickel, cadmium, phthalates, and others (Sheesley, 2008). In design making a product sustainable is often tacked on to the brief as an after thought for pleasing consumers, for the reputation of the organisation or to follow regulations. This is gradually changing as we move from a cure

approach to a prevention approach. This expands the role of Designers wherein they become the link between production and society, enabling more sustainable lifestyles as we move from designing just products to designing entire systems. Design for Sustainability (D4S) is a system design approach beyond Life cycle Accessibility (LCA) and Cradle 2 Cradle (C2C) that embraces the best practices to meet environmental, social and economic needs. This means preserving natural resources, protecting local communities while meeting economic goals, via the '4P' approach, ie, Product, Planet, People, Profit (Diehl and Marcel, 2008).

7. The Coevolution of the Artificial and the Natural

A Transhuman is a human being who has transcended boundaries of human intellect and physiology through technology. Transhumanist thinkers also postulate that someday humans may be able to become 'Posthuman', ie, beings evolved from humans through technology but vastly more capable and radically different.

Raymond Kurzweil, Google's Director of Engineering, predicts that "By 2029, computers will have human-level intelligence". According to Kurzweil, the process towards 'Technological Singularity', a stage at which machines surpass human intelligence, has already begun.

Kurzweil has announced, "That leads to computers having human intelligence, our putting them inside our brains, connecting them to the cloud, expanding who we are. Today, that's not just a future scenario. It's here, in part, and it's going to accelerate." Since the 1990s, Kurzweil has made 147 predictions which he claims have had an 86% accuracy rate (Reedy, 2017)

There are also strong concerns that this evolution in technology may not happen in tandem with human existence, ie, machines may surpass us thereby threatening human life and dominance. Bill Joy postulates that technology will either overtake or overrun humanity itself or that the intelligent machines will be controlled by an elite few where the masses will lose value, be reduced to the status of animals (Joy, 2004).

Design Exhortation-

Design Fiction is a discipline and a method of postulating the ethical, social and cultural concerns of emerging and future technologies through design and storytelling. It often employs diegetic prototypes to convey how a piece of technology could function within the fabric of our world. The term was first used by Bruce Sterling in 2015 who elaborated on how such a model could "suspend disbelief about change" (Bosch, 2012)

Emerging technologies offer great benefits but pose serious risks with great potential for abuse and their potential to replicate which makes them especially problematic given that we also do not fully understand the technologies themselves and their future evolution. (Joy, 2004) . There are independent groups and individuals working formally in the field, such as

the Near Future Laboratory, that create conceptual and tangible prototypes, models, and research to explore the future ("Near Future Laboratory", n.d.).

Design fiction is a young but promising discipline that can help us visualise the impact and function of existing and speculative technology in our lives and society. It does not address design problems but rather creates dialogue around them. The field is still in need of formal models of prototyping, critique and evaluation (Lindley, 2014).

In Conclusion

"The future is no longer regarded as predestined…It is now seen as the result of the decisions, discoveries, and efforts that we make today. The future does not exist, but a limitless number of possible futures can be created."

(Bell, et al., 2013, p. 5)

Design can help us improve how we apply technology to everyday life today and help us both visualise and create better models for technological application in society in the future. On one hand the democratic nature of the field allows for many explorations but on the other, designers are rarely held accountable for many of the problems related to the consumption of technology today. We crucially need regulations and policy to determine the course of technological exploration and we need better models to assess the roles of designers, their responsibilities and their potential in designing our lives in the present and the future.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing Somatic Play for Digital Natives through a Body-centric Design Process

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Abstract | Designing interactive toys for digital natives is an emerging field that embraces new ways of integrating digital technologies with physical objects to create tangible whole-body interactions. This paper presents Wearable Play, a project that followed a design process inspired by human body movements to develop age-appropriate "somatic play" experiences for children. It is a soft interactive toy WORM-E and its five potential interaction scenarios that engage children in bodily activities for more self-awareness and social interaction. Reflections on the design process address the importance of a body-centric design approach, the difficulties that appear when integrating electronics into textiles, and the challenges of working on a physical design in a remote team.

KEYWORDS | E-TEXTILES, INTERACTION DESIGN, INTERACTIVE TOYS, PLAY, SOMA-DESIGN

1. Introduction

"Digital natives" who are born into the digitally augmented world, have an experience of the material culture, in which the connection between them and the world around them is largely mediated through digital devices (Prensky, 2001). Most of the time, children interact with the devices that allow them to play, learn, and communicate through a screen. Some scholars argue that this can have consequences and effects on the wellbeing of children, ranging from psychological, physical to social implications (Turkle, 2015; Kardaras, 2016). However, children's digital technology use is a reality which should be handled delicately and wisely (Prensky, 2012), rather than blindly accepted or totally rejected. New ways of creating harmony between what happens in the physical and the digital sphere can enhance the wellbeing of digital natives by weaving the digital technologies "into the fabric of everyday life" (Weiser, 1991, p.94). Technology embedded toys (e.g. smart toys, connected toys, etc.) help children explore the physical world while offering a variety of input and diverse output to create interactive and connected play. This potentially extends the interaction from finger-tips on a screen to a whole-body contact with objects, spaces and peers or parents. As it is an emerging field, it also brings the necessity to refine principles, attitudes, tools and methods for designers.

This paper analyses the insights gained from Wearable Play project funded by WORTH Partnership Project. Within one year, a team of e-textile designer-researchers aimed at creating an interactive soft toy – WORM-E that would provide children with whole-body interaction and "somatic play" experiences. The project connects the safe and comforting character of textiles with the dynamic properties of digital technologies to create synergies between the screen-based and physical play. The work follows an experimental design approach combining elements from body-centric design with participatory design methods integrating the users in early phases of the project through exploration of mock-ups and prototypes. The paper addresses the design process inspired by body-centric experiments and describes how this method gives rise to "somatic play" experiences for children. Moreover, it contributes to the discussion about how designers can incorporate electronics into toys while considering issues such as safety, privacy and sustainability.

2. Background

2.1 Children in Digitally Augmented World

Smartphones act as entry level devices through which children make their first contact with the digital sphere by watching videos, playing games, participating in video calls, etc. (Chaudron et al., 2015). While smartphones allow us to connect with others digitally, they often isolate the child from his/her own surroundings and from possible physical interactions with other children or adults in the same space (Turkle, 2015). The American

Association of Paediatrics-AAP (2016) suggests the avoidance of any screen contact for toddlers under 18 months and recommends maximum one-hour screen-based play per day for 1-5 years-old children. In Germany, the screen time is recommended to be maximum 30 minutes for pre-school children (4-6 years), while physical activity should be minimum 180 minutes per day (Rütten & Pfeifer, 2016). Moreover, Harris et al. (2015) mention that breaks with stretching body exercises could be helpful for children while using digital devices.

The need and desire of keeping the body physically active while playing a video game gives rise to new type of interfaces – so-called "bodily interfaces" – in which the body plays an active role in controlling the virtual game (Parisi, 2011). These interfaces can expand the game into physical space by involving the whole body: through hand-held devices complemented with motion sensors (Nintendo, 2020); hands-free systems with motion-tracking cameras (Xbox 360, KinectTM); or interactive mats (DDRGame, 2020). Although these games aim at making people move, they still rely on a strong mediation of visual outputs and this requires a continuous eye contact with the screen. This type of interaction modalities creates "a new set of bodily habits" (Parisi, 2011), which sometimes do not follow natural body movements, but require adaptation.

Besides these examples, there are also smart toys embedded with sensors and actuators that respond with various sensorial outputs such as vibration, sound, etc. without the need of a screen. For instance, the Moff band (Moff, 2016) is a wearable smart toy that turns motion into sound to augment everyday objects by giving them a voice. OCTOBO (Thinker-Thinker, 2019) is a smart companion for storytelling activities, reading physical tokens to create new stimuli for reading a story. Besides smart toys, there is an emerging field of the Internet-connected toys. In the market, there are different types of connected toys providing communication over distance by tactile and visual signals (VaiKai, 2016), informing children about their curiosities to make learning more playful (CogniToys, 2018), or chatting with them as companions (Mattel, 2017).

2.2 E-textile Toys

From early ages, children seek comfort in textile objects, for example, having a preferred stuffed toy or blanket (Winnicott, 1953). This instinctive behaviour continues as the child grows, however materials of toys become harder and colder, especially when smartphones enter in the play activities. The field of e-textiles (electronic textiles) shows a great potential in creating new tangible and bodily interfaces for children. E-textiles embody soft and sensorial characteristics that are augmented with responsive features of electronics. Conductive yarns can be knitted, woven, or combined with textiles through other crafting techniques to create soft sensors and actuators. Being soft and flexible, e-textiles can be worn on the body as a garment, hand-held as a stuffed toy, or applied on surfaces, such as a carpet. E-textiles can provide a whole-body experience, inviting the user to touch and move intuitively (Honauer et al., 2019).

There are some examples of e-textile toys for children merging electronics and textiles to create new experiences and play modalities. They enhance children's physical connection with their own body, the surroundings and with others. Spookies are one of the first interactive toys that use smart textiles as soft interfaces providing free play with various input and output possibilities (Berglin, 2005). BabyTango is an e-textile stuffed toy integrated with embroidered sensors and soft circuits to support empathy by embodied play for toddlers (Berzowska et al., 2019). Besides, Pouta and Mikkonen (2019) presented an interactive hand puppet with a woven touch sensitive textile that creates an interactive gaming experience between a child and an adult by detecting the wearer's hand movements and the touch of the viewer. Mazi is another e-textile toy that aims at providing sensorial regulation and collaboration for children with autism in a playful way (Nonnis & Bryan-Kinns, 2019). Children with various spectrums of alertness sensitivities can also be supported with e-textile toys created by design students as part of their social design course (Kuusk & Nimkulrat, 2018, 2019). Within the Rhyme project, the researchers developed creature-like, large-scale, interactive soft objects providing a whole-body interaction through audio, visual and haptic feedback to enhance the users' wellbeing (Stensæth, 2014). Only few of the e-textile examples are brought to the mass market, as many details need to be addressed first (e.g. production at scale and marketing).

3. Wearable Play

Wearable Play combines contemporary, digital technologies with textiles to create new "somatic play" experiences for children. The authors attempt to design with, through, and for the body (Tomico & Wilde, 2016). They take a Research through Design approach (Frayling, 1993) by learning from designing, making, as well as testing prototypes on their own and observing users in interaction with the resulting prototypes. In doing so, the authors involve children and adults at various stages of the design process assigning them roles, ranging from users and testers to informants (Druin, 2002). The project involves two age groups of children: the preoperational (2 to 7-year olds) and the concrete operational stage (7 to 11-year olds) (Piaget, 1964). The whole project was conducted in a remote design team with members situated in three different countries (Italy, Germany and Estonia).

3.1 Multi-Method Design Process

The Wearable Play project follows a multi-method design process, combining body-centric design and participatory design methods to understand respective needs of the target group, and to design for their body movement. The project consists of three phases: 1) requirements analysis and problem definition, 2) design of the prototype and its interaction modalities, 3) production of the prototype with the integration of textiles and technology.

3.2. Requirements Analysis and Problem Definition

Before the official start of the project, two of the authors initiated a workshop "Children, Interaction Design, and Soft Materials" at Unibz, Faculty of Design and Art, in Bolzano, Italy. They conducted a brainstorming session with design students participating in the workshop. It was followed by a body-storming activity introducing an embodied ideation process based on role-playing (pretending to act like a child) and a case study mapping of children toys embedded with technology. Based on the outputs of the workshop, a critical reflection was made to cluster topics and issues around digital natives. For example, raising awareness for social reality and their own body, and reducing screen time and smartphone usage were some of the issues which emerged from this reflection session.

After defining the design space, the authors started sketching initial design ideas based on the three main pillars: design for children, design for bodily and social interaction, and design with e-textile materials. This collaborative brainstorming session opened the authors' imaginations and helped to discuss the users' needs.

Next to idea generation, the authors conducted direct observation in children's natural environments. All authors did an observation session lasting approximately one hour. The sessions were conducted in three remote geographical locations (Estonia, Italy, and Germany) in a playground, skate park, and kindergarten. That enabled the authors to observe how children of different ages (3-15 years) play and move. Across age and country, the observation of the children's movement in free-play revealed that children usually play together in groups, they explore the space with full-body and highly active motions. An individual game only lasts a few minutes, and playing is mostly driven by the parents, children's fantasy and objects at hand.

3.3. The Design of the Prototype with Its Interaction Modalities

After analysing the observations and the results of the first ideation session, the authors remotely created low-fidelity prototypes based on agreed ideas to test them by themselves, through taking a first person-perspective to design for the body (Höök et al., 2018). A big stuffed toy, a hug-inviting soft object, a worm-like soft object and a stretchable textile tube were developed by the authors (see Figure 1). The try-out sessions were filmed and photographed for exchange of the lived experience between the three authors.



Figure 1. First prototypes and body-based explorations of them.

The worm-shape object could be worn around the body, wrapped around multiple persons and allowed for both active and calming activities. Hence, it was selected as the most suitable form for further prototyping. In this stage, the prototyping was meant to investigate the look and feel while exploring different ways of interaction, therefore there was no technology integrated yet in them. After developing the low-fidelity prototypes, each author remotely created a worm-like object as a probe to test with children and a professional dancer, since it was difficult to fully immerse being a child by the authors. Dancers are experts for movement because they are trained in body tension, dance motions, and body postures that usually go beyond what laypersons can do with their bodies. Therefore, a dancer was involved by one author to explore more possibilities of body movements (Figure 2, on the left). The two other authors observed children (3-6 years old) playing with the probe in a home and kindergarten environment (Figure 2, middle and right). While the children were asked to freely interact and play with the probe, the instruction for the dancer was to improvise with the given shape. While freely playing and improvising, our young and adult test users figured out a lot of interesting movements that the authors later used in order to develop the interaction scenarios as described in section 4.



Figure. 2 Testing the probe with a dancer and children in three different locations.

Based on the observations done in the sessions of free play with the probe, the authors generated movement cards illustrating five different play possibilities (Figure 3). In a further testing, these cards were given to children together with the probe to see if the cards could inspire the play (Figure 4, on the left). The evaluation with 4 to 7 years old children revealed that the users were very interested in the movement cards. They could easily enact the tasks shown on the cards and developed their play beyond the inspiration by the cards. Moreover, the cards were tested by two design students that found the cards useful for some initial triggers to play, but after a while they did not follow the cards and rather invented new game modalities with the probe (Figure 4, on the right). These cards later became a part of the application which the authors explain in the interaction scenarios (Figure 6).



Figure 3. Movement cards illustrating five play modalities.



Figure 4. Tests with movement cards and the probe.

3.4. Production of the Prototype with the Integration of Textiles and Technology

The authors decided to use Near Field Communication (NFC) technology for enabling communication between the soft toy and the smartphone or tablet used by a child. The NFC tags were the preferred choice because these computational elements are soft, tiny, flexible, robust, easy to integrate into textile objects, battery-free, and compatible with all NFC-ready devices. For a more advanced version, LEDs could be embedded onto the NFC tags. Additionally, tactile feedback would enhance the interaction with haptic sensations. For that, small vibration motors were chosen because they can be controlled with an e-textile microcontroller, such as Lilypad or Flora and their power consumption is manageable with smaller batteries. To enhance the tactile sensation, the cover of the final prototype was constructed with different textile segments that have various tactile properties with different surface structures (Figure 5).



Figure 5. The textile cover combining different tactilities.

4. Interaction Scenarios with WORM-E

The prototype of WORM-E consists of a 2-meter-long stuffed toy embedded with NFC tags. The tags inserted into the textile cover turn the toy into a key to activate various content elements shown on an application for open-ended somatic play experiences. The toy aims to engage children (4-11 years old) into whole-body play after or during continual usage of a smartphone or other screen devices.

The WORM-E application friendly interrupts the user and prompts to stop looking at the screen after a certain time (approx. 30 minutes, but can be modified based on the parents' decision). It invites the user to try a game with WORM-E. The only way to know more about the game is to bring the WORM-E close to the smartphone in order to access the content by scanning the NFC tags on the toy (shown in the interaction scenario in Figure 6). Then, a predetermined activity is proposed. The activities described below are enhanced by actuation components (LEDs and vibration motors) embedded into the prototype using e-textile techniques. All interaction scenarios are derived from observations and tests with users addressed above.

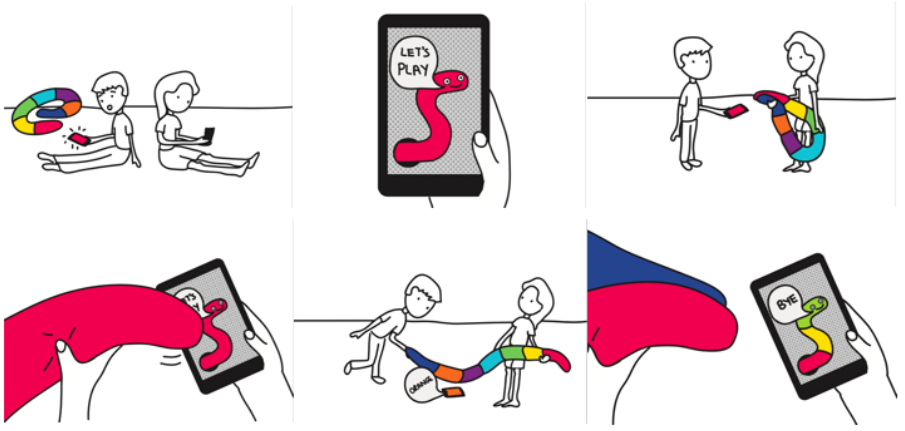

Figure 6. Interaction scenario with WORM-E and the application.

4.1 Balancing

The body-balancing activity looks like walking on a rope, asking the child to walk on the soft toy while following the vibro-tactile feedback on his/her feet (Figure 7). The activity requires concentration and a good sense of one's body. The tactile stimuli delivered by the vibration motors within the toy guides the balancing steps. The child is invited to feel and follow the buzzing sensation with her/his feet. Every time the vibration pattern varies from the previous experience through speed, direction and intensity. The attention of the child is brought to the sensation felt by the feet.



Figure 7. Children and adults exploring the low-fi prototype, that lead to the balancing activity.

4.2 Skipping Rope

In this activity, the soft toy is used as a swinging rope to jump over. The activity stimulates the children, alerting and exciting them (Figure 8). It can be played by 2 or 3 children as it

exercises teamwork and trusting others. In the case of two children, the phone should be placed on the floor in the mid distance between both children, and the NFC tag acts as a counter to keep track on the number of swings. In the case of 3 children, there is a light pulsing on both ends of the worm to indicate the speed of skipping. The game has various levels; for example, light can indicate when to jump with one or both legs.

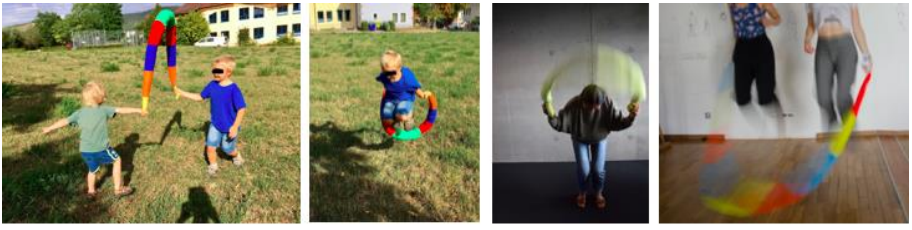

Figure 8. Children and adults exploring the low-fi prototype, that lead to the skipping rope activity.

4.3 Tug of War

Tug of war makes children pull the toy from two ends (Figure 9). It stimulates the players, requires strength, might create some tension and invites for teamwork as well as friendly competition. The smartphone is on the ground under the middle of the toy, children at both ends grab the toy. The players pull the ends of the toy when the game has started while trying to make the “opposite” team move forward from where they stand. The users need to let the toy down after each “battle” in order to collect points though NFC reading with the phone in the middle, LEDs in the read segments light up shortly to indicate a successful read.

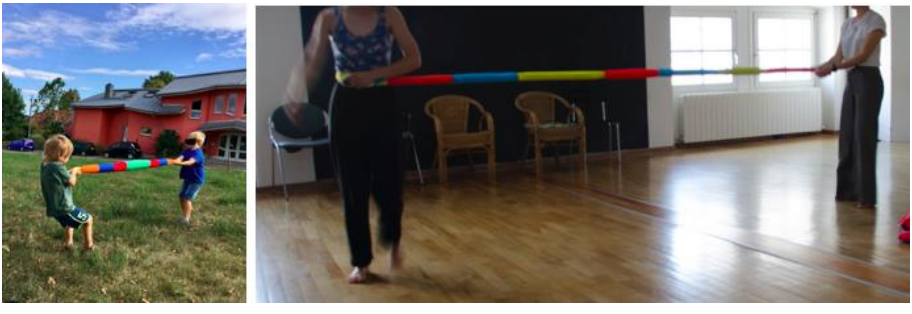

Figure 9. Children and adults exploring the low-fi prototype, that lead to the tug of war activity.

4.4 Embracing

In this activity, WORM-E “hugs” the user while sending vibro-tactile stimuli (Figure 10). It aims to calm the child and allow them to look inward, relax and focus on their own body and soul. The soft toy is wrapped around the body of the user in a comfortable position. While doing this activity, the phone can play an audiobook or sleeping song, while the LEDs are lit up in a dimmed manner.



Figure 10. Children and adults exploring the low-fi prototype, that lead to the embracing activity.

4.5 Swirling

The user spins around having one end of WORM-E attached to their shoulder (Figure 11). The toy follows the player. This activity stimulates and excites the user. It helps them to concentrate and look for body balance. The light embedded into one end of the toy lights up based on the growing speed in brighter colours. This motivates the player to swirl faster and faster.

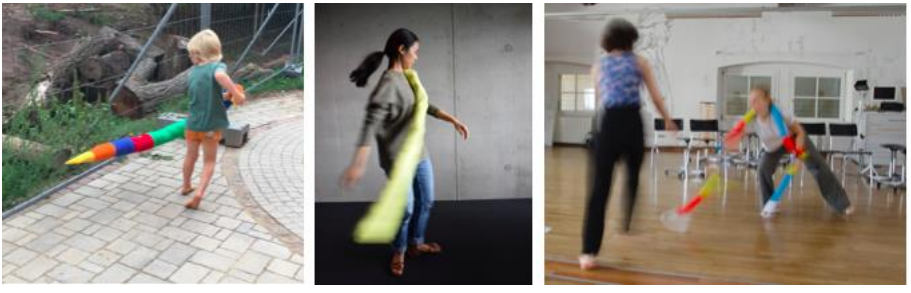

Figure 11. Children and adults exploring the low-fi prototype, that lead to the swirling activity.

5. Discussion and Conclusion

The integration of digital technologies into soft objects opens new ways of play and allows digital natives to spend less time in front of the screen, to engage more with their physical

environment and with other children. To achieve this, the technology should not be the main starting point for the design process, but rather it should be an enabler for new interaction modalities that are driven by the user's body. Designers can use the soma-aesthetic design approach which makes the designers learn from their bodies (Höök, 2018). Ideating with the body allows "designers to design for the senses from the senses, opening the door for multisensory interactive qualities and complex interrelations between the senses" (Tomico & Wilde, 2016, p.13). In the Wearable Play project, the authors combined methods from soma-aesthetic design with participatory design methods to understand the wide spectrum of experiences available between the designed object and the moving body. Experiencing objects from a first-person perspective gave more embodied information and provided a more reflective view than observing users or conducting a brainstorming. Additionally, the authors could gain more insights into bodily motions through involving a professional dancer. That all allowed to combine the first-person experience with the analysis of the users and the improvisation of the dancer.

Over the course of the project, the authors discussed how to seamlessly and sustainably integrate textiles with technology. Taking advantage of craft techniques allows for quick prototyping, but places some constraints for later production possibilities. The use of e-textile brings major environmental concerns to the discussion (Köhler, 2013; Velden et al., 2015; Veske et al., 2019). One of them is the use of energy and how to ensure the power source to be environmentally friendly and safe for the users. One of the reasons to use NFC was driven by the fact that it functions independently from an additional power source. However, this shortly influenced the ideation process to be more technology-driven, focusing on what NFC could do, rather than the bodily interaction. Moreover, technology inside a textile prototype rises also the question of washing and robustness. The final object was designed modularly, so technological components can be temporarily removed for cleaning and maintenance. Further sturdiness and recyclability issues need to be solved once the WORM-E prototype has been thoroughly tested.

Providing a smartphone application and collecting user data raises important issues about privacy and safety. The Designing for Children Guide (D4CR, 2018) considers the risk of misuse of data as one of the ten principles to keep in mind when designing digital products and services for children. On one hand these data are helpful, so the parents can observe children's activity. On the other hand, this demands great attention to make sure the data is not misused or does not get into wrong hands. Also, it puts the responsibility to the parents, so they need to be informed sufficiently about different possible consequences. Here, designers can provide ethically valid solutions to inform and empower the users.

The authors experienced benefits and difficulties of working in three physically different places and using different communication channels to be in contact. This challenged them to present the concepts and ideas clearly, in a way that they could be "experienced" over distance, which at the same time created a good trace of documentation of the project development along the way. Additionally, the geographical distribution allowed the authors to involve expertise and participants from various locations extending their network and

reach. Here, the importance of the prototypes, as the only physical touchpoint, became crucial to communicate the project, and the authors all constructed the same shape remotely in the exploration phase. Later, they distributed tasks (product design, hardware design, and application design) and sent all the results to one of the authors who put them together.

In the future, the authors plan to do elaborated user tests with children of the respective age group. Possible data collection methods are observation, interviews, and diary keeping. Tests are planned under semi-controlled conditions in the children's natural environment while the researchers are present (e.g. in a kindergarten or public playground). For a longer test period, the final prototypes will be handed over to be used as probes for individual tests in a child's home. Soma-based methods are not only useful to design interactions and engage with materials or digital technologies, they are likewise important for evaluating prototypes and existing design solutions (Höök, 2018). That is why, the authors plan to not only test their final prototype with the target users, but also to experience the final prototype with their own bodies and to feel the individual psychological and physical sensation triggered by the soft toy.

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Acknowledgements: This research was partially supported by WORTH Partnership Project and is funded by COSME Programme of the European Union for the Competitiveness of Enterprises and Small and Medium-Sized Enterprises (SMEs)."

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing unpredictable futures.

An anthropological perspective on the algorithmical prediction of human behaviour

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Abstract | In this paper, we propose a cultural interpretation of the role of designers who work with data in Global North society, drawing on a comparative anthropological method. We trace connections between them and those who master technology in other societies, i.e. blacksmiths in West Africa, in order to interrogate the cultural meaning of the practice of pattern recognition. There are many concerns (mainly ethical and epistemic) and an increasingly lively debate around the growing role played by data-driven objects, infrastructures and systems in our daily life. The comparison that we propose draws on but also adds to this debate, emphasizing the socio-cultural risks and opening to reflections that may avoid these. It calls into question the emerging feature of aliveness of technology and the scientific and socio-cultural consequences that come with it.

KEYWORDS | BIG DATA, ALGORITHMS, FUTURE, WILDERNESS, ANTHROPOLOGY

1. Introduction

This paper proposes a cultural interpretation of the role of designers who work with big data and algorithms for the prediction of users' behaviours, ideas and tastes. To this aim, we will adopt a comparative lens, which will trace connections between global North designers and West African blacksmiths.

While Mande blacksmiths and global North data designers are quite fairly two different groups in many aspects, both are masters of technology. By naming smithery as a technology, we join efforts within history and the social sciences to multiply technological imagination about what *techne* can be when the material meets the social (see Olson, 2018, p. 229, note 4). Our aim in this paper is to offer insights to data designers to think otherwise their role in dealing with technology.

We found the comparison between these two very different groups particularly propitious for two main reasons. First, both groups aim to master apparently invisible and wild forces through their technology. Second, in both cases what they are dealing with (data or spirits) seems alive, wild and invisible.

There are many concerns (mainly ethical and epistemic) and an increasingly lively debate around the growing role taken on by data-driven objects, infrastructures and systems in our daily life. The comparison that we propose will draw on but also add to this debate, emphasizing also the socio-cultural risks and opening to reflections that may avoid these.

2. Methodology

The comparative approach is at the core of the cultural anthropology research method. Clyde Kluckhohn has famously defined cultural anthropology as the "longest way round", which happens to be the shortest way back home (Kluckhohn, 1949, p. 20). Through this apparent paradox he intended that one should explore different ways of approaching and framing the world, in order to grasp the limits and potentialities of his/her own ways of thinking and doing. More recently, Tim Ingold has defined the anthropological attitude as a "constant awareness of alternative ways of being, and of the ever-present possibility of 'flipping' from one to the other" (2011, p. 239). This constitutes a "'sideway glance'. Wherever we are, and whatever we may be doing, we are always aware that things might be done differently" (2011, p. 239). From this perspective, cultural difference represents a fruitful repertoire of alternatives, which expands the imagination and helps to encompass the constraints of one's own cultural world. In a similar vein, throughout his career, Francesco Remotti (2014) has made a strong argument for the adoption of a transversal gaze in anthropological research. In his view, intercultural comparison has the fundamental function of offering a critical standpoint from which it is possible to scrutinize one's own society. Only when researchers distance themselves from their *hic et nunc* and craft - as Remotti (2014) would put it - "untimely spaces [spazi di inattualità]", new theoretical perspectives to grasp and change the status quo can emerge. According to this methodological framework, legitimate cultural comparisons do not happen merely between geographically close and historically connected societies; they also occur between societies

that are distant in time and space, if they allow for "illuminating connections" (Geertz, 1973, p. 56-57). It is in this vein that in this paper we take the "longest way round", which goes across the Mande blacksmiths, to look at (and challenge) contemporary global North data designers' culture (Pype, 2018, p. 5-6).

3. West African masters of technology: the Mande blacksmiths

Mande people are a linguistic group, made of several ethnic clusters (e.g. Banama, Malinke, Wasaluka, and Dyula people), who inhabit a region that includes part of Mali, Burkina Faso, Senegal, Gambia, Guinea, Sierra Leona, Liberia, Ivory Coast, and Ghana. Being a language, Mande offers a strong sense of belonging to the people who speak it, and the linguistic identification can exceed the ethnic one. Mande society is traditionally characterized by three fundamental divisions: the farmers, who were the nobles (*horonw*), the slaves, who were war prisoners (*jonw*), and the specialized professionals, called *nyamakalaw*, as *nyama* means "the energy for action" (McNaughton, 1993, p. 5).

Blacksmith men belonged to this latter social group, together with bards, praise-singers, entertainers, woodworkers, leatherworkers, and Muslim holy men. Even today, blacksmiths are associated by West Africans to these other specialists, revealing the fact that these masters of technology play a multifaceted social role. Their main job is to fabricate tools and artefacts. However, they work as healers, rainmakers, diviners and fortune tellers too. Thanks to their role as makers of amulets and other secret devices to protect oneself from disease, improve finances, and help in other social matters such as romance, they are acknowledged as able to mediate conflicts, arrange marriage and even to perform ritual roles in the circumcision of boys, transforming youth's bodies from natural into cultural. Mande blacksmiths are recognized so powerful because it is thought they have a privileged relationship with the spiritual world, which imbues them with secret knowledge and skills. To master technology, in the Mande world, is to channel the wild powers of nature into cultural frames with the goal of improving the community both materially and spiritually. When Mande blacksmiths shape iron into tools, wood into masks and immature boys into Mande adults, they articulate spiritual, physical and social forces together, bringing movement and change into Mande society (McNaughton, 1993, p. 156).

Blacksmiths' role as "articulators" between the visible and invisible world draws on the belief – widespread in African societies – that invisible spirits are wild but not necessarily dangerous (Geschiere, 1995). In their wilderness, spirits are neutral. The role of the blacksmiths is therefore key because they can master invisible and wild forces either for the good (i.e. to reinvigorate society) or for the bad (i.e. to break social bonds). By straddling the visible and the invisible world, blacksmiths should be able to domesticate the "wilderness" of the invisible to put it to work for human benefits. Their creations (being them tools, amulets, treatment, etc.) are not untamed wild nature but socialized assemblages of materiality and sociality, which, ideally, should follow and facilitate human needs (Pype, 2018, p. 8).

The imbrication of nature and culture embedded in blacksmiths' technological artefacts makes these ambivalent products because they retain a symbolic link with the wilderness of spirits that even if not necessarily dangerous, has always something that escapes human grasp. The technology produced by blacksmiths is always open to the possibility to turn being evil or unexpected, even if momentarily its potential danger and polymorphism has been tamed. Mande people are aware that the technology produced by blacksmiths has always a link with a world which is beyond everyday life, potentially charged with an unsettling energy which is partly out of control (McNaughton, 1993, p. 149, 162). Technology, in the Mande world, far from being something stabilized or something one can fully rely on, it is rather considered liminal, constantly overlapping the world of humans and non-humans, familiar and strange, beneficial and dangerous. Even if the "wild" energy of technology is tamed and channelled for human needs by blacksmiths, it always and necessarily maintains the potential for an autonomous agency, which escapes humans' understanding and will. Mande people are thus remindful that blacksmiths technology has an original otherness that does not fully match their world, neither their wishes and needs. In light of that, blacksmiths - as producers of technology - are perceived as liminal and ambivalent too. As mediators between wilderness and culture, they tend to occupy a liminal position, being invested with salvific and dangerous power at the same time. They are simultaneously admired and feared, respected and contemned (McNaughton, 1993, p. 41, 160). Moreover, in the past (Ezra, 1989, p. 13), their power was also at the service of the rulers, sometimes with unjust and dominative ends. They fabricated the tools and weapons that rulers employed to control the people through taxes, military break-ins, and other kind of intrusions in everyday activities. This legacy is still alive in the Mande popular perception of the figure of blacksmiths, enhancing their ambiguity. People, indeed, are aware that blacksmiths could use their secret knowledge to weaken human society, instead of reinvigorating it. As they used to equip powerful rulers with their means of control, thus contributing to people's disempowerment, in some respect they also are the target of resentment (Ezra, 1989, p. 13).
In the next section, we will analyse how Mande blacksmiths' activity, role and recognition can be compared to global North data designers and inform what they do.

4. Data designers as masters of technology: comparative insights

4.1 Similarities – Data as spirits

Like West African blacksmiths, global North data designers are considered powerful for their capacity to create order out of the chaos of data. Data, for data designers, are what spirits are for Mande blacksmiths. In the digital era, data have become a new wild nature. The cultural imagination of data conceives them as raw material, which needs to be "harvested", "mined", "captured", "hunted", "mapped", "extracted" and "analysed" by data scientists. This terminology, which is typical of both the scientists' jargon and the ordinary talk, clearly

shows that in global North's culture the world of big data is symbolically understood as a wild, pre-cultural realm that data scientists are able to tame and "cultivate", making it intelligible (and thus sellable) for human needs (Zaloom, 2003; Weinberger, 2011). Google computer scientists played a pioneer role in this regard, since they firstly envisioned the possibility to make sense of the sheer amount of data produced by users, seeing them as "golden dust" (Zuboff, 2019, p. 68) and the "next natural resource" (Deutscher, 2013), rather than as useless "waste material". Founded in 1998 by Stanford graduate students, Google was able to impose computer mediation to an increasing amount of human actions, thus producing new data on the users. Even though initially data were considered simply by-products and ignored as "waste", engineers quickly understood that data could be aptly analysed as sensors of people's behaviour. To this aim, they embarked in designing machine intelligence operations that transform raw material into algorithmic products, which could predict the behaviour of the users (Zuboff, 2019). This extra information has been used to improve services and users' experience, offering them customized technologies that ideally are able to mirror what they think, feel, and like. For example, Facebook has recently launched Facebook dating, which is a service that makes suggestions to the users about people they might like, on the basis of their preferences, interests and other things they do online. The so called "like button", firstly invented in 2005 by VIMEO, is at the core of this development, being part of an increasing number of networking services. In addition to Facebook, it has been integrated into Youtube, Twitter, Instagram, Tik Tok, Linkedin, and other social media alike. As a critical aspect of our present-day human interaction with computers, it provides data designers with a bulk of data on people's opinions, tastes, and feelings regarding a wide range of aspects of their life, such as politics, employment, health, and education. In return of this information, data designers constantly adjust and refine their creations to better match users' profiles. This work of entering into contact, mastering and disciplining the wilderness of data appears then similar to the one performed by Mande blacksmiths who have to master the wilderness of spirits. The technology produced by both data designers and blacksmiths through their work of domestication is put at the service of human needs.

4.2 Similarities – The aliveness of technology

As in the case of blacksmiths, the technology produced by data designers retains a connection with wilderness because it seems "alive". Even if technology anyway needs humans to keep "living" and doing so properly (Pols, 2012), current technology and their spectacular performances (as smart services or algorithmic recommender systems) may give the impression to have their own intelligence and autonomy, thus being "alive" (MacKenzie & Munster, 2019). The "Internet of Things", for example, has opened a new discourse in interaction design, putting into dialogue objects with people, both sentient entities. Designers have started to design quasi 'living entities' that can perceive us and "perceiving us perceiving" (Overbeeke, 2011). O'Sullivan and Igoe put into question how computers perceive humans, and proposed a change by shifting our focus from our own perception to the computer's perception (O'Sullivan & Igoe, 2004). "Beyond human-centered design"

(Antonelli & Tannir, 2019), “post-human-centered design” (Forlano, 2017), “Xenodesign” (Schmeer, 2019) and “designed animism” (Laurel, 2008) are among the terms that are emerging. While this has opened a series of new ethical concerns, here we simply wish to point to how technology is increasingly perceived as having a life of its own. We expect that new technologies not only perform tasks, but also perceive and comfort us, that they recognize who we are and what we need, becoming customized. In this vein, technologies are not to be understood as mere tools anymore; they are rather “partners” with whom to exchange and have pleasant experiences. The fine line between alive and non-alive, the physical and the social, humans and other intelligent entities is undermined (Suchman, 2007).

4.3 Differences – How to manage the relation between spirits/data and humans

While so far we have highlighted elements of similarity (despite the many obvious contextual differences) between Mande blacksmiths and data designers, we now turn to analyse one crucial difference that distinguish them and has important scientific, social and cultural consequences. The technology produced by West African blacksmiths always retains a link with the wilderness of spirits: both users and blacksmiths are aware that technology is a transient product, deriving from a world which is beyond everyday life and potentially escaping its grasp. Mande people do not expect their technologies to neatly and fully match themselves. They always handle technology with care, as it comes from an alien world, never being able to have the guarantee that it has been fully socialized for good. What escapes human’s grasp permeates technology because, for Mande people, culture and chaos are not two impermeable worlds; they are rather interconnected by a fluid and porous boundary. Mande blacksmiths, accordingly, are always aware of their liminal nature and the opportunities but also responsibilities attached to their role (McNaughton, 1993).
On the contrary, in the global North, technology is perceived as what has emancipated human beings from the laces that would make them pray wild and invisible forces, being these spirits or God. Even if debates about technology being either a blessing or a curse are a constant through history, with Enlightenment people perceived that the light of reason arrived to illuminate and get rid of the shadows inhabiting Middle Age darkness. Nowadays, we rely on technology for an increasing number of activities and processes of the daily routine. The goal of designing technologies that match quite fully their users by thinking, behaving, and even feeling as humans is not just a technological utopia but a present reality. In last years, the wondrous advances made by the technological infrastructure, which is able to make sense of big data, have increased both hopes and fears of technology being able to redesign a better future. As a consequence, technology-related professions are gaining both increasing recognition and scrutiny.

5. Beyond common concerns: letting data be otherwise

5.1 Critical big data/algorithm studies

A transdisciplinary debate, called 'critical algorithm studies' or 'critical big data studies'[1], is pursuing the aim to analyse the merits and the faults around the epistemology and related politics of these technologies of prediction and construction of tastes, attitudes, opinions, ideas, ideologies and behaviours. To summarize this debate, Neff and colleagues (2017) have identified the main critiques mobilized against data scientists, which are 1) to consider data as objective rather than the product of interpretative practices, 2) to abstract data from their context rather than to recognize their embeddedness in the context, 3) to reify data without considering the socio-technical apparatus that produces them, 4) to not acknowledge the fact that data are a means to negotiate, produce and reproduce social and cultural values.

The tone employed in advancing these critiques creates an "algorithmic drama" in which "algorithms are figured as powerful, inhuman, and obscure, leaving critics and their readers to fight on behalf of humans (Seaver, 2018, p. 377). More often than not, these critiques proceed from an ideological position, ignoring how things really work in data science and at the expenses of the possibility to create genuine and productive interdisciplinary collaboration. The second Author has instead embarked on a long-term ethnography of data-scientists in the field of computational biology (Raffaetà, 2020) and this experience made her understand that data scientists are usually well aware of the considerations listed above (at least the first three). She could observe how data scientists are not data fundamentalists but critical thinkers, who care for the context, its interpretation, and for data infrastructure. This has also been illustrated by others studying diverse communities of data scientists (Leonelli, 2016; Lowrie, 2017, 2018; Seaver, 2015).

Yet, what all these studies agree on is that the way in which data scientists make sense of 'context', 'values' or 'culture' is highly formatted by their epistemic practices. In the case analysed by the second Author, for example, the context considered by data scientists rarely exceeds the walls of the molecule and the most rewarded value is parsimony (in informatic terms) and efficiency. This is very different from making sense of data as part of a context that always, already and necessarily exceeds human's grasp and understanding, as Mande do in constantly reminding of the inescapable connection between spirits and technology.

5.2 Ethical concerns

These epistemological concerns are linked to the main debate that revolves around data-driven technology and society, which is ethics. This centres on users' privacy, new forms of mass surveillance and the exacerbation of inequalities. For example, the concept of "surveillance capitalism" underlines the peculiarities of present-day information capitalism

[1] For a list of readings and other resources, see https://socialmediacollective.org/reading-lists/critical-algorithm-studies/?blogsub=confirming#blog_subscription-2

driven by data (Zuboff, 2019). Similarly, the notion of "sensor society" (Mark Andrejevic & Mark Burdon, 2015) contributes to shed light on the "dark side" of the algorithmic prediction of behaviours. Nowadays, the collection of information is less and less purposeful and active, and increasingly pervasive and automatized, the users generating data inadvertently, while they go on with their everyday lives. This is the case, for example, of mobile phone users who generate data on where people make calls, what websites they visit and for how long, etc. This amount of data eclipses the data they actively communicate in the form of text messages, emails, and phone-calls, as the device is doubled as a sensor. As a result, data miners' practices are opaque, aiming at correlating rather than interpreting bits of information, and the users have little chance to become aware of their data extraction, feeling rather powerless and intimidated by the complexity of the automated intelligence (Mark Andrejevic & Mark Burdon, 2015; Zuboff, 2019). This brings to the forefront the emergence of new inequalities and discriminations, that draw a line between those who mine and those who are mined (O'Neil, 2017).

5.3 The socio-cultural risk

But beyond these well-debated epistemic and ethical concerns, with this paper we want to bring attention to the socio-cultural risks advanced by designing data without letting space for data to be otherwise. What do we lose by living in a technological world which assumes that we can grasp everything and that aims to fully match our wishes, ideas and behaviours? Will the sense of familiarity and safety we could gain in such a world be able to reward us for the losses?

To live in a technological world which is designed to match as much as possible users affects the viability of "escape routes" (Favole, 2018). According to Favole, "escape routes" are critical moments, during which the normal flow of events is suspended and unexpected occurrences may happen. These moments of "crisis" foster people to think out of the box and to rely upon improvisation and creativity. Following this perspective, when objects run wild, not performing as we might expect, spaces of possibility open up, where to think and act differently (Jackson, 2014). These are "leaks" in the status quo that should not be "plugged" but let them flow as they carry with them cultural dynamism. They come together with feelings of estrangement and unsettlement, which force people to change their perspective and experiment with diversity.

6. Conclusion

In this paper we have drawn a comparison between data scientists/designers and Mande blacksmiths to draw attention on the emerging feature of aliveness of technology and the scientific and socio-cultural consequences that come with it. Both Mande technology masters and global North data analysts are seen by ordinary people as liminal figures, who straddle culture and nature, society and the wild realm, bearing secret knowledge to tame the untamed (being this knowledge either ritual formulas or secret algorithms). Their special skills consist in the ability to articulate and connect different realms, assembling together

raw materials and culture. In doing so, they concentrate in their hand exceptional power, which is regarded as both dangerous and salvific by the rest of the population, who is somehow aware of the fact that they forge technology and society at the same time.
While Mande blacksmiths and data designers have many things in common, one aspect distinguishes them dramatically. This is the *attitude* put into being in translating a wild and chaotic world (of spirts or data) into a cultural one, adapted to human needs and wishes. Usually, epistemic and ethical concerns are those mostly at the forefront, but the "longest way round" offered by Mande blacksmiths sheds light on the socio-cultural risks of designing data without letting space for data to be otherwise. A world with no "escape routes" is not just an intellectual problem: it has concrete consequences on how we live because 'culture' it is not made of abstract ideas but it materializes in how our lives are shaped by objects, infrastructures, norms, relations, etc.
To ask designers to let "escape routes" to data - and to us - it is not being naive or against technology. We acknowledge the great benefits technology has brought to humanity and its power as an inescapable and creative force in tracing humans' path in this world. That's why we care for technology and how it is made. Clearly, we are not advocating for a technology we cannot rely on or that fails. What we aim to address to designers with this paper is to reflect on which solutions and routes they can devise to continue to make our lives better while keeping open routes for wonder, surprise, regeneration and change.
By promising intimacy and perfect mutual understanding, smart objects and environments risk impoverishing culture of its escape routes towards the untamed. This is, indeed, a source of regenerating chaos, from which to learn to tackle and to come to terms with the unknown. Is the selfie the best metaphor of this dynamic, where people mirror themselves as they look at the world, the technology and the surroundings becoming a projection of the self, without any chance to grasp anything else?

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Acknowledgements: The present article is the outcome of joint and indivisible work by the authors; however, if for academic reasons individual authorship is to be assigned, Giovanna Santanera wrote section 3, 5, 6 and Roberta Raffaetà section 1, 2, 4. We also thank Secil Ugur Yavuz for enriching discussion on the topic of the article.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Digital Creativity Tools Framework

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Abstract | The objective of this study is to define a framework for clustering and analysing digital tools that facilitate the Design Thinking process. The framework, based on an extensive literature review, is developed as part of a more articulated and complex ongoing research aiming at identifying the most crucial factors that influence creativity in the digital era. The purpose of our model is to map and classify digital tools in order to support designers to face the digital transition. This study outlines the way in which we produce new ideas and different forms of knowledge through a creative design process by adopting digital technologies.

KEYWORDS | DIGITAL TOOLS, DIGITAL CREATIVITY, DESIGN THINKING, CREATIVE PROCESS

1. Introduction and aims

In the last years, the integration of new digital technologies has been used not only to innovate products and services, but also to support and foster the creative design process.

Increasingly, the digital era and its technologies are having a profound influence on the digitally enhanced generation (Prensky, 2009) who need to develop new competencies and skills among which human creativity is the most important one. It is, therefore, becoming essential for the design research to understand how digital technologies are influencing the creative process and creativity abilities to develop appropriate tools and models for the next digital generation of designers representing the actors of a near future. Indeed, designers are facing a digital revolution which required them to be prepared to work in an interactive digital world in which everybody does design (Manzini, 2015) in order to address new technological challenges achieving large-scale innovation.

The digital transition is also affecting the tools that designers adopt to follow the different steps of the design process such as gathering and sorting different information or generating project opportunities and identifying new directions. There is some confusion as to which tools and techniques to use, when, and for what purpose. Therefore, we are proposing a framework to help organize the proliferation of tools, techniques and methods in hopes that the design community will benefit by discussing relevant applications and identifying potential areas for further exploration. The framework that deconstructs the design process into phases and tasks and defines the taxonomy criteria for clustering the tools that could potentially play a role in all stages of the design process.

Starting from our expertise and knowledge about the Design Thinking approach (Meinel & Leifer, 2015, Canina et al., 2020) we analysed for each phase of the design process which digital tools could be applied to facilitate design activities. All the tools identified during the research could enhance designer and non-designer's creativity in different terms, some of them are more design phase-specific and others are more collaborative or linked with the entire design process.

To identify the methodology with which to structure the framework it is essential to consider the several forms of support that facilitate or improve designers' activities:

- design methods to facilitate the process of product development (Araujo, 1996; Schneider & Lindemann, 2005) or to help designers better understand users' expectations and needs (Wharton et al., 1994);
- ergonomic principles or recommendations (e.g., Norman, 1993) and ergonomic criteria (Scapin & Bastien, 1997) to help designers create products or objects that are more adapted to users;
- computational systems that aim at supporting designers at several stages of their activities (Fischer et al., 2005; Maher, Kim & Bonnardel, 2010).

The framework will deliver a repository of digital tools, as computational systems, based on the steps of the design thinking process could support designers during the stages of their activities, empowering creativity in different contexts, improving products and services on a holistic level.

2. Digital Creativity

Creativity has a fundamental role in the design process, is not the domain of a few called "creatives". Every creator throughout the design process should be guided by creativity in order to enrich his project with new insights and innovation opportunities.

By the coming of digital technologies, designers started to adopt the new potentialities offered by the latter. They recognise certain possibilities allowed by the digital, but also emphasise that there may be certain kinds of limits that get left out when engaging with digital technologies.

This belief was born when platform and digital tools began to appear, which is the same moment the definition of Digital Creativity was coined. Lee and Chen, (2015) describe it as: "All forms of creativity driven by digital technologies. In other words, digital creativity occurs when digital devices are used for various creative activities".

Digital Creativity is the result of a creative process implemented by a computer aided technology. Every time we employ tools or platform for supporting our creative thinking, the digital technology dynamics and mechanics influence creativity principles, that are motivational, cognitive, and attitudinal constituents of the design process. (Corazza & Agnoli, 2015).

Digitally supported creativity encompasses the study of how creativity can be supported and enhanced by digital technologies. Digital creativity technologies support many different kinds of artwork in digital representation (text, layout, image, sound, 3D object, moving image, etc.) as well as new form of art such as the generative art. The technologies also enable us to capture, store, manipulate and output these representations to produce media forms we can experience.

Within the computer science field and the HCI domain digital creativity is studied from a technological perspective testing and studying the application and potentialities of specific digital technologies for creative achievement. By approaching the HCI field, emerged that one of the main recognized research works has been done by Ben Shneiderman (2000, 2002, 2007) that has always undertaken study on "Creativity Support Tools" (CST) intended as user interfaces or software supporting creativity across domain, empowering users to be more productive, and more innovative. As he states (2000)

> "the goal of designing creativity support tools is to make more people more creative more often, enabling them to successfully cope with a wider variety of challenges and even straddle domains".

In 2005 he organized the workshop, "Creativity Support Tools" sponsored by the National Science Foundation, with the main aim of accelerating research on this topic and defining guidelines for the design and development of these tools. According with the result obtained (Shneiderman et al. 2005), a CST should enable more effective searching of intellectual resources, improve team collaboration and speed up the discovery processes. They should also provide support in hypothesis formation, speedier evaluation of alternatives, improved understanding through visualization, and better dissemination of results. HCI apply digital technology to develop tools that could enhance and support some aspect of the creative process that allow individual or a team of individual working together in reaching high performance. From the workshop are emerged several concepts, types of practices, and aspects of human cognition as important ingredients for research on tools for supporting creativity. For our research is useful to acquire the outlined roles of tools for supporting creativity, positioned in terms of three dimensions (Nakakoji, 2005) in order to analyse in deep the hypothesised taxonomy for the framework.

The first dimension includes tools to train people to develop creativity, or skills of creative thinking. Such tools aim at helping people to develop skills to engage in creative ways of looking at problems and framing solutions by using these tools.

The second dimension includes tools to support people's creative process while engaging in a creation task.

The third dimension includes tools to enable people to have new kinds of experiences that they would not be able to have without using these tools allow people to engage in completely new experiences of producing expressions.

These three dimensions, in particular the first and the second one, are the lenses adopted to scout the digital tools to be included in the framework since they are well connected with the design process structures behind the framework.

2. Methodology

The construction of the framework followed three main steps:

- The definition of the design process structure that was mainly based on one side on the authors expertise and knowledge.
- A literature investigation to identify and select the criteria on which based the framework and the scouting of design tools.
- A scouting of web-based design tools and their positioning within the framework.

An extensive body of literature have examined and discussed - within the digital creativity domain - the characteristic and design principles to guide designers in building efficient digital design tools.

Within the review we decided to focus on three main contribution provided by Shneiderman (2002, 2007) (Shneidermanet al., 2005) that clearly highlight design principles for building creativity support tools. Modern creativity support tools enable new forms of expression for individuals, and they are especially potent in supporting group collaboration and social creativity.

> "Creativity support tools extend users' capability to make discoveries or inventions from early stages of gathering information, hypothesis generation, and initial production, through the later stages of refinement, validation, and dissemination." (Schneiderman, 2007, p. 22)

The guidelines for designing these tools address the design process and the creative principles within the design process.

From the analysis of this contribution 12 design principles that highlight the relation between digital tools and the creative design process have been extrapolated (Figure 1).



Fig. 1. List of the selected design principles for building digital creativity support tools.

The identified principles have been analysed, elaborated and clustered in order to support the construction of the framework. The 12 principles have been indeed transformed into three main elements:

- *Design process activities*: this represent the most relevant activities that can be supported by a digital design tool. The activities have been defined within each process phase and are relevant for building the framework structure.

- *Tool's selection criteria:* these criteria are relevant for determine which tool can be selected and included in the framework
- *Tool's cross characteristics*: these criteria are fundamental to analyse and identify the different traits of the design tool collected. Digital design tools that are classified within the same design phase and that support the same design activity, can have different cross characteristic.

These three elements contribute to define the framework and the taxonomy with which select, analyse and classify the digital design tools.

3. The framework

The evolution of Design Thinking has been continuous, and the original paradigm has changed frequently and has acquired new names and facets.

In line with the evolution of the paradigm also the processes of Design Thinking changed, despite this in the last decade, four are the ones most used by the organizations. All these methodologies divided the Design Thinking process into many different phases, someone prefers to use a more linear path others adopt an iterative loop process. The names of the steps are different by the approach and the criteria behind these processes are the same (Figure 2)

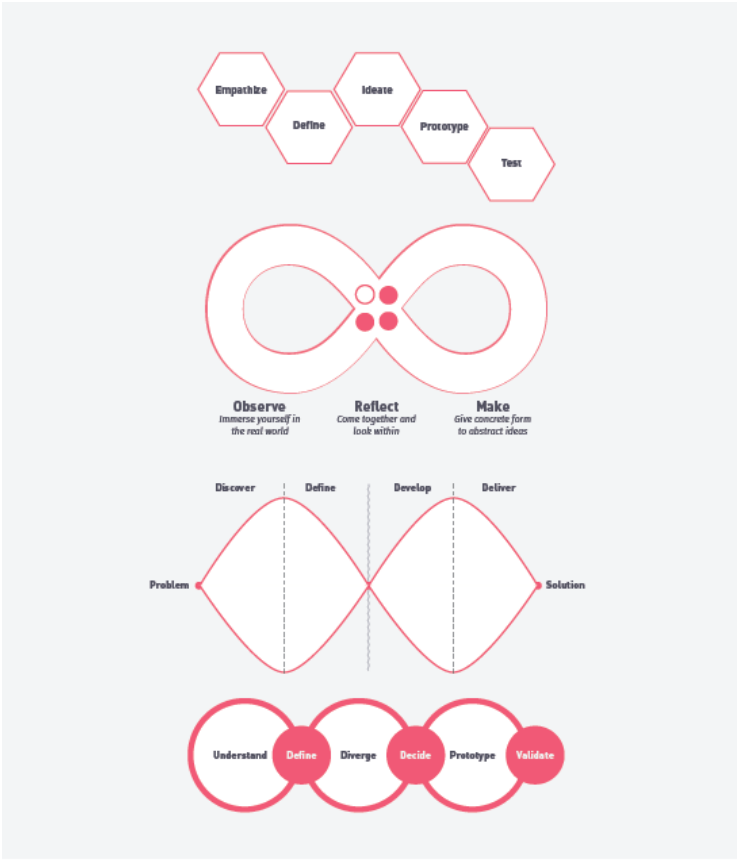

Fig 3. From top to bottom: D.School framework, IBM Loop, British Council Double Diamond and Google Design Sprint.

The design process model adopted for building the framework, comes from the experience and background of the authors on the topic. Indeed, we adopted the IDEActivity process as the specific Design Thinking approach (Canina et al., 2020).

Using the study of various most significant existing models as a springboard - the 3I model (Brown and Wyatt, 2010), the Double diamond model by the British Design Council, the Service Design Thinking proposed by Stickdorn and Schneider (2010) and a key reading in Human Centred Design (HCD, IDEO 2011) - the IDEActivity process model was developed and the user is recognised as having significant creative potential. IDEActivity process model adopt a stage configuration based on the two main moment of the design process called Explore and Generate. For the two main stage of exploration and generation, it includes

different steps, from Clarify Goal and Define Opportunities in Explore, to Ideate and Prototype in Generate (IDEActivity Toolkit, 2017). Each stage is always constituted by a first phase of divergence, which is followed by a classification, and finally convergence to arrive at the definition of the problem or a solution. The Creative Diamond (Tassoul and Buijs, 2007) is characterised by a diamond shape and its phases have specific rules.

In order to build the basic structure of the framework, have been extrapolated from this model the 2 main stages, and the steps to be carried out during the process that represented the four cluster within which we placed all the digital tools.

3.1 Design process structure and activities

The Digital Creativity Tools Framework is based on a simplified yet exhaustive version of the human-centred creative design process that, using the potential of creativity and the approach of design thinking, support individuals from different backgrounds to actively experience the development of ideas or strategies.

The process focuses on two main consequent stages, Explore and Generate, and a total of four explicit process steps, each one with specific objectives, and each one characterized by specific activities. The activities have been determined and integrated thanks to the literature investigation of design principles for creativity support tools.

The first stage, Explore, allows the creation of a basis from which a significant and potentially viable goal can be defined its possible development in relation to a given context. Within this stage an understanding of needs, hopes, and aspirations is crucial, and an analytical process of information interpretation is fundamental to identify opportunities.

Explore is divided in two main steps: Clarify goal whose aim is to bring the goal clearly into focus and Define Opportunities whose is to transform the information collected in design opportunities.

The activities emerged from the literature analysis and integrated within these two steps are: Searching, Empathising, Clustering/Visualizing, Open possibilities, Prospecting

The second stage, Generate, aims at the generation of suitable concepts in line with the given context and the prototyping of innovative ideas.

Generate is divided in two main steps: Ideate whose aim is to generate one or more novel ideas which is meaningful for the design challenge framed, and Prototype whose aim is to enrich and refine the idea, through the development of tangible artefacts

The activities integrated within these two steps are: Inspiring, Conceiving, Selecting, Making, Reflecting (Figure 3).

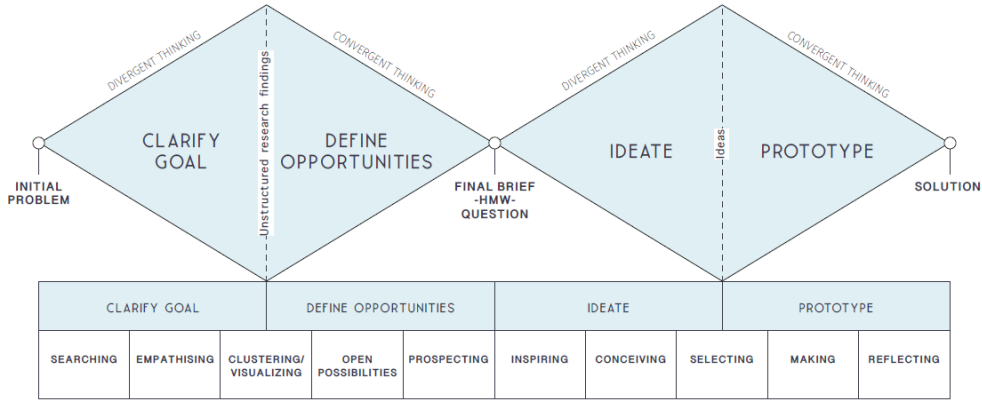

Fig. 3. Design process structure and activities.

Table 1. Summary of the design process structure and activities

PROCESS STEPS	ACTIVITIES	DESCRIPTION
CLARIFY GOAL	Searching	Accelerating the collections of information. A task which people undertake to find or retrieve specific data and resources.
	Empathising	Analysing user behaviours and creating harmonious relationships with him, to collect information about actions, feeling and emotions of others.
CLARIFY GOAL / DEFINE OPPORTUNITIES	Clustering/Visualizing	Grouping the large amount of data gathered and having a better visualisation of them, helps designers to organize their knowledge, see relationships, and possibly spot what is missing.
DEFINE OPPORTUNITIES	Open possibilities	Tools that show you all the possible implications of decisions. Enhancing the conception of which possible scenario might be done or might happen.

	Prospecting	Converging all the possibilities in a specific scenario or future event
IDEATE	Inspiring	Being mentally stimulated to do or feel something, especially fostering creativity. Collecting and combining immediately your ideas in order to get new inspirations.
	Conceiving	Inspirations bring you to a list of ideas that have to be simulated in all their possible implications of decisions.
IDEATE/ PROTOTYPE	Selecting	Making a decision on the strongest and most impacting ideas.
PROTOTYPE	Making	Building and composing artifacts, prototypes and performances. In order to test all the possible implications of the product/service
	Reflecting	Disseminating the final solution to all the stakeholders involded, in order to gather feedbacks to play with, to experiment with, to talk about.

3.2 Tools scouting and analysis

The inquiry that has been conducted, started with an analysis of the basic design tools for Design Thinking. Both for illustrating the state of art of analog tools and to give an exemplification of what kinds of techniques design currently offers. Secondly, we determined to go deeper in terms of specificity and to cluster a series of digital tools who could enhance the creative approach for each phases of the design process.

Two main general criteria have been identified for the selection of the digital tools:

- META-DESIGN. Creativity needs the “synergy of many” (Benkler, 2006) and this kind of synergy can be facilitated by meta-design. Meta-design is a socio-technical approach that characterizes objectives, techniques, and processes that allow users to act as designers and be creative in personally meaningful activities (Giaccardi & Fischer, 2008).
- LOW THRESHOLDS / HIGH CEILING. Tools should be easy for novices to begin using, they should not be intimidating, and should give users immediate confidence that they can succeed. At the same time, the interfaces should be

> possible for experts to work on increasingly sophisticated projects (Shneiderman et al., 2005)

The two specific criteria used for selecting the tools are related to two dimensions mentioned earlier:

- Tools enabling creative thinking in the different step of the creative process.
- Tools supporting the steps and activities of the creative process.

Each collected tool has been analysed firstly to identify which step of the process and which activity can support. Secondly, it has been analysing according to 4 criteria that allow to specify some characteristic of the tool that are transversal to all the steps and phases of the process. These are:

- COLLABORATION: The tool enables a sharing system and a safe environment that allow team members to contribute and work on their own parts in parallel, supporting the integration and iteration, building trust.
- RICH HISTORY KEEPING: the tool allows to record the process history and which alternatives the users of the tool have tried. The tool allows them replaying session histories, comparing the many outcomes and going back to earlier ideas to make modifications.
- CO-CREATION: the tool allows an expert facilitator to plan, modify and adjust co-design activities in which different parties work together and jointly produce a mutually valued outcome.
- RELATE AND INTERACT: the tool utilizes any form of communication for consulting with peers, experts and mentors for clarify requests and intellectual and emotional support.

From the collection emerged that some of the tools are mainly used by a design facilitator for training and co-design sessions with a larger audience (i.e Stormz) and others can enhance real-world interaction, discovery, exploration, and imagination through Augmented or Virtual Reality (Zünd et al, 2015).

Some of them are phase-specific digital design tools that are online platforms or tools repository with a high level of specificity, which support one specific phase of the process. Here we can find for example tools characterised by computer-mediated brainstorming, tools that allows to capture plans and ideas in a web-based virtual whiteboard (i.e. Miro), or others only for testing and evaluating already existing prototypes (i.e. Proto.io).

Others are considered as multi-phase design tools that are all those platforms that could keep track of the entire process. They are totally cloud tools that allow the collaboration between team members to develop new projects, from ideation and envisioning to gathering feedback directly from users. (e.g. Shape by IDEO)

3.2 Digital design tool positioning: Shape

For each tool analysed a card has been designed, indicating the Name of the tool, the Cross characteristics it answers, a description of how it supports the activity/activities of the process, and a link (Figure 4). Each card is then visually located in correspondence with the process activities he supports or empower. In this paragraph an example is described.

Shape (IDEO)[1] is a visual and collaborative environment for building, testing, and refining ideas. With respect to the design process, the web-based tool allows to *engage and guide a team of people through all the steps of the design process* also providing template to let people get quick access to convert the ideas. It allows to gather inspiration and ideas creating visual spaces to brainstorm a new idea or share design inspiration across a team.

Among the cross characteristics is possible to identify that Shape it is a platform designed to guide and *support collaboration* at multiple scales, from small teams to large organizations and global communities. Shape allows to guide, document and manage the creative process of a team of people who is solving a challenge, in a transparent way. It has been designed for simplify *communication* between the designer and its customer, allowing the latter to enter in the process, understand the main steps and contribute, and to easily *relate and interact* for request feedback directly within the platform. The visual support facilitates evidence-based decisions and allow to *keep track* of the best practice analysed, the idea shared allowing people in going back and iterate on the process done.

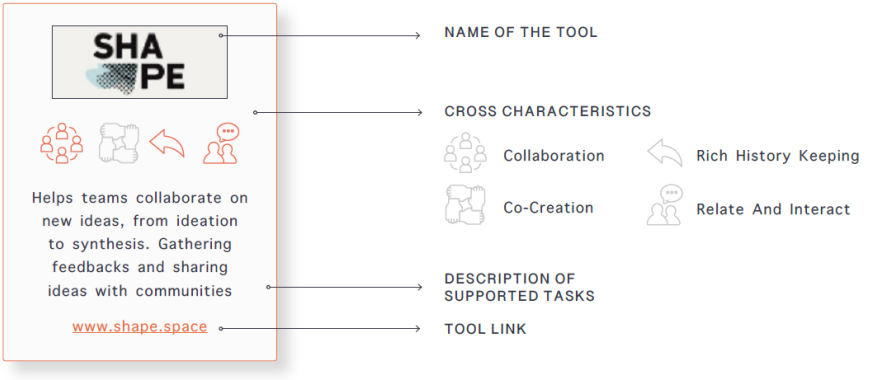

Fig. 4. Shape tool analysis card.

[1] www.shape.space

4. Conclusion

The research and the development of the taxonomy and the framework wished to identify some of the characteristics of the digital tools that nowadays designers can use in order to expand their minds and visions. As Literat and Glaveanu (2018) affirm, this new typology of tools emphasises individuals and individual minds. In fact, it is exactly the emergence and growth of digital technologies that contributed to new, systemic ways of thinking and talking about creativity.

The developed taxonomy highlights tools intended for a wide variety of uses and varying in complexity, from a simple tool with one specific function to multiple function tools or an entire suite of tools. The framework allowed us to characterise every tool with its own phase of intervention in the design process, and to identify areas in which nowadays there is an absence of supporting tools. We can, therefore, assume that the generated framework will benefit several contexts and open opportunities for other future researches. For example, it could support companies aiming to adopt digital creativity tools for exploring and anticipate design opportunities and needs. In the design field, it could shape new digital creativity tools to support designers at all stages of the design process and to diverge their thinking and get carried by lateral thinking.

This research is at an early stage and does not have the ambition to map all the existing digital tools that can support the creative design process. Only web-based digital design tools have been considered in this first scouting of tools.

The speeds with which these tools and digital technologies are emerging and developing would make the research never complete. The main aim is to identify in the different steps of the process the relation between the tools, the activities and the creative factors of the step itself, to facilitate the achievement of a more novel and useful result. Future directions aim at testing some of those tools in a real design setting, in combination or in comparison with other analog tools, to verify and understand what features can better meet the designers of the digital era works.

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DC(S)
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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Digital tools that support students to reflect on their design competency growth paths.

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Abstract | This paper reports on the design and testing of two digital learning systems. The first, STUDIO*,* supports individual and collective reflection on the design process. It allows design students who are undertaking a work placement in industry, to capture professional attributes they are acquiring and to share progress with their peers. The tool is intended to be used *post facto*, that is in supporting students' self-reflection, to aid development and inform future work in the field of design. The second system, *Trajectories,* supports student journeys through a course of study. It is intended to be used live. As students proceed through their studies, acquire new skills, and deepen their existing knowledge they assess their own level of mastery of a specific competency on a continuous basis by connecting it to specific design outcomes.

KEYWORDS | DESIGN COMPETENCY, SELF REFLECTION, DIGITAL LEARNING SYSTEM

1. Introduction

We deploy the notion of design competencies to enlarge our inquiry beyond any one specific course of study. We understand competencies to be more than technical ability or mastery of domain knowledge and to include personal characteristics. These characteristics may include cognitive, social and emotional attributes (Dubois, 1993; Lucia and Lepsinger, 1999) deployed by designers in the production of their work. The idea of competencies thus emphasizes abilities beyond traditional studio design skills. Some theorists (Boyatzis, 1982) go further to include the environments and relationships featured in a particular context and the motivations and perceptions an individual may have of themselves and their abilities.

We contrast the respective educational and learning cultures of two design schools in London, UK and Toronto, Canada. In Toronto the system is used by undergraduate industrial design students doing a semester long work placement during the third year of their (four year) Bachelor studies. The professional nature of their work placement range widely, students may be placed at a product design agency but increasingly are placed in UX/UI firms, or service /experience design consultancies.

In London the system is used by an international postgraduate student cohort studying user experience design at master's level. The London course is 35 week-long and ends with a final major project. The curriculum follows a cohort model with students working collaboratively in small groups on a range of projects throughout the course. As user experience design is a convergent discipline, students are drawn from many different disciplinary backgrounds including graphic design, media arts, art history and philosophy. Students may also wish to end up in a wide variety of design-oriented careers including user research, interface design, information architecture, or experience design. We have found that a competency-based approach works well to scaffold the many different pathways available to students.

We assume a set of positions regarding culture in this context and are in sympathy with Hall's (2016) definition of culture as 'experience lived, experience interpreted, experience defined'. Design students address this by reflecting on their own experiences, and reaching out to inquire about the experiences of others. Designers use a wide range of tools to explore, interpret experience from interviewing, observing, journey mapping, to drawing, story boarding, diagrams to coding, and impose constraints to define the experiences they are designing for. Hall also defined culture as a space of negotiation, open to diverse voices and responsive to people, places and languages. We take the view that culture can be thought of as national, institutional, pedagogical, social and individual. From this it follows that the learning process of a design student is situated within a constellation of these cultural dimensions.

Appreciating these complex and ever-changing cultural dimensions there is a necessity for students to be able to navigate and chart their unfolding learning pathways within and across these constellations. Findings suggest there is common ground in how both digital learning systems enable students to describe and tag their experiences with competency

definitions to help them identify their current learnings, assess individual competency strengths and weaknesses and to inform future learning needs and required project work. Both digital, competency-based learning systems also show differences, most pronounced in how the systems are structured temporally and how they contribute to different aspects of a design student's personal profile. The conclusions we draw from this comparison include the centrality of local pedagogical cultures, and the need for a multi-faceted and integrated curriculum that can stimulate self-knowledge.

2. Background

Development of digital learning systems covers a wide range of topics across the last two decades. Research into online classroom delivery in the early days of the web (Siegel and Kirkley, 1997) emphasizes the linked and dynamic nature of web-based information access, the threat to validity and integrity of material published outside established practices of editorial reliability, and the screen-based experiences of learning online. This work is followed a decade later by more systemic and applied approaches to digital learning systems that examine the challenges for learners of a digitized information landscape and look across at adjacent domains of knowledge and practice for methods that might be useful.

Peters (2000) uses the phrase 'digital learning environment' to describe how learning using digital technologies is a fragmented experience using multiple devices, operating systems and software applications. Prensky, (2003) identifies game-based learning as fruitful for engaging young learners, Clyde (2004) focuses on what she calls 'digital learning objects' meaning content items, communication tools, assessment items or learning management tools. The two projects we discuss in this paper could certainly be described as knowledge management tools but with the particular emphasis on the practice based creative learning activities that design education involves.

The introduction of the first iPhone in 2007 meant a turn in digital learning research towards mobile learning with the implication that digital learning systems imposed on students by University IT departments such as *Moodle*, or *Blackboard* would be rendered out of date. Jarvis (2010) points out the possibilities for 'experiential field-based learning' whilst also identifying that learners may end up feeling exposed and frustrated if the systems they use are unfamiliar. The transformation of the delivery of education and training by mobile learning is evident in examples from nursing, museums, and distance learning (Ally, 2009). In art and design education specifically, Heaton (2019) opens up a space for 'collaboration, moral consciousness, and social responsibility' in digital provision, suggesting a sensitization an alignment of art and digital practice, what she calls 'curated cognition'.

We can thus see a transition from researchers interested in digital pedagogies from viewing them as a threat to established knowledge practices, to offering opportunity to learn from adjacent domains, to a systemic analysis of a fractured technological landscape. There can now be very few design education curricula with no element of digital provision. This might

include students using creative software, online materials such as theoretical readings, online marking and assessment, digital submissions in the form of blog posts and PDF files, or digitally enhanced outputs such as spaces and products.

The projects we describe in this paper are knowledge management tools for design students and are more accurately described as tools for creative reflection. Valkenburg and Dorst (1998) describe some cognitive tools for creative reflection used by design teams. These draw on Schön's theory of reflective practice by attempting to specify how designers frame a problem, what actions ensue and how they are named by designers. Actions are captured in the concept of moving, meaning making choices and generating ideas. Mewburn (2012) positions actor network theory as a way to both challenge and enrich Schön's notion that the design teacher is the source of knowledge for design students through demonstration of their own 'artistry'. Instead, she suggests the design studio contains non-human technologies (actors) arranged in a specific relation to each other (a network) such as photocopiers, projectors, computers, desks, cellphones that all contribute to the pedagogical situation. We thus position that our own work on digital systems supporting creative reflection, as acting in a way that similarly constitutes a movable, individualized but peer sustained learning digital environment.

Tools for reflection are commonly taken to be abstract. Gray (2007) epitomizes this approach in a study of tools for reflection in management learning. He mentions storytelling, conversation, dialogue, metaphor and analysis as tools for reflection in the learning process for a student of business management. Where technologies are used to support reflection in education they tend towards presenting portfolios of completed tasks for students to reflect upon (Oner & Adadan, 2011; Oakley et al., 2014). Both *Studio* and *Trajectories* feature aspects of this function but are more oriented towards collaborative, generative and the kind of abductive reasoning common in design (Kolko, 2010). The projects discussed in this paper express the generative nature of design work and the ways in which learning design involves students making things that have not existed before. So, while our tools may encourage abstract qualities in the process of reflection such as conversation, storytelling and metaphor, these are understood to be fundamental to design learning and thus arise in the doing of design work.

Resnick et al.'s (2005) set of principles for tools that support creative thinking epitomize another strand of research in the field of digital tools for creative work in design. We are in broad sympathy with these principles which include '*support exploration*', '*support collaboration*', '*design for designers'* among others. We note however that they are oriented towards software that designers can use to create their designs such as image manipulation tools, or 3D modelling applications. Instead our focus is on facilitating reflective evaluation of the process while creating design work, and reflection and evaluation of the work once it is completed.

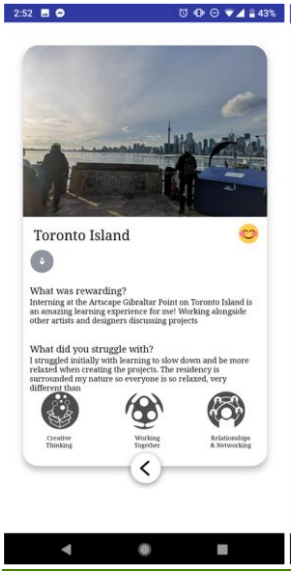
3. STUDIO

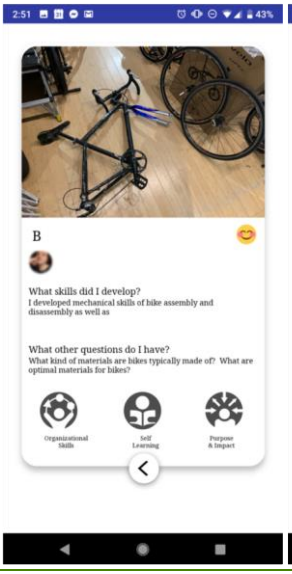
The Toronto University has a department to support emerging artists and designers. This department has identified 'self-learning' and 'self-reflection' as critical capabilities for students doing internships. To help foster these capabilities in students, they have explored the use of on-line tools and mobile apps that can support student in their self-reflection processes.

STUDIO is a smartphone app that responds to this need. The application features four main functions. Firstly, students can use STUDIO to write down and document their everyday reflections on what they do and learn during their work placement. Secondly, the app provides a series of probing questions to stimulate thinking about the learning in their everyday interactions. Thirdly, STUDIO allows students to add photos and text annotations to their entries. Fourthly, STUDIO has sixteen predefined tags, each representing one of the professional practice competencies that are associated with experiential learning. These professional practice competencies have been defined and curated in collaboration and consultation with teaching staff in faculties of Art and Design and with experiential learning specialists.

By tagging each diary entry with up to three competencies students build a visual representation of the competencies they are growing in, those that they face difficulties with, or those that are lacking. This provides opportunities for identifying gaps in learning and validating individual strengths. Students can choose to share their learnings with their peers or not. If an entry is sharable, the student can open their entries for feedback. In this way STUDIO works as a social network of students who are engaged in a workplace learning experience.

Figure 1) features a Material Art & Design student STUDIO entry on a field trip to an artist residency, remarking on the relation of the environment and the students' creative process. Figure 2) features an Industrial Design student STUDIO entry on an exercise in which students disassemble a mechanical object, and probing the relationship between mechanical artifacts and the materiality of its components. Figure 3) features a Material Art & Design student STUDIO entry on an exercise in which the student was organizing existing fabric pieces along their color, remarking both on the creative process and the role of hands on, tangible learning.





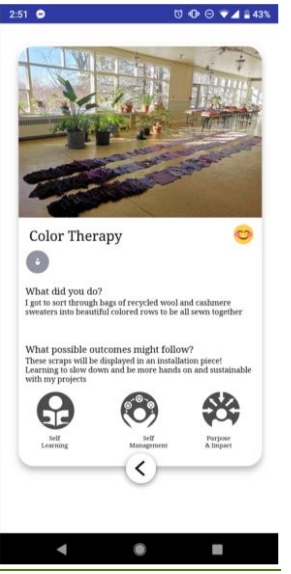


Figure 1. Student Entry *Figure 2. Student Entry* *Figure 3. Student Entry*

STUDIO has been tested by two groups of five students each. Group 1 used STUDIO in a structured context as part of a Design Internship Placement Course, and Group 2 used STUDIO in a more unstructured situation by students that were enrolled in an independent Field Studies. For Group 1, STUDIO was integrated into the placement experience. Key features of this group included requiring students to submit one post, one comment, and one response every week during the semester. Discussions related to posts and comments occurred during every in-class meeting and was integrated into final presentations. During the first week of introductions, students were introduced to the Benchmark Activity, which features a printout of the sixteen competencies and asks students to identify the competencies they want to work on or improve. They were then asked to select 12 out of 16, then 6 out of 12, then 3 out of 6, and 1 out of 3. An in-class discussion around their final choices then took place. In the final session students were asked to complete the benchmark activity again. They were asked to identify the competencies that they worked on or improved throughout their placement. There was then follow-up discussion around the students' personal experiences.

For Group 2, there was an unstructured integration of the app into the placement experience. While students were given a tutorial and encouraged to use the app, there was no established structure for how the student should use the app, nor minimum engagement requirements. Group 2 received no reminders apart from a mid-term and year-end check in.

Feedback from the testing process shows a number of findings. Students felt empowered by the immediacy and visibility of their entries, particularly that they were able to see entries of their own and their peers. The list of competencies was very useful in establishing terms and framing the internship learning outcomes - 'a great way to make sense of the experience'. The terminology made it easy to associate moments in the workplace with what was covered in class. The brevity of the entries 'took away some intimidation related to reflection' allowing timely and relevant reflections related to the placement because each entry was expected to be so short. One student was excited about the potential to take notes about some of the things she was facing as they happened. She felt that '*using a cellphone would be fast and easy compared to having to remember thing and write them down when I get home*'. Negative feedback included difficulties creating an account and logging in, and accessibility problems with a screen reader unable to read all menu items. Navigation was an issue '*the UX means it is not clear how to navigate the posts, I felt the process was complicated and not totally intuitive'*, 'I could use more guidance in the app on how to use it'. More detailed comments include '*it would be good to be more open ended and have a framework for structuring thoughts*' and '*the ability to export or share selected posts both private and public would allow this to become part of graded assignments*'.

In summary, there is clearly more work to do to develop STUDIO, particularly around integration with course curricula and accessibility, but the ability to frame the informal learning that takes place during a workplace internship in terms of competencies that relate to specific activities helps students keep track of, and share, what they are doing and how it is valued at program level.

4. Trajectories

MA User Experience Design (UX) at the London based university is a 45-week Postgraduate degree. Students come from many different cultural backgrounds including from China, Italy, Brazil, USA, Ireland, Korea, and India. Students also have diverse educational backgrounds in graphic design, product design, philosophy, architecture, finance, computer science and marketing. UX is an integrative and convergent discipline and provides creative opportunity in fields such as design research, user interface design, interactive prototyping, creative coding, interaction design and increasingly, service design and experience design. There are thus many pathways or trajectories through the program that means students, even while collaborating on the same project briefs, may have different goals and end up with very different design abilities. *Trajectories* is a smartphone app that addresses these many possible routes through the program by using the competency model we have explored in previous work (Fass et al., 2017, 2018). Like STUDIO, students choose a maximum of four competencies from a grid of sixteen per project. The sixteen competencies are the result of two years research and consultation activity including workshops with staff and students. They are intended to provide a set of choices for students to decide what they consider to be their existing strengths and what they wish to be better at. The focus of *Trajectories* is on

completed and ongoing design work. Competencies are thus connected to visible and shareable output. Projects are connected to assessed program units, and specific design briefs. On launching the app students must initially populate their profile with a project including title and image. Then four competencies are attached to that project and a level chosen for each one. Project work is described and made available to the whole cohort at various levels of visibility for peer and tutor feedback.

Trajectories is structured around three navigational principles. The first navigational mode 'Timeline' shows how an individual student is progressing through the program week by week. This gives an overview of competency levels per project as they develop over the weeks of the unit, and ultimately of the whole course. The second navigation mode: 'Competencies' shows the four specific competencies selected by the student that are associated with a particular project, with levels set in the most recent week. The third navigation mode: 'Projects', displays each project entered by a student. Projects have text descriptions (shown in Fig. 4) and are connected to units (shown in yellow boxes in Fig. 6).

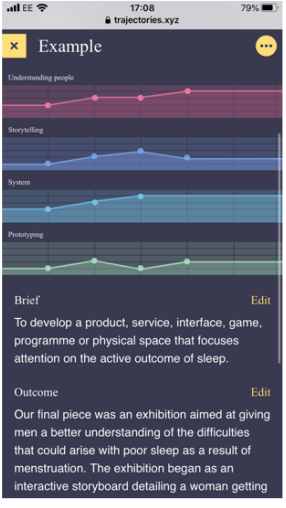


Figure 4. Timeline



Figure 5. Competencies

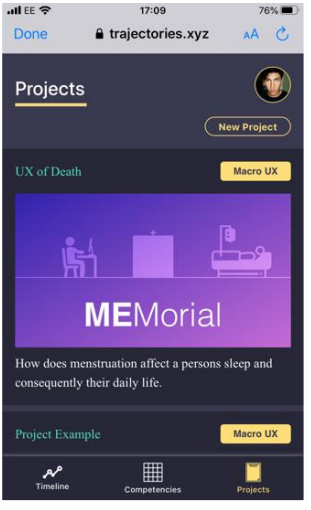


Figure 6. Projects

Further detail about individual competencies is provided in order to describe what they mean, and how they are applied in UX. Most importantly, in *Trajectories* competencies are exemplified and explained through their application on projects that other students have completed or are currently working on. In this way we hope to emphasize through design example rather than theoretical description. Reflection is thus based on student output, allowing competencies a degree of latitude and flexibility in what they come to mean over time for individuals and groups. At the end of the program after 45 weeks students can

orient their graduating portfolios and career aspirations towards those competencies that they can provide evidence for in the work they have done.

Trajectories has been tested by 12 students by asking them to use the app in prototype form as they worked on a design project and provide spoken and written responses on their experience. Positive feedback includes comments about the depth of explanation '*I like that there's a definition for each competency since this is the first time I have encountered the idea'*, and the learning style enabled by a competency framework '*Tracking the competencies allows for a much more relaxed learning experience instead of a strict marking scheme*.' Using competencies to frame the learning journey allowed students to reflect on their current learning position - a snapshot of how they are doing on the course and why, *'By breaking down what there is to be learned in this way it helps me to what I'm finding most interesting and why I want to develop those skills further*.' The system helps students to think about their future development. The navigation mode *'Competencies allow me to break down the skills I believe are important to have, the skills I have already started to develop and what other skills I can develop*' and position themselves in the broad field on UX design.

The emphasis on projects as a way of demonstrating competencies through completed design work, rather than written reflection alone was seen as valuable because it recognizes the practice-based nature of the course and '*lets us showcase exactly what skills we are using and how those skills develop through different kinds of designed outcomes and topics this in turn allows us to see where our strengths lie by adapting to these different topics of research and design*.' Having a personal portfolio of projects helped students understand and identify their strengths, how those strengths have been expanded and how they might be reflected in career opportunities '*It (projects) helps in understanding which skills I value most, use most often and have improved the most in over time through the course of individual projects and the entire course. The competencies themselves help me to see exact names of skills that could be found in job roles*.'

Elements of the system to improve include a peer review function. '*I feel some of the things missing are anonymized peer reviews allowing people to give one another advice on how to improve their competencies and help to keep evaluations of competencies honest*'. A connection to careers in the field was also seen as useful '*having a job roles page so that you can better match the competencies you are happiest improving with against what careers those combined competencies are best suited to*.'

We can see from these reactions that the value is the system is in how it helps reflection on student development over time and hands control of the learning journey to students in a more granular way than summative assessments can provide. In addition, it can be difficult to stand back from everyday studio tasks and projects to gain an overview of how an individual might be progressing, *Trajectories* was seen to help this process. Finally, the connection with post-university career opportunities was identified as a current weakness

that can be improved along with some difficulties in navigation and data entry tasks. These will be a focus for the next phase of development.

5. Discussion

While it is early days for both these systems, there is much to build on. The implications for digitally enhanced pedagogy are related to levels of autonomy for individuals and groups, and to the possibilities for peer learning and review. By enabling self-assessment, the power of experts in design teaching situations (suggested by Schön in the form of 'teacher artistry') that was questioned by Mewburn (2012) is mitigated. Students are empowered to assess their own levels of ability in a particular competency and to elicit feedback from their peers and tutors on a level playing field. The flattening effect of digital systems (Fass, 2018) is here an advantage since teaching staff do not have privileged access to an individual's feedback section. This chimes with Kulkarni et al. (2013) who find in a study of large online class using peer and self-assessment that there was high correlation with staff-assigned grading. In terms of pedagogy in design education it is clear that most forms of design today now include aspects of digital creativity. Students arrive for study at design school equipped with a sophisticated understanding of digital ecosystems, although perhaps not the critical ability to use them productively. STUDIO and Trajectories both validate a specifically digital approach to reflection and review. Some of the negative feedback from students shows how far it is possible to go and how high expectations are for a student facing a digital learning tool.

The implications for personal development and the individual learning journey are shown in the ways both systems have the potential to transcend their immediate context. In the unstable and unpredictable economy inhabited by creative professionals, who are more likely than other workers to be self-employed freelancers (Pitts, 2018; Merkel, 2019), sustaining a creative career over a lifetime of work can be a major challenge. The ability to identify strengths, and provide evidence for those strengths enables designers to continue to build their abilities after graduation and adjust to the ever-changing priorities of the creative marketplace. Critical reflection on competencies and on design work shows the kind of advanced abilities valued across the design sector and shown by Giroux (2018) to be fundamental qualities for 'socially responsible and civically engaged citizens'.

The implications for design education are clear. Without access to tools; whether cognitive, abstract, tangible or digital for critical reflection students are at the mercy of the 'disimagination machine that remakes social identity by turning civic subjects into consuming and marketable subjects.', (Giroux, 2018).

Finally, the implications for a competency-based view of design education are validated by both systems. By emphasizing competencies rather than skills, abilities, or expertise students are encouraged to see themselves as acquiring a mix of complementary capabilities that may fluctuate in level depending on what they are doing, and who they are working with. The

competency framework allows for self-identification by students with a set of competencies that can gain resolution and detail through design work over the duration of a program or a workplace internship, and ultimately over a creative lifetime. A competency-based view of design education also admits new areas of design such as bio-design or robot behaviors. In this way design curricula can be constantly updated within specific programs and respond in an agile manner to the emergent challenges of the age. Our future work in this area involves a global reporting project in the context of a Cumulus Working Group. We have elicited participation from over 30 design education institutions and 100 individuals who have agreed to contribute to an ongoing project that gathers the design competencies of the future, and provides evidence for how they are addressed in curricula worldwide and in student design work.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Domestic AI and Emotional Involvement. Design Perspectives

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Abstract | The contribution addresses the current phenomenon of AI spreading in domestic environments but making no meaningful contribution to people's life. The main purpose is to stimulate a conversation about the topic in the design community, trying to trigger critical reflections through the envisioning of – more or less – near future scenarios. Regarding the emotional sphere as a possible asset for the solution of the problem, the investigation starts from the field of psychology, translating some of the basic theories about (positive) emotions into scenarios where AI systems enhance houses, embodying these principles in an intentionally overstressed manner. Science Fiction Prototypes have been applied as research tools to build the scenarios and to infer critical points and interesting possibilities. The outcome of this work is a set of different envisioned futures that can be introduced in workshops and/or didactic activities to further advance the discussion.

KEYWORDS | ARTIFICIAL INTELLIGENCE, EMOTIONS, DOMESTIC ENVIRONMENTS, INTERACTION DESIGN, SCIENCE FICTION PROTOTYPES

1. Introduction

Referring to the topical issue of AI spreading in domestic environments, with no effective results, this argumentation aims at stimulating a conversation from a design perspective. Since we naturally invest objects and environments with emotional values (Branzi, 2013; Canter, 1972; Diani, 1988; Norman, 2004), as if they were a measure to assess experiences, we wondered if and how design and the latest technologies can improve our emotional well-being at home.

Starting from the analysis of psychological literature about emotions, to better understand the matter to design for, we explored 6 scenarios of a future life with non-human intelligence, each of them embodying a different theory about (positive) emotions. To guide the investigation, we employed Science Fiction Prototypes. This method allowed us to go further to almost dystopic scenarios, clearly stressing the main critical points and interesting possibilities they imply.

Finally, the outcomes of this experimentation are discussed and an integration of the scenarios in workshops and didactic activities is proposed to advance the debate.

2. Future AI-enhanced domestic life: a possibility for design

The transition towards a life of sharing our homes with non-human intelligences has already begun. The first wide-spread materialization of AI in the domestic environment is represented by smart speakers integrating virtual assistants: at the end of 2019 over 200 million installed units were expected, and the trend seems growing (Canalys, 2019). Moreover, other AI-enhanced objects are emerging, namely lights, thermostats, doorbells, and even showers, while robots – varying from domestic assistants to pet substitutes – are multiplying (Hitti, 2020).

However, people's relationship with this technology is controversial. Excluding the anxiety generated by filmic hyperboles depicting a world overwhelmed by robots, one of the most frequent sentiments characterizing the use of smart speakers is a disappointment, probably due to a lack of understanding, caused by the underlying invisible operations of these devices (Norman, 2004). Especially, when compared to the promises made by advertising campaigns, smart speakers fall below expectations, having issues in basic elements of interaction like discoverability and proper exploitation of functions (Kinsella, 2018; White, 2018).

Indeed, a positive impact of technology on people's mood and life is key: Norman (2004) states that it should bring richness and enjoyment. Aware of that, brands delivering AI-enhanced products launch commercials leveraging emotional aspects. Accordingly, Amazon Echo is a tool to connect people or just the evolution of a human mate, while Google, emblematically states "You make a house a home. We make a home a nest", overshadowing the product by highlighting people's different emotional states at home.

The reality, though, tells us a very different story. Even if no deep investigations addressed the topic of smart speakers' emotional impact, especially in the long run, we could intuitively

compare them with design theories related to (positive) emotions, to understand that they need further development. As anticipated, following Khaslavsky and Shedroff's principles of the seductive power of design (1999), they excel in the enticement step with attractive promises, but miserably fail in maintaining them, and in making a memorable experience. Likely, whether they respond to an idea of novelty, favourably preserving the quite familiar aesthetic of a speaker, they do not always require the least effort to perform a task, contradicting the first and overarching beneficial feature Hekkert (2006) recognizes. As well, problems arise when it comes to the meaning of the experience, as it is difficult for them to respond to personal significance, virtuous (Desmet & Pohlmeyer, 2013), reflective (Norman, 2004), psychological, or ideological qualities (Jordan, 2000), even marking a rejection of sensuous curiosity and pleasure (Spallazzo et al., 2019).
These limitations, accentuated by the daily relevance they have in the domestic sphere, underline how AI represents a field full of possibilities for design, and the intervention – aiming at humanizing a technology which seems still too far from people – will need to take emotions in consideration because, as Minsky (2007) said: machines cannot be intelligent without any emotions.

3. Translating emotion theories in design scenarios

For a conceptual exploration, different theories about emotions have been adopted as literal guidelines to orientate the design process, in a sort of *exercise in style.* Sharing the spirit that drove Raymond Queneau (1947/2007) to experiment with literary variations of speech, our aim is to activate the creative engine towards unusual outcomes, and meanwhile, to collect different pictures that portray alternative futures and clearly embody the core principles of the currents of thought they stand for.
Future-focused thinking is one of the primary activities of design, especially when related to emerging technology research and the HCI field. For this purpose, the method of science fiction prototyping has been adopted. Considered an "embodiment of the third wave of design and HCI practices, [it has] the aim of capturing the essence of culture, emotion and experiences, and emphasizes the reflective role of the designer in HCI processes" (Kymäläinen, 2016). According to Dourish and Bell (2014), Science Fiction Prototypes (SFPs) as tools for design research could not only anticipate but actively shape the technological futures. In this context, SFPs are employed according to Keinonen's model of design-oriented research (2006), as artefacts that may "open new spaces for design", triggering critical thoughts and further speculations about the topic. In a reinterpretation of his model, here the phenomenon to be analysed (field of research) is AI in the domestic environment, while the framing for interpretation (in this case lying in the field of psychology and not of the art) are positive emotions, conveying focus and creativity to HCI. Design, instead, maintains its overlapping role to enable the communication between the other fields and brings, as an added value, its expertise to deal with the moment of drunkenness characterizing the introduction of new technology (Antonelli, 2018).

In the following examples, the authors created SFPs with the aim of envisioning domestic scenarios of a more or less near future, where AI exemplifies different psychological theories of emotions. In particular: 3.1, 3.2, and 3.3 address the issue in the most general sense and from a causal perspective; 3.5 and 3.6 express possible ways to pursue positive emotions; while 3.4 lies in-between. The outcomes are intentionally hyperbolic to stress their characteristics, and they show an individual-centred perspective, reflecting the ego-centric character of the psychological theories.
For the argumentation, Johnson's steps to create an SFP (2011) have been followed. Here how they have been intended and indicated in the text: (i) Technology enabling the scenario and set up of the world. (ii) Scientific inflection point –which dramatic change marks the transition to a new progressive scenario? (iii) Implications and ramification of the technology for the world. (iv) Human inflection point – how people's life is modified? (v) Implications, solution or lessons learnt – judgments are intendedly avoided not to influence the reader.
All the scenarios portray future AI-enhanced houses, designed for people's well-being according to the specific theoretical conception explained at the beginning of each SFP, and trying to highlight the key points of the technology: autonomy and adaptivity.

3.1 The physiological house

Literary reference. Emotions and the physiological responses manifested by human bodies are patently interrelated. In some of the earliest emotion theories of modern psychology, these physiological responses appear to be central in the definition of emotions themselves. In particular, there are visions sustaining that emotional behaviours are a direct consequence of the alterations revealed by the body, as the Peripheral Theory exemplify (James, 1884); while others just state that they occur simultaneously, it is the case of Cannon-Bard Theory (Lindzey et al., 1991). Anyway, modifications of skin conductivity, body temperature, heart rate, blood pressure and other possible reactions, if well balanced with contextual information, can make emotions measurable.
SFP. (i) Devices measuring and keeping track of our physiological parameters are already part of our reality, and they will be central in the physiological house. Smart bands and watches integrate sensors to monitor, among others, skin conductivity, heart rate and even heart rhythm for personal ECGs. Even Google's installation *A Space for Being* at Fuorisalone 2019 used wristbands to assess whether people were at ease throughout three multi-sensorial domestic environments (Hitti, 2019a). (ii) To overcome the problem of environments subjectively affecting people's parameters, AI systems, trained to evaluate contextual and personal data and to assess what the physiological responses stand for, are required. (iii) The physiological house will be characterized by a ubiquitous AI system that will have access to the physiological parameters of its inhabitants – wearing their apposite *house bands* – and will be in control of all the environmental facilities (lights, thermostat, music, etc.). Over time it will get to know how its users show their feelings and react to different situations. Then, as a caring mother, the house will interact with them by adapting the environment to people's emotions for their well-being, or by sending messages on their

house bands. (iv) Living in the physiological house will mean that, once at home, one has nothing to worry about: even *before experiencing* negative emotions, the house will have it all settled. Of course, at the beginning, there will be some misunderstandings, for instance, if one gets scared watching a horror movie, the house may turn on the lights and suggest him/her to call someone not to stay alone. (v) Inevitably, an ideal scenario takes time to settle because human emotions represent a very complex matter, and so many different data need to be triangulated for a complete overview. This would also implicate that a huge amount of power and digital/physical space will be necessary for the infrastructure of the AI system.

3.2 The neurological house

Literary reference. Emotional responses can also be attributed to the internal activity of the brain. Neurological theories suggest that emotions arise in the limbic system (Picard, 1997). Activating the amygdala, the anterior cingulate, or the prefrontal and somatosensory cortices (Damasio, 1994), emotions become an observable phenomenon: they leave a neural signature, identifiable through fMRI (Functional Magnetic Resonance Imaging) as a distributed pattern of activity (Kassam et al., 2013).

SFP. (i) Being able to access data from the brain and the nervous system is essential for the neurological house, and the premises to facilitate this task are emerging. In fact, Elon Musk's start-up, Neuralink, is developing implants that can connect minuscule electrode threads to the brain, to record the detected electrical signals and transmit the information outside the body (Hitti, 2019b). (ii) Musk envisions the implant to create a symbiosis with AI, and this may represent the first sparkle for the neurological house. Everybody would have implants that AI systems integrated in the house will read, analyse and respond to, directly stimulating the appropriate part of the brain with electric impulses – similarly to the neurologist Duchenne de Boulogne eliciting emotion-related facial expressions by applying faradic shock on facial muscles (Duchenne, 1876). AI systems will be trained to recognize and reproduce emotional patterns in the brain, and their focus will be to understand its inhabitants' preferred states and to satisfy their requests. (iii) Not much will be needed in the house to reach a balanced state of well-being, as positive emotions will be directly inferred through the brain implant. Furnishings and decorations will be superfluous, as only the survival-related equipment will be necessary. Secondary needs, like midnight snacks, will not be a problem as the right stimulus will quiet the hunger. (iv) Satisfying non-vital yet beneficial needs with no material aids will have several silver linings: it will increase people finances, as superficial goods or services will have no use, and it could even prevent health problems like obesity or drug addiction. (v) Nonetheless, the artificially induced constant positive state of mind will impede people to do anything non-related to subsistence.

3.3 The cognitive house

Literary reference. Cognitive theories of emotions indicate the element of reasoning as determinants for emotional behaviour. Two main currents are accredited. According to the Appraisal Theory (Lazarus, 1991), a personal automatic evaluation immediately follows an event, determining whether it is beneficial, non-relevant or harmful, then a suitable emotion is elicited. While, Schachter-Singer Theory (1962) hypothesizes that when we experience an event that causes physiological arousal, the resulting emotion depends on the motivation that our cognitive process recognizes. If no explanation can be found, we search the environment for clues as to how to label the physiological response, As emerged in an experiment (Schachter & Singer, 1962) people who could not understand that physiological responses of their bodies depended on epinephrine injections could be emotionally manipulated with induced cognition towards euphoria or anger.

SFP. (i) As cognition cannot be measured, a basic assessment of human-AI interaction has to come from external manifestations of emotions: body language, voice tone, etc. All functions currently under development. (ii) For the cognitive house, AI ubiquitous systems – in control of all the environmental facilities, including pervasive monitoring – have to be implemented with notions about what is beneficial for people's well-being, and with their inhabitants' preferences and goals. (iii) More or less subtly manipulating people's internal appraisal of events, it will encourage well-being by changing the contextual conditions to trigger positive affects if it detects good behaviours or habits, or negative sensations if it spots bad ones. The house will act like a stubborn educator, ever conceiving new ways to get the better of them, and inhabitants will choose it precisely to achieve their goals. For instance, if one wants to get in shape, the house could low the temperature and make the lights colder to infer discomfort as (s)he eats sweets, or turn on energetic music to celebrate an exercise session. (iv) Either if the user perceives the intentions of the house (appraisal theory) or not (Schacter-Singer theory), (s)he will be encouraged to follow the right path. Though, the motivational process will not have immediate positive results, and people could quit early or endure and reach their goals. (v) In any case, AI finding a balance between physical (health) and psychological well-being (happiness) will be a challenge.

3.4 The activity house

Literary reference. In line with a phenomenological approach, Activity Theory, mainly explored by Leontiev, suggests that human perception of the world lies in the experience, and it is triggered by subject-object activities, intended as purposeful, transformative (Kaptelinin, 2014). Even though it does not directly address to the nature, function and underlying mechanisms of emotions (Kaptelinin & Nardi, 2009), it can be inferred that they may be a consequence of experience. In particular, Csikszentmihalyi (1990) identified the highest level of well-being in the condition of Flow. That means being immersed in an activity which lies in a balance between one's skills and perceived challenge.

SFP. (i) The activity house, as the name implies, will pursue an active home life. For a dynamic interaction, AI should focus on always improving Natural Language Processing and

Generation (NLP/G) and Computer Vision (CV) to detect and respond to emotions accordingly. (ii) As soon as the AI system connected to the activity house will be installed in people's smartphones, it will unobtrusively monitor what happens to the user by accessing the device microphone, calendar, email and messages. Thus, it can keep track of the daily routines and modulate organization and propositions accordingly. Once at home, in fact, the AI system will manage the time of the inhabitants to make them reach a preferred state of well-being, by proactively proposing positive activities as a conversational agent, and by following them through a system of environmental cameras. (iii) At least at home, people will not need to think about what to do, as AI knows it better. As an entertaining system for happiness, it could suggest relaxing with a yoga session after a tough day or to try a new recipe for a personal sense of fulfilment, and it can guide the inhabitants throughout their activities by warning them in case of wrongdoing and with visual supports. For the system to work, AI capability to learn and adapt over time to its users' characters, lifestyles, aims, increasing skills and external events, is essential. (iv) People will find in the activity house a matching support: who likes being surprised will look forward to discovering in which kind of activity they will be engaged in, while planners will see everything perfectly settled with no efforts. No wasting of time will bring to frustration: AI will allow making the most of it. (v) As a bespoke system that enables and encourages people to live an active and meaningful domestic life, it will prevent them routine organizational matters, becoming indispensable over time.

3.5 The hedonic house

Literary reference. In the hedonistic tradition, life is a quest for pleasure for pleasure's sake, while negative affect is avoided (Deci & Ryan, 2008). This kind of well-being is ephemeral in nature. As demonstrated by the treadmill metaphor (Brickman & Campbell, 1971), the constant pursuit of increased well-being always returns to hedonic neutrality: positive and negative feelings provoked by a change of condition do not last forever, and people get used to them. Like rats on a treadmill: they keep running, but their condition will never change.
SFP. (i) In addition to bring pleasure, the hedonic house should be attentive to what happens inside and self-sufficient, not to bother the owners in any way. Thus, CV, NLP/G, and AI applied to robotics seem a perfect fit. (ii) Home appliances would be designed to autonomously perform their duties, and to create pleasurable sensations. (iii) The house will be filled with appealing and intriguing objects, and their functioning will be an enjoyable event. For instance, a laundry machine, directly linked to the wardrobe, could autonomously manage dirty and clean laundry, deciding when to do the washing or refreshing clothes. While in operation, it will give off a fresh scent, both to please people with positive sensations and to communicate its operational status. To facilitate the autonomy of the appliances, the space will be appropriately configured, and a control room will host the necessary equipment for the autonomous updating of self-sufficient machines. In fact, as soon as people get used to their functions and positive elicitations, these will evolve, adding new functions and positive feedbacks, involving also physical modifications. (iv) Then, the house will be a personal paradise, completely at the service of its inhabitants. It will shelter

people from mundane negativity while functioning just to convey pleasure. The only thing people will have to do when they need something will be to push the right button. (v) As the next frontier of consumerism, it may create addiction.

3.6 The eudemonic house

Literary reference. In contrast with the previous one, Eudemonic Theories focus on living life in a full and deeply satisfying way, pursuing personal development and meaning (Deci & Ryan, 2008). This conceptualization does not imply that happiness coincides with only positive emotions, instead it considers well-being not as an outcome or end state but as a process of fulfilling or realizing one's true nature. To better define the characteristics of an eudemonic life and identify its key elements, different theories have been elaborated, such as self-determination theory (Ryan & Deci, 2000), well-being theory – PERMA (Seligman, 2011), or the six dimensions of psychological well-being (Ryff, 1989) including, for instance, self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth.

SFP. (i) The eudemonic house will be the refuge to find well-being in the most meaningful dimensions of life. Acting like a conscience, its relationship with people should be quiet and discreet. In this respect, an AI system linked with sensors to perceive human beings and enhanced surfaces to communicate with them will constitute the basic technological equipment. (ii) To make the system flourishing is a proactive and shared perceptual (Marti, 2010) behavior, i.e. when the house detects the presence of a user, it should manifest its interactive intention and start it without being prompted. (iii) The eudemonic house will be a safe place to improve one's psychical and emotional health. The AI system will – more or less directly – assesses its inhabitants' levels of psychological well-being. Any surface in the environment can be a spot for communication: portraying questions, making suggestions, and instilling reflections to increase the personal values that mostly require an intervention. The interaction is smooth and subtle, and it depends on the user whether to embrace the cue or not. Impositions will not be allowed as without voluntariness, involvement is impeded. (iv) People living in the eudemonic house will learn to advocate their free time to meaningfully improve themselves and their lives, gradually reaching a complete sense of personal fulfillment. (v) Despites its pervasiveness, too much freedom may cause users to ignore the system's inputs, as it happens with apps notifications.

4. Discussion

As anticipated, SFPs have been employed as theoretical experimentation to infer useful insights that could guide future design inquiries. Indeed, the scenarios are deliberately exaggerated to easily bring out the main features of the underlying psychological theories as well as the main critical points and interesting possibilities. Of course, they have the limit of being highly subjective, as they are the result of the authors' brainstorming activity. Though, our intention is to initiate a discussion, oriented to focus the attention on the topic and to open a debate in the design community towards concrete and viable solutions. A possible

outcome of this work could be submitting the SFPs – with no design clues – in didactic contexts or workshop involving scholars and professionals to further advance the discussion.

In particular, the illustrated scenarios led us to three levels of considerations.

Design-driven considerations. From a design perspective, what emerges is that a cross-disciplinary approach is powerful to both address topics with more meaningful insights and to trigger creativity. Unconventional starting points for the discipline can lead beyond the borders of the absurd, but also suggest interesting directions. Maybe similar exercises can be developed changing the baseline references (a classification of AI possibilities could be one) to uncover different outcomes.

While, the main issue resulting from the development of SFPs in relation to domestic AI is the relevance of spatial dimensions. In all the scenarios it affects the entire environment somehow, as it seemed to be the most natural and consistent way to respond to the brief. Otherwise, confined in a single device, AI would not exploit its full potential.

Human-driven considerations. The overemphasized scenarios also reveal several issues related to the human sphere. They immediately raise ethical and ontological questions like privacy, sustainability and the role of sociality – both from an interpersonal and a collective point of view – that should be addressed even before designing, as regulators are trying to do. A further reflection involves the meaning of AI as part of domestic life. Self-determination theory (Deci & Ryan, 2008) sustains that the three universal psychological needs to satisfy for our well-being are: autonomy, competence and relatedness. Yet, is not AI aiming at the opposite? If we will rely on it, we will lose control over many things and even unlearn some basic tasks, while it is unclear how relationships could be improved. Evidently, fulfilling one request has multiple downsides and a balance has to be found.

AI-driven considerations. AI-enhanced products or systems are not like any other predetermined object, and this is a matter we must learn how to deal with if we want meaningful experiences. Then, understanding how this technology can affect interactions, especially long-term ones, is essential.

Additionally, as intuitively suggested, both emotions and AI are multifaceted and complex domains to work with, then solutions cannot be simplistic, and a comprehensive approach is needed. In fact, in the scenarios, a univocal approach was often limiting the possibilities of the AI, while summing up different psychological and design perspectives could enrich the experience.

Eventually, if AI is going to be implemented exploiting its full potential, it will radically change the paradigm of people's life. Then, how can design drive the transition towards a beneficial outcome? Right now, it is a very open and debated question, concerning experts from different fields – i.e. Beneficial-AI movement (Tegmark, 2017) – and the design community really needs to contribute.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Empowered by Code, to act in real word

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Abstract | Learning code is nowadays a common practice in many academics design curriculum; formal languages are probably the best "production tool" for creating parametric objects or interactive environments as Webs, Apps, immersive experiences or Data Visualization. This paper will explore the boundaries between analogical and digital world – illustrated by a few case studies – and will presents the results of a short summer workshop on generative design – for a non-visually skilled group of students – to underline the role of creative coding as an effective educational tool in Design.

KEYWORDS | CREATIVE CODING, DESIGN EDUCATION, PROCESS, IOT

1. Coding and education

Educational use of coding is almost as old as coding itself. There was a time when the word "computer" referred to people who computed – before it was applied to machines that did the same; at the beginning both, people and machines, manipulates numbers to obtain … others numbers, until we realised that almost every piece of information can be represented as number (Alpaydin 2016); this was probably the mayor driving force in computing technologies and led us to the technological, social, industrial and cultural process of what we know as "Digital Media Convergence". Nowadays, in an "internet of things" (IoT) scenario, this ability to "calculate" is spread among connected devices of any kind and sort. As Nicholas Negroponte predicted (1985), we are very close to a time where every single light bulb will have it's own IP address.

Educational us of coding has a lot to do with both aspects: the ability to operates with almost any (digital) media and the capability of bringing the results to a tangible environment. This approach appears since the very early examples of educational programming language like Logo - the language developed in 1967 by Wally Feurzeig, Seymour Papert, and Cynthia Solomon at "Bolt Beranek and Newman" research labs in Cambridge, Massachusetts. One of Logo's key futures was the ability to draw using a method known as "Turtle graphic". Developers soon realised that kids were uncomfortable with the traditional way of drawing used in computer graphic – a cartesian space where X an Y axes have a fixed point of origin – and envisioned a different technique, much closer to the natural way of holding a pencil and moving it on a paper. Drawing using a computer became a matter of "driving" a "traveling pen" plotter (the turtle) steering, counting steps, rising and dropping the pen to the paper.

The educational value of coding come essentially from the versatility of computing technologies. As as Seymour Papert (1980) pointed out: "[computing] can take on a thousand forms, can serve a thousand functions […] and appeals to a thousand of tastes". A great example of the versatility of modern educational programming languages is Scratch, the event-driven visual environment developed since 2002 by the MIT MediaLab. Thanks to its block-based approach, Scratch brings the ability to create drawing, games, stories, animations and on-line applications – using techniques as physical computing, remote sensing, computer vision or music synthesis – to kids, without the hassle of writing the right syntax, focusing entirely on logic (and fun).

The following case-studies are aimed to illustrate why coding should be considered not just as an effective educational experience, but also as a powerful didactic practice in Design curriculum.

2. Focus on the process

Creative coding is not just an easy way to create many visual variations; drawing by algorithms moves the designer's attention to the process that produces shapes rather than on the shapes themselves. The use of a formal language to create a visual output – as in generative visual design – is somehow unnatural but it's an interesting training on rules, proportions, spatial distribution and color spaces. In a brother sense, is a way to work on visual issues at a more abstract level.



Figure 1. Software Structures - by Casey Reas..

"Software Structures", the serie of generative algorithms created by Casey Reas with Jared Tarbell, Robert Hodgin, and William Ngan in 2004, exemplify very well how a simple geometric behaviour is able to generates a surprising visual result (Reas 2004). "Structure #003", for instance, is a surface generated by 100 medium to small circles moving at the same slow rate and bouncing at the edges during a given time. The pattern is created by drawing straight lines at the intersections of the circles frame after frame. When the process is over – or even while is taking place – is quite difficult to infer the generative behaviour just by looking at the final result.

Coding is an efficient manner of exploring iterative shapes, like fractals, that are at the very heart of several natural processes. In "drawing a tree", Bruno Munari (1978) suggested a mix of drawing techniques and analogical models for a better understanding of this simple recursive structure. Cutting a strip of paper in 2,4,8 … branches, and folding them on a table with different angles, reveals the key elements that may be reproduced on the screen by loops in code. The tangible paper model also allows to easily detect witch magnitudes are

more suitable to be converted in variables in order to produce a range of variations from the same abstract archetype.

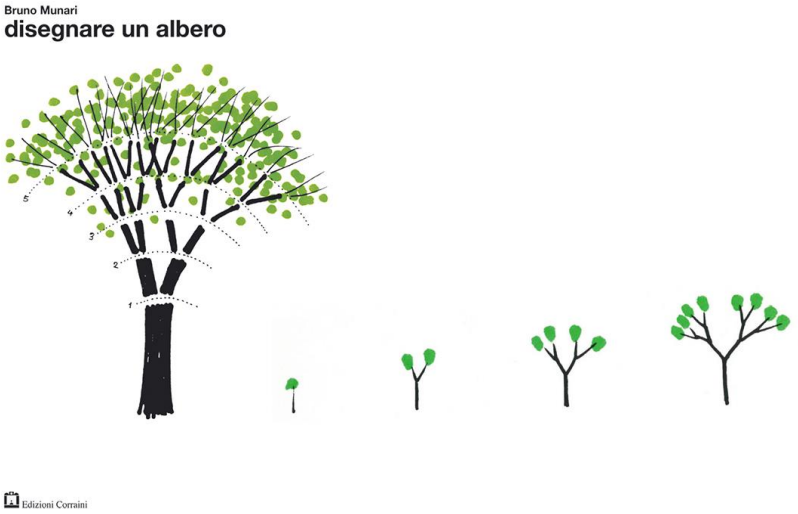

Figure 2. Bruno Munari - Disegnare un albero.

Moreover, coding is probably one of the easiest way to simulate complex systems and to observe (or create) emergent properties. Simple object oriented basic coding techniques, like those proposed by Daniel Shiffman in "The nature of code" (2012), have empowered a whole community of creative not-so-experts coders. One of the nice side-effects of working is the support of a strong collaborative community and, as the evolution the Open Source Software movement remind us, communities (as Universities should primarily be) have a key role in the creation of common goods and in the development of a collaborative culture (as Design have sometimes been).

Design is not always a matter of applying ready-made recipes or predefined protocols to a given brief. Working on the process, rather than on the final proposal, is often a good method for a more strategical approach in the quest for a suitable design solution.

3. Mixing media

Every digital media have its own editing tools; most of the proprietary and open source applications of this software ecosystem allows user to merge different supports and create standard multimedia contents. Aside from desktop applications, coding languages are still one of the most common interfaces for the creation of interactive environments, even if a significant part of the design community (including some interaction designer) is still trying

to avoid this field and prefer to let tech specialists to craft and bring to digital devices their interaction's blueprints. Truth be told, most production workflows in the digital media industry are designed according to this tayloristic approach. However, creative coding solutions, like Processing, OpenFrameworks, Vvvv … and so on, allows coders to work at the roots of digital information, much closer to multimedia bits, at a level that desktop and web applications – optimized for production tasks – can not reach.



Figure 3. Colla Castellera de Madrid.

As an example, the *Colla Castellera de Madrid* used a small dataset of coloured dot samples for the visual identity of an event, published as printed materials, web animation and a short motion graphic's video. "Human castles" (*Castells*) are a popular traditional activity in Catalonia, Balearic island and the Valencian Community; the construction of a 10 floor human castle may involve up to 700 people – most of them at the ground level disposed in concentric circles around the tower. For this reason, the metaphor of an ordered cloud of coloured dots is often used in human castle's iconography. The main illustration used for the visual identity of the "Festa Major del Cercle Català de Madrid" is a detail of a human castle represented as a very low-res dot sample, in a kind of a pointillism image (not so far away from what you can get with a pointillize filter in any image editing software). The difference here is that the data obtained in the dot sampling process (x, y, size and color) were "stored" in a json file used to create both, the final static svg illustration and a motion graphic sequence that showed the inbetweening of ordered and unordered distributions of the dots.

Designers are increasingly called to operate and design on non-standard outputs. As part of the refurbishing of the Madrid's headquarter of Abanca – a mid-size Spanish bank – a custom led sculpture have been installed on the façade, behind the balconies, at the corner

of the building. This four floor height custom lighting device acts as a very low-res big screen and is made of 900 lighting elements hanged in a 30 cm depth and 3 meter wide space. The irregular distribution of the lighting elements, and the distance between them, allows the device to display only abstracts black and white patterns. The lighting effects are generated by algorithms that converts a musical pattern, like J.S. Bach's Goldberg variations, into geometrical shapes. The result is a kind of "digital synaesthesia" that take advantage of a well-shaped musical signal as a source for a consistent, but still unpredictable, visual output on a silent façade.

4. The IoT scenario

In nowadays IoT scenario, coding enables designers to take controls on simple (connected) objects to creates complex choreographies.

"A million Times", the kinetic sculptures created by "Humans since 1982" represents a good example of this approach. In this ongoing project, first exhibited in 2013, Bastian Bischoff and Per Emanuelsson - who met as postgraduate students at HDK Goteborg in 2008 - played with the hands of multiple analogue clocks, ordered in a matrix, to create visual effects that "unveils hidden figurative qualities without denying its primary purpose".



Figure 4. Objectifier - by Bjørn Karmann .

Things become even more interesting when the connected objects can acts as sensors or actuators. The creative framework of solutions known as "physical computing" allows engineers, programmers, designers and hobbyist to push computer interaction far beyond

mouse, trackpads and screens. Prototyping this quite new field of user tangible interactions is now an attainable and affordable task thanks to microcontroller kits – i.e. Arduino – designed to translate analog input to a software system and / or control electro-mechanical devices such as motors, servos, lighting or other hardware.

On this path, "Objectifier" – by Bjørn Karmann – represents an interesting simple proposal from a promising radical premise. Developed in 2016 as graduation project at the Copenhagen Institute of Interaction Design (CIID), Objectifier reverse the traditional approach of ergonomics and affordances where the user has to learn how to use an appliance. The device acts as a smart interface and is able to grab user's gestures that can be assigned to specific functions of a given object as, for instance, a lamp. According to its author: "Objectifier empowers people to train objects in their daily environment to respond to their unique behaviours". A video camera, a few computer vision algorithms and a little bit of artificial intelligence are the main ingredients of this solution that let the user to teach its lamp witch gestures will be used to switch or dim the light.

Another interesting proposal the involves computer vision and artificial intelligence is "Water Machine Control" by Sergio Galán. The main purpose of this artistic installation was to drive public attention toward the algorithms that control video surveillance systems and their social and political bias. The proposal was developed in 2016 as part of a workshop on technology in public spaces held in Zaragoza (Spain) at the Etopia Art Center. A swiveling water gun, installed two meter above the floor in a public garden, was controlled by a face detection algorithm and pointed straight at the face of people who passed by. The coloured toy followed and threatened the pedestrians but shot a drop of water only when a certain kind of face – namely young males with beards – was detected. The installation made use of an available and quite sophisticated cloud API that allows not only face recognition but also an accurate segmentation of facial traits.

5. Artificial Intelligence and Machine Learning

The unprecedented availability of digital data we are experiencing in recent years is setting a new paradigm for what algorithms can do, the way they do it and – more generally speaking – our definition of artificial intelligence (AI). This evolution is having impacts even in creative fields and, as we have seen, is already part of the design practice.

Until very recently our idea of AI was associated to smart algorithms, like a chess playing one, a logical structure that contains all the information required to efficiently perform a given task and that could be adapted to achieve other similar duties. Machine learning (ML), a branch of AI named by an essay of Arthur Samuel (1959), operates in a completely different way and behave as a dumb analyst of a lot of samples to perform very specific assignment. Machines can be trained to complete one single specific task (like recognising faces in a photographic image) without using explicit instructions, thanks to statistical

models that simulates neuronal networks. ML is the perfect match of XVIII century Math – like Bayes theorem – and III millennium abundance of digital samples.

For creative coders, training a neuronal network of data samples can be much easier than learning the logical skills of a good computer analyst. Open source digital libraries – like Tensorflow – have been already widely used in arts and design. Python libraries as "Magenta" have successfully implemented Tensorflow for music and image data training in order to generates new original content. "Performance RNN", a model for polyphonic music with expressive timing and dynamics, is one of the best known Magenta's outputs. As its authors claims: "[Performance RNN] … is trained on the Yamaha e-Piano Competition dataset, which contains MIDI captures of ~1400 performances by skilled pianists". The model has no notions of harmony, melody or musical composition, the only thing it knows is that skilled pianists press piano keys over time according to certain patterns. Results are astonishing enough to suggest a debate and eventually reconsider certain assumptions about creativity.

Code can guide and assist designers – and design students – to figure out unexpected solutions and to give new answers to contemporary or traditional design brief. From an educational perspective, formal languages may offer to the academic community a new vantage point for the observation of design processes, as illustrated in the last section of this text.

6. A summer workshop on coding and generative graphic design

NeoLocalDesign (NLD) is an annual event organised by DADU (Dipartimento di Architettura Design e Urbanistica - Università degli Studi di Sassari) aimed to re-think design as the vehicle to combine tradition with innovation and rediscovering local knowledge as a major asset. In its 2018 edition, NLD hosted in Alghero – in the north of Sardinia – a summer workshop on coding and generative graphic design. The goal was to create a visual identity for a small network of local archeological sites using generative techniques.

6.1 On generative visual identities

Generative techniques have already successfully been used in visual identity probably because they are the equivalent – in a "design systems" approach – of a predefined collection of static signs in a classic "Corporate Identity Manual". Generative visual identities are not intrinsically better than more traditional ones, the reasons why they are sometimes implemented are – most of the times – rhetorical and concern poetic rather than communication performances.

While explaining their 2011's proposal for the MIT Media Lab - The Green Eyl Studio team declared:

> "The 45,000 possible variations […] represent what the Media Lab constitutes: creativity, diversity and reciprocal inspiration. The design is based on three geometric figures that are rearranged and coloured for every application. Each figure symbolizes the contribution of an individual towards the collaborative process; the entire form stands for the result: a continuous redefinition of what media and technology could be today"

None of these reasons applied to our case; from our perspective the network of archeological sites represented a great chance to work with an awesome iconography of strong ancient signs.

6.2 On ancient shapes

Workshop attendees had little or no formal background in visual communication and probably they wouldn't be able to produce, from scratch, original shapes of the same graphic quality; nevertheless, they were actively involved in a real design experience. Ancient signs have been efficiently adapted to contemporary logos by professional designer in the past. Back in 1975, Pino Tovaglia, Bob Noorda, Roberto Sambonet e Bruno Munari converted the "camunian rose" – a symbol from the iron age – into the logo of the Lombardy region.



Figure 5. Workshop's sketches .

Alghero's network of archeological sites preserves heritage from the Nuragic civilization, that lasted from the 18th century BCE (Bronze Age) to 238 BCE, when the Romans colonized the island of Sardinia.

6.3 Activities

Workshop activities were organized in three main blocks: a general introduction on generative visual identity, a short hands-on training on a coding platform and the design experience where students worked in three small groups, one for each archeological site: Palmavera, Santu Pedru and Anghelo Ruju.

After a preliminary iconographic research, each group selected the ancient mark they were willing to work with, two of them – the silhouette of a bull head and a horn motif – where already a "family" of images composed by several specimens carved on the stone, the other one was the aerial view of the archeological site of Palmavera. Groups were asked to observe and redraw a streamlined version of their mark paying attention to geometrical proportions and to the physical arrangement of different elements. By doing so, they were forced to simplify details and to focus on qualitative properties of the shapes. Thanks to this analysis they were able to define a set of rules, a graphic procedure, for the reproduction of the simplified mark and its possible variations; with some external help they were even able to formalize their procedure as a generative code and starting playing with it. One group, the one working on the horn motif, decided to explore several ways of repeating the original shape – changing size and orientation, the other two prefers to keep one single element at the time.

6.4 Conclusions

The overall experience was not just about coding but the initial assumption of working with generative code shaped the design process and implied an analytical and heuristic approach.

The educational value of creative coding in design depend largely on our personal appreciation of what Design pedagogy should be. We all know that is probably not a matter of "telling people how to do things" but rather to prepare a next generation of design professionals for a never ending training on the search for (several) methodologies, experiences, dialogues and conceptual references that may bring them to an appropriate practicable answer.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Exploring Digital Inequalities: How Welfare States are disappearing behind an AI.

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Abstract | This paper draws on the literature around the so-called third wave of digital inequalities (Daly, Devitt and Mann, 2019), which moving beyond the concept of digital divide, explores deeper inequalities that platforms and algorithm are generating in our societies. As digital platforms and algorithm are increasingly used to plan and deliver welfare programmes, it has been argued that these new technologies are in fact creating what Virginia Eubanks defines as the new 'digital poor houses' (Eubanks, 2017). The paper will start by introducing the field of digital inequalities and will then draw on ethnographic field-work and policy examples from the UK Welfare Services to present the state of the art on the use of digital platforms in this field. and highlight some of the critiques that have recently been raised.
By posing into question the emergence of a technocratic culture of public services, the paper also aims at outlining possible ways in which design can play a role in this context.

KEYWORDS | DIGITAL INEQUALITIES, SOCIAL ENGINEERING, TECHNOCRATIC CULTURE, WELFARE SERVICES

1. Introducing the Field of *Digital Inequalities*

The field of Digital Inequalities could be defined as characterised by three waves of scholars, activists and rights that have shifted the focus and the way we define inequalities in relation to the digital realm in a quite dramatic way. The so called 'first wave' was mainly focused on the digital divide and discourse on information poverty. Initially developed in the 1990s this way of framing inequalities put the focus on the differences between Countries (and later *within* Countries as well) on those who had access to a digital device (and namely usually a

computer), access to the internet and therefore access to information and data. The digital divide was through these discourses depicted in terms of '*have'* and '*not* have' (Jurich, 2000).

The 'second wave' is very much linked to the first, but starts from a different understanding of the complexities of the question of access, which were deployed more simplistically in the first definitions of the digital divide. Questions of access, for instance, become understood as question of engagement and outcomes as well, as it becomes evident that having a computer and internet connection is not enough in order to give everyone the opportunity to engage with online content and services. Different skills and resources would be needed in order to face a divide that becomes more nuanced, as engagement is understood as something that does not just happen once in time but needs to be sustained as well in the longer term, and what we achieve as a result of that engagement also comes into the equation. Through these lenses, we could start developing a more sophisticated understanding of digital inequalities through the prism of what has been defined an *Access Rainbow* (Selwin, 2004) which highlights different shades of inequalities.

The so called 'third wave' is more typical of our current times, as scholars and activists shift the focus away from the digital divide and raise issues of how the use of data is impacting stigma, as for instance in the use of digital public services. This is not a shift of little consequences, as the discourses have moved from devices to platforms and data; from the question of *how one can use* the digital resources available, to a question of *how our data are used* and what they do *to* us.

Whilst the first wave was clearly built on a techno-enthusiastic paradigm - which framed the being out of digital connectivity as missing out of the advantages of the digitalisation - the third wave, very differently is borne out of the critiques of what has come to be considered as an opaque, unregulated, and un-contestable system of digital tools and data (Daly, Devitt and Mann, 2019). Central to the discourses of the third way, especially when digital tools are used in public services I would argue, are questions of digital rights and data justice, as citizens using public services are made visible, represented and treated differently as a result of their digital activities and records (Heeks and Shekhar 2019, Taylor 2017, Arora 2016).

Digital tools in Welfare Systems Technology for poverty management is what this paper and my practice are concerned about and I will move in the next section to introduce the field where I have been researching, which is the field of social and health services in the UK and specifically the field of mental health services.

2. The Case from the UK: Mental Health *digital by default*

A recent UN paper formulated strong critiques to the UK Government, advancing the accuse of making the "*British welfare state (..) gradually disappearing behind a webpage and an algorithm*." (UN, 2019). This paper refers very much to the current situation in the UK, where a fully automated and 'digital first' system of welfare services has been designed and

delivered with the intention of improving the effectiveness of welfare services, avoiding waste of resources through optimisation of data and information flows.

In the UK, the Voluntary Community Sector (VCS) contributed £17.1bn to the economy in 2016/17, representing around 0.85% of total GDP (according to the UK Civil Society Almanac 2019). As denounced in a paper from 2016 (Pierri and Warwick), the Government public services reform (HM Government, 2010, 2011) has significantly impacted the mental health system: reducing its costs, aiming to shift the demand away from acute services and into prevention, delivering care that focuses on recovery and self-management instead. Community mental health services in the UK are those services designed and delivered within the community, which provide non-medical and alternative interventions (e.g. talking therapies or alternative therapies). In the context of social welfare relationships, a strong tradition exists of mental health users' movements, borne out of collective action and independent from any invitation or encouragement by public officials or other organizations. These movements, and the mental health organisations which were organised as a result, aim at enabling people to have more control over the issues that affect their lives. Most of the evidence collected by the UN report comes in fact from these sources, as well as larger mental health and social services organisations, across the country.

In January 2019, the British National Health System (NHS) published the NHS Long-Term Plan, which outlined ambitious target for health care service delivery in the next ten years. Mental health, for its high-cost on the health system, figures among the seven clinical priorities that are identified in the document. Without going in the details of the plan, what is interesting to mention is that "Digital technology underpins some of the plan's most ambitious patient-facing targets." (Charles et al 2019). This should not take anyone by surprise, who has been working in the past 10 years in health and social care in the UK. It was already in 2012, in fact, that the UK Government started the nationwide experiment to make public services 'digital by default' (HM Government 2012). In 2016 the Government made a further step ahead and made a clear commitment in that direction by stating in its Transformation Strategy (2017): "We will transform government services and make government itself a digital organisation.".

My work mainly developed in the field of health and social-care and particularly in the mental health services. I did not start studying the digital field or the digitalisation processes of Government first hand, but I got interested into this topic as services in health and social care for people who were experiencing mental health distress were increasingly and rapidly being digitalised. Drawing on Virginia Eubanks (2018), we could see the field of welfare services as the field where social experiments with digital tools have taken shape first, that will be expanded to other groups and the general population later. This situation, as this paper wants to illustrate, raises important questions of equality and rights as new modes of surveillance are deployed through Welfare Systems Technologies and algorithmic-led predictive models are introduced to predict social deviance and poverty. This is a long-term trend, which Eubanks identified as started back in the 1970s Welfare models in the US: "They commissioned expansive new technologies that promised to save money by

distributing aid more efficiently. In fact, these technological systems acted like walls, standing between poor people and their legal rights. In this moment, the digital poor-house was born." (2018, p33).

Digital platforms and algorithms used in public services, although not responsible for creating stigma and social exclusion of those who are most marginalised, can supercharge discrimination by removing the human factor from the process of managing the welfare system and therefore reducing empathy and compassion in this area. Moreover, has been argued, through the digitalisation of the welfare systems more marginal groups end up being increasingly subject to higher level of data collection and violation of privacy (Eubanks 2018). The UN paper (2019) has had the incredible merit of bringing the topic of algorithmic welfare services on the radar in the UK and beyond, as the British example – I would argue - raises wider questions and implications that would apply to other welfare systems around the world. I would like to use the British example to build two broader reflections on the impact of design in shaping our digital public services and the wider public space: first on the role of design in *programming* the future, second by analysing the theme of stigma in design.

3. The Role of Design

Driven by a culture of 'data fundamentalism' (Crawford, 2013) computational power is introduced by design in public services, behind the assumption that complex issues can be solved by getting the right information, at the right time, to the right people. This is based on a culture of technocratic models of public services, which is spreading in different countries and is developing what Bucher (2018) has defined a '*programmed sociality*'. This concept, rather than creating a vision of technological determinism, aims to shed light on the politics of 'categorisation'. Algorithms, in fact, create categories that end up programming our sociality and this, I would argue, is especially true in the welfare system.

3.1 Future orientation

In one form or another, the future has always been at the centre of interest for design as the discipline that more than others deals with issues of becoming and the giving shape to the *not-yet*, which is the future. As John Urry reminds us, whether it was by matter of divination, through the study of the past events, and the legacies of our ancestors, humanity has always been busy trying to guess, understand, preview and control the time of the 'not yet' (Urry 2016). Whereas in the earliest approaches to the future, this was supposed to be falling in the domain of Gods, as something humans could perhaps get to know but never to change; with the crisis of Christianity in the West, and the rise of industrialisation later, this attitude started to change, and women and men began to think that they could forge and make the future the ways they wanted, or at least try to do so. As Barbara Adam reminds us (2010), this change in *ownership* of the future, from Gods to humans, also saw the emergence of new kinds of specialists, who knew how to trade and shape the future better than others.

From fortune-tellers, to astrologists and priests, to the new experts who go under the identity of economists, technologists and, I would add, *designers*, many different actors and professions have claimed for themselves a specialism around the future at different points in history.

In our current times, I would argue, we are possibly witnessing a new shift in the governance of our future. Complex, emergent, nonlinear, futures had become at one point to be perceived as impossible to plan, even from the perspective of more traditional future studies (Inayatullah 2013). With the introduction of big data and algorithmic decision-making, futures seem to have gone back to the time of the Gods. Human can do very little to shape their futures but they can only look into the future scenarios that algorithms are depicting for them. As society becomes obsessed with questions of prediction, risk-management and control algorithms are left to take the most important decisions about our futures. As Philipp Alston stated (2019) in the special rapporteur on extreme poverty and human rights:

> "Systems of social protection and assistance are increasingly driven by digital data and technologies that are used for diverse purposes, including to automate, predict, identify, surveil, detect, target and punish. But the very real risk is that we are stumbling zombie-like into a digital welfare dystopia. Such a future would be one in which: unrestricted data matching is used to expose and punish the slightest irregularities in the record of welfare beneficiaries (while assiduously avoiding such measures in relation to the well-off); evermore refined surveillance options enable around the clock monitoring of beneficiaries; conditions are imposed on recipients that undermine individual autonomy and choice in relation to sexual and reproductive choices, and in relation to food, alcohol and drugs and much else; and highly punitive sanctions are able to be imposed on those who step out of line."

The question of the future, which is ultimately I would argue a question of people's agency, is one that is often overlooked and which I believe designers involved in the field of Welfare Systems Technologies should embrace. Beyond the immediate breach of privacy and negation of rights that is happening through the digitalisation of welfare services, forms of social determinism are introduced, which aim at building algorithmically-led predictive models that can tell us with increased precision – or at least this is what they claim - how people who are in charge from social services *might* behave. These models built though the use of predictive variables are potentially eternal, as data collected about social benefits and health care records will last for very long time, and risk depriving the subjects involved of their right to have and build a future for themselves which is open to infinite possibilities, also of turns that might seem unpredictable now. What will happen to them – and potentially this could be extended through data triangulation to their friends and families – is predictable, therefore predicted, hence it becomes real. If design is about the opening of possibilities – as so often predicated by scholars and practitioners of design – what these algorithmic-led predictions do to designers (and vice versa) would be an area to further explore.

3.2 The Disappearing Human: are we Designing for the Algorithm?

In this paper, I propose to frame the design of the digital tools and platforms for welfare services as a terrain of struggles for social justice and equality of treatments. As an increased number of designers are employed in the new digital health and social services, issues should be raised about the role they perform and the assumptions behind their design choices. Designers involved in the design of Welfare Systems Technology should consider the fact that "Those designing AI systems in general, as well as those focused on the welfare state are overwhelmingly white, male, well-off, and from the Global North. No matter how committed they might be to certain values, the assumptions and choices made in shaping the digital welfare state will reflect certain perspectives and life experiences." (Alston 2019, p4).

The data-driven approach that is built in these technologies through machine-learning processes risks to ignore a number of human factors that are the core values on which welfare systems have been traditionally built, and namely: dignity, empathy, respect and social justice. As Meredith Broussard reminds us in her book, whilst law and institutions are made to take care of things that societies believed to be important, data–driven decisions rarely reflect these values in their functioning: "Part of the reason we run into problems when making social decisions with machine learning is that the numbers camouflage important social context" (Broussard 2019, p115).

Designers could play a key role in bringing these social and human contexts back into the way machine learning decision making is made. This is a question of central importance and where designers should not remain ambivalent. If it is true that design could be understood as a 'double-headed monster' (Borka as cited in Bieling 2019:5) – one side powerful and progressive and the other side dangerous and potentially conservative – we should be intentional in searching for ways to maximise one side (the powerful and progressive) over the other, for instance by exploring how could design take an explicit political stance in this new field of designing *for* the Algorithm. It might be worth clarifying that here I am not referring simply to more mainstream human-centred design approaches, as in these more consumerist instances users are definitely not understood as political subjects (but perhaps as subject *to*). In these instances, in fact, users are considered central only to the extent to which they can support the design process to improve service efficacy and users' satisfaction. I am rather referring here to a *humanistic*-centred approach that considers the subject as a democratic subject (the subject of rights and respect).
Following from Anja Bechmann and her work in the field of human rights, I believe designers should focus "not accounting for the algorithm itself as a standalone solution, but on social values that have been encoded into the algorithm directly or indirectly as (political) choices made by developers." (2019, p87) and I would add designers as well.

3.3 Stigma and the Design of the Digital

Stigma is a socially constructed, relationship-specific attribute that exists in a social context. Actors become stigmatised when they have an attribute that devalues them in social situations. This attribute and the consequent stigma would be differently constructed in

different contexts and according to different identity traits. Once an individual – or a group – is affected by stigma from other groups in the wider society, this process impact negatively on life opportunities of those individuals and groups, including health outcomes, housing opportunities, academic achievement, income, and the likelihood of criminal involvement. We could therefore say that stigma is a powerful and complex force that produces inequalities. Link and colleagues (2001) identified four type of these inequalities: (1) direct person-to-person discrimination; (2) discrimination that operates through the internalization of negative ascriptions among stigmatized individuals (i.e., self-stigma); (3) interactional discrimination involving the perceptions of stigmatized individuals; and (4) structural discrimination. We should perhaps start thinking about adding an additional type which will have to do with the design of the algorithmic decision-making in the welfare context.

Stigma is a causal process, which develops through the act of *labelling* individual or groups, with labels that have of course a negative stereotype attached to them. This labelling exercise causes exclusion and discrimination, through the attribution of a low status (social, cultural, or in other domains) to the person or the group affected (Link and Phelan, 2001).

Working in the field of mental health, the question of stigma is a question I have faced many times and one which requires designers involved in the field to adopt a more self-aware approach, in order to make visible the layers of identity, discriminations, and power structures that interact when somebody is identified as a person with 'mental health problems'. We shouldn't forget that within medical models of mental health, it is usually the culturally dominant group that gets to define what the healthy, appropriate ways to conduct oneself are, and do so in accordance with their own norms and practices. The field of design that deals with digital mental health services I would argue, therefore, offers a stark insight into the dynamics of categorisation that are inscribed in the algorithms and that influence stigma and inequality in turn.

As the design researcher that collects and present insights based on personal stories that will end up feeding the technical design and development of the algorithm within these Welfare System Technologies, one has a great power in choosing how to represent the people one has talked to. Acquiring more awareness of the language of discrimination, thinking carefully about the chosen visuals representations to use, finding ways to convey the diversity without reinforcing existing stigma and stereotypes would be the skills and capabilities that the designer working in these contexts should sharpen.

On an even more basic level designers could do much more to avoid still existing issues of digital divide in this area. These issues could generate *absolute inequalities* like "When (people) are forced to use digital channels for which they have no access or skills, they will be excluded in absolute terms." (Van Dijk 2020, p112). In this instance the concept of second class citizens is constructed, as in a *digital only* scenario the only option left to those who have no skills and access is to be able to access services through the help of others (in the case of welfare services this happens predominantly through the support of mental health organisations).

4. Where next?

Technologies of poverty management – as Eubanks defined them (2018) – are as we know not neutral, since they ultimately reflect back to our wider society our own most intimate prejudices, stigma and fears about questions of poverty. As digital tracking and data driven decision-making are becoming predominant in public services, questions of social justice and human rights should be addressed by everyone designing for these platforms. This is particularly true of what have been called "low rights environment" (Eubanks 2018, p12), which are the fields of social and health-care services.

Issues of transparency and accountability have been raised on several levels, starting from the UK Government's purchasing system of digital tools (Black and Safak 2019), going to evaluate potential social worker surveillance (Devlin 2017) and algorithmic decision-making. Recently, a Dutch Court has made a key decision affirming that the automated surveillance system developed for detecting welfare frauds (something similar to what has been recently developed for the UK as well) was violating citizens' human rights. The organisation Human Rights Watch which has been monitoring the Dutch case and other cases of human rights violation within digital welfare systems has many times denounced the lack of transparency and consultation as one of the main issues with the Welfare Systems Technologies. I believe this is another area where design could play an important role.

As in the machine-learning community's concerns around issues of inequalities and accountability have been already raised (Broussard 2019, p195), it is time in fact for the design community to do the same, and to interrogate its role within the UK Government and Departments, and specifically within the digitalisation process, more seriously.

I believe in fact that by focusing on these issues instead – and namely, the question of stigma, the issue of transparency, the human element and the role for public engagement and civic participation – design could play a very different role within the digital agenda of the current Government. It could for instance focus on an area which has been surprisingly overlooked so far, and which would bring forward the question of how to use these technologies to transform the welfare state for the better:

> "Instead of obsessing about fraud, cost savings, sanctions, and market-driven definitions of efficiency, the starting point should be on how existing or even expanded welfare budgets could be transformed through technology to ensure a higher standard of living for the vulnerable and disadvantaged, to devise new ways of caring for those who have been left behind, and more effective techniques for addressing the needs of those who are struggling to enter or re-enter the labour market. That would be the real digital welfare state revolution." (Alston 2019, p4).

The case has now been made, by the movements of those mental health service users who have been fighting against the conditions of services, by the many organisations advocating on their behalf, and recently by the UN Report as well. I think it is time for those designers

involved in this field to start discussing whether and how to accept the challenge ahead and repurpose their role in Governments for the digital agendas, around Europe and beyond.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

From Decoration to Functionality — Research on smart accessories design in the Internet era

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Abstract | From primitive society, jewelry is born in functions, which were a kind of tool to protect people from attacking, by wild beast and other primitive. As society advances, the decoration property of jewelry has become stronger and stronger, which were ignored that jewelry did not have functionality by people. Over many thousand years, with the development of technology and the improvement of the Internet, jewelry combined with wearable technology has become a new form of functional jewelry that has unprecedented functions. Throughout following discussion and a large quantity of cases analysis, this paper discusses functional jewelry, especially smart jewelry, which is fashionable and functional, and solves some daily problems. It provides design directions and guidelines for future smart accessories design.

KEYWORDS | SMART ACCESSORIES, WEARABLE TECHNOLOGY, FUNCTIONALITY, INTERNET ERA

1. The Background of the research

1.1 Technology improvements promote the fashion industry

Over the last decades, technology develops, particularly fast, which can be described as a completely explosive leap. Nowadays, the Internet era is gradually mature and the digital information and industrialization is growing fast. It is said that the development of art and new technology is always supplemented and complement each other and help each other forward. Technology supplies technical support for the jewelry design. With the development of Internet, Internet of Things (IOT), cloud computing, Big Data, wearable technology and other information technology, the application of digital software, 3D printing, and intelligent wearable technology have greatly promoted digital accessories design. Technologies like 3D Printing, Rapid Prototyping, Rotational Moulding, Selective Laser Sintering, Sheet Metal Forming, Stereolithography, CNC, Laser Cutting and Acid Etching — a complete description of these can be found in the appendix — will be available through outsourcing, and with collective creativity will also be able to be applied to jewelry, with the possibility of creating new forms and finishes.[1] Likewise, under the influence of fast paced lifestyle and the requirement on aesthetics from customers, it requires jewelry need add more functional and popular elements on modern jewelry. Therefore, the modern jewelry needs to be designed creatively to meet new requirements in the information age.

From 2012, it has been the first time for the fashion industry to embrace technology industry. Google glasses have aimed to high fashion and wearable technology has been a hot spot in both wearable technology industry and fashion industry since that time. After that, so many companies are all working hard to launch the product combining with fashion elements and wearable tech. Nowadays, wearable technology industry is gradually mature. Compared with the former wearable products that were made of plastic, silicone material and paid more attention on technical intelligence and male customers, the current wearable products are jewelry-based and fashionable those are attracted by female customers. The smart products based on fashionable jewelry form will become the next focus in a few years.

1.2 It is necessary for accessories from decoration to functionality.

In the past thousand years, traditional jewelry is mainly considered as the symbol of identity and a store of value. It was just belonged to the rich. Recently, the market sales of traditional jewelry made of precious metal has been declined gradually. The jewelry market is intensely competitive, serious and grave now. Accordingly, developing new product line, seeking a breakthrough for the brand and occupying competitive advantages on the smart accessories field are the only choice to face difficulties. Recent years, wearable technology has been a part of people's daily life, improved people's quality of life, and gradually became an essential thing in daily life. As a result, it's a necessary trend from decorative jewelry to functional jewelry.

[1] Alba Cappellieri, INTORNO AL FUTURO (AROUND THE FUTURE), Marsilio Editori s.p.a., 2014, P24

1.3 The market requires innovative accessory products, both on aesthetics and functionality.

Design can lead fashion trend, and the science can create the future. Innovative design is produced. The monotonous product is far from satisfying the needs of consumers. Practical functions are no longer the only standard to be measured, but also novel styling, comfortable colors and the application of new technologies and so on. These factors have a great impact on consumer decision making. The customers from different social class, different cultural background, as well as different psychological needs have different demands. Nowadays, many companies have turned to tech and jewelry market, so that it forms a highly competitive market. Some luxury brands are aiming at cooperation between fashion and technology industry and continues striving to design new fashionable and tech-based products. As for fashionable wearable products, entering jewelry market is a necessity. I believe in the near future, with the development of science and technology, jewelry is not only a symbol of the status or beautiful ornaments, but also giving people more unique wearing experience. Meeting the functional needs of all aspects, helping improve people's quality of life, and achieving the perfect blend of art, technology and science is modern designers' duty.

2. Accessories with functions

2.1 Functionality of accessories in the past

Defending the enemy and protect themselves

In the past, from the ancient period, the jewelry is a kind tool to defend the enemy and protect them prevent from attacking by the beast. Later, this kind of tool had evolved a form of initial jewelry decorating around people's bodies. Data shows that, besides the Karen's lots of long neck collars, some neck accessories are to prevent the beast's attack that plays a unique protective effect.

Decoration & Adornments

The world's oldest Paleolithic ornaments, such as animal teeth, feathers, or stone beads have a pretty distinctive feature that are smooth, regular, compact and beautiful. These features further explain that the jewelry for making up have shown a kind of psychological motivation to attract the opposite sex. So the statement that pursuing beauty is an origin of physiological instinct is really scientific. The "beauty of the human body" function, which is evolved from this origin, is the most primitive function of jewelry. Decoration is the most important function from now on. From the simple shell beads worn by Palaeolithic hunters to the splendor of Renaissance goldwork and the sumptuousness of Art Nouveau enamels, the jewelry is always revealed in the importance of decorative function all the time. According to different cultures and the background of the times, the aesthetics and appearance of jewelry are different.

Showing status and keeping memory

People have always felt the need to transfer their sentiments to a symbol, which strikingly embodies their mystery and represents their eternal nature.[2] For example, wedding ring shows the marital status, also people wear pendant as a necklace and usually put some photos in it for missing their friends and relatives. In the Song dynasty of ancient China, the ring is also a tool of imperial concubines showing whether during the period or not.

A symbol of identity

In primitive tribes, in order to show their power and ability, chiefs and warriors decorated themselves with objects that were easy to identify.

A store of value

The materials for making jewelry were mostly precious metals and precious jewels, so that jewelry could be preserved for many years. So most of the remaining jewelry has a high economic value.

Health care

In oriental culture, some gemstones, like jade, pearl, agate and crystal, has functionality of massaging acupoints and meridian as well as activating blood circulation. Some metal like silver, it has effect of sterilization. Wearing silver can absorb the toxic substances to prevent from wound infection. Moreover, wearing pearl necklace can make people feel good and pearls can also relieve the pain of neck. Non-stop swing can play the role of external application, resulting in a variety of natural substances absorbed by the skin.

Exorcise evil spirits and blessing

There are some mask-like jewelry that shows the role of exorcising evil spirits, being worn in a grand ceremony, carnival and other activities in China and the Europe. For example Chinese Nuo Mask, it would keep away from evil and bring good luck. In Asia, there are Nuo Masks, Tibetan Opera Masks, while in Africa there are masks of Baoule with animal-horn shape, Helmet masks of Yoruba. The type of mask and carving style is extremely rich, usually as camouflage of a ritual, carnival or other important festivals. Additionally, there are Venetian masks in Europe.

Ordinary gadgets

Some jewellery has practical value, like buttons, chatelaine, pins tying cloth, buckles, clips for hair, twins, brooches and pomanders. Because these ordinary objects have a sort of function, so they existed. The reason why this functionality is not taken seriously by ancient people is because the decorative function is much more important than functionality. (Figure.1.2)

[2] Alba Cappellieri, Sentimental Jewellery, Marsilio Editori s.p.a., 2014, P27



Figure 1. Three silver Korean hairpins of the Koryo period (13th-14th century AD). The silver prongs have solid gilded heads, each with a small knob (missing on one of the pins) at the center of a ring of radiating incised lines and a scroll border. This is a very unusual form of pin, contrasting with the more usual, slender types. The scroll design can be paralleled in other types of metalwork and on other materials of this date[3].



Figure 2. A late Tang or Liao dynasty silver comb (10th century AD). The gilded upper section is worked with raised decoration enhanced with chasing, against a ring-punched background. This comb was intended to be worn in the hair. The decoration derives from Tang-dynasty bird and flower motifs.[4]

[3] Hugh Tait, 7000 YEARS OF JEWELRY, Firefly Books, Updated edition, September 12, 2008
[4] Hugh Tait, 7000 YEARS OF JEWELRY, Firefly Books, Updated edition, September 12, 2008

2.2 Functionality of accessories in modern society

With the development of science and technology, modern jewelry combines with functional products and wearable devices to expand the application range of jewelry. The combination of industrial products improves the aesthetic aspects and popularity of products, while increasing the functionality of jewelry. Combined with wearable devices, smart jewelry has less difference from the traditional jewelry. It is the product of wearable technology combined with fashion, and improving the appearance of the wearable devices. Moreover, it makes jewelry has more digital electronic functions, such as reminding messages and calling, GPS, marking locations and sending out distress signals and so on. It has unprecedentedly expanded the functionality of jewelry. The two types of functional jewelry will be elaborated and case analyzed.

2.3 Functional accessories in modern times

In the ancient age that was short of material culture, industrial products had the same source as the jewelry totally means of the same clan and origin. Later, the decoration of jewelry was stronger and stronger, which leads that jewelry is often considered useless, opulent and with no other function than to be decorative. Nowadays, in the rich material culture society, the single utility function of the product can no longer meet the needs of the people. The design of the product also changes unceasingly under the new demand, while the jewelry design can satisfy the esthetic need for users. Combined the ordinary industrial products with jewelry forms, functional items transformed into jewelry blurs the limit of industrial product and jewelry. While wearing functional jewels accessories, it is convenient to use some ordinary gadgets with fashionable outshape, which are both functional and aesthetic. Functional products performed as jewelry have satisfied the user’s psychological requirements on aesthetics.

Some gadgets like mini-notebooks, flash drives and dental floss, are usually forgotten to take with and easily to be lost. This problem bothers lots of users and takes inconvenience. Making the functional gadgets combining with jewelry, enduing jewelry functions and making functional gadgets aesthetic, which is a new trend for functional jewelry.

Dental floss dispenser ring

The dental floss dispenser designed by the author is used for the users who always eat out. Although some dental floss dispensers are designed really small and easy to take with, some users still always forget to take when they eat out. Or they put lots of gadgets in the bag and it is difficult to find out in the right time, which leads that they cannot clean teeth in time (Figure.3). The out-shape of dental floss dispenser ring keeps the real shape and color of the tooth, which can remind users to clean their teeth in time and pay more attention on oral hygiene and keep teeth healthy. The material is 3D printed resin and it looks like elegant ceramics. Putting the dental floss into the dispenser to ensure the hygiene of dental floss. Likewise, the dental floss is refillable and it can be changed a new one after using up.



Figure 3. Dental Floss Dispenser Ring

2.4 TECH AS FASHION——Fashionable wearable technology

At 1960s, the original intention of research and development of smart wearable devices is for the pilot with the display function of the headdress in the battle. The embryonic product of wearable devices can be traced backward to the 1970s, and the product became a hot spot in the fashion industry at that time. It could also be regarded as a revolution in wearable computing technology, and also the first time appeared as accessory. In 1997, the Massachusetts Institute of Technology, Carnegie Mellon University, Georgia Institute of Technology jointly organized the first international academic conference about smart wearables. After that conference, the wearable technology began to earn widespread attention in the academia, and then it showed the application potential gradually in the industry, medical care, military affairs, education, consumer goods, entertainment and other fields to demonstrate the application potential. In 2012, with appearance of Google glasses, wearables became a hot spot in an intelligence terminal industry, widely recognized by global markets. Nowadays, smart wearables' market gradually becomes mature. Compared with smart bracelets made of plastic and silicone material as well as technical smart wearables for men, accessory-based smart wearables will be the next focus and hot spot. The application of smart accessories greatly expands the traditional function, such as real-time monitoring and analysis of information data from precise sensor hardware, virtual software, Big Data and other technologies, as well as perceived the bodies' and the surrounding environment's changes. Smart accessories have the advantages of small size, easy to wear, precise technology, real-time monitoring and other characteristics, provide users with a good human-computer interaction and product experience, and expand the accessories market with powerful functions.

Smart accessories are the wearable devices embedded in the clothing, jewelry, or the carry-on goods with the electronic communication equipment. It combines information collection, recording, storage, display, transmission, analysis, solution and other functions with the daily

wear, and becomes the smart wearable devices. Smart accessories not only has a certain decorative and aesthetic function, but also to meet people's living needs such as health, sports, shopping, entertainment and other functional requirements. Now there are so many smart accessories in the market, such as the smart glasses JINS MEME, TZUKURI, an unlosable glasses. As well as smart pearl accessories called Momento pearl, smart bracelet INTEL MICA and so on.

3. Analysis on the application prospect of smart accessories

3.1 Functional accessories solve common dilemmas

As the wearable's market developments, new solutions for specific usability and functionality needs are emerging. Using jewels to treat some diseases is not modern inventions. As early as 1000 years ago, there were lots of people knowing the magical effect of jewels and use it in China and India. Emperor of Ancient Babylonian puts the gold cap as a crown with most often decorated with sapphire. Sapphire was recognized it had the treatment of fever, healing, cardiac and so on. The octagonal crown of Western Germany Otto I in AD 961, embedded with a piece of orange spar each side, which has a calming affect and life the state of tension. Another example is that, an actress from German admitted that she used crystal every time on the front of the lens. "With crystal reflecting my head, it makes me more concentrate, "said of the actress. In the New York Museum, it collected a funerary with crystal belly of the ancient Maya. The Germany psychologist Doctor said after studying the crystal belly, "The crystal belly is used as hypnosis when surgical treatment." From this evidence we can find that European and Easterner have attached great importance to the magical healthy effect of jewels treatment. In modern times, Japanese scientists, according to the meridian theory of Chinese medicine, produced the magnetic therapy jewelry based on the theory that magnetic field can promote blood circulation.

Digital jewelry is a new branch of the wearable device that combines the wearable technology and fashion jewelry design while enhancing the beauty of the wearable device, which can attract female user groups. For the aesthetic need of customers, jewelry meets the health care wearables to solve some health problems. Currently on the market, healthcare digital jewelry products are mainly concentrated on the movement detection, reminding function and helping function. Its appearance is similar to the ordinary jewelry. With the increasing maturity of sensors, chips, communications, mobile Internet and other technologies, the awareness on health of national and demand for health services is improving. Wearable devices in the medical field have shown a huge application potential in such case. As of the end of 2013, 3 million patients obtained remote monitoring services by networked worldwide. ABI Research has predicted that the global healthcare wearable equipment shipments will reach 100 million units by 2020 with a developing prospect.

Sports fitness monitor, health care, entertainment and living convenience and environmental monitoring is the most normal functionality in smart accessories. And the products include smart watches, smart wristbands, smart glasses, smart headband, smart ring and so on.

3.2 Misfit case study for fashion smart accessories

Misfit a company established by former Apple CEO John Sculley and Sonny Vu in 2011 specializes in wearable technology that utilizes sensors and home automation products, owned by Fossil Group[5]. Misfit's wearable activity trackers are unique in design, and count sleep, calories, and basic steps that ban be synced to a mobile app on a compatible smartphone[6]. The first product Misfit Shine, which its first reviewers have called "fitness-tracking jewelry," has gained great success after launching to the market in 2013. Later, it launched many kinds of fitness trackers like Misfit Ray, Misfit Shine 2, Misfit Flare, Misfit Flash and so on.

Dedication to quality and attracting female customers, in 2015, Misfit has launched Swarovski Shine Collection, which seamlessly blends jewelry design and technology. Joan Ng, Swarovski's senior vice president of product marketing for the Asia-Pacific region, has explained that, according to their observation of wearable technology market, it would be a ideal time and a good chance for high-tech products to combine with some aesthetic elements, and transform them into fashion accessories.

The Swarovski Shine Collection, an upgraded version adorned with a violet Swarovski crystal that's actually hiding a solar panel beneath that extends the wearable's life from six months to whenever our sun burns out and you should never need to swap in a new battery. The Swarovski Shine Collection tracks and records all your daily activities including walking, running, swimming, sleeping, and more. After syncing the device with the Misfit app, the customers are able to view a daily summary including steps taken, distance traveled, calories burned, points earned and sleep pattern.[7] It can be worn as a bracelet on the wrist, as a necklace and also attached to the clothes and shoes.

Misfit got good reviews from users who were attracted by stylish appearance and long life of using after charging. Other attractive points are the function of viewing time and waterproof, as well as it can be worn in everywhere around the body. Although some data are not accurate enough, customers also like monitoring their daily life as an accessory role.

[5] https://en.wikipedia.org/wiki/Misfit_(company)

[6] Liz Gannes, "Misfit Wearables Raises $15.2M on Back of Shine, Even as Founder Dismisses Activity Trackers", AllThingsD, 4th December 2013

[7] https://www.swarovski.com/Mob_CA/en/customer_service?contentid=10007.376299

4. Future vision of functional accessories

4.1 More jewellery-like and more concentrate on the health sector

Technology is shaping a new anima mundi that by fusion crystallizes past, present and future. Jewelry is at a turning point and in its futures we may find unexpected pathways and unimaginable opportunities.[8] In this context, the design guidelines for smart accessories will also change. The design criterion is also the focus of this paper.

Wearable devices are trying to conquer the market and to enter the users' daily life. However, wearables show their limits when creating long-term engagement, which is crucial for helping the users to build healthy lifestyles that can accompany them during their lives.[9] However, it will take time for mainstream adoption. In addition, as for future vision of functional accessories, as technology gets more advanced, it seems that the idea of functional fashion for the health sector is being taken more seriously. Nowadays, fast-paced life takes people lots of pressure that will be ten times than before. And jewelry is a kind of important accessories worn by modern people. This trend is the cooperation between fashion industry and sub-health topics. Helping young people alleviate the pressure and remind them to take care of their health with wearing fashionable jewelry is the duty of smart jewelry's designer. Because being fashionable doesn't mean you have to sacrifice function, and it is also a test for designers. On the other hand, wearables will become more jewelry-like and a kind of ornate and bridge the gap between fashion and function.

4.2 More applications with Internet of Things

Smart jewelry must not be a fashion replica of sporting bracelet, but covering all areas from rings, bracelets, pendants and other jewelry forms. The "smart era" has brought a colorful transformation to people's life. Undeniably, smart jewelry is constantly improving their function, and the connection with smart devices such as mobile phones has gradually realized its connectivity with all aspects of human life.

It is predictable that smart accessories will gradually realize the application of the Internet of things, such as the control of cars, air conditioners and smart TVs.

4.3 More daring ways to wear

The attachment method of wearable technology currently is still based on traditional jewelry forms, such as bracelet, ring, necklace, brooch and so on. In the near future, smart jewelry maybe will become false teeth, nails and other half embedded ways. Jewelry is not only some

[8] Alba Cappellieri, INTORNO AL FUTURO (AROUND THE FUTURE), Marsilio Editori s.p.a., 2014

[9] Maurizio Caon, etc, Smart Garments and Accessories for Healthy Lifestyles, ISWC '15 ADJUNCT, 2015 September 7-11

normal and limited forms. However, now it may be hard to accept and sounds absurd. But in the near future, when people go to the dentist, it's likely that the dentist will recommend dentures with a monitoring function to monitor the mouth and even the entire body.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

From the evaluation of acceptability to the design of an assistive robot for elderly

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Abstract | According to a study conducted by ARS Toscana in 2014 the old people in Tuscany were 916.640 and there will be an increase of 36% in 2050. The "non-self-sufficiency" of elderly is a condition which entails their need of assistance. Often such a condition leads them to move from their home to the nursing home, radically changing their habits and everyday life. Over the past few years, robotics has represented a potential solution to improve the quality of life. This paper describes the methodology used for CloudIA research project, which concerns the development of an assistive robot to support fragile and non-self-sufficient people. An *ad hoc* questionnaire was developed to evaluate the acceptability. The questionnaire was addressed to 75 people, aged between 30 and 99 years, living in five nursing homes. The results allowed to target the design of the new robot.

KEYWORDS | DESIGN FOR THE ELDERLY, HUMAN-ROBOT INTERACTION, ACCEPTABILITY, ERGONOMICS IN DESIGN, HUMAN-CENTRED DESIGN

1. Introduction

The aging of the population is a widely known phenomenon. Europe is facing unprecedented demographic changes due to the progressive aging of the population and low birth rates (WHO, 2002), producing a significant increase of the over-80s in the total European population, even if the highest variations they are registered in Mediterranean countries such as Italy and Spain (ARS Toscana, 2014).

According to the worldwide projections, by 2050 people over 65 will be more than the double compared to the children under five. Globally, by 2050, the number of people aged 65 and over will also exceed the number of teenagers and young people between the age of 15 and 24 (United Nations, 2019).

As a result, Europe is facing the challenge of offering high quality and affordable health care to all citizens. This challenge is very tough because of the increase of the medical care need for an aging society, the costs of treating chronic diseases together with the constant demand by citizens for ever better health care.

This trend, increasingly prevalent in Europe and in Italy, is significantly marked in the Tuscany region. In fact, according to a study conducted by ARS Toscana (ARS Toscana, 2014), by 2060 almost a third of Europeans will be over 65 and the demographic trends in Tuscany are even more pronounced. In 2014 the elderly in Tuscany were 916,640 and they will increase by 36% in 2050 and there will be an increase of 36% in 2050. A typical condition of the elderly in need of assistance is the "non-self-sufficiency", defined as a functional impairment in the basic activities of daily life (dressing, personal hygiene, movements at home or away from home and nutrition).

The aging process and its related dynamics results in significant changes in the market in terms of demand of products, services and environments for the quality of life, especially in the field of diagnostics and monitoring. Luckily, the emerging technologies have the potential to help the old people to maintain their independence. They can support the users in mobility both inside and outside home and in daily activities, promoting social relationships and improving the feeling of security and therefore delaying the physical and mental decline. This is confirmed both by the rapid development of smart technologies aimed at improving services in different sectors, and by their economic accessibility among the population.

One of these technologies is robotics. For example, the assistive robots represent a fast growing business, as well as one of the most attractive sectors in the field of medical technologies. They have the potential to maintain or restore the independence of older people in the near future (Ezer, Fisk ,& Rogers, 2009; Fisk, Rogers, Charness, Czaja, & Sharit, 2009; Jayawardena et al., 2010).

Bearing all this in mind, this paper describes the methodology used during the Design phase foreseen by the CloudIA research project, financed by the Tuscany Region, which entails the

development of a robot to support fragile and non-self-sufficient people (elderly and disabled) in the nursing home (for the elderly and for the disabled) and at their own home. For that purpose, an *ad hoc* questionnaire was developed to evaluate the acceptability of four commercial robots: Pepper, Sophia, RP Vita and Paro. More specifically, the following factors were assessed: appearance, humanity, facial expressions and adaptability. The results that emerged enabled the authors of this article to direct the design of the new robot.

The questionnaire was administered to 75 users, aged between 30 and 99, hosted in the 5 cooperatives involved in the research program.

2. Approach to acceptability evaluation

Over the past few years, robotics has become a potential solution to improve the quality of life of the users and the services provided to them: robotics can improve mobility, communication possibilities, promoting social inclusion and increasing the sense of security, e.g. through systems for monitoring vital signs and daily life activities (Jayawardena et al., 2010).

The scientific literature (Forlizzi, DiSalvo, & Gemperle, 2004; Goodrich & Schultz, 2007; Information Resources Management Association, 2017) provides many examples of robots developed to meet the needs of the users: health monitoring, drug assumption support, physical assistance and mediation between users and assistive technologies. Assistive robots can be classified according to the need they satisfy, including:

- robots for socialization;
- information robots;
- security robots;
- health robots;
- leisure robots;
- robots for physical support.

However, these technologies are not used yet, due to factors such as stigma, (non) adaptability or social influences (Heerink, Krose, Evers, & Wielinga, 2009).

Robotics appear as groundbreaking but, in the coming years, it will have to find a place among human beings and humans, in turn, will have to accept this technology.

To avoid a human-robot incompatibility, it will be important to ensure the acceptability and the adoption of robots by people. On this basis, the researches in the Human-Robot Interaction (HRI) field aims at understanding, designing and evaluating robotic systems for use by or with humans (Goodrich & Schultz, 2007). The HRI therefore focuses on the two

dimensions of interaction: the physical one, which is often referred to as teleoperation or supervisory control and the social one, referred to social, emotional and cognitive aspects.

One of the key elements of the HRI is acceptability, together with safety and usability requirements (Salvini, Laschi & Dario, 2010).

In robotics, the concept of acceptability has received considerable attention, especially in the field of biomedical devices, such as surgical robots and robotic prosthesis, but it is gaining relevance also in the field of assistive devices and companion or domestic robots (Dario, Guglielmelli, Genovese, & Toro, 1996; Salvini, Laschi & Dario, 2010; Welch, Lahiri, Warren & Sarkar, 2010)

Acceptability is usually described as the “demonstrable willingness within a user group to employ information technology for the task it is designed to support”. The goal of acceptability is to measure and identify key determinants of user acceptance or resistance (Dillon, 2001).

The term “acceptability” is "user-centered”: it is exclusively based on the study of the relationship between a product and its user (Salvini, Laschi & Dario, 2010).

Robotics therefore opens new challenges for the discipline of Design and consequently for designers. The contemporary society needs products that meet people’s needs through a human-centered design (HCD).

This brings the need to develop evaluation methodologies. In particular, in the field of robotics and screen agents several methods have been used, varying from applying heuristics or other usability type tests and classifying tests to measuring physical responses (Heerink, Krose, Evers, & Wielinga, 2009).

The approach and the methods of Human-Centered Design are one of the possible strategies for innovation in the European production system and also for the small and medium-sized enterprise system (EU Commission, 2013).

Designing the acceptability (Design for acceptability) consists in applying principles and methods during the early stages of robot design in order to minimize the risk of resistance or rejection by users. According to some authors, designing acceptability means understanding the factors that can influence the adoption of technologies (Dillon, 2001) and assessing the HRI through five main methods: interviews, self-assessments, behavioral measures, psychophysiology measures and metrics of task performance (Bethel & Murphy, 2010).

This paper shows the methodology used for the design of a new robot. The presented methodology provided for the active involvement of end users (elderly and disabled), during the first Discover phase (as proposed by the Design Council's Double Diamond). Users completed a questionnaire for the evaluation of acceptability: the questionnaire was focused on those morphological, both general and specific aspects, able to give rise to users’

likeability and influence their attitude toward the robot. The main focus of the questionnaire method was to define the guidelines for the development and design of the new robot.

Given the nature of the end users and their location on the whole regional territory, the questionnaire was found to be the most effective method among those present in the literature, because it allowed to receive quantitative data in a short time (Stanton, Young, & Harvey, 2014). Data were subsequently interpreted and used during the design phase of the new robot.

After a review of the scientific literature relating to the acceptability of robots, the questionnaire was developed, with a special focus on Mori's Uncanny Valley (Mori, 1970; Mori et al., 2012). According to Mori, there is a non-linear relationship between the likeability or familiarity and the humanoid aspect of a robot. The appearance of a robot, when it is too similar to a human being, could annoy and generate in the observer disturbing feelings such as anxiety or negative attitudes (Mori, 1970; Mori, MacDorman, & Kageki, 2012).

According to the study conducted by Dario et al., the appearance of an assistive robot should not necessarily be anthropomorphic. Consequently, the best design solution should be a balanced mix between the domestic device appearance and the machine appearance (Dario, Guglielmelli, & Laschi, 2001).

On the contrary, Breazeal claims that when designing a robot, it is essential to consider that humans, as an extremely social species, uses his socio-emotional intelligence to understand the behaviour of more complex entities, like people or other living things. Human beings interact with other non-living elements with sufficient complexity, applying social models to explain, understand and also predict their behaviours. For example, people are known to anthropomorphise all sorts of technology (e.g. cars, computers, etc.) (Breazeal, 2003).

The same author also argues that people generally apply a social model when they observe and interact with autonomous robots. Autonomous robots make decisions and perform actions independently to perform their tasks. This makes them, for human beings, similar to a creature with which they can communicate, cooperate and learn from: for this reason, it is almost impossible for anyone to not anthropomorphise them (that is, to attribute human or animal qualities to them).

As claimed by Breazeal, aesthetics is fundamental in a robot:

> "when designing robots that interact socially with people, the aesthetics of the robot should be carefully considered. The robot's physical appearance, its manner of movement, and its manner of expression convey personality traits to the person who interacts with it. This fundamentally influences the manner in which people engage with the robot" (Breazeal, 2005).

2.1 The questionnaire

As stated by some scientific evidences (Johnson, Slaughter, & Carey, 1998; Scheeff, Pinto, Rahardja, Snibbe, & Tow, 2002; Minato, Shimada, Ishiguro, & Itakura, 2004; Breazel, 2005), the morphological aspect of the robot can influence its interaction with the human beings. This is more evident in relation to specific groups of users such as the elderly. Therefore, in the period from May to October 2019, an online questionnaire was sent to the 5 cooperatives partner of the CloudIA research program.

The specific objective of the questionnaire was to understand how the end users perceive the four selected commercial robots, and which aesthetic features they accept and find more likeable and acceptable. The four commercial robots were chosen after a careful review of the scientific literature as well as for their functionality and services provided.

As a result, the following robots were selected (see Figure 1):

- Pepper (Android), produced by the Softbank Robotics company. The robot is able to talk, understand, move independently, and react to emotions;
- Sophia (Humanoid), produced by Hanson Robotics. It is a platform created for advanced robotics, for AI research and for exploring the Human-Robot Interaction;
- RP Vita (Automaton), produced by AB Medica. The robot provides the remote presence service within hospital and care-intensive environments;
- Paro (Zoomorphic), produced by Paro Robots. The robot was designed to provide therapeutic assistance to various kinds of patients. It can be used both in the hospital and at home.

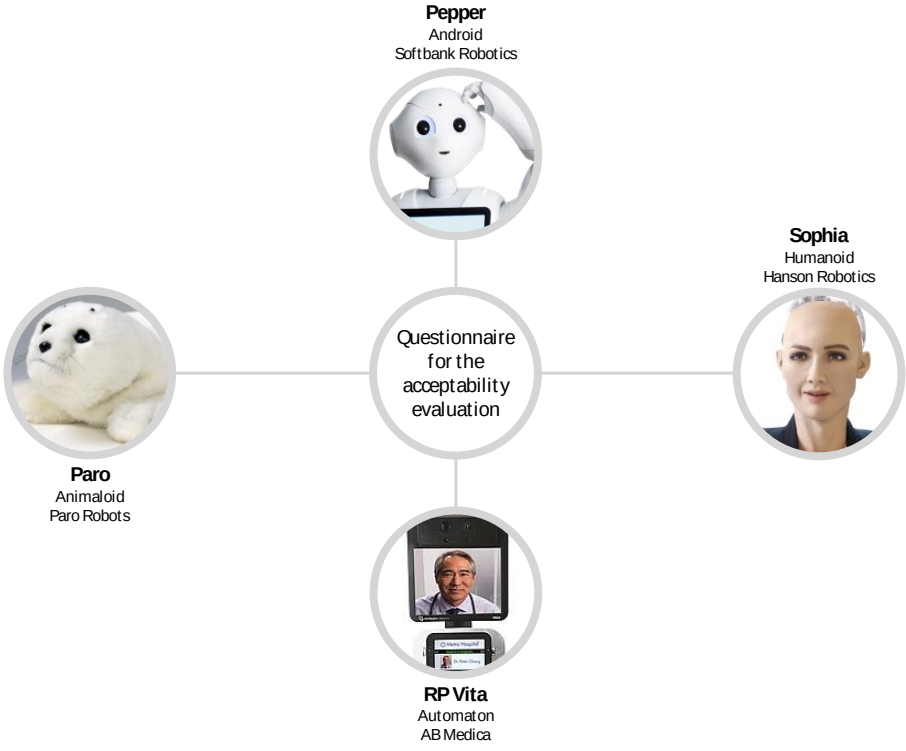

Figure 1. The four selected robots for the questionnaire.

The questionnaire was submitted to two categories of users (elderly and disabled), aged between 30 and 99, all hosted in the cooperatives partner of the research. 75 users of both genders participated in the questionnaire.
The questionnaire consists in 4 yes-or-no questions and 1 open-ended question:

1. is this robot beautiful? Y/N
2. is this robot likeable? Y/N
3. would you stay alone with it? Y/N
4. would you hug it? Y/N
5. is there anything in particular that you like?

3. Results

The data collected from the acceptability questionnaire are shown below.

17 males and 58 females replied to the questionnaire. 12 of them were under 65 (<65) while the other 63 were over 65 (> 65). Table 1 shows in detail the age of the users who took part in the survey (see Table 1).

As for the first question "is this robot beautiful?", most of the participants showed pleasantness towards the robots Pepper, Sophia and Paro. While for the RP Vita robot only 49% said that the robot is beautiful (see figure 2).

As for the question "is this robot likeable?", the data relating to the 4 robots are very similar (see figure 2).

Different results emerged from the question "Would you stay alone with it?". As shown in figure 2/question 3, the 49% of the interviewees would stay alone with the Pepper robot. While the 51% would stay alone with the Sophia robot. As for the RP Vita robot, only the 41% would stay alone with the robot and the 60% of the interviewees would stay alone with the Paro robot.

The results from the question "would you hug it?" are very different. The 65% of users would not hug the Pepper robot. The 56% would not hug the Sophia robot, and the 80% of interviewees would not hug the RP Vita robot. The 56% of interviewees said they wanted to hug the Paro robot (see figure 2).

Age	Participants	Gender	Age	Participants	Gender
30	1	Male	83	2	Female (2)
42	3	Female (3)	84	5	Female (5)
53	1	Male	85	6	Male (1) Female (5)
58	2	Male (2)	86	3	Male (1) Female (2)
59	1	Female	87	2	Female (2)
61	2	Male (1) Female (1)	88	2	Female (2)
62	1	Female	89	3	Male (1) Female (2)
63	1	Female	90	4	Male (1) Female (3)
65	1	Male	91	3	Female (3)
68	1	Male	92	3	Male (1) Female (2)
73	1	Male	93	2	Female (2)
75	1	Female	94	2	Female (1) Male (1)

77	1	Female	95	4	Female (4)
78	1	Female	96	3	Female (3)
79	2	Female (2)	97	1	Female
80	4	Male (3) Female (1)	99	3	Female (3)
81	3	Female (3)			

Table 1. The age of the users who took part in the survey.

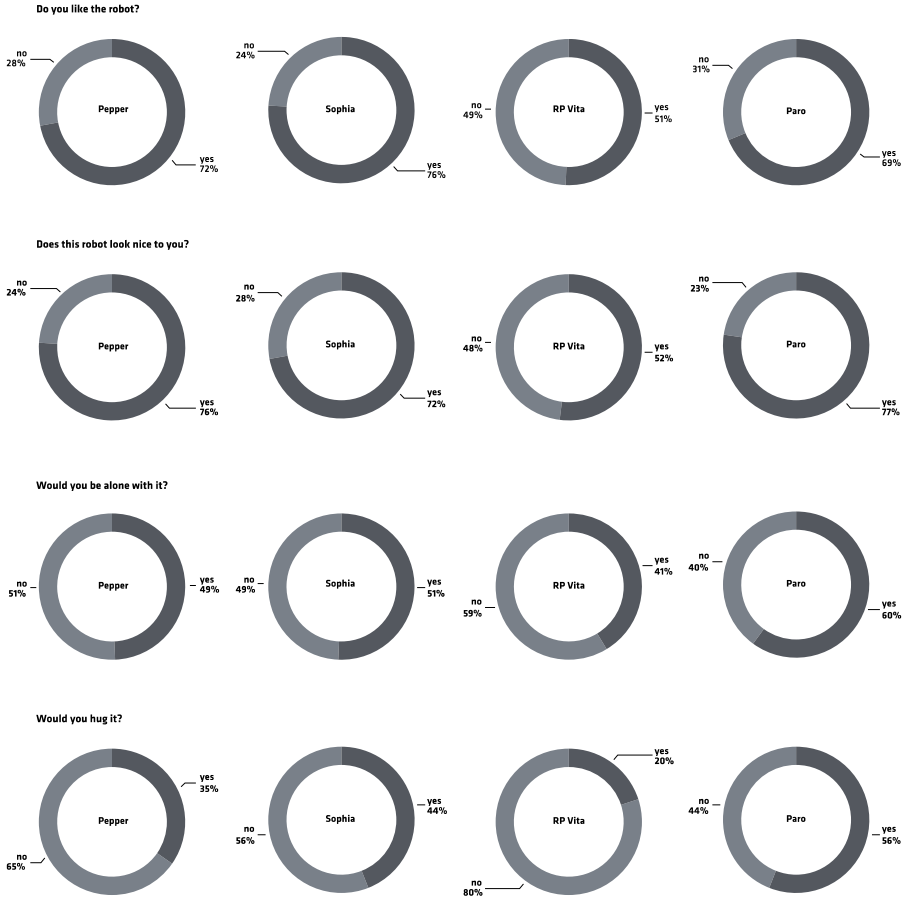

Figure 2. The data emerged from the questionnaire.

The results that emerged from the question "is there anything in particular that you like?" are very interesting.

As shown in figure 3, although many of the interviewees stated that there is nothing particularly beautiful in these robots, the data suggest a high degree of pleasantness towards the following characteristics of the selected robots:

- face;
- eyes;
- mouth;
- hands;
- arms.

In conclusion, the results show a strong tendency to appreciate soft and smooth shapes, with non-humanoid features.

Furthermore, the display is not considered as an annoying feature of the analysed robots.

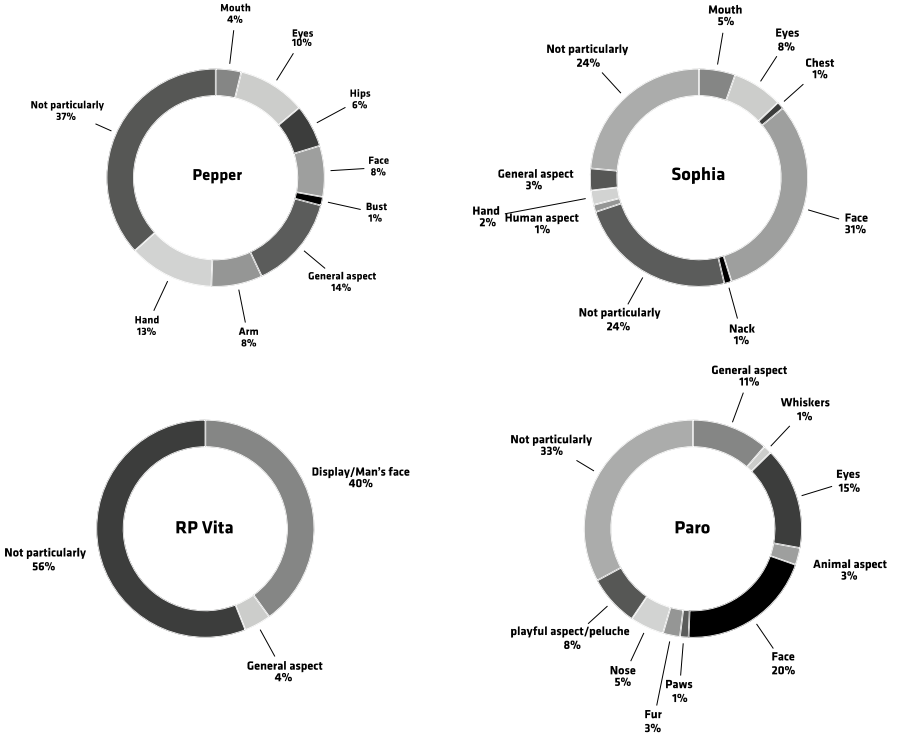

Figure 3. The results from the question: "is there anything in particular that do you like?"

4.1 The new robot: CloudIA

Before proceeding to the design of the new robot (sketch, 2d and 3d drawings and renders), simultaneously with the submission of the questionnaire, together with the cooperatives involved in the research program, the *desiderata* were defined: they were useful for defining the new robot features in relation to the real needs and expectations both of the end users and of the health care workers who provide daily service in the nursing home for the users and also at home.

The *desiderata* allowed to design a new robot for assistance, socialization, active support for hydration and for the assessment of users' cognitive and/or physical abilities, to be used both in nursing home and at home (Pistolesi & Becchimanzi, 2019).

After the definition of the design brief, the design and development of the robot was conducted on the basis of the user analysis. Specifically, the development of the robot was carried out on the basis of the results that emerged from the desiderata and the acceptability questionnaire. Moreover, the new robot was designed also in relation to the robotic platform designed and assembled by the Institute of BioRobotics of the Scuola Superiore Sant'Anna in Pisa, a research partner together with the authors of the CloudIA research program (see figure 4).

Although the robotic platform has constrained the shape of the new robot, its final shape is smooth and balanced, without protruding elements or edges. The chassis of the robot is made by three elements: a right part, a left part and a compact hinged door with magnetic closing. The basis is larger than the top so as to ensure the stability of the entire robot. The chassis topcoat are smooth and soft. In order to satisfy sustainable aspects, the entire body of the robot is made by plastic urban wasted 3d printed.

Furthermore, it was necessary to design a mobile arm to orient and support the tablet. It is fixed to the highest part of the robot chassis in order to allow the user to arrange and interact with the display. This feature provides a greater humanization of the robotic platform.

The height of the new robot, and consequently the customizable position of the tablet, allows all users to interact with the tablet without excessive effort.

The tablet is useful to carry out the following activities:

- hydration support through an alert;
- support to drugs intake through an alert;
- socialization activities in common areas;
- emotional/cognitive status monitoring through the submission of the Mini-Mental State test (Folstein, Folstein, & McHugh, 1975), currently used by the 5 cooperatives;
- cognitive stimulation.

These activities will be tested within the 5 cooperatives involved in the research program.



Figure 4. The robotic platform assembled by SSSA.

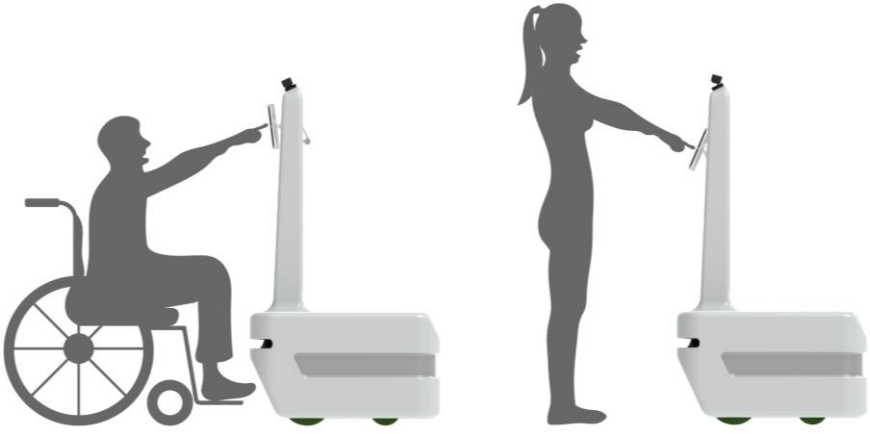

Figure 5. The new robot.



Figure 6. The new robot.

5. Conclusion

This paper presents an experimental methodology, aimed at applying the Human-Centred approach to the design of assistive robotic technologies. In fact, as stated by Forlizzi et al. (Forlizzi, DiSalvo, & Gemperle, 2004), many of the products analysed by the scientific literature on assistive robotics, have been designed with little consideration of the social, aesthetic and emotional relationships that the users will establish with the product.

The HCD (Human-Centred Design) approach, applied by the authors of this article, focuses on the analysis of users' needs, aspirations and expectations declared and/or tacit, so that they provide the basis for the design of the new robot.

The experimentation and design development presented in this paper are based not only on functionality and efficiency but also include elements such as attractiveness, likeability and the absence of stigma and non-reluctance towards technology.

The research methodology was aimed at obtaining feedback on the various personal aspects that contribute to generating the complex human-product interaction. Although this is influenced by extremely subjective factors and the personal experience of each individual user, it can be designed according to universally shared patterns and features.

The collected data contributed to the development of an accurate knowledge of the profiles of pilot users who will subsequently interact with the robot.

In addition, although the Design is often associated only with the aesthetics of products, its application is actually much wider. The Human-Centred approach therefore becomes a fundamental requirement in order to create a truly suitable, useful and acceptable product.

In conclusion, the next step of the research program concerns the definition of a new experimental protocol aimed at evaluating the overall experience of Human-Robot Interaction, through the analysis of the emotional quality of the interaction, such as acceptance, safety, intentions, perceived likeability. The experimentation will be conducted with pilot users both at home and in the nursing home for the users.

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Acknowledgements: The authors would like to thank the guests and the social-health workers of the social cooperatives of Tuscany for their participation and for their valuable contribution to the exploratory survey. In no particular order: Arca cooperativa sociale, Uscita di Sicurezza, C.RE.A cooperativa sociale, Pane e Rose and Gli Altri cooperativa sociale. Special thanks are due to Dr. Filippo Cavallo, to Dr. Laura Fiorini and to Ivan D'urso of the Institute of BioRobotics of the Sant'Anna School of Advanced Studies in Pisa, and finally to Jacopo Francesco Montalto for his fundamental contribution for the development and design of the new robot.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Future heritage and heritage futures. A design perspective on the activation of Digital cultural heritage stored in archives.

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Abstract | This contribution aims to investigate what role archives of digital cultural heritage can have for the creative industries, and to understand the inverse relationship: how design culture can foster the activation of digital archives aggregators in order to stimulate the production processes of new cultural expressions. This research was conducted with the aid of a specific case study: the Europeana platform, the multi-thematic aggregator of European Cultural Heritage. If Heritage is to be considered as a process and result of a relationship with the past and attributing it social and cultural meanings in the present; and if the objects contained in the digital archives are Heritage themselves, considerable research efforts should be made to develop project proposals relating to the use of those objects.

KEYWORDS | DIGITAL HERITAGE, ARCHIVES, CULTURAL PRODUCTION, CULTURAL PARTICIPATION, DESIGN FOR DIGITAL CULTURAL HERITAGE

1. Cultural process of heritage

In its current meaning, Cultural Heritage is identifiable as a broad term whose value is mainly of use, and it is rooted in the ability it can have to generate new culture.
GLAMs (Galleries, Libraries, Archives and Museums) have been overwhelmed by a profound change already in the way of understanding heritage, which has shifted from protection of cultural assets by their conservation to a vision of protection intended for use. With the Faro Convention (European Commission, 2005), attention turns from the object -cultural heritage- to the subject - citizens and communities - and participation becomes the key to increasing the value of heritage. This value is mainly expressed in the use and in the ability that society has to introduce it into the processes of creating new culture.
In this transition, Heritage protection is needed to be also meant as attention to the process that allows its creation (Bortolotto, 2007). Thus, consumption and production of culture are part of the same process that is historically fluid and can be identified in a *Continuum*.
Cultural heritage, therefore, becomes an "umbrella term" which incorporates material objects, rites, traditions and know-how, closely connected to each other. Tangible and intangible cultural heritage are interdependent; they no longer represent something circumscribed and concluded but are part of a fluid process.
From an idea of heritage firmly rooted in the monument, in the document, we are witnessing a shift towards a process-oriented approach. "There can be no folklore without the folk, no traditional heritage without living participants" (McCann et al., 2001).
This type of approach considers heritage deeply rooted in the contexts that generate it, according to a dynamic vision of a culture that continuously produces its expressions. In this perspective, heritage is not only symbolic but is alive and needs the communities of heirs to appropriate and use it.
Moreover, digital technologies have had a significant impact on GLAMs, prompting them to rethink their role and functions completely. The grouping of cultural institutions under an acronym, in fact, already suggests almost imperceptible differences and blurred boundaries.
This contribution aims to investigate what role digital archives can have for the creative industries, and to understand the inverse relationship: how design culture can foster the activation of digital archives aggregators in order to stimulate the production processes of new cultural expressions. This research was conducted with the aid of a specific case study: the Europeana platform, the multi-thematic aggregator of European cultural heritage.

Hence, if heritage is the process and the result of a relation with the past and attributing it social and cultural meanings in the present (Smith 2006; Harrison 2013); and if objects contained in the digital archives are heritage themselves, considerable research efforts should be made to develop project proposals relating to the use of those objects.

2. Archives of digital cultural heritage

Digitization of the historical-artistic heritage concerning safeguarding, activation, and enhancement today has a widespread role, and it is possible to state that in its emergence, it has assumed the features of a sort of invasion that is anything but gradual. The progressive digitization has dramatically enriched the archives and, together with essential initiatives for Open Access, has made a large amount of digitized cultural objects freely available online. However, it happens that digital archives do not find sufficient response in public in terms of consultation and even less of use; moreover, in many cases, the alleged recipients of the service do not even know its existence.

Technological evolution has affected every aspect of our lives, including the dynamics of heritage. However, the irruption of new technologies does not represent a wild colonization of heritage territories (Burdick, A., Drucker, J., Lunenfeld, P., Presner, T., & Schnapp, J. 2012), but is a result of changes in cultural paradigms that have led to making also digital reproductions rightfully part of heritage (UNESCO, 2003).

Therefore, digital archives need to be placed in that continuous process of creation of which heritage becomes a vehicle and interpreter. Digitized and accessible online cultural objects potentially represent an "open-ended knowledge system" (Sennett, 2008), composed of forms, processes and cultural contents to be used as tools to build a "collective memory" (Halbwachs, 1992) (as traditionally happens), and above all as resources for the production of new cultural contents.

GLAMs have progressively digitized their collections, and many institutions have chosen to make them available online, not as a surrogate for the physical museum, but as a digital archive that can be consulted anywhere. Then, cultural institutions have begun to wonder whether the internet could become a tool for disseminating evidence of preserved knowledge. In this new scenario, some pioneering institutions join the Open Access and Creative Commons movements and "free" their collections by renouncing reproduction rights. Thus, it is possible to perceive a matured awareness of an archive heritage that need to circulate, be used and re-used, all actions that are finally possible thanks to the new digital dimension.

The archive, therefore, assumes an active role in the present and is part of every cultural institution, extending its meaning: no longer an institution dedicated exclusively to the conservation and cataloguing of obsolete documentary material, out of the everyday use, but potentially dedicated to the activation. Thus, it is possible to observe a conceptual shift also in the field of archives, an emerging role in the process of building memory.

2.1 The archival turn

Heritage in digital format leads the archives towards a substantial change in functions and purpose, the “archival turn” (Bearman, 1991, 1994, 1999; Cook, 1994; Duranti, 1997, 2001): archives are no more considered as places of passive storage, on the contrary they had become containers of information ready to be used.

Terry Cook argued that digitization required a great change in the role of the archivist: as a creator and custodian of "physical things", now is called to make sense of electronic information in relation their context, structure and content (Cook, 1994).
The scenario is of a lively, animated archive (Schnapp, 2013) and digitization fosters two types of transformations: the first, quantitative, concerns the abatement of the space-time constraints that allow access to information in a short time and remotely. The second one is purely cultural, since being able to consult the archives digitally modifies "the forms of knowledge production" (Vitali, 2011). The growth of digital archives, therefore, affects the way in which it is possible to approach the past, explore it, know it, process it and transmit it.
The "archival turn" lead to numerous initiatives aimed at access to DCH material, giving life to "invented archives": the aggregator that collects material belonging to different institutions under a single website, as Europeana.
Moreover, thanks to the Open Access movement, a conspicuous number of DCH material is now available with Creative Commons 0 (CC0) licenses, or Public Domain: freely reusable for any purpose, ready to be reworked and transformed, representing an important unexpressed resource for project cultures.
Recognizing the process also in archives brings changes in the concept of the archive itself. If (traditionally) the term presupposes a closed inheritance, a sort of "memory delivered", the documents are no longer preserved, but "buried" in an archive. However, according to these reflections, the archive can no longer be understood as a warehouse but as a factory that allows, in its continuum, to (re) write history, (re) write the present and the meaning of the present before it appears (Barnet, 2001): it is a project tool.

3. The Europeana case study

Europeana is an aggregator of digital archives of European heritage, and in this research, is taken as the main case study. It was born in 2008 and declares to address scholars, GLAMs, and cultural and creative industries (Europeana, 2015).
The case study analysis consists in a first phase of desk research, and a semi-structured interview submitted to internal individuals and experts from Europeana. Then, to verify the starting hypotheses, a questionnaire was developed to be disseminated to designers and creatives in order to understand how their creative process works and what tools they use. Subsequently, the current model was analyzed according to how Europeana relates to its users, taking into consideration the semantic evolutions of the catalogues (Bianchini 2015), which aim to improve the archives, but are rarely strengthened by studies on the satisfaction of end-users (Feliciati, 2016).
In more of a decade, Europeana made considerable efforts to collect a mass of digital material that is currently almost impressive (about 58 million objects from all over Europe). Moreover, together with the crucial Open Access and Open Culture initiatives, Europeana allowed much of this material to be available with Creative Commons 0 (CC0), or Public Domain licenses, representing an essential resource for cultural and creative industries.

Among the main successes of Europeana is data standardization. The portal offers standardized procedures and APIs (Application programming interfaces) in order to offer GLAMs the tools to continue digitizing, and to introduce qualitatively better data into Europeana. Free access to standardized APIs also allows professionals to develop digital products and services that directly access Europeana content.

Current practices are still strictly focused on the quantity of digitized content and quality linked exclusively to the attributes of the information entities and mostly to their system of connections (metadata). At the same time, less attention is paid to the purpose and method of access and of use (re-use) of the contents.

The Europeana platform proves to be a tool with potentially extended opportunities, but due to the more considerable attention paid to the quantitative aspect of the collection of an increasing number of records, compared to the dissemination, knowledge and encouragement of initiatives aimed at re-use, still presents significant conceptual problems.

From the analysis emerged that the development of Europeana was rooted in the idea that by building the infrastructure, the platform would help create opportunities and these, in turn, would generate value (Fallon, 2018). However, in recent times the the platform seems to have noticed that it has achieved "too much": too much material, too generic, too many records to improve, too large the target audience, etc.

Despite a large amount of digital material collected, the development of standardization systems for the collection and management of data, Europeana still cannot reach the people it wants and above all not in the way it wants. In this regard, it is believed that the IT structure should be considered as a means, not as the end: the end is the experiences, knowledge and combinatory actions that the aggregator can generate.

The independent assessment on Europeana (Enumerate, 2018), shows that the project still has significant criticalities that are not only of a technical-technological nature.

The most critical aspect lies in the knowledge and use of the portal by the primary recipients and stakeholders. The report shows that more than 50% of respondents do not consider themselves satisfied with the results of their Europeana research, particularly regarding the relevance and accuracy of the results. Moreover, more than 50% of the respondents admit they were visiting the platform for the first time, or they visit it once in a while. There is, therefore, an obvious problem of engagement and participation.

In the face of the analysis carried out, a lack of focus is therefore identified in the progressive change of objectives which has not led to an evolution of the strategies, but rather from time to time to adaptation. Indeed, since it is an immense project and the outcome of financing programs, it is possible to understand how difficult it is to make substantial changes in such complex contexts.

In the case of creatives, the situation is even more critical. From the results of the questionnaire, it emerges that among 100 designers no one had ever heard of Europeana and, of course, no one had never used it before.

Technical problems related to the data structure are partly solved and certainly far from the competences identifiable in design research. Efforts concerning the participation of the users and ways to use and reuse the material in order put it into processes of creating new culture

seems to grow in importance, and that is a matter of design research.
In the wake of Jeffrey Shnapp's reflections, what happens when we move from a selected collection to the immense? from tens or hundreds of cultural objects to hundreds of thousands and tens of millions? "How do we navigate, describe, analyse", but above all interpret cultural heritage "with, on and through these enormous aggregates?" (Shnapp, 2013). It is precisely here, in the relationship and in the mediation, that design can and should take action.

4. Design and digital archives of cultural heritage

Cultural heritage and archives have experienced a profound conceptual transformation that has led both domains to be no longer static and custodian, but processes dynamic and continuously evolving. Both the heritage and archive processes in the digital context tighten a relationship so close as to sometimes overlap (Gibbons, 2014): layers and contexts, assumptions and relationships make the cultural heritage and the archive highly integrated. However, when it comes to the relationship with information technology, the traditional training of the archivist still has some gaps and highlights the need for deep interdisciplinary collaborations (Hölling, 2015). Often, digital archives fail to make themselves explicit in this new role that emerges since it is not sufficient to translate the physical object on a screen to allow it to become something new. The exploration of how and where in this translation values and meanings can be added and not subtracted grows in importance.
In other words, it is a question of knowledge design (Shnapp, 2013) but also of strategic design. The archive today has the potential to allow the creation of new visions, to become an entity no longer static but dynamic and directed towards the future.
New interactions emerge, enter the archive and transform it. On the basis of these observations, the research starts from the hypothesis that through a project action on the archive, which is not reduced exclusively to a design of the interfaces but involves a project of a strategic type, of the meaning, of the information and of the relationship between the archive and the designers, these aggregators can truly emancipate themselves and become an instrument of design and creation of the heritage of the future. The action of design can generate different impacts by improving visibility and engagement but also drastically changing the role that the archive plays today and its meaning by extending it to a use that is not exclusively specialized.

Recognizing the relational need of heritage, the need it has to be in relationship with people to be interpreted and manifest its value, every action of design in this direction is a "relational project of cultural heritage" (Lupo, 2007). In this case, the action of design can convey the relationships within and around the heritage, triggering construction and generative processes of new heritage by moving away from mere enhancement to achieve activation.
This happens for the development of the technologies of which design has always become a vehicle. We are in a time when design and cultural heritage do not meet only within

museums, therefore the unexplored area that this research intends to occupy concerns precisely this space of relationship outside museums. The focus is on the relationship that design and cultural heritage can have thanks to digital archives, or in the context of digital archives.
The field of application of design to the territories of the heritage today concerns more the relational and visual aspect than the material one, and digital technologies propose the exploration of new interpretative models also in the context of archives. Hence, it is possible to argue that design can play an essential role in this translation, in this threefold relationship that over time it has built between technology, cultural heritage and design. What emerges is a vaguely paradoxical picture in which the action of design makes its way into the development of strategies or proposals aimed at bringing people closer to heritage while the product of design, being part of the cultural and creative industries, is itself recognized as heritage. It follows that design is both an active actor and a result of this process of continuous creation which identifies itself with cultural heritage; design helps to produce the cultural heritage of the future by interpreting the present and the past and at the same time designs the relationships that can allow this construction.

Conclusions

This contribution adopts an approach that aims to remove disciplinary barriers between the tangible, intangible and digital dimensions of heritage. It wants to stimulate to look at creation and conservation as aspects of a single cycle, of a single process. Taking care of the digital cultural heritage also means promoting its regeneration, supporting contemporary creativity.

Continuous use and active participation in heritage dynamics can trigger a whole series of impacts and externalities, both positive and negative (Sacco, 2018). Heritage can identify as a set of social and cultural processes that are mutually interconnected, interacting with each other and with the external environment, which reacts and evolves as a whole, in short, as a system.
Material, immaterial or digital, it is heritage in its past being that is handed over to the future to be an active part of it and to help build it. Design has the ability to connect, to act as a catalyst to lead to the desired change that sees the material contained in the aggregator genuinely become part of the heritage process of creation and construction.
To do this, design needs to work with its skills and competences in interdisciplinary projects that deal with the organization and activation of archives. What therefore emerges is that design can begin to deal with these archival contexts, first of all by working on meaning.
In conclusion, design can begin to deal with the heritage creation dynamics that can be triggered thanks to the archives by offering its expertise, at several levels and in several stages.
"Creativity does not happen inside people's heads, but in the interaction between a person's thoughts and a socio-cultural context. It is a systemic rather than an individual phenomenon

"(KEA, 2006)
Even the art world, for example, has always turned to the past to produce the new: Manet could not have painted the Olympia without having Titian's Danae as a reference, Andy Warhol uses objects symbol of mass culture such as the Brillo boxes, and Jeff Koons has repeatedly reworked the sculptural works of the classical world in his works. Copying, pasting, inspiring, quoting, reproducing and scrambling are terms that have always belonged to the vocabulary of the creative industries. It is precisely in the very nature of the heritage that the ability to implement new realities through contingent processes of assembly and reassembly of bodies, technologies, materials, values, temporality and meanings (Harrison, 2016).
The digital material contained in the archives represents an essential resource for creative industries such as design or fashion design as well as for contemporary artists. Those are among the areas that can benefit most from Digital Cultural Heritage to introduce it into new processes of creation of what will be the culture of the future.
This study is rooted in the awareness that DCH materials acquire value only if they are understood, interpreted and used: they need to be involved in the continuous process of creation and construction thanks to a design action. Hence, relationship and contamination that has always existed between the culture of the past and contemporary creativity, seems to be essential to explore the 'future heritages' and 'heritage futures'.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Going beyond the problem of privacy: individual and social impacts of the use of personal information in connected services.

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Abstract | We are seeing an incremental spreading of devices able to collect and use personal data. Many types of services such as personalized assistance, healthcare solutions and smart cities rely on personal data for the improvement of the service. The management of personal data allows services provider to add value within the system and design practice needs to understand and consider the impacts that personal information can have on the individual in terms of changes on personal awareness, on actions the individuals perform, on relationships with other individuals, and on individual agency in the society. Personal data is now a matter of design for product and service in order to push forward the technology advancement avoiding serious consequences. We need to design services in a conscious way considering possible issues related to the use and sharing of personal information while exploiting the value that this information can have in the services.

KEYWORDS | PERSONAL INFORMATION, INDIVIDUAL IMPACTS, SOCIAL IMPACTS, PERSONALIZED SERVICES, SERVICE DESIGN

1. Introduction: technologies and the use of personal data

We live in a world where the incremental spreading of products and devices that embed sensors and logging mechanisms allow to detect, collect, store and manage personal information (Greengard, 2015). Companies and service providers take advantage of this ability to create personalized experiences to the final users as well as gather knowledge from the information collected. The current trend of hyper personalization of services that aim to provide an extremely tailored experiences for users, strongly needs data that describe the behavior, the preferences and the habit of people as a knowledge base and as a continuous feeding for the adaptation of the services' reactions and proaction. Despite the usefulness of personal data analysis for services, the persistent and ubiquitous collection of these data raises several concerns, one of this is that users cannot actually avoid providing their data for two main reason: first, they are not really aware of some automatic tracking; second, service providers often deny accesses to services if the consent of sharing data is denied by the user.

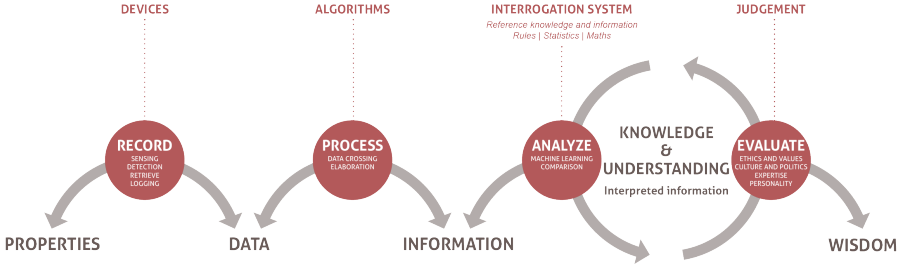

Figure 1. Revised DIKW Model.

In *Figure 1* I represent the Ackoff's DIKW canonic model (Ackoff, 1989) revised so to generally frame it within the process of creation of wisdom from personal data in services. Starting from the physical world in which all the presences and actions take place, devices record the properties of individuals and related data. Devices can be seen as objects as wells as environments that embed sensors that record the data in the systems. This recording of properties represents the 'what is' and 'what happens', creating the reference of the physical phenomenon on digital supports. To create the information, the technological solution (algorithms) processes data through elaboration, data crossing and/or aggregation. Technological solutions can then give back the processed information to the users as well as analyze it to create knowledge and understanding of phenomena. When the analysis of information is made by users from the visualization of information, personal skills in interpretation is key: the person must have the capability to understand the provided information thanks to the application of background contextual knowledge that supports a proper analysis. Being it performed by interrogation systems or by the user through the

interpretation of information visualization, the analysis of information needs the application of reference knowledge that allow to properly interpret the information. The knowledge extracted from the analysis is given back to the users in the form of insights, suggestions through the proactivity of the service. The generation of wisdom relies only on the human abilities and evaluation according to the individual's ethics, values, culture, political and social vision, and personality traits.

2. Using personal data to add value within the service

The single person generates data that can be collected from conscious and active providing made by people (e.g. sharing of content, activities and presence through social networks) as well as passively gathered from user's actions in both digital and physical worlds. People are surrounded by technologies (such as cameras, scanners and many other different sensors) that are capable to gather information about them. People carry around powerful devices that are able to communicate with the surrounding systems. In everyday life, we move from A to B in different ways such as riding a bike, driving a car, or catching a bus and paying the ticket for the ride. We walk on streets looking for specific places with the help of digital maps that constantly track our position. Users rely on systems that provide them useful information, insights and alerts about themselves, about their everyday performances, about what and who surrounds them. Private and public companies, governments, and other public and private actors have the power to collect and use data to enable service's functions, to personalize the user experience, to create legitimacy through identity verification, to provide access and authentication, to create new services and to improve already existing services (Joinson et al., 2010).

Modern services rely on self-tracking devices (Neff & Nafus, 2016), personal logging and automatic detection of personal data from ambient intelligence (Gunnarsdóttir & Arribas-Ayllon, 2015) to integrate the knowledge about the users and to know them in detail. Current available solutions and ongoing projects in many fields imply the use of personal data for several purposes. While personal devices tailor fitness and wellness experience providing hyper-personalized feedback to the user to trigger actions for goal achievement (Neff & Nafus, 2016), they can be also a source of knowledge about health status that healthcare providers can use for services to engage and support patients through interactions with personal information. This also enable the shifting of the healthcare paradigm from cure to self-care and prevention of illnesses (Lupton, 2013). Modern home appliances not only react according to user's control as they ever did, they allow remote control, use behavior analysis, and collect users' preferences to enable the proactivity of the services. The systems provide insights and automatically perform and manage tasks such as good purchase and automatic heating. Home automation systems move to a comprehensive house management that integrates all these tasks to reduce cognitive efforts and number of interactions (Pillan & Colombo, 2017).

Moreover, service providers not only take advantage from the data analysis to provide better and more tailored services, they can also imply the knowledge derived from such data to promptly adapt the company strategies to fluid markets that constantly change day by day, as well as provide knowledge to other stakeholders involved such as governments, research and other actors that can make profit or have non-monetary advantages. The sharing of patients' data can make a difference in the advancement of medical research (Weitzman et al., 2010) as well as cities and governments take advantage of citizen's data to improve and better manage public and private services (Goodchild, 2007) (Mitchell, 2010) (Ratti, 2010).

The creation of services that rely on the use of personal information is a complex chain of value creation that starts from the human element. The value that the of personal data add to the service can be of two types: awareness and function.

2.1 Awareness as service value: enhance self-knowledge and support behaviour change

The practice of tracking personal data is able to increase self-knowledge through the analysis of personal traces (tracked data) and the derived information (Ferraris, 2009) (Buckland, 2017). Reading visualization of personal information, the users increase their knowledge about activities performed, about personal preferences and trends, and about body behaviours. Self-tracking is also able to promote behaviour change in a goal-oriented approach. *Figure 2* shows how feedback-loop leads to behaviour change using self-tracking as a support. (Lupton, 2016) (Young, 2013). The feedback-loop derived from data tracking is broadly used by services and systems as a way to promote and support behaviour change in several fields of applications. It is often a core part in the switch of paradigm in healthcare from cure to prevention and self-care where the patient becomes a participant actively involved in self-care (Marr, 2015) (Lupton, 2013) (Lupton, 2017).



Figure 2. Visual representation of the feedback-loop for pursuing a goal: from self-tracking to behavior change.

Despite the creation of feedback-loop can involve uniquely personal interactions with the user's own information, some service offer the opportunity to reinforce behavior change mechanism through the comparison and sharing of personal data with other people improving personal knowledge of the individual and among the community, and engaging in a community goal-oriented approach (Lupton, 2016) (Lupton, 2013).

2.2 Function as a value for the service: increase the proactivity, and improve the experience

As mentioned before, the knowledge derived from personal information, can be used by interactive artifacts to increase the proactivity of services and to improve the functions through wearable prosthetics, beacons (Purpura et al., 2011) and residential objects (objects that belong to living places and aim to enhance the relationship between individuals and their networks, and between human body and the environment), as well as to enhance the potential of places through physical objects/devices in public spaces. Services that rely on users' personal information to provide personalized insights, tasks and goal, have a higher level of proactivity toward the individuals. The digital solution becomes an everyday companion for the user who trusts on it as a supporter for activities that provides useful suggestions tailored on individual actions and need. The proactive system is a digital symbiont that knows its owner and act and react accordingly. Among many possible examples, entertainment apps are highly proactive services that use individual preferences to extract information and so actively suggest tailored content to the user. Fitness and workout apps (Balsalobre-Fernández et al., 2017) work on the same principle using individual body parameters and goal setting to suggest actions to the user. Personal information can also be involved in the improvement of already existing functions making them faster, more reliable and personalized. The use of fingerprint detection and face recognition for fast authentication has improved several existing services enabling seamless interactions such as for home banking accesses, fast payments and smartphone and security unlocking.

Moreover, the knowledge extracted from personal information, is a valuable element not only for the user and the service provider. This knowledge, in the form of awareness can support decision making processes as well as contribute to functions also for third party service providers and other involved stakeholders. As examples, the knowledge coming from users' lifestyle behaviors and bio-parameters can contribute to progresses in health research as well as the tracking of people's everyday activities can support the creation of smart city practices and policy creation.

3. Personal data as a critical element

While creating services that rely on the use of personal data as core or additional matter for the service, providers are focused on the opportunities that the use of such data offers to improve functionalities. However, many concerns raise in the society regarding the possible consequences of the use, the share and the spread of personal data. When it comes to regulation and policies, the majority of the effort is spent on considering privacy concerns. Being information meaningful with respect to data, people are less willing to give away their data when they realize they are also providing the opportunity to extract information from it. The main concerns on privacy and use of personal information is related to the user's lack of trust in the company that is collecting and using the data (Joinson et al., 2010). Considering technologies as non-neutral elements (Winner, 1980), this paper aims to raise awareness on the other possible consequences that the use of personal information could raise on individuals in a complex and connected society. The practices of tracking data and returning knowledge to the users impacts on individuals on different layers. Here I formalize the four layers of the identity that can be perturbed. These impacts have the power to change not only the way individuals perceive themselves and the world, they are able to affect the way the technological solutions will evolve as well as the social practices and the trust people have in companies, institutions, and professionals (Young, 2013) (Schneier, 2016) (Pillan et al., 2017) (Colombo, 2018) (Varisco et al., 2017). I define as 'impacts' all the consequences that the use of personal information has and could have on the individuals considering both positive and negative outcomes.

3.1 Data impact layers

Awareness. The users receive feedback from the service it in the form of visualization of real-time and historical monitoring, patterns and anomalies, personalized goals and automatic setting, notification and alerts thanks to the automatic evaluation based on comparison to references, standard or average. This feedback impacts of the individuals self-perception altering the way they feel about themselves, the way they perceive their identity and increase self-knowledge (Li et al., 2011). Active or passive self-tracking allow users to increase self-awareness about their behaviors, activities, performances, and body parameter and health status (Neff & Nafus, 2016) creating self-mirroring in the provided information. While increasing the knowledge, the visualization of historical data, real-time status as well as possible projections of future trends thanks to AI predictions allows an effortless and seamless monitoring that perturb the self possibly in positive and negative ways. Especially for medical feedback, the way information is automatically return to the user as well as its amount is a critical matter. According to self-perception theory, the returned feedback implicitly reflect the individual perception as a result of personal self-observable behavior (Bem, 1972). In glucose level monitoring systems for diabetic people, for example, the return of information about real-time or historical glucose level has to be consistent with the user ability to understand it and at the same time has to consider emotional aspect of diabetic

people so to avoid unnecessary distress. Patients with diabetes have depressive and anxiety symptoms, such more than general population due to psychological factors such as coping and locus of control (Mućko et al., 2005). The act of being aware of some knowledge has a sort of placebo effect on the individual. A recent study confirmed that the knowledge of individual risk (the study considered DNA analysis for health risks evaluation) affects the personal physiology even if the risk is not true (Turnwald et al., 2019). The practice of profiling individuals such as in the case of behavioral targeting and social labeling for marketing also alter the awareness of individuals. Considering that people are labeled according to their behaviors, beliefs or personality, by receiving a targeted advertising the individuals project themselves in the type of persons the ad is directed to, perceiving themselves according to an external source (Summers et al., 2016).

Actions. Proactive services lower the load on humans in making decision triggering actions according to the understanding extracted from computed data. The interaction between the user and the service, mediated by personal information, enables faster, tailored and meaningful tasks completion and service functions. Biodata such as fingerprints and face recognition empower current fast and seamless authentications for unlocking smartphones, for digital payments and for fast access to services. Furthermore, user's information can enable useful and meaningful micro-interactions such as the use of face proximity recognition for automatic adjustments of tones' and audios' volume in order to be less invasive when the user's ears are close to the phone (Attention Aware, 2017). The eliciting of self-awareness through returning information and feedback also has an agency on people actions and behaviors. The mechanisms related to behavior change such as the feedback-loop are supported and empowered by the monitoring of actions and activities. Altering the user's awareness about status and performances, the visualization of information sets the bases for modifications in the actions performed through the creation of self-understanding. Then the user reacts to this understanding and to the engagement provided by action triggers such as goal settings and personalized experience and tailored suggestions. The result of this engagement is a change in the single actions performed and even in whole behaviors and attitudes (Neff & Nafus, 2016). By logging data about food eating and even by automatic detection of food intake, users can monitor and develop self-understanding about their own lifestyle and modify their eating behaviors according to the information received. The more types of different data are considered for the elaboration of feedback, the more complex and accurate the tailored experience can be. If the user tracks eating habit together with exercises and performed activities, and the related health parameters, a comprehensive service is able to offer tailored suggestions or nudging to improve behaviors toward a better lifestyle. Considering personalized advertising not only for its impact on self-awareness as a mirror of the identity but also on the point of view of the changes in performance of actions, it has been invented so to have an impact on purchase behaviors way more than untargeted advertising.

Relationships. Considering that "the convergence of social physical and virtual spheres of human life has boosted a transformation on the interaction of individuals with their environment" (Aranzabal et al., 2013), we can extend the concept to the interaction between individuals that inhabit this environment being it physical, digital, augmented or intelligent ambients (Gunnarsdóttir & Arribas-Ayllon, 2015). By sharing information within the Internet or among users that take part to the same digital community, individuals can alter their own public images and acquire knowledge about other people. These public images are made out of personal information creating an extended self that multiplies virtual identities and data doppelgangers adapting to the type of service (professional network, health monitoring, recreative network, and so on) and according to the community where the interaction takes place. The data doppelgangers affect the perception that individuals have each other perturbing the interpersonal relationship that occurs among the close circle (family, close friends, relatives, partners and other individuals significantly close to the user in an intimate relationship), the trusted network (friends, acquaintances, colleagues, and other people in which the user trusts at different levels and for different purposes), and among professionals (doctors, employers and employees, and other people with whom the user has a more formal relationship). Moreover, thanks to ubiquitous connected services, knowing people through personal data is today easier than before. As an example, on online dating platforms, people represent themselves to find personal matching. They can meet, chat and know each other through their online personal representations with a very intimate purpose. Personal information is now broadly used also to provide professional services that rely on technologies and connectiveness. Data and information about people, impacts on the relationships people have with doctors, insurers, employers and many other professionals changing the paradigms of entire services. Digital care services and genome analysis, enable new types of interaction between doctors and patients (Lupton, 2013). Doctors no longer have to see the patients in person, they can remotely review patient's record and monitor parameters. Moreover, patients can access personalized healthcare services according to their information and receive tailored assistance directly from automatic systems. In the case of personal medicine as well as for online dating, however, the provider has to consider that, even if the solution facilitates and supports the service, the personal and physical interaction has a high psychological involvement that could not be properly transferred in the digital remote interaction.

Social agency. From active commitment to passive data providing, information about people impacts on their societal contribution in both conscious and unconscious ways. Personal data pass through behavioural analysis, pattern recognition, real-time monitoring and aggregated data analysis to extract information of all sorts aiming at shaping the society and the environment the people live in. Collective values shared among the society reinforce users' willing to disclose their data for societal improvements fostering public participation in publicly sharing their personal data for the greater good. The voluntary donation of health information such as EMR and genome analyses can contribute in terms of source of knowledge for medical and pharmaceutical research (J. H. Frost & Massagli, 2008)

(Weitzman et al., 2010) (J. Frost et al., 2011). The impact that the use of personal information has on the personal societal contribution applies not only to medical research, but also to people's participation in the society as citizen and actors of their community. In modern cities, people are nodes of the augmented infrastructures. Their actions, reaction and proaction shape the surrounding environment of ubiquitous connected systems of sensors and actuators. Municipalities, private and public companies, and independent entities create urban services, neighborhood, and entire cities that are designed, organized and built starting from data collected from citizen in a mutual exchange of services and social values (Goodchild, 2007) (Mitchell, 2010) (Ratti, 2010) (Chourabi et al., 2012). The social and infrastructural environments act and react according to their inhabitants and connected services take advantage of people's information to improve and adapt according to historical data and real-time monitoring. The approach of smart cities built 'from the internet up', needs constant stream of data to provide reactive and proactive public services and all the decision are made according to the received information. The use of personal information for societal purpose applies also to social policies safety justice and law making. Artificial Intelligence can analyse surveillance cameras' footage in real-time to extract valuable metadata aiming at improving traffic monitoring, capacity planning at shipping ports, and even detecting and reacting to emergencies. AI, as an interpreter of people's records, is now broadly used in USA as a decision-making supporter for justice and safety impacting on people's freedom. In order to gather data for social purposes, people are so constantly monitored, even without having a real consciousness of the different moments of tracking and sharing of their data, and of the consequences that their contribution in terms of personal information will have in the societal organization. People's preferences, historical activities, real-time and everyday data are collected to shape service experience and to create personalized contents. These filtering of experiences and contents provided by services, impacts on the user's representation of the external world and so on their societal perception.

Consistently with the description of the four layers, *Figure 3* shows how the different mechanisms that involve the use of personal information and the derived knowledge, involve more than one layer of impacts, so the four layers have to be considered as linked and communicating rather than separated each other.

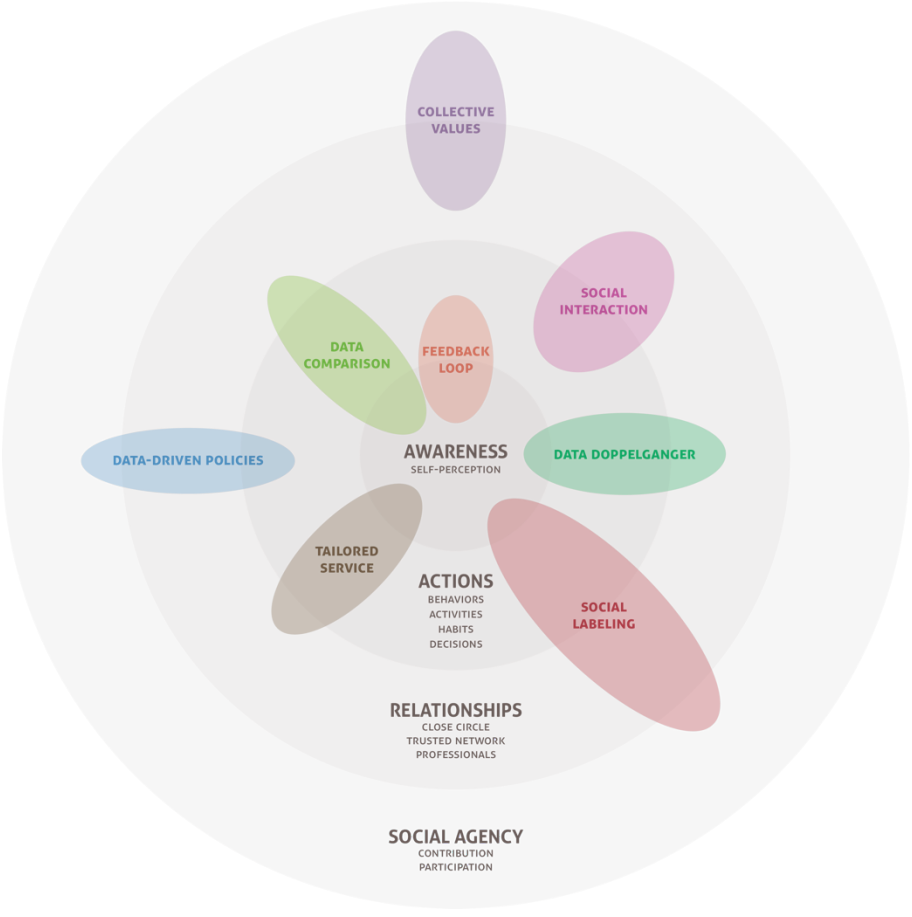

Figure 3. Impact layers

4. Conclusions: personal data use as a matter of design

Design is a complex task for complex problem solving. Designers have to cope with the complexity of the world (Norman, 2011) to find solutions to problems so to create a more functional world. Problem solving through design is however utopian. While solving a problem, designers have to face with the uncertainties related to the unpredicted factors that could intervene in the functions of the designed artifact in the moment it is released in the social construct it is built for (or when used in different contexts). Designers cope with the balance between understanding and simplification.

New services and innovative solutions bring changes that can be perceived as utopian to somebody, and as completely dystopian to somebody else. In the creation of such innovative services, designers face with the multiplicity of different perspectives about wellbeing, sustainability, and social justice; they should orient design choices embracing both the contradictions implied by the changes they can produce, and deal with the complex issues that goes beyond utility. While designing digital services, we deal with the inconsistency, variability and variety of the human perception; we should explicit and focus the tangle of issues involved in the use of personal information, so to better understand what is at stake. In the physical world, material tools are open to different uses. As an instance, a blade can be employed to prepare food, to heal injuries, to shape materials for the creation of artefacts, and also as a weapon. In the same way, connected objects, environments and services opens to different uses of the information.

The design of service that implies the use of personal information is a critical task and there is a need of critical thinking in the design of such solutions. Designers have difficulty in figuring out and so be aware of both how and when personal information is implied in designed solutions as well as of the potential impacts that the use of such information could have. While designing connected services that employ the use of personal data and the related extracted knowledge, designers are aware of the importance of the management of personal information mainly with respect to privacy (Varisco, Pillan, et al., 2019), there is a strong need to increase their awareness about the variety of the impacts of the use of personal information while keeping them focused on the utopian goal of improving a specific experience. This need of critical thinking and fostering of the discussion among the design community has the specific purpose of helping designers in creating more robust, consistent, reliable and resilient solutions for the benefit of the company that is providing the service, for the user who is taking advantage of the provided service, and for the whole society as a final target of the advancement of technological solutions. More thoughtful design choices take into account not only the user's right regarding privacy and security, but also: i) the perturbation in self-perception and self-awareness due to self-mirroring into data and feedback received by the service; ii) the automation of the extraction of the knowledge about individuals as a possible agent on changes on people's cognitive load, actions and behaviors; iii) the alteration of people's quality of life, freedom and accesses to services thanks to increasing availability of services that imply personal data as a matter from which extract knowledge; iv) the changes in individuals' participation in the society and the community and in their interpersonal relationships and roles.

Designers have an active role in designing innovative solutions and their aware design choices can produce an active contribution to the individuation and interpretation of users' needs and rights about the management of their data.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Human and Artificial Intelligence for the Cultural Reform of Design

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Abstract | What was once a science fiction topic, now has become reality. We are witnessing the positive trend of robotics and Artificial Intelligence technologies, abandoning specific fields of experimentation and bringing benefits to entire society. Design compares itself with technologies highlighting potentialities and limits in order to define the meeting between human and robot, suggesting new project scenarios and expanding the boundaries of what can really be achieved. Starting from the "logics" of robotic systems, the paper investigates the complex relationship between human and technology in order to encourage the link between Artificial Intelligence and cognitive-relational factors, promoting the dialogue between the actors involved with human at centre of issues as ergonomics, usability and accessibility of robot. Design discipline, with interpretation of needs and interdisciplinary approach, will emphasize the need to use Artificial Intelligence in creative processes and to "humanize" the machine system to define hypothetical relationship between human and robot.

KEYWORDS | ARTIFICIAL ABILITIES, COMPLEXITY, HUMAN BEHAVIORS, MACHINE EVOLUTION, HUMANIZATION

1. Robotics and Artificial Intelligence for the definition of new future scenarios

The unstoppable spread of technologies such as robotics and Artificial Intelligence redefines the future of the interdependent society of intelligence systems expressed by machines that will impact everyday life and change the way we live and perceive our surroundings.

> "Education in the proper use of technology presupposes an ethical culture, as well as a scientific-technological one, without which humanity is unable to manage the results of its own knowledge." (Cingolani & Metta, 2015, p.45)

This will inevitably lead to the need to think about the transformative impact on society because the human of the future will have to interface more with intelligent robotic systems.

Initially the object of industrial applications, robotics represents one of the main innovations that the digital transformation is determining in the organization of social as well as productive processes in which human-machine interaction imposes new design challenges.

In particular, the current scenario shows the presence of people and machines that collaborate together in order to achieve jointly a goal: improving the quality of life through the synergy between human abilities and the "attitudes" of cutting-edge technological systems, generating new forms of secure and flexible collaboration (Vicentini, 2017).

In parallel with the diffusion and pervasive use of robotic technology in the different application fields, the processes, the actors involved and the related skills to be deployed change. Artificial Intelligence, understood as a resource to exploit (Chiriatti, 2019) and not as a threat, represents the innovative potential of the design discipline for the identification and definition of new design processes.

> "If we look at robotics as a global opportunity for the human being, on which to invest ideas and resources, we could modernize and make more efficient our welfare, improve the quality of products, making work less dangerous, create a new professional and manufacturing chain. This is the approach we have to adopt. The human sciences can play an important role in this evolution: in order to establish the right role of robots in the future society, to identify risks and to direct research in the most useful directions for humans." (Cingolani & Metta, 2015, p.51)

Robotic technology and Artificial Intelligence systems, which have become increasingly present as an integral part of everyday life, as well as being more accessible in economic and employment terms, represent the future and the way to continue the process of evolution and definition of the needs of mankind, in order to identify new frontiers of interaction.

Thanks to the continuous use of new technologies, new forms of intelligence are spreading that generate changes in human behavior, attitudes and perceptions. Through the use of Artificial Intelligence, the potential developments in technology, the expected technical

challenges, the opportunities to be seized and the ethical, economic, political and social problems to be addressed are determined.

Artificial Intelligence, one of the major drivers of innovation that has emerged in last years, is not a recently developed discipline. It was born after World War II, with the advent of the first calculators considered as tools able to "reproduce" the human mind and concurrently with the research project proposed by J. McCarthy of Dartmouth College and other representatives of university centers whose main objectives were to focus the in-depth studies on the describable and narrable intelligence of machines.

> "Since the mid-1950s several researchers realized that computers are not only number manipulators but can also handle symbols of a general nature, performing non-numeric operations. At that time, several attempts were made to transfer the ability to perform intelligent operations to machines." (Lerda, 2002, p.7)

It is an area of multidisciplinary research in constant development rich in ideas for advanced research that over the years has consolidated important results in the design of robotic systems and in the field of Human-Robot Interaction, to the point of:

> "systematizing and automating certain intellectual activities, and [applying] it to every sphere of human thought. In this sense, it is a truly universal field." (Russell & Norvig, 2015, p.4)

Therefore, the challenge is to identify ways in order to make the best use of the potential of new technologies in the various areas that are at a mature phase until become a priority for the definition of innovative processes. This is not an easy challenge that sees robotics as a tangible and reliable tool for improving quality of life.

> "this shows that the correct and conscious management of these resources can help to optimize the status quo of human beings without excessive distortion and evolutionary risks." (Cannito & Palumbo, 2019)

The positive intuition in the use of such systems defines the current paradigm shift and reinforces the importance of combination of design and Artificial Intelligence by translating technological innovation into design concreteness.

> "Artificial intelligence is not just a new technology that is developing with extraordinary speed. The roots on which it feeds have spread like wildfire around the world, [...]. We must understand that Artificial Intelligence is no longer an option that can be deactivated, a switch that we will still have the ability to turn off. It has become indispensable." (Alexandre, 2018)

2. Humanization of robotic technology

In 1998, Hans Moravec, in his book Robot: Mere Machine to transcendent Mind, claimed that within a few decades, machines would reach human ability for reasoning until surpass it around 2040.

> "We will see more and more things done to Artificial Intelligence, and in the meantime, costs will fall, results will turn out better, and our lives will be better. Soon there will be countless pieces of Artificial Intelligence working for us, often behind the scenes. They will help us in fields ranging the trivial to the substantial to the epochal." (Brynjolfsson & McAfee, 2015, p.100)

This is a futuristic and sometimes boundless prediction, but it is undoubtedly the direction that research in the field of Artificial Intelligence is taking through an optimistic approach, aware of benefits and opportunities arising. Machines with "super-human" performance, able to act humanly to the point of empathy with the human being.Current robotic systems are intelligent machines designed to reproduce human behaviour and to "support" human intelligence during the performance of activities, in order to optimize human – robot collaboration and at the same time to amplify cognitive and sensory capabilities as well as physical (New Scientist, 2018).

> "I would argue that through our use of technology we in fact, are attempting extend and transcend our emotions by way of robot and other intelligent technological agents." (Tettegah & Noble, 2015, p.53)

In the Human - Machine Interaction, that is continuous, constant and evolving, through the use of Artificial Intelligence, the "instrumental" support for man becomes technology and not vice versa, so as to highlight the concept of "increased humanity", of innovation at the service of man that can increase the potential and improve the quality of life.

> "For this reason [it is preferable] to talk about "increased humanity" rather than Artificial intelligence, in which human potential is improved rather than hindered it. It is fundamental that we learn to use Artificial Intelligence in order to integrate and to improve our abilities instead of trying to compete with it." (Arienti, 2018)

The importance of the topic of "humanization" of technology is currently among the most discussed in the field of design and engineering. Different are the examples of robotic solutions that transform science fiction into reality, through Artificial Intelligence systems.

As part of these innovative systems, the first case study identified in this research has been Sophia Robot, equipped with artificial intelligence systems connected to the Internet and developed by the robotics company Hanson Robotics.

In detail, Sophia is able to interact naturally with human beings, answering questions and remembering conversations previously held thanks to the infinite database of information that it "updates" by learning from the surrounding environment. This humanoid robot is

modelled on Audrey Hepburn's traits and shows its reactions and responds to stimuli through about 60 facial expressions.

Covered by a special silicone rubber similar to human skin, the robot interprets human expressions through two micro-cameras installed in the eyes in order to establish a visual and empathic contact with the interlocutor.

It is a project born from the combination of science, engineering and art and represents the future of Artificial Intelligence and robotics, to be defined as “hybrid human-AI intelligence” (Figure 1).

Another relevant reference for this topic is the exhibition “Affinity in Autonomy”, presented by Sony Design for the first-time during Milan Design Week 2019 and subsequently at the London Design Fair 2019, in which the relationship between human, emotions, artificial intelligence and robotics has been “brought to light”.

Visitors have been able to experiment and interact with robotics, through five different spaces, exploring the ways in which technology enriches the lifestyle through the emotional links between man and robotics thanks to the developments of Artificial Intelligence.

It is an interactive exhibition that offers a glimpse into the future of Artificial Intelligence for the creation of fundamental and positive emotional connections with humans, imagining a world in which intelligence, technology and creative design are more integrated and define the relationship between human and technology through a deep understanding of Artificial Intelligence and the ability to show emotions (Figure 2).

A further good example is the Project called Neon presented by Samsung at Consumer Electronics Show 2020, a human-artificial being designed on a computational level that assumes human behaviours such as the ability to show emotions, to communicate affectively with the human being, to learn from experiences and to form new memories.

They are real autonomous digital avatars with human features able to dialogue and support the human being in the performance of specific tasks. Each “Neon” can be customized on the basis of physical characteristics, starting from the images of a human being taken from a video camera and replicating on video the same expressions (Figure 3).

> “More than a machine and less than a man [...]. Therefore, a mixed society made up of humans and humanoids represents a cultural, social and anthropological challenge, as well as an immense scientific and technological challenge. It needs clear and defined rules and principles. First of all, humanoids have to be human-centric, i.e. they have to be at the service of man.” (Cingolani & Metta, 2015, p.53)

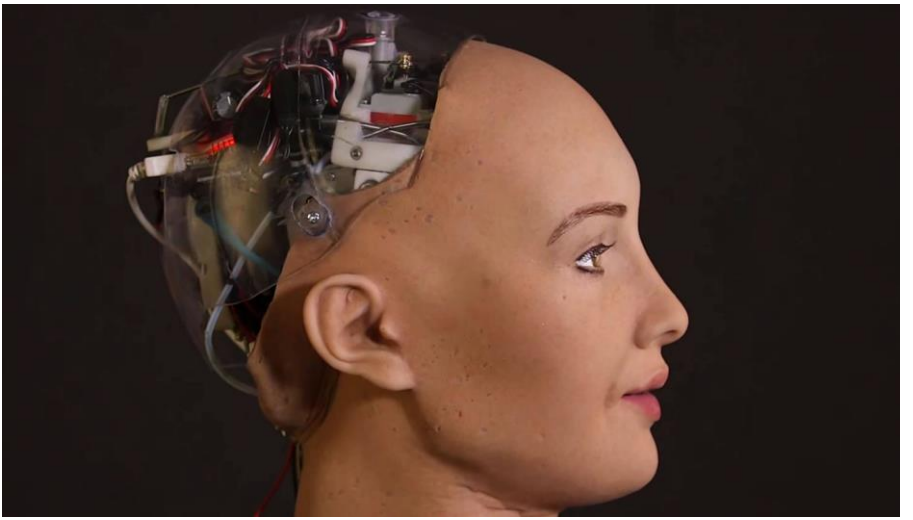

Figure 1. Sophia Robot represents a framework for cutting edge robotics and Artificial Intelligence research, particularly for understanding human-robot interactions and their potential service and entertainment applications.

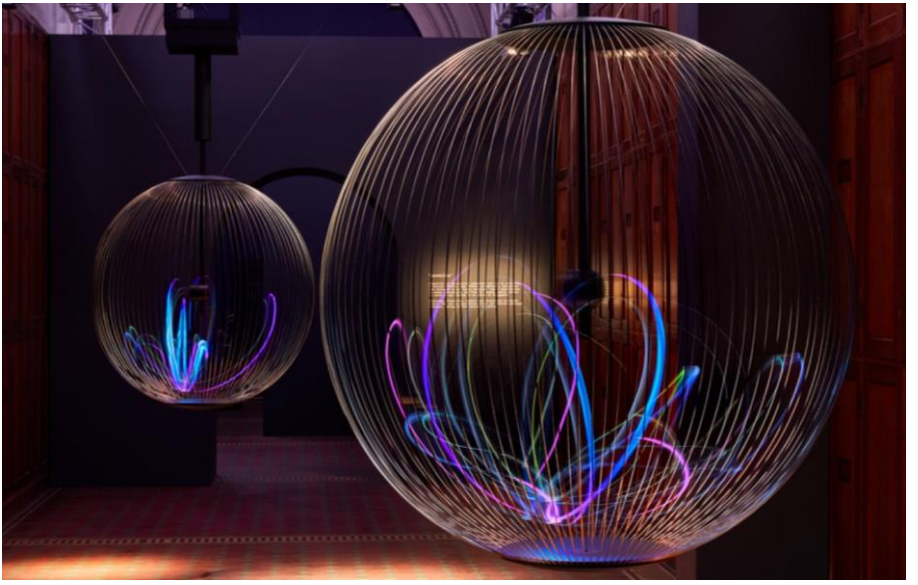

Figure 2. Pendulus is an interactive robotic pendulum in Affinity in Autonomy that portrays the independence of robotics using random movements and detects human presence engaging visitors and retracting emotion and sensitivity.



Figure 3. Neon Project of Samsung. This technology makes video chatbots that look and act like real people.

3. Human-robot interaction for secure collaboration

Despite the enthusiasm in favour of robotic innovation and the rootedness of Artificial Intelligence, there are many critical issues that influence the adoption of the technology and the real success of the implementation.

> "For all these reasons, the strategy for Artificial Intelligence has to develop on two synergistic levels: on the one hand, it is essential to innovate, experiment and thoroughly evaluate the application of the state of the art in AI and data science in all productive, scientific and social sectors, but this is not enough. On the other hand, research efforts need to be stepped up in order to tackle the open problems." (Pedreschi, 2019)

One of the main factors that represent such criticalities is found in the Human-Robot Interaction, which has only recently become a disciplinary area as part of the Human-Machine Interaction, leading to the need to define new and better "relational" human-machine forms through the multidisciplinary effort that brings together the skills of different professional figures such us engineers, psychologists, sociologists, designers and artists.

The Human - Robot Interaction studies introduce great changes in robotic research that identifies the role of the design discipline through the creative strategic approach and the configuration of innovative scenarios. These studies are needed to investigate human-machine interaction and communication between a robot and human being through human-

friendly way. Human-Machine Interaction has always been one of the main themes of the design discipline. Donald Norman claims that:

> "this area of research is experiencing a real boom. [...] Designing real autonomous robots able to interact with people is very difficult; moreover, the social aspects of interaction, including the need for common ground, are much more complex than the technical aspects, and this aspect is often forgotten by the enthusiasm for technology." (Norman, 2007, p.157)

Thanks to Artificial Intelligence, robotic systems are able to grab objects, to manipulate instruments and make movements once unthinkable, as well as to recognize the surrounding environment, to communicate with humans, to transmit data to other machines, reason, react and to reproduce behaviors, machines that are able to perform tasks and have relationships with other robots and humans, with decision-making autonomy and communicative "mediators". All the skills that characterize robotic systems include the possibility of contact between system and man and for this reason in the design processes

> "Designers must be generalists able to innovate across several disciplines and, in turn, able to turn to specialists to help them develop their design, and to make sure that each component is adequate and functional. [...] Creating intelligent machines means creating interactions, symbiosis and cooperation, both with people and with other intelligent machines. [...] The future confronts our design with new needs." (Norman, 2007, p.167)

Human - Robot Interaction is based on the concept of safety, especially in the case of contact between humans and the countless collaborative robots present in today's industrial environments during the performance of tasks carried out in a synergistic "mode".

A robot capable of creating symbiotic relationships with the human being in domestic and work environments needs to be equipped with intelligent devices and external perception sensors that help in case of unpredictable dynamics allowing to "see" and respond adequately to the different situations.

> "The objective to aim for is a Human Artificial Intelligence aimed at the benefit of the human person both individually and socially, systems that incorporate european ethical values by design, which are able to understand and adapt to real environments, to interact in complex social situations, and to expand human abilities, particularly at the cognitive level." (Pedreschi, 2019)

In addition to safety through the presence of integrative systems, another fundamental factor in research on the Human - Robot Interaction is represented by the need to implement the regulatory framework, which is currently insufficient if we consider the strong development and application of multiple robotic and Artificial Intelligence technologies. Systems based on Artificial Intelligence and machine learning have become part of everyday interactions generating a disruptive impact in different sectors, in order to represent the turning point that will progressively change design methods and activities.

For all these reasons, it will also be essential to “reformulate” the regulatory framework, which is currently limited compared to the exponential spread of robotic systems and Artificial Intelligence.

In this context, it is worth mentioning ISO TS 15066:2016 Robots and robotic devices - Collaborative robots, which is currently the main normative reference for collaborative solutions in the industrial field, specifying the technicalities of physical human-robot interaction. From the study of this Technical Specification it has been possible to understand the urgent need to “enter” the field of robotics identifying the points of contact with the discipline of design through the ergonomic approach as the key to understand the technological complexity in order to govern the factors related to safety in the interaction between man and robot.

Design will contribute to the definition of the appropriate design responses of robotic systems through the synergy between multidisciplinary knowledge, outlining new trajectories that provide unexplored fields of action and spaces for the study of physical and cognitive-sensorial interactions for the configuration of robotic and Artificial Intelligence solutions based on ergonomic factors and Human-Robot Interaction.

Current research is also able to develop appropriate interfaces that allow interaction and communication with natural, intuitive, multimodal and human-friendly features.

4. Design and Artificial Intelligence in creative processes

Artificial Intelligence technologies in design are used to bring broad benefits to this sector. Today the technology not only integrates with project, but it simplifies every process in the industry in order to be so helpful in solving problems playing a central role at every stage of development.

The design goes through a phase of change in which it becomes “contaminated and technologized” thanks to the ability of hybridization that allows to identify new possible scenarios. Design becomes a meeting point between the technological innovations and everyday life in order to reduce complexity and to highlight the actual needs of users.

> “Machines may become self-aware, humans and computers with processing capabilities may merge seamlessly, or other fundamental transitions may arise.” (Brynjolfsson & McAfee, 2015, p.267)

It will be necessary to hypothesize robots and machines able to perform the tasks carried by humans, moving from the automation of repetitive tasks to making complex decisions, so as to create innovative opportunities “offered” by Artificial Intelligence.

> “In a nutshell, current Artificial Intelligence looks smart, but it's an artificial resemblance. This situation may change in the future. One day we could start making digital tools that mimic our minds more faithfully, perhaps even using our rapidly

> improving scanning and brain mapping abilities. And if so, these digital minds will surely enhance ours and may even eventually merge with them, or become conscious." (Brynjolfsson & McAfee, 2015, p.268)

Thus, the use of Artificial Intelligence will accelerate the process of innovation and growth, rethinking and transforming the social and productive system through the collaboration between human and machine, which will give new shape to the markets and to the society.

So, the real strength of technology lies in being able to amplify human abilities, "co-creating" with Artificial Intelligence in order to define forms of creativity between art, science, engineering and design.

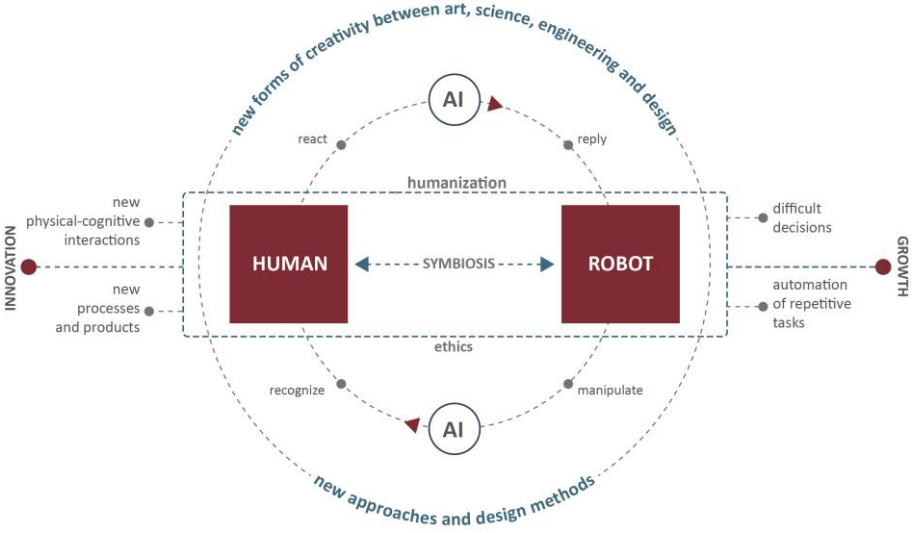

Figure 4. Symbiosis between design and artificial intelligence for innovation in creative processes and humanization of machine.

The role of Artificial Intelligence in design processes will not be "reductively" of "generating" products through algorithms and generative systems based on Artificial Intelligence. This factor will and will continue to be part of change, an

> "emerging model of symbiosis between human and machine [that] is unlocking what we have called the third wave of industrial transformation." (Daugherty & James Wilson, 2018, p.18)

The transformation of the design world will lead to a reformulation of design approaches and methods that will require greater efficiency, a reduction in the possibility of errors in human-robot interaction and a special attention to experience that is as human as possible. From the 1970s onwards, the discipline of design has been observing people and specifically

behaviour in order to capture and to interpret the story and therefore the needs, generating direct involvement in the design process. User Centered Design is part of this context.

In particular, the application of Artificial Intelligence technologies will innovate the sector in the field of Experience Design in order to focus attention on the design and quality of the process and experiential factors during user-product interaction. The roles and skills to be deployed will also change, “while creating new professional profiles related to design, control, maintenance and advanced manufacturing” (Cingolani & Metta, 2015, p.50).

Robotic systems able to have social relationships with other robots and human beings are no longer scenarios of the future as robots and people already interact with each other to improve business processes and quality of life.

> “Today the use of robots goes beyond mere manufacturing activities thanks to the convergence of a series of technical-scientific disciplines that have reached a degree of maturity that allows the creation of a new generation of machines equipped with a strong artificial intelligence and sensory organs that make them suitable to interact autonomously with human beings and the surrounding environment, be it a factory, an office, a private apartment, a battlefield or a highway.” (Forni, 2016, p.5)

The real potential of Artificial Intelligence lies in the new possibilities offered by the increasing humanization that renews and redefines the boundaries of the design process. If in the past man had to adapt to technology, in the current scenario, technology will have to be controlled by man, interacting with human rules in order to determine the technological innovation that comes from the design of machines for people.

What seems certain is that in the era of emotional connections, the new humanized systems based on Artificial Intelligence, represent the future and the "context" in which to experiment and formulate new rules for the cultural reform of design.

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Acknowledgements: In this paper, the first and the fourth paragraph have been written by the authors, while the second and the third paragraph have been written by Elena Laudante.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Human Sensibility, Robotic Craft: Toward Autonomous Stonework

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Abstract | Recent advancements in architectural robotics allow designers to explore the coupling of traditional craft with digital tools. However, current methods remain limited in capturing the qualities and nuances in manual techniques. The paper presents a protocol for transferring traditional stonework to robotic fabrication, aimed at supporting future autonomous manufacturing. The protocol re-instills the qualities of manual stonework in contemporary architecture by employing advanced sensing and fabrication tools. The paper presents three capacities, drawing upon historical practices and current standards: documenting - recording and analyzing stonework techniques; augmenting - enabling to reenact the craft using a robotic arm, and enhancing - a proposed framework for autonomous robotic fabrication in uncertain conditions. In the face of the demise of manual work, these new avenues for robotic fabrication assist in preserving and advancing regional stonework.

KEYWORDS | COMPUTATIONAL DESIGN, DIGITAL FABRICATION, TRADITIONAL CRAFT, STONE CARVING, FEEDBACK-BASED AUTONOMOUS MANUFACTURING

1. Introduction: Digitizing Craft

Craft is defined by an intimate relationship between the craftsman and the material at hand (Pye, 1968). The rise of automation in the recent century is associated with the demise of craft and the replacement of manual work by industrial manufacturing (Giedion, 1948). The introduction of digital fabrication presented the opportunity to reconnect design conception with the making process, marking a return to craftsmanship in what is often termed 'digital craft' (Kolarevic & Klinger, 2008). However, in practice, digital fabrication has only limitedly bridged the distance between the designer and the artifact (Mindrup, 2015).

Researchers formerly explored practices for digitizing stonework in the context of historical restoration. Amongst these practices are CNC sandstone milling to reconstruct sculptural stone façades based on 3D scanning (Hayes, Fai, & White, 2014), and restorative stone sawing by industrial robotic arms of columns in the Sagrada Familia (Burry, 2016). While both present a novel approach to digital stone fabrication, their focus is on form-production rather than the traditional technique used to create the original elements.

Decoding traditional techniques is elemental to transferring craft from humans to robots. The use of motion-capture technologies is explored to enable this. This practice relies on recording skilled workers to produce an initial database for digital fabrication protocols (Bard, Blackwood, Sekhar, & Smith, 2016). While researchers previously explored this technique on stonework, they focused on documenting single tool-strokes, with little regard to traditional finishing techniques (Steinhagen et al., 2016). However, a process cannot be generalized from a single stroke. As far as manual carving is concerned, the distance and the relative angle between strokes is as defining as the stroke itself. Also, each tool is operated uniquely. Therefore, data derived from one tool recording does not apply to the operation of another. Expanding the scope of motion capture to include an array of specific techniques and their respective tools can help create a robotic fabrication protocol for multiple tools as well as for a multi title of material conditions (Figure 1).



Figure 1. A detail of a robotically produced element based on traditional carving techniques.

2. Paper Structure

This paper presents a robotic stonework protocol towards an autonomous fabrication process, explored through regional stone practices. It describes the current status of digital craft and provides background for the regional stonework case study in terms of finishes, tools, and techniques. A specific case study is presented, transferring craft from human to robot. Two capacities are demonstrated in this regard - documenting particular techniques and augmenting them to robotic fabrication. Enhancement, an autonomous stonework procedure, is presented as a future avenue for research.

3. Case Study: Regional Stone Craft

Stone holds a central role in Mediterranean cultures and Israeli architecture, in which stonework represents a primary craft. The predominant stone types used in Israel are dolomitic limestone, all originating and mined in the area (Perath, 1984). Historical research refers to the use of stone alongside a range of carving techniques and chiseling tools (Shadmon, 1972). The Jerusalem master plan protects this longstanding tradition, providing guidelines for the application of stone in the city. The guidelines specify that: “The outer walls and pillars of houses will be covered with natural, finely dressed stones.” (Jerusalem Municipality, 1959). Stone related guidelines are also part of the Standards Institution of Israel, which defines the characteristics of various stone dressing techniques for cladding (Figure 2). These regulations highlight the continued significance of stonework to the region.

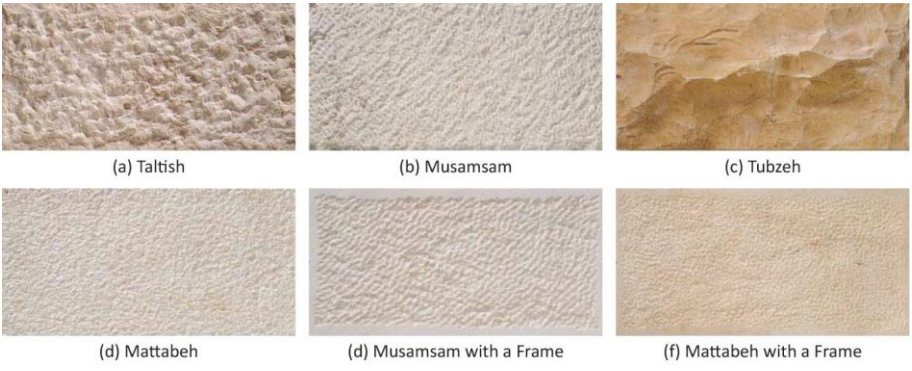

Figure 2. Stone dressing standard examples (The Standards Institution of Israel, 2012).

Despite the specificity of the standard in terms of the stone dressing’s appearance, and the centrality of stone in the local context as reflected in the literature, research does not directly refer to the specifics of stone dressing techniques. Historic documentations shed light on this aspect, as they depict stone processing tools and techniques used in the region. Conrad Schick, a 19th-century German architect and archaeologist, includes sketches of the chisel marks on the Jerusalem city wall believed to be carved in ancient times – circa 2500 BC (Figure 3).

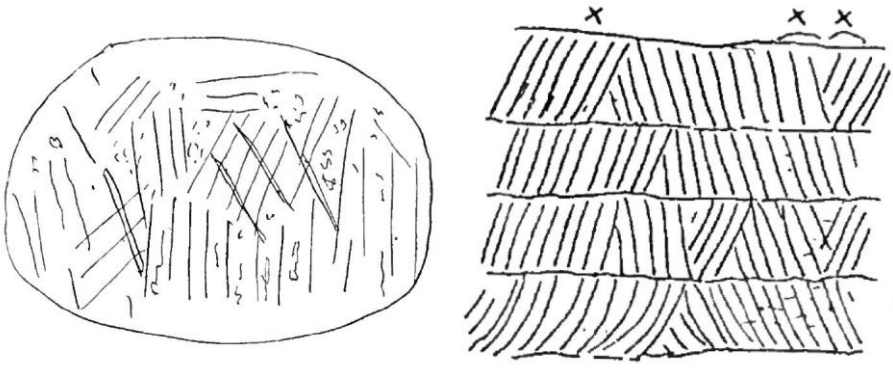

Figure 3. Left - Chisel Marks in the Cotton Grotto at Jerusalem; Right - Chisel strokes outside the old Jerusalem city wall (Schick, 1891).

The sketches are accompanied by textual descriptions, detailing the general measurements and geometrical features of the carving:

> "*They are nearly straight strokes exactly parallel, and 3/8 inch distant one from the other, vertical, but to some degree sloping, and sometimes forming a slight curve, so that one row of them meets another at a sharp angle. They are not deep, but from 15 to 18 inches long, and so arranged as to form layers one above the other.*" (Schick, 1891)

However, when Schick attempts to classify the techniques, and in lack of familiarity with the local culture and language, he refers to chisel strokes as "flaking" and "pocking" and to patterns as "irregular," overlooking the essential characteristics of each technique. In this context, almost a century ago, the Palestinian Physician and Ethnographer Taufiq Canaan documented local tools and methods, addressing the imminent extinction of traditional architectural stonework in the face of modern building technologies (Canaan, 1933). Canaan's ambitious work documents stone building processes and describes the tools in use (Figure 4). However, it is limited in its ability to convey the actual technique - namely, the specific hand gestures enabling them. This form of tacit knowledge foregrounds technique over expression (Sennett, 2008). While this technique previously resided in the human mind and hand, it can now be transferred as operational instructions to technological tools (Shaked & Dubin, 2019). Hence, the relevance of digital methods in documenting and augmenting traditional craft.

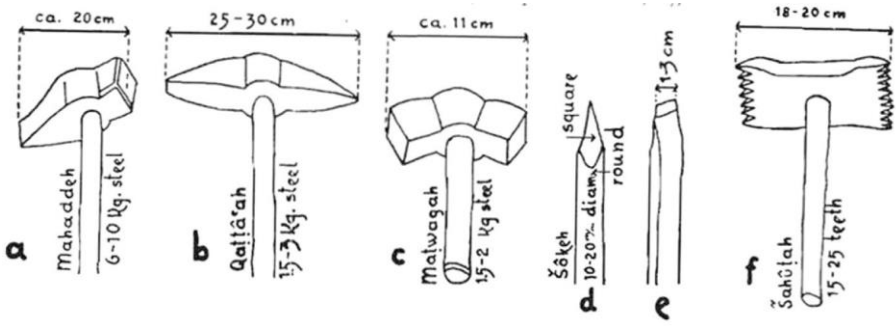

Figure 4. Traditional stonework tools described by Canaan (Canaan, 1933).

4. Manual to Robotic: Transferring Craft

The protocol allows transferring manual craft to robotic fabrication following three capacities: documenting, augmenting, and enhancing. These capacities are demonstrated through a regional stonework case study.

4.1 Documenting

It is possible to link stonework products with the techniques and tools that enable them by drawing on the historical accounts (Table 1). However, documenting regional stonework cannot rely solely on literary descriptions or existing artifacts. While these depict the technique and tool, they do little in capturing the parameters of stone production. While some of these parameters are visible (tool orientation and stone position), others are either too subtle to perceive (specific entry and exit tool-angles and stroke distances) or undetectable to the naked eye (for instance, stroke force and chisel speed).

Table 1. Carving techniques and their respective chisels.

Carving Technique	Finish Description	Chisel Type
Taltish (Figure 2, a)	Coarse dressed surface	Pointed chisel (Shawkah)
Musamsam (Figure 2, b)	Short, fine parallel lines	Toothed chisel
Tubzeh (Figure 2, c)	Roughly dressed surface	Flat, slightly sharp chisel (Izmil)
Mattabeh (Figure 2, d)	Finely speckled surface	Bush or granulating hammer

A local craftsman was recorded working to capture the stonework data. The stone used was yellow limestone typical to the region, quarried in Mitzpe Ramon, located at the Negev desert of southern Israel. This stone is primarily used for wall cladding, architectural detailing, and sculpting. Its measurements were standard-sized (25-by-60-centimeters). The set up included a motion capture camera system and a carving table. In parallel, the chisel was mounted with a series of markers to reconstruct the tool's position and orientation during the carving session. The craftsman performed three traditional stone carving techniques with the correlating hammer and chisel: Taltish, Musamsam, and Tubzeh (Figure 5, Figure 6).

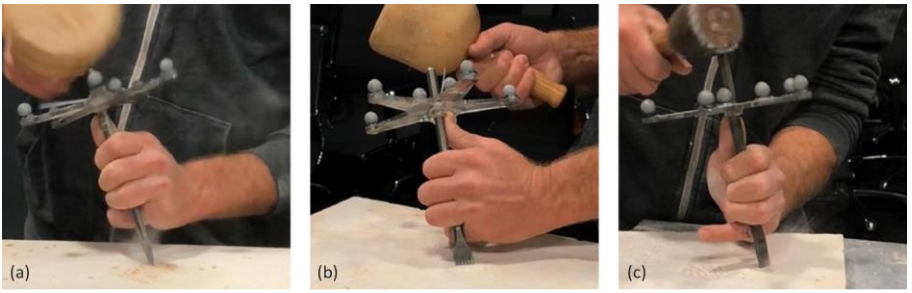

Figure 5. Documenting the three techniques using motion capture. Using the (a) pointed chisel, (b) toothed chisel, and (c) flat chisel (Shaked, 2019).

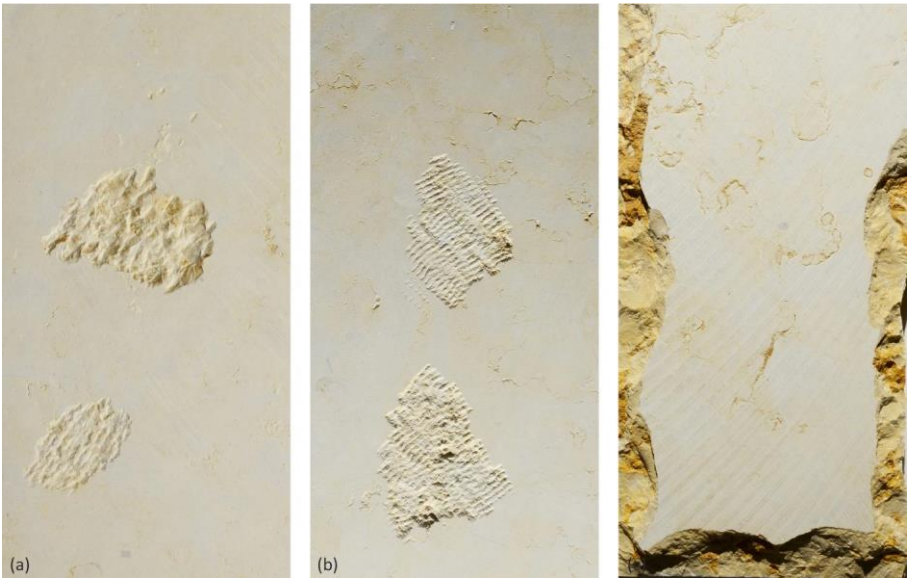

Figure 6. The respective outcomes of the carving sessions: (a) Taltish, (b) Musamsam, and (c) Tubzeh (MTRL, Technion, IIT, 2019).

An initial calibration session was performed, aligning the virtual and the physical tools. For statistical validity, each technique was recorded three times, producing nine data sets (Figure 7). The captured data includes the essential tool and pattern parameters (such as the chisel speed, carving path, and strokes). In the future, this data could amount to a digital archive of stone craftsmanship, which is particularly pertinent in the face of the craft's disappearance from the region.

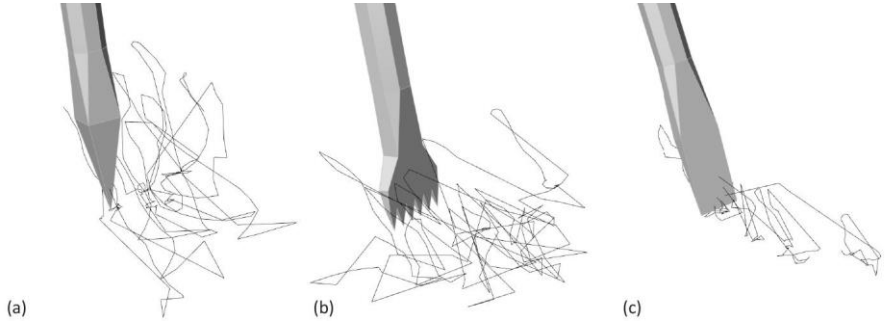

Figure 7. 3D visualization of the three techniques based on the motion capture sessions database. The lines mark the toolpath in space throughout each session. The position and orientation of each chisel are recorded in a 100hz refresh rate.

4.2 Augmenting

The documentation results were analyzed and translated into robot motion commands to enable augmenting the stonework. The robotic set up includes a KUKA KR60 industrial robotic arm mounted with a custom-designed, multi-chisel carving end-effector. The modular end-effector allows performing various carving techniques using a single end-effector and easily alternating between different chisels during a single carving session. In parallel, a custom application was developed to translate the documentation results to robot motion commands. The application derives the tool's motion in space from the craftsmen's gestures and converts them into a robot toolpath.

An artifact titled 'Augmented Stonework' is presented. It was created using the information gathered from the Taltish carving session. This information was converted into a parametric carving pattern, which could then be applied to multiple stone sizes and types. A block was then placed on an XY positioning table, and scanned to produce an accurate point-cloud, converted into a three-dimensional virtual model. Followingly, the carving pattern was projected onto the virtual model (Figure 8). The integrated model, including both the block and the carving design, was then used to produce specific robot commands for forming the object (Figure 9).

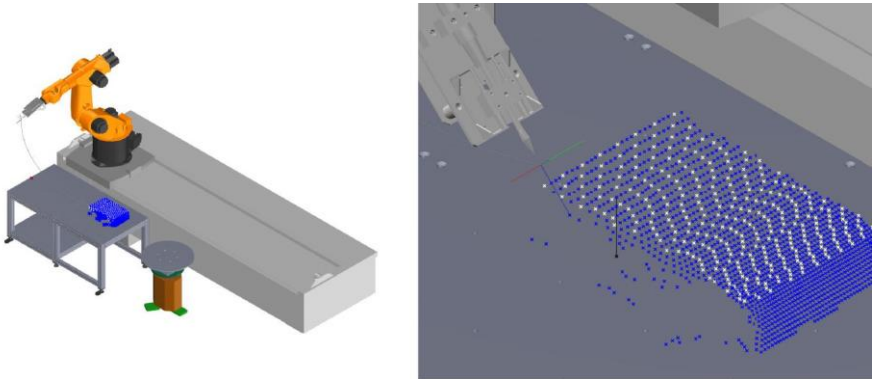

Figure 8. Carving pattern generated using the documentation phase data, projected onto a 3D scan point model of the material, and converted into robotic fabrication instructions.



Figure 9. 'Augmented Stonework' – A robotically produced element based on traditional regional stone carving techniques (MTRL, Technion, IIT, 2019).

4.3 Enhancing: Future Development Towards Autonomous Craft

Augmenting the craft allows for increased precision and repetition within the stonework process. However, achieving autonomy in craft relies on the ability to contain imprecision and handle variability. In stone carving, the craftsman analyzes the material's state before each stroke and positions the tool accordingly. This capacity for real-time material analysis is elemental to manual subtractive techniques. Therefore, the transference of traditional stone craft into a robotic fabrication protocol can go beyond documenting and augmenting – to enhance stonework with autonomous capabilities. In contrast to automatic processes that enable repetitive acts or motions, autonomous processes can facilitate the adaptation of robot gestures in response to changing material and environmental conditions.

To this end, the enhancement of robotic stone craft will include developing a sensor toolkit and a respective real-time communication protocol. The protocol will enable receiving input data from the external sensors and communicate it to the robotic arm – thus updating the virtual model and altering the initial prescribed motion plan (Figure 10). The received data will be translated to motion control via a series of pre-defined parameters based on behaviors defined in the case study phase. These parameters will determine the appropriate reaction to environmental and material information in terms of the robot's end-effector location, orientation, and actuation. Enhancing the robotic fabrication process will allow the robot to react to uncertain conditions during the fabrication process. For example, in the stonework case study – this could enable adjusting the chisel position, orientation, and stroke speed during the carving process according to sensory data - regardless of the initial motion plan.

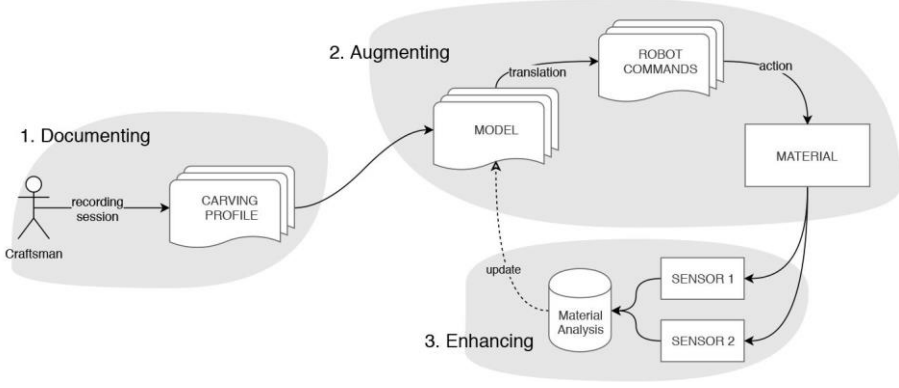

Figure 10. An autonomous fabrication process for dealing with material uncertainty (MTRL Technion IIT).

5. Conclusion

Transferring manual stonework to robotic craft requires a comprehensive understanding of the craftsmen's gestures and techniques. This need highlights the continuing relevance of

artisanal knowledge in an age of increasingly digitized manufacturing processes. In this context, the paper focused on human-robot regional stone craft transfer. Drawing upon historical records, it highlighted the link between the tool, the gesture, and the particular stone dressing characterizing this traditional practice. It proposed using industrial robots as a production platform and integrating sensory data and manual capabilities into architectural production to enable the documentation, augmentation, and enhancement of manual crafts through advanced fabrication.

Documenting and analyzing a stone craftsman at work was used for capturing this hitherto inexistent data about the specifics of the technique associated with each stone finish. The data then served as a basis for augmenting region-specific methods using a robotic arm. As the case study experiments demonstrate, detailed documentation can provide a foundation for autonomous stonework. Each case study coupled a carving technique and a tool-type, together with the respective robotic platform allowing the automated craft version. The presented protocols and resulting artifacts indicate the possibility to advance autonomous fabrication, not limited to stonework, but also to other forms of craft, as well as with a wide array of materials.

Stonework craft is traditionally passed on from father to son. With the prevalence of automation, the number of skilled workers diminishes, and the craft is on the brink of extinction. The research addresses this crisis by documenting the gestures of local craftsmen at work. The resulting database can be used in the future for historical and cultural preservation, as well as for training new craftsmen. This approach entails a new form of conservation for architectural elements while also providing ways for fabricating them. However, this capacity relies on examining the tools and techniques guiding craft and seeking a greater sensibility in their application. A full understanding of this can, in turn, help establish a more nuanced relationship between designers, robotic tools, and the matter at hand.

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Acknowledgements: The authors would like to thank the Azrieli Foundation for supporting this research; Yotam Carmel of Arco Planning, Preservation, and Restoration Ltd; and A. Grebelsky & Son stone manufacturers for sharing their expertise. The research was conducted at the Material Topology Research Lab (MTRL), Technion IIT.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Interface takes command. Educational environments, tools and practices to face the new normal.

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Abstract | The Covid–19 pandemic has underlined the new role of digital experience in everyday life. Nowadays, pedagogy and digital technologies should be investigated in order to educate young people to produce knowledge and not to uncritically consume digital products. The development of digital technologies like AR or VR – applied to teaching and learning – is providing an exciting opportunity to design realistic, authentic, engaging and extremely fun learning environments in a broad way. Because of this, the gap between physical places and virtual spaces seems to disappear. The interface between human and computer is an essential part of this process, providing technology accessibility and new approaches to learning and teaching. By the development of increasingly pervasive digital technologies, it is undeniable that the interface, from its first forms of GUI, to TUI, VR, or AR has become a tool capable to blend the differences between the two worlds – tangible and intangible – looking for a fusion that is very close at the moment.

KEYWORDS | INTERFACES, PEDAGOGY, NEW NORMAL, EDUCATIONAL ENVIRONMENTS, DIGITAL TECHNOLOGIES

Premise

The following contribution intends to provide an overview on the contemporary interface project as generator of environments in the educational field as answer to the new skill requested by the digital revolution society and the new normal after Covid–19 pandemic. In particular, paragraph two presents a theoretical overview and key to understanding the whole contribution; emphasis is placed – on the one hand – on the definition of interface as an environment and design of culture – on the other hand – we focus on the possible effects and potential of mixed reality interfaces in the field of education. Paragraph three – instead – presents a series of best practices related to the educational field divided by the ability of the interface to be a driver of environments or vice versa, by reviewing Tangible Interfaces projects up to immersive learning spaces.

1. Introduction

The Covid–19 pandemic, that has spread over the entire world since the end of 2019, despite being a purely health issue, has inevitably highlighted the role of digital technologies in the life of every single person inevitably (Ting, et al., 2020). If once, the World Wide Web was considered as a parallel world – in the dichotomy between the physical and virtual one – today we should assert the overcoming of this split in favor of a single hybrid world, the information society (Floridi, 2014) and the Mixed Reality (MR) world: a condition in which the digital information are totally pervasive and layered over the physical world (Resmini, Rosati, 2011). The need for social distancing, lockdown and all the prevention and containment measures against Covid–19 have influenced the social, cultural and behavioral aspects of all humanity (Nicola, et al., 2020).

For this reason, pedagogy and digital technologies should be investigated in order to educate young people to produce knowledge and not to uncritically consume digital products. No one can deny that smartphones play a central role not only in our lives but also in children's one (Maes, 2019). Digital Revolution is gradually changing different aspects of material and immaterial society by the ubiquitous Internet, IoT and ICT (Bollini, Caccamo, Martino, 2019). Nevertheless, as Maes states (2019), we live in an illusory dichotomy between parallel worlds: the tangible physical world and the intangible digital one mediated by a theatrical wall (Laurel, 2013) – the interface – enclosed in the palm of our hand.

On one hand, the traditional pedagogical systems seem to be unable to attract youngsters. Accustomed to look beyond the textbook, they are fascinated by what allows them to enter into the subjects. In order to do this, one of the keys is the use of non–invasive but additive technologies, such as Mixed Reality – AR or VR. The power of these technologies – applied to the environment – is their ability to design functional spaces based on physicality, construction and imagination (Ärlemalm, 2006; Fj⃠rtoft, 2004).

The development of digital technologies like AR or VR – applied to teaching and learning – is providing an exciting opportunity to design realistic, authentic, engaging and extremely fun

learning environments (Kirkley, Kirkley, 2004) in a broad way. Because of this, the gap between physical places and virtual spaces seems to disappear. During the last decades, different pedagogical approaches that combine technology and education have been developed, such as Digital Object Based Learning (Chatterjee & Hannan, 2015), Visual Thinking (Housen, 2002), and Digital Storytelling (Rappaport & Liguori, 2019). All these approaches are characterized by an active involvement of the people. In addition, it should be also considered how the web and related technologies affect the sensorial, perceptual and behavioral relation between children and educational objects.

2. Theoretical background and main concepts

2.1 Interface: a contemporary definition

Due to the strong influence of the disciplines from the Human Computer Interaction, the cognitive psychological to the engineering sciences (Pold, 2005), the concept itself of interface has been declined in its purely functional meaning, i.e., as the tool able to make man and machine communicate in order to achieve the intended task. This approach reflects the will of invisibility that Norman (1990) affirmed as the ultimate goal of achieving perfect affordance, underlining how the interface's problem is itself the interface (Norman in Pold, 2005). Nevertheless, neutrality is impossible. Because the interface "is designed within a cultural context and at the same time designs cultural contexts" (Interface Manifesto, 2015). This approach can be seen from the beginning of the Graphic User Interface. The interface design has always borrowed the concept of environment, first through rhetorical forms of spatiality – such as the WIMP interface – until today in which digital technologies such as Virtual or Augmented Realty allow interfaces to be designed as environments and to actually interact with the surrounding space. But is the interface an environment?

> "we look at interface as a thing, a representation of a computational process that make it convenient for us to interact with what is really happening. But the interface is a mediating structure […] it is a space between humans and procedures […] and determinates what can be done in any digital environment". (Druker, 2014, pp.138–139)

Drucker's theory (2014) turns out to be the natural evolution of the intuition that Gudrin (1989) had theorized. Gudrin – in fact – affirmed that different forms of interface – terminal, functional, software, dialogical – and ultimately social have followed one another in history, thus underlining its pervasiveness towards the environment. According to Manovich (2001) and as reiterated within the Interface Manifesto (2015) today we could say that the interface – in a broad sense – has reached the level of Culture, as it is not a mere tool of *man–machine communication* but has become the main communication medium between men (Johnson, 1997), as well as a tool capable to design culture. More than before – due to the Covid–19 pandemic – we use the interfaces to talk with other people through social media, discuss

about works by Skype and produce culture, for example digital art, books and so on. Finally, we design interfaces by using other interfaces (Manovich, 2010).

From a metaphorical point of view, analyzing the relationship between interface and environment, we could also introduce the terms of movement and corporality in the use of the interface. In general, the design of a GUI or of the UX of a digital product is nothing more than the design of the movements in a given space – virtual or not – of a single or multiple users. Laurel (2013) in this regard, creates an interesting parallel between the interface design and the theatrical project. Analyzing, in fact, it is possible to find at least three points of contact between the theatrical world and the interfaces one: stage / background, interaction, metaphor. Both show a touch point, in which the action takes place (the UI), and a backstage, which supports the structure (the architecture and the back end). From the interaction point of view, this process – in the theatre – can be seen both as the interaction between the actors on the stage and also on the empathic relation between actors and public/user. In the interface world, this process is attributable to the design of the interaction. Lastly – the clearest – theatre and interface, as mentioned, are based on rhetorical systems able to reflect us from one world to another, managing to break down the barrier as long as they are used.

Thanks to the development of increasingly pervasive digital technologies, it is undeniable that the interface, from its first forms of GUI, to TUI, VR, or AR has become a tool capable to blend the differences between the two worlds – tangible and intangible – looking for a fusion that is very close at the moment.

In order to understand the relationships between digital physical and digital environment, it is necessary to mention the "*Reality–Virtuality Continuum*" scheme by Milgram (1994). The scheme is a scale that moves from a completely real environment up to a completely virtual one. The space between physicality and its virtualization of the environment is defined by Milgram: *Mixed Reality* (MR). It is the place of interaction and intersection between the real environment and the virtual one at progressive point mitigated by technology. Using Mixed Reality, the hybrid real–virtual environment takes concrete form, and the interface becomes a generator of environments.

The interface is a *media* (Manovich, 2001), which mediates and filters between data, algorithms, coding languages and humans. It is a *cultural action* in which we produce culture using interfaces (Manovich, 2010) and form the world. For this reason, the Milgram scheme can be updated with the Mann scheme (2006) in which the mediation value of technologies respect to the environment is highlighted. It is a matrix system that shows the greater complexity of the physical–virtual relationship, compared to a "purely" linear system. We live thought interfaces and thanks to them we communicate, work, get excited, learn and grow (Pold, Anderson, 2018). More and more information will be accessible to us. Only by the use of new forms of MR, we'll be able to balance the constant growth of knowledge, accessibility and dissemination of contents (Samit, 2019), thanks to an intelligent environment able to communicate with us. Starting from these considerations, it is

deducible that education could be seen as a fertile ground for the applications of MR technologies.

2.2 The interface as driver for education

Contemporary society – called society 4.0 – is the society of the digital revolution. Increasingly accessible technologies that allow us to open new horizons and new ways of living and experiencing life. A complex society that requires inhabitants to have complex skills accessible to everyone. There is a evident research for innovative pedagogical tools to meet the skills demand of the current and future society. As stated by Fullan & Langworthy (2013), interesting and new forms of pedagogy are taking hold thanks to the intersection of *design–technology–education*. In this context:

> "The interface between human and computer is an essential part of this process, providing technology accessibility and new approaches to learning and teaching" (Starčič, Turk and Zajc, 2015)

In fact, today, we are able to understand and shape the surrounding world by interfaces (Interface Manifesto, 2015). The new digital technologies open up new scenarios and contexts of education that move away from the classroom format (Starčič, Turk and Zajc, 2015), to different, customized and immersive realities, both in term of content and users. Among these, the growing demand for personalized educational supports within museum contexts capable of implementing curiosity, attraction and developing critical thinking through a re–reading of the collections present in museums (Poce, Amenduni, De Medio, Valente and Re, 2019).

Education should be considered the basis of a society that aims to create a better, sustainable, responsible and conscious future (World Economic Forum, 2018). Education is the first step towards evolution. As can be read within the programmatic lines of the Italian Digital Schools National Plan (Piano Nazionale Scuola Digitale, 2015), the introduction of digital technologies in the educational field is first and foremost a cultural action, based on a new concept of school intended as an open space for learning and not just a physical place. In this paradigm, technologies become enabling, daily, ordinary. So, Do MR interfaces enhance education?

Educators who see technology in action immediately recognize its potential to engage, educate and entertain (Parlier, 2019). There is numerous scientific literature that testifies the use of Mixed Reality technologies in educational contexts. Nevertheless, the state of current MR research for education is still in its infancy (Bacca, et al, 2014; Wu, et al., 2013, Cheng & Tsai, 2012). According to (Nincarean et al., 2013) despite of the numerous previous studies have shown a positive impact and encouraging results in the use of MR technologies in the educational field, scientific research must now move towards a pedagogical and learning theory linked to the implementation and development of MR tools. The educational value of digital technologies such as virtual, augmented reality and so on, cannot be based

exclusively on their specific characteristics. Many themes must be investigated in terms of aesthetics, characteristics and peculiarities that these technologies can give compared to other mediums (Bacca, et al., 2014). First of all, the interaction–relationship with the surrounding space. The study conducted by the Computer Education and Instructional Technologies departments of the Universities of Kirikkale and Gazi in Turkey (2017), highlighted the pedagogical role of the introduction of the MR in the band called K–12 of teaching. Within the research work, different AR applications in education were analysed and the potential of new digital technologies has been brought to light. In the report, citing Chang et al. (2014) it is found that AR is able to increase the level of attention towards the topics covered. In another study by Dunleavy et al. (2009) – contained in the Turkish research project – AR technology via mobile device has facilitated collaborative learning in hybrid learning environments. Lastly, Liu and Thai (2013) through a multisensory AR system based on the sight, hearing, speech and movement of the whole body of the students, were able to increase the physical activity of the students by improving their motor skills.

The possibilities offered by these technologies allow to increase the knowledge of traditional supports, which as stated by Sun, Wu, Fan, Dong (2019), are bound to the limits of the two dimensions, favoring instead a third or even fourth dimension, in order to boost imagine engaging, immersive and multimodal learning processes. In fact, the power of MR technologies resides in the local ability to generate environments with latent information and content (Samit, 2019).

> "Learning becomes more enjoyable and effective, even when it comes to exploring and knowing abstract concepts or complex phenomena, and this thanks to the possibilities of visualization and realization of the concepts that this technology makes accessible to the learner". (Klopfer & Squire in Elmqaddem, 2019, p. 238).

If on the one hand the need for a tangible experience is highly recommended, at the same time it is required to innovate pedagogical tools capable of making the best use of the power that new digital technologies expect to have. Products and environments developed in MR – as we will see in the examples in the following paragraphs – could become the test of the new way of experiencing a complex reality in a digital society on top of the maturity (Baricco, 2018) made of the info–tangible diversity and the info–intangible one. Therefore, the role of educational interfaces in MR becomes transmitting culture, which in accordance with Bruner (1996) is the "toolbox" given for adaptation to civilization, a way of solving crises and problems.

3. Best practices and state of the art

The interface – as stated in the previous paragraphs – shows capabilities that go beyond mere functionality. It constitutes the main medium of contemporaneity (Andersen, Pold, 2018) and the most important cultural form of our century (Johnson, 1997). The strength of the interface lies in its ability to be multi–media, i.e., in its nature of re–mediation (Bolter,

Grusin, 1999) of classic and contemporary media – texts, images, videos, sounds within a new form and attractiveness. It is no coincidence that we understand how education – driven by the need to innovate its pedagogical protocols – sought to make use of the interface as a pedagogical driver. Education, in fact, places in the interface the value of cultural leverage and promotion of critical thinking, analysis, and in general, of the new contemporary skills.

The interfaces that will be presented in the following paragraphs can be represented by an inversely proportional linear scheme in which the relationship between environment and interface is interpenetrated and modulated. If on the one hand, the Tangible User Interface, have the ability to generate and control a digital interaction environment through the manipulation of reality (Ishii, 2006), on the other hand, multisensory environments and in general the interactive environments make use of the environment itself to become the interface with which the user can interact both physically and emotionally. Both forms start from the consideration of the role of the sense and of the body in the interaction and educational process (Kim & Maher, 2008), demonstrating effectiveness in terms of cognitive impact, improvement of analysis and criticism skills both in standard subjects and in subjects suffering from cognitive disabilities. Movement is an integral part of a child's psycho–physical process. Since "it is not enough to simply accept that play is important in education" (Waller et al., 2010), it is necessary to rethink what it represents for a child to play in the 21st century (Änggård, 2017).

3.1 When an interface acts as an environment

The ifs | 2020

Gaming is a fundamental activity for the solid construction of bases capable of increasing various factors of brain development, both as regard social and communication skills, as well as emotions and cognitive and physical abilities (Mastrangelo, 2009). The ifs [1] is a project currently in the crowdfunding phase, which compared to the following cases is characterized by its totally tangible nature. The educational set has the aim of teaching the basics of coding without the use of digital displays, but by using tactile interfaces only. As we can guess from the name – the Ifs – the logic of the game is to convey the concepts of action and reaction – if and then – through the intrinsic perceptual characteristics of the individual robots: sensitivity to sounds, touch, light. By leveraging imagination and creativity, children have the opportunity to learn coding and improve logical thinking, teamwork, creativity and notions of robotics. The robots can be programmed both in the *IF* condition and in the *Then* condition, thus increasing the possibilities and combinations of interactions [2].

[1] www.theifs.cc
[2] https://youtu.be/AcZlN3hAf6k

Tangiplay | 2019

Computational thinking is recognized as a necessary skill for everyone (Wing, 2006), by virtue of this, there are numerous products that, by an analog / digital relationship, teach the foundations of a new language that is an integral part of the digital literacy of the new generations. Within the range of products available on the market, Tangiplay [3] is certainly one of the most interesting. Developed through a crowdfunding campaign in 2019 and winner of the IF Design Award 2020, the game aims to teach the fundamentals of coding – sequencing, condition, function, loop – using coloured puppets as physical controllers of the activities available on the tablet. Children – from 4 to 12 years old – have the task of designing a railway track capable of going from point A to point B: the metaphor of a code string. The individual puppets – chromatically divided by function – are used as programming elements, defining the route that the train will have to take. When they press, slide, or rotate the robot, this translates into code that creates a unique response in the game. [4]What children do is the logical transcription of an algorithm, understanding the logical basis of the coding language.

Project Zanzibar | 2018

The blending of physical and digital interfaces has the promise of creating more fluid, dynamic, and ultimately engaging user experiences (Spadacini, McDonald, 2017). This is the goal that the Microsoft Research team has set itself in the development of Project Zanzibar [5], unveiled in mid–2018. The idea of the project is that of a polymeric capacitive platform – a sort of flexible and portable pad – capable of detecting objects, connecting them and perceiving their contact with the user's hand. The technology behind this project is a combination of capacitive sensing and the NFC protocol, allowing the touch and mouse to coexist with the manipulation and control of physical objects. Every single object present in Project Zanzibar is listed through a unique ID, which is therefore able to keep track of all data – movement, rotation, pressure – thus archiving the history of the individual object. Children use the individual objects on the pad as a tangible interface by manipulating and controlling the related digital avatars on the pad. In addition to semantically neutral objects – therefore capable of being used within the platform without alternating their content – there are semantically active objects, whose presence changes the digital environment. The introduction – for example – of a palm–object interferes in the digital context by changing the scene [6].

[3] www.tangiplay.com
[4] https://youtu.be/QjyzutQU0v0
[5] www.microsoft.com/en–us/research/project/project–zanzibar/
[6] https://youtu.be/4Gl6iaVXZu0

3.2 When an environment acts as an interface

In Tune with Nature | 2019

Museum systems are among the most active promoters of new technologies related to the learning and use of cultural content (Poce, Re, Amenduni, De Medio, Valente, 2019). Immersive and augmented experiences are now proposed to different target users with the desire to enrich the cultural heritage of the museum itself. Outdoor contexts are re–proposed in a digital key, offering learning opportunities and thematic focuses that are not always achievable through a purely tangible experience. With this in mind, the project created inside the Cayton Children's Museum in Santa Monica, entitled In Tune with Nature[7] should be read as an immersive room in which experiencing the natural cycles of day and night. The underlying technology is the consolidated projection mapping with motion sensing. Children find themselves projected into different natural contexts, analyzing and understanding the changes in the elements over time [8]. In addition to the interaction factor, the work done – in terms of the visual language of the illustrations – is interesting: combining fidelity of detail with formal dryness.

Interactive Immersive Classroom | 2018

The educational environment par excellence – the classroom – is also undergoing a revolution thanks to the advent of digital technologies (Oke, A., Fernandes, F.A.P., 2020). In fact, we are moving from a purely frontal form of teaching to an "experience" of teaching that involves all the senses to improve attractiveness and critical thinking. This is the mission of *Interactive Immersive Classroom* [9] a teacher–friendly system that offers customized experiences for teaching. The strength of the project lies both in the availability of content – opensource library, as well as content selected from streaming platforms such as youtube.com – and in the total immersion of the classroom. The system is also extremely flexible based on the contexts of use, meeting the different architectural settings that arise from time to time within the schools. Designed for the teacher, it becomes an active teaching support for selection – display – validate the teaching content. Furthermore, immersion guarantees a high level of engagement and attention threshold, managing to effectively convey complex concepts, for example regarding the teaching of STEAMs[10].

Lü – Interactive Playground | 2017

Interactive projection mapping systems combined with motion capture are certainly not new in the education sector. Despite this, the Lü – Interactive Playground [11] project has two important structural features: on the one hand, the possibility of adapting the technological

[7] www.ideum.com/portfolio/in–tune–immersive–room
[8] https://youtu.be/TqRu–oGFM6I
[9] www.immersiveclassroom.one
[10] https://youtu.be/TCD3H70o5B8
[11] www.play–lu.com

configuration according to the needs of the space in which it will be installed, and on the other, to offer a very wide platform of activities that allows educators and children to always make new experiences. Through the combination of projectors, XBox Kinect, and sound and light systems, Lü allows to increase the canonical environments of the school – like a gym – without altering the physical–spatial structure. Depending on the configuration chosen, it is possible to obtain more or less immersive environments in which children can play interacting tangibly with the contents projected on the walls. It is possible – for example – to play an off–scale version of space invaders by using a ball as a weapon to destroy spaceships [12]. The goal of the project is to create new pedagogical forms, looking for a fruitful relationship between mind – body – emotions.

4. Conclusion

What has been described is intended to be an attempt to reconstruct a conceptual framework and a preliminary state of the art regarding the design of digital supports for the implementation of contemporary pedagogy. In particular, it emerges how much Design – can be an interpreter of contemporary processes and a "designer" of languages, able to adapt the interaction to the new pedagogical needs that characterize "society 4.0" in terms of critical, analytical and coding skills. The cases described, show that It is necessary, and it is possible, to bridge the gap between physical and virtual fruition, leveraging the elements of storytelling, involvement, interaction and experience, in order to develop fundamental skills in people – such as Critical Thinking (Poce & Re, 2019) – in educational context.

It is deduced that the big question is how to generate awareness and knowledge – with all the appropriate afferents – in the new generations through new educational approaches that integrate physical spaces with virtual interactions, educating – correctly – to a new way of conceiving the complexity of reality.

One possible strategy is to make a transposition from the video–gaming world to the educational ones through the application of gamification principles (Tayara & Yilmaz, 2020). These principles – leveraging the conceptual aspects of the game – allow to generate involvement and interest in a given theme, through narratives, the use of achievements, rewards and immersed environments. At the same time, they stimulate the so–called skills of the 21st century: Critical Thinking, Creativity, Communication and Collaboration (Qian & Clark, 2016)

The touch points between tangible and intangible – as seen in the examples shown – confirm that the interface is not really tending to disappear – as stated by Norman (1990) – how much it has managed – breaking the screen – to break the so–called "fourth wall"

[12] https://youtu.be/qAaZ7–fJv0s

(Caccamo, Mariani, 2020) of its theatricality, opening to a new era of interaction that involves all the senses and the surrounding space thanks to technologies.

The cultural sector – schools, museums, theatres, cultural centres – had to face the question of remote or hybrid fruition both for economic reasons and mainly because of the role of Culture as an integral and fundamental part of people's lives; as never seen before – due to the Covid–19 pandemic – *Culture* had to convert and adapt its way to communicate and mediate information to a new reality (Shaker, 2020).

So, If – therefore – reality and virtuality can coexist thanks to the development of digital technologies, design the education of the new normal will mean designing interfaces: tangible, multimodal, widespread–accessible and narrative (Caccamo, Mariani, 2020).

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Intelligent Voice Assistants: A Review of User Experience Issues and Design Challenges.

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Abstract | In recent years, voice interfaces have become the primary interaction modality with virtual assistants. While such interfaces have been advertised as a natural way to communicate with virtual agents, research has highlighted a number of issues related to voice-based interactions. Despite the abundance of commercial voice assistants, the groundwork concerning how they should be designed is still missing. Therefore, the need emerges to face the specific challenges of this novel interaction paradigm. As a contribution to the debate, a literature review on domestic voice assistants has been performed. The review follows a framework structured around three lenses: theoretical discourse, user experience, ethical issues and concerns. As a result, six design challenges have been identified. Such challenges represent spaces where design can intervene to improve voice assistants and to mitigate some of the issues stemming from their current design.

KEYWORDS | VOICE-BASED INTERACTION, INTELLIGENT VOICE ASSISTANTS, USER EXPERIENCE, ETHICS, DESIGN CHALLENGES

1. Introduction

Research on Artificial Intelligence traces its roots back to the 1950s. Machines that can interact with humans via “natural language” have a considerable heritage in both fiction (e.g. HAL 9000 from 2001: A Space Odyssey, KITT from the Knight Rider series, and JARVIS from Iron Man comics) and research. However, only in recent years have voice-based user interfaces matured enough to be embedded into many devices we interact with daily, from smartphones to televisions to cars.

More recently, voice has become the primary interface for standalone screenless devices such as Amazon Echo and Google Home. Typically, such devices are described as systems embedding virtual assistants that answer users’ questions, connect to and control multiple applications. These voice-activated devices, also called Intelligent Voice Assistants (IVAs), are making smart homes popular across millions of households in the US, Europe and Asia (Lima et al., 2019).

1.1 Intelligent Voice Assistants

Intelligent Voice Assistants (IVAs) - also referred to as Intelligent Personal Assistant, Virtual Personal Assistants, Personal Digital Assistants, Voice-Enabled Assistants or Voice Activated Personal Assistants - to name a few, support conversational interactions, most often with limited visual feedback. Placed in the home environment, they are designed to be “always-on” and “always listening”, although they engage in interactions only when prompted by users through specific keywords or sentences (e.g. “Hey Google”). From a technical viewpoint, they combine speech recognition, natural language understanding, dialogue management, language generation and speech synthesis to understand and respond to users’ requests. In general, IVAs process a wide variety of verbal instructions to, e.g., run Internet searches, access information and multimedia contents, or compose text messages.

Voice interfaces have been advertised as a natural way to interact with virtual assistants. However, several interaction problems with this type of interface have emerged, as discussed in both academic research and public debates, especially online. According to Murad and Munteanu (2019), while affordable commercial voice-based devices abound, the high-level groundwork concerning how they should be designed is still missing. As a result, there is a lack of specific design principles and usability heuristics for IVAs. Therefore, the need emerges to face the specific challenges of this new interaction paradigm, and to adapt existing heuristics and design guidelines to such emerging field.

2. A review of Voice Assistants

As a contribution to the current debate on IVAs, we have performed a literature review on domestic voice-based assistants, using a specific set of keywords to search the ACM Digital Library. As a result, a final selection of 40 papers and journal articles, all published in the last five years, have been analysed. The review was structured around a framework composed of three lenses.

The first lens examines the theoretical discourse around voice assistants: how they are designed and advertised, their potential benefits, what users expect from them. The second lens scrutinises the user experience of voice assistants. Through it, we have collected and organised outcomes from the growing research that analyses the interaction between users and IVAs in practice. The third lens covers emerging issues related to the use of voice assistants: from usability problems, up to social and ethical concerns. From this analysis, six challenges have emerged in relation to the design of such systems. They are discussed in the final section of the paper.

2.1 First Lens: Theoretical Discourse

In this section, we have summarized contributions by three influential groups of stakeholders (Krippendorff, 2005) of voice assistants: companies who design and manufacture them, users who buy them, and researchers who study them - mainly HCI scholars. Each group provides a specific point of view on the (expected) features and (potential) benefits of voice assistants, which also affects the intentions and expectations of the other two groups.

Manufacturers' intentions

IVAs interfaces are modelled after the human-human conversation metaphor (Branham et al., 2019). By analysing users' reviews, Purington et al. (2017) conclude that *personification* of the voice assistant is a marker for satisfaction. Therefore, it is not surprising that companies try to increase the probability that users personify their virtual assistants. In order to achieve this goal, and to make the conversation feel human, IVAs need to showcase unique personalities while interacting with users. To design these systems, designers define a persona (i.e. the personality and profile of the virtual assistant) and then outline their talking style, voice tone, and detailed scripts accordingly. Designers also define the details of a possible interaction, foresee the actions and reactions of the users, and design the reactions of the virtual assistant according to the situation (Lee et al., 2017).

As stated by Branham et al. (2019), who reviewed the design guidelines by five top manufacturers, voice assistants are also designed to carry on personal and efficient conversations. In order to maintain the conversation *personal*, the guidelines suggest the use of contextual data to cooperate with the individual. This includes remembering past conversations, especially if there is "static information and frequent actions" that will likely

recur. For the sake of *efficiency*, voice assistants are designed to keep the conversation short in length and low in complexity, to avoid cognitive overloads on the user's side.

Users' expectations

The ability of IVAs to manage dialogues in a "natural" manner (i.e. fluid, simple, effortless) is at the heart of the promotional discourse surrounding them. Therefore, one of the most spread (and mismatched) users' expectations when buying a voice assistant is that there would be no need for them to learn how to interact with it. Users expect the conversation to unfold naturally, as it happens in a regular human-human conversation. They do not expect the assistant to behave inconsistently, although that is often the case.

As maintained by Kocielnik et al. (2019), users' expectations on AI-powered solutions tend to be inflated; however, there has been little work on designing methods for setting more appropriate expectations. This mismatch between users' expectations and IVAs actual performance carries the risk to decrease users' satisfaction.

Researchers' insights

According to studies performed on IVAs, the possibility to enable hands-free interactions is one of the most important benefits of speech recognition technologies, due to different reasons. Hands-free interactions allow users to use the system even when they have their hands and eyes engaged in a primary activity. Moreover, voice inputs enable users who cannot write to access digital contents and to collect information from the Internet. This could impact large numbers of potential users, such as pre-school children and illiterate people. According to Lima et al. (2019), the rapid diffusion of voice control systems will particularly impact countries where a large part of the population is functionally illiterate.

Finally, some categories of elderly people or people with disabilities, in particular mobility or dexterity impairments, can be empowered by voice-based interactions (although people with speech disorders might be excluded). Despite this potential, as claimed by Branham et al. (2019), voice assistants are currently being designed with white, well-educated, young or middle-aged, able-bodied users in mind.

2.2 Second Lens: User Experience

The spread of voice assistants in millions of households raises several questions about the kind of experience users have while interacting with them. What is the nature of people's interactions with these assistants? What kind of relationship do users' have with them? Are users' expectations met, and how?

Through our second lens, we reviewed studies exploring these questions, to gain a better understanding of the actual user experience with voice assistants. We focused our analysis on two main aspects: the personification of these systems and what it entails in terms of user experience; how voice assistants match (or mismatch) users' expectations.

The Personification of Voice Assistants

Voice assistants' ability to talk can lead users to personify them, although studies diverge in their assessment of how pervasive this practice is (Branham et al., 2019).

Lopatovska and Williams (2018) performed a small qualitative study on users' tendency to personify Alexa. Their results show that less than half of participants engaged in personifying behaviours with this IVA, and such behaviours could mainly be explained as "overlearned social mindless responses". In other words, users automatically responded to human-like expressions and language, without engaging in actual, meaningful personification.

The study conducted by Pradhan et al. (2019) on elderly people living alone suggests that someone who is in need of social interactions may be more likely to personify a technology, and, at times, seek social connections through it.

Porcheron et al. (2018) performed a qualitative study on the everyday social practices of households interacting with Amazon Echo. The study sheds light on the complexity of users' relationships with such systems. Indeed, Echo is "recruited" and engaged in the intricate communications and actions, which are at the basis of the family everyday life. In this respect, the researchers observed that the use of Echo is embedded in the social order that the family members produce and live upon.

Users' Expectations Mismatch

Recent studies conducted in household settings have highlighted how IVAs can generate the illusion of natural conversations. In this respect, human-like traits attributed to IVAs play a dual and contradictory role. On the one hand, they engage users in interactions. On the other hand, they cause users to overestimate the assistants' intelligence, creating false expectations about their performance (Cambre, Kulkarni, 2019). In this regard, the most common technical challenge for voice assistants is speech recognition. In a study performed by Cowan et al. (2017) on a group of 20 Siri infrequent users, several problems with users' accents and language comprehension emerged. Participants in the study provided many examples of how Siri did not accurately understand what they said.

Velkovska and Zouinar (2019) highlight issues connected to the use of indexical terms by users when interacting with their voice assistant. Indexical terms refer to contextual elements (such as "here" or "it") that voice assistants are often incapable of understanding. In the same vein, Lee et al. (2017) mention that voice assistants receive not only simple commands from the user, but also several emotional inputs including rough and aggressive tones. Voice assistants' inability to understand the context and the user's emotional state is considered one of the biggest challenges for these systems, because it can undermine the quality of the user experience.

Participants also mentioned several strategies they used to prevent speech recognition mistakes, such as avoiding idiomatic expressions and speaking very slowly.

Branham et al. (2019) affirm that voice assistants, which are optimised to comprehend young adult and middle-aged voices, can have interaction problems with non-standard users' categories (e.g. elderly people and children). Moreover, for users with cognitive impairments, the average duration of the conversation is problematic: researchers who studied populations with speech impairments, e.g. Alzheimer's disease, and intellectual disabilities, have shown that the current timeout period of IVAs is insufficient for these users to utter their voice command. Users with visual impairments also found the timeout frustrating, but for a different reason: it limits their ability to input longer and more complex voice commands, which they are more used to adopt in human-human interactions.

2.3 Third Lens: Ethical Issues and Concerns

The spread of IVAs raises a variety of social and ethical concerns. In this section, we elaborate upon these aspects.

Reinforcement of Gender and Cultural Biases

The sound of voice conveys a diversity of cues that humans are naturally predisposed to recognize. They include the speaker's gender, age, and personality (Cambre and Kulkarni, 2019). The use of female voices in IVAs raises controversy over gender discrimination and stereotype reinforcement. As maintained by Søndergaard and Hansen (2018), voice assistants give shape to the dominant narrative of "female servants and secretaries that are part of our collective imaginings" (p. 878). In addition to using words that can be ascribed to women, Alexa also reproduces expressions that can be associated with people with a low social status (Habler et al., 2019). When voice assistants are designed with gender stereotypes in mind, such stereotypes will be reflected in the assistant's "personality". As a result, pre-existing biases and stereotypes of people interacting with the assistant will be reinforced and amplified.

IVAs can also carry cultural biases. Lima et al. (2019) conducted an experiment aimed at understanding whether the user's gender and accent influence the quality of the interaction with the system. Results suggest that accent and mispronunciation due to regional and socio-economic differences significantly affect the quality of speech recognition.

Consequences on Human-Human Interactions

Can the interactions that users have with digital artifacts affect the way users interact with other human beings? This social issue is raised by Habler et al. (2019), who investigates the effects of gendered voices and language on the perception of voice assistants like Siri, Alexa, Cortana, and Google Assistant. Results show that virtual assistants with low status language were associated with higher performance and received higher ratings by participants, as such IVAs apparently better conveyed the metaphor of obliging assistants.

Lovato and Piper (2015) raised the issue of how question-asking behaviour in children can be influenced by the use of this technology. If children begin to see IVAs as potential sources of answers to their questions, how would that affect the relationship between children and

their parents? Moreover, the authors argue that there is the risk that children "establish a master-servant relationship with robots that could bring about negative developmental outcome", based on the results of previous studies on children-robots interactions.

Privacy

The rapid spread of virtual assistants raises social and ethical concerns also in terms of privacy and security. Firstly, IVAs are designed to be "always-on" and "always-listening", posing serious privacy concerns. Moreover, Mitev et al. (2019) report on recent multiple attacks - consisting of unauthorized commands - against devices that utilise voice-based UIs. To check the level of security of Alexa, the scholars designed and implemented an attack to Echo's smart lock and home security system. Their experiment demonstrates that it is possible to bypass the security features of the system by implementing malicious "skills" (i.e. software extensions that can be developed by third parties to, e.g., control household appliances or call delivery services).

Technology Anthropomorphism

Serious ethical concerns arise when technology imitates human-human conversation – the human voice in particular – to such an extent that users are driven to wonder whether they are interacting with a real person or a machine. In this regard, Google recently introduced a speech synthesis engine and dialogue system able to book appointments over the phone in place of the user. The system was so human like that Google had to add a feature to let the person at the other end know they were talking to an artificial system (Aylett et al., 2019).

At a social level, anthropomorphism of technology can have both a positive and negative impact. Positive aspects include therapeutic benefits for certain user groups. Negative consequences refer to reduced human-human interactions and the danger of manipulation. For instance, users who tend to personify their voice assistants might be more likely to share personal information with them (Pradhan et al., 2019).

3. Six Design Challenges

Based on the features of IVAs and the issues emerged in our literature review, a number of design challenges have been identified. Hereafter, we illustrate six of them, which, based on our analysis, are the most significant ones. In our view, these six challenges represent spaces where design can intervene to improve IVAs and to mitigate some of the issues connected to their use.

1st Challenge: Questioning the Human-Human Conversation Metaphor

As identified in our second lens, voice assistants' responses do not necessarily follow the human input in a coherent way, making the interaction substantially different from the human-human one. This mismatch between users' expectations and system performance

may affect people's experience and their level of satisfaction (Cowan et al., 2017). This is the reason why Porcheron et al. (2018) reject the idea, popularized by the dominant promotional discourse, that voice assistants are "conversational" in nature and that the interaction with them is a "true" conversation.

Drawing on prior work about the needs of people with visual impairments, also Branham et al. (2019) critically assess the taken-for-granted human-human conversation metaphor, arguing that it restricts usage from a variety of user categories, including people suffering from blindness. The researchers solicit more inclusive interaction models, especially with respect to elements such as conversation length, complexity, and speed. According to them, not only people with visual impairments, but also other groups of users with disabilities would benefit from IVAs that adopt such an inclusive approach.

It follows that developers should consider carefully whether humanness is the right metaphor to adopt when designing a voice assistant.

2nd Challenge: Designing for Situated Interaction

The interaction between the user and the voice assistant unfolds in a specific context of use, which implies a specific set of cultural values. This cultural milieu influences the user experience and therefore needs to be considered when designing voice assistants.

According to the analysis performed by Velkovska and Zouinar (2018), the inability of IVAs to be context-aware is one of the main usability issues currently faced by developers. To improve conversational technologies, two areas of interventions are addressed. The first consists in allowing users to understand the source of the problem both when the system gives a wrong answer and when the system is unable to respond. The second consists in helping users formulate their commands effectively.

Linguistic factors also play an important role in the user's perception and expectations. For example, research has shown that people prefer devices that use an informal language, and that preferences on gender and personality vary depending on geographical regions and languages (Cambre and Kulkarni, 2019). It is in these elements that the complexity of designing voices for smart devices across cultural contexts lies.

> "For example, the word for "dishwasher" is masculine in Spanish, yet feminine in German. Would these linguistic cues make it more likely for a Spanish speaker to expect a male voice from a smart dishwasher, and more likely for a German speaker to expect a female voice from the same smart dishwasher?" (Cambre and Kulkarni 2019, p.10).

The authors conclude that there is no globally optimal voice for a certain device that obtains users' liking across different cultures.

3rd Challenge: Aligning Users' Expectations and System Behaviours

It is well recognized that the user experience of a system cannot be evaluated considering only performance or usability (Gürkök et al., 2011). Indeed, such evaluation is highly influenced by prior user expectations as well as by the specific context of use. The findings of a study performed by Kocielnik et al. (2019) show that shaping users' expectations correctly can be an effective way to improve user's acceptance of AI-based solutions.

The alignment of users' expectations with the actual system behaviour is the focus of a study by Azmandian et al. (2019). Based on their results, the authors acknowledge that designing the behaviour of virtual assistants is a challenging problem: the alignment of end users' expectations with an agent's actual behaviour is indeed influenced by many factors. What makes it harder for designers to address the issue is that, in any specific interaction, there may be more than one correct answer regarding how an agent should behave. Indeed, even if designers purposefully create personas to attain a desired user experience, the same persona will be perceived differently by different users. This is the concept of second-order understanding, well-illustrated by Krippendorff in his semantic turn (2005). Therefore, designers should include the perspectives of end users in the persona-creation stage, gathering viewpoints related to what different user groups or individuals might expect from their voice assistants (Pradhan et al., 2019).

4th Challenge: Is Voice just Voice?

Cambre and Kulkarni (2019) investigate how users would react if the IVAs' voice were gender neutral. Some researchers have already proposed gender-neutral voices for voice interfaces. We might also question the choice of replicating a human voice in virtual assistants, instead of having a deliberately robotic type of voice. Non-human voices may indeed mitigate some of the issues related to the mismatch of users' expectations and to the reinforcement of cultural biases and gender stereotypes.

According to Kim et al. (2018) the single-medium, voice-based communication limits expressiveness and richness of information. In their view, IVAs designers should explore multimodal interaction modalities. They propose, for instance, adopting tactile forms of interaction to enrich people's experiences with IVAs.

5th Challenge: Designing for Embodied Interactions

To date, designers and researchers have largely focused on the conversational aspects of voice assistants. What has been neglected is the form and embodiment of this technology, as well as how that makes a difference in the user experience. Cambre and Kulkarni (2019) believe that, besides the specific context of use and the characteristics of the voice interface, the user experience is also "shaped" by the physical dimension of the devices. Therefore, form, aesthetics, and physical features do influence the resulting experience of users.

According to the them, adopting a human-robot interaction (HRI) perspective would offer a more holistic approach, since HRI merges embodiment and voice in its research.

6th Challenge: Taking a Political Stance

As maintained by Søndergaard and Hansen (2018), voice assistants are neither innocent nor neutral: regardless the actual awareness of their developers, they are political entities that raise ethical and philosophical issues. Such issues should be addressed and acknowledged by all the stakeholders we analysed in our first lens (manufacturers, users, and researchers) but above all by researchers and designers.

Aylett et al. (2019) claim that the mere analysis of the systems in place – as most researchers have been doing – is not going to innovate IVAs. Researchers and designers should take an active role in questioning the status quo, also by developing provocative and critical artefacts that challenge the dominant perspective on the design of IVAs. A recent example in this direction is VORO, a couple of "data hungry pets" that perform their role as smart assistants correctly only if the user gives them attention and constantly feeds them with the data they crave. According to its designer Findlay Macdonald, VORO is meant to challenge "*the current paradigm of the lack of control that we, as users of smart home products, have over our data."* (https://www.finmacstudios.com/voro)

In a similar vein, instead of reproducing traditional gender roles, IVAs could be designed to question them and to leave them open. If the design community does not take up these challenges, large corporations will continue to set the rules, pursuing their commercial objectives. As a result, any possible alternative scenarios - built upon a different conception of humanness, culture, and interaction modalities - will have no chances to come into being.

4. Conclusions

We performed a literature review aimed at providing a structured overview of scholars' contributions in the field of IVAs, organized around a three-lens framework. We also outlined six design challenges, which represent a call for the design community at large to take action, both by developing consistent design guidelines, and by envisioning and prototyping novel and critical alternatives for IVAs.

As Søndergaard and Hansen (2018) point out, technological futures are built on and (re)produce collective imaginaries that intersect technology with social, cultural, and political matters of gender, race, and class. Such technological futures, therefore, are not pre-determined, although not entirely open either. Indeed, it is the designer's task to challenge the dominant narratives in order to propose different, and still acceptable, futures.

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Acknowledgements: We would like to thank Gabriele Barzilai for his valuable contribution to the literature review presented in this paper.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Research on Gender Differences of Adult Head Shape in China

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Abstract | Studying the differences in head shape, especially between genders, is vital to the design of head-mounted products. However, current studies on the head size of contemporary Chinese remain incomplete. Therefore, this study collects the latest head-related data from 2200 male and female adults from typical cities in seven populous areas of China, and analyzes gender differences in the head, face, eyes, nose and ears according to the items measured. Specifically, feature data collected through 3D measurement include averages, standard values, maximums, minimums and percentiles (5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles). The results show that in the analysis of 33 features of 5 categories, the averages of male adults are larger than that of female adults ($p<0.05$). Additionally, the head models of male and female adults in China generated from the above mentioned data provide the design of head-mounted products with data support and references about gender differences.

KEYWORDS | HEAD-PRODUCT DESIGN; ANTHROPOMETRY; ERGONOMICS; 3D SCAN; CHINESE HEAD AND FACE

1. Introduction

With the rapid growth of smart wearable devices, more and more head-mounted products come out. A head-mounted product needs precise data about head features to achieve high suitability (Ball, et al, 2008). Therefore, studying the differences in head features is vital to the design of a head-mounted product. In the past, the head was measured with contact measurement tools like tape and caliper to collect head length, width and circumference (Huston, 1995). For traditional head-mounted products like hat or bicycle helmet, this type of product differs in their "suitability" to men and women largely because of their differences in size with head breadth, head length and head circumference as the basis of data. Yet, as more smart head-mounted products emerge, e.g. VR and AR helmets, cephalic and facial parts involved become more complex and diverse, and since head curves are diverse and divided into elastic part and inelastic part, traditional contact measurement mode is unable to satisfy deeper study needs (Widyanti, 2015). In this case, the development of 3D scanning techniques can make up for this problem.

As 3D scanning technique advances, currently there is a growing number of studies about 3D measurement, especially for head and face: in Europe and America, L. Talbert et al. (2014) conducted a study of 3D analysis of facial features of white Americans and African Americans, while Perret-Ellena T et al.（2015）conducted 3D anthropological measurement of head and face of children in Holland to better design oxygen masks for them; Zhuang et al.（2005）used an advanced 3D scanner to capture the facial features and corresponding changes of American respirator users.

However, the current studies on the head size of contemporary Chinese conducted at home and abroad are not thorough: in 2008, SizeChina completed by Roger Ball is the first digital database to store head and face shapes of the Chinese people, yet it has some problems, including outdated samples, limited facial and aural features extracted in number and poor data precision; in 2016, the China National Institute of Standardization (CNIS) used 3D scanning technique to set up a regression model of body size with male adults as samples measured (Xing, 2017). As a result of the lack of analyses on head differences among Chinese, most of the head-mounted product designers who target users are Chinese relied on Western anthropometric data, making it hard to produce head-mounted products more suitable to the head of Chinese.

Through 3D scanning and measurement of the head of the respondents, this study set up a digital model, thus acquiring massive data about the heads of Chinese adults. Besides a traditional analysis of the sizes of men and women (averages, standard values, maximums, minimums and percentiles), methods like feature point fitting were also used to analyze data about male and female heads and output a visual model. The purpose of this study is to set up a Chinese head measurement data system that is more complete and accurate and identify the relationship between gender and different head-related parameters, to enable it to be applied more effectively in the field of head-mounted product design.

2. Sample distribution and data collection

2.1 Sample distribution

This study selected 2200 adults from typical cities in the seven populous areas of China, and the numbers of male and female respondents recruited in each region are basically the same. Advanced non-contact optical scanning technique was used to obtain high-precision data on head shape, then 3D data was processed to get 3D model files, 57 features related to head, face and ears were extracted and 33 related items were measured (Fig.1).

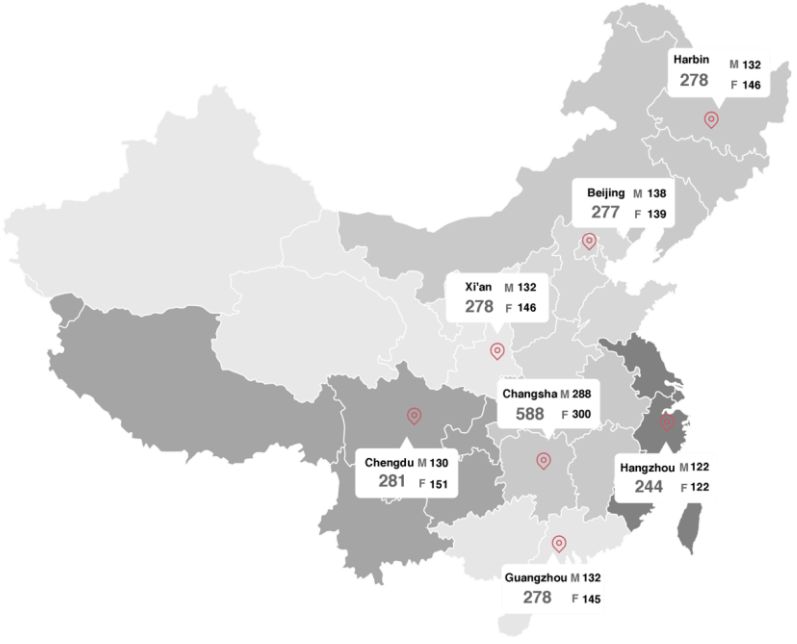

Figure 1.Sample size and sample distribution.

2.2 Features measured

33 anthropometric and anatomical characteristic points (Fig.2) defined in this measurement and study are:

- Head circumference (HC): The maximum circumference of the head just above the ridges of the eyebrows (supraorbital ridges) and the attachment of the ears;
- Head length (HL): The distance from the glabella landmark between the brow ridges to the rear-most (posterior) point on the back of the head;

- Head breadth (HB): The maximum horizontal breadth of the head above the attachment of the ears;
- Frontotemporale Distance (FD): the minimum frontal width, which is the horizontal distance between left and right frontotemporale;
- Glabella - Pronasale Distance (GPD): The vertical height of the nose, which is the vertical distance between glabella and pronasale;
- Infraorbitale - Pronasale Distance (IPD): The vertical distance between infraorbitale and pronasale;
- Tragion distance (TD): The horizontal distance between left and right tragion;
- Zygofrontale Distance (ZD): The horizontal distance between left and right zygofrontale;
- Otobasion Superius Distance (OSD): The horizontal distance between left and right otabasion superius;
- Glabella – Otobasion Superius Distance (GOSD): The projection length on the sagittal plane of the straight line between glabella and otobasion superius;
- Vertex - Glabella Distance (VGD): The vertical distance between vertex and Glabella;
- Vertex - Tragion Distance (VTD): The vertical distance between Vertex and Tragion;
- Infraorbitale Distance (ID): The horizontal distance between left and right infraorbitale;
- Glabella-Infraorbitale Distance (GID): The vertical distance between glabella and infraorbitale;
- Biocular Distance (BD): The horizontal distance between left and right Ectocanthus;
- Interocular Distance (ID): The horizontal distance between left and right Entocanthion;
- Interpupillary Distance (IND) : The distance between left and right pupil;
- Otobasion Superius - Pupil Distance (OSPD): The projection length on the sagittal plane of the straight line between pupil and otobasion superius;
- Sellion – Pronasale (SP): The vertical distance between sellion and pronasale;
- Sellion – Subnasale (SS): The vertical distance between sellion and subnasale;
- Pronasale - Subnasale Distance (PSD): The straight-line distance between pronasale and subnasale;
- Alare Distance (AD): The horizontal distance between left and right alare;
- Otobasion superius - otobasion inferius Distance (OSOID): The vertical distance between otobasion superius and otobasion inferius;
- Ear Length (EL): The distance between superior auricle and inferior auricle;
- Ear Breadth (EB): The distance between posterior auricle and otobasion superius;
- Cavum Concha Length (CCL): The distance between superior cavum concha and incisura intertragica in the direction of the ear length;
- Cavum Concha Width (CCW): The distance between posterior concha and tragion in the direction of the ear breadth;

- Superior Cavum Concha to Anterior Cymba Concha Length (SCCACCL): The distance between anterior cymba concha and superior cavum concha in the direction of the ear length.

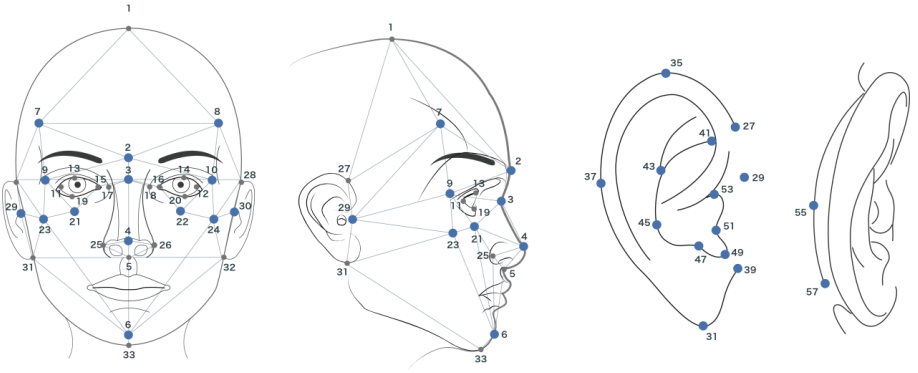

Figure 2. Characteristic points.

2.3 3D data collecting and processing

The measurement group of this study consists of many well-trained anthropometers and professional photographers. This group finished collecting data on head from typical cities in the seven areas in mainland China within four months. Since the number of the members in the measurement group is limited, the research group would hire around 5 staff locally for assistance in each place. In the whole process, the measurement group would spend around 2 days checking and adjusting the venue and installing and calibrating devices, and the scanning process takes 2 to 3 days. Therefore, each measurement point needs 4-5 days to finish collecting expected data. The concrete data collecting process takes the following steps:

1. Project introduction and questionnaire filling
2. Numeration and photographing
3. Traditional anthropometric measurement
4. Fixing hair
5. Feature point marking
6. 3D scanning and data check

2200 original datasets collected through scanning need to be preprocessed before extracting feature-related data and measuring and analyzing related features. This process includes the following steps of data processing (Fig.3):

1. Data alignment

2. Noise elimination and integrated registration
3. Sharp fusion
4. Mesh simplification and hole filling
5. Mesh smoothing
6. Texture mapping
7. Uniform coordinate system
8. 3D file export

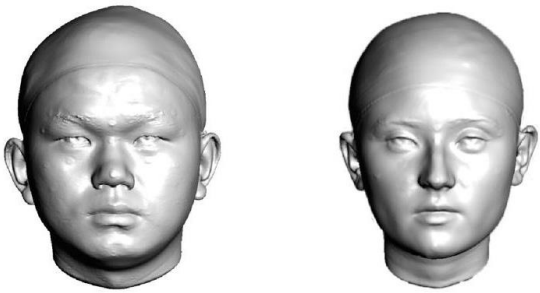

Figure3. 3D Chinese head model.

3. Sample data analysis

The features measured in this study are divided into five categories, namely head, face, eyes, nose and ears, and each category is subject to data statistics and comparison by gender. Statistical data about 3D measured features include averages, standard deviations, maximums, minimums and percentiles (5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles). Anthropometric data of this study used IBM SPSS Statistics 23.0 software package (IBM, US) for analysis and summary. Two-factor analysis of variance (ANOVA) was adopted to identify the influence of gender on human body characteristics of the head, Tukey's honest significant difference (Tukey HSD) was used for ex post analysis and multiple comparisons. When Sig. value (p) < 0.05, it is believed that it is of statistical significance. Pearson correlation coefficient (r)was used to conduct a bivariate correlation analysis and examine the correlation between dependent and independent variables. The results show that in the analysis of 33 features about head, face, eyes, nose and ears, the averages of 33 features measured of men are all larger than that of women ($p<0.05$).

3.1 Comparative analysis of head features

Tab.1 shows detailed statistical data on head circumference, head length and head width by gender. Among three measured features, the average head circumference, head length and head width of men are greater than that of women ($p<0.01$). Besides, the head circumstance, head length and head width of men at every percentile (5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles) are larger than that of female heads at the corresponding percentiles.

Tab.1 Comparison of head feature data (gender); unit: millimeter

Variable	Gender	N	Mean	SD	Min	Max	Percentile						
							5th	10th	25th	50th	75th	90th	95th
HC	M	1047	566.01	17.18	507.00	634.00	538.00	543.80	555.00	566.00	577.00	588.00	594.00
	F	1131	544.21	14.71	494.00	609.00	520.00	525.00	534.00	545.00	554.00	563.00	568.00
HL	M	1047	185.75	7.06	160.00	209.00	174.00	177.00	181.00	186.00	190.00	195.00	197.00
	F	1131	175.60	6.58	155.00	204.00	165.00	167.00	171.00	176.00	180.00	184.00	186.00
HB	M	1047	158.61	6.72	137.00	187.00	148.00	150.00	154.00	158.00	163.00	167.00	170.00
	F	1131	151.09	5.96	129.00	172.00	142.00	143.20	147.00	151.00	155.00	159.00	161.00

3.2 Comparative analysis of facial features

Tab.2 shows detailed statistics about frontotemporale distance, glabella-nasal tip distance, infraorbital point-nasal tip distance, tragion distance, bizygomatic breadth, supra-auricular point distance, supra-auricular point-glabella distance, vertex-glabella distance, trichion-tragion distance of different gender groups. According to the analysis of facial features, the averages of the nine features of men are all larger than that of women ($p<0.01$). Meanwhile, all the measured features of men are larger than that of female heads at every percentile (5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles).

Tab.2 Comparison of facial feature data (gender); unit: millimeter

Variable	Gender	N	Mean	SD	Min	Max	Percentile						
							5th	10th	25th	50th	75th	90th	95th
FD	M	1047	113.31	6.30	92.38	138.93	103.12	105.45	109.13	113.57	117.46	120.90	123.75
	F	1131	108.54	5.54	90.50	127.01	99.82	101.46	104.97	108.58	112.25	115.68	118.11
GPD	M	1047	54.23	5.37	35.67	71.85	45.87	47.86	50.56	53.95	57.51	61.17	63.32
	F	1131	52.667	4.65	40.39	70.45	45.13	46.98	49.61	52.50	55.70	58.62	60.76
IPD	M	1047	17.83	4.28	6.83	35.63	10.97	12.40	14.91	17.46	20.64	23.51	25.17
	F	1131	16.83	3.81	7.02	33.45	10.91	11.87	14.16	16.79	19.36	21.58	22.91
TD	M	1047	155.38	6.42	135.17	177.11	144.74	147.28	150.99	155.31	159.62	163.34	166.53
	F	1131	146.40	5.42	129.05	168.69	137.58	139.47	142.70	146.37	149.97	153.42	155.51
ZD	M	1047	124.46	6.32	103.19	145.82	114.30	116.03	120.19	124.51	128.86	132.79	134.77
	F	1131	118.13	6.17	92.06	137.41	107.51	110.18	114.41	118.33	122.21	125.69	127.68
OSD	M	1047	164.07	6.62	141.27	184.47	153.51	155.71	159.59	163.97	168.80	173.04	175.42
	F	1131	156.62	6.22	136.23	182.08	147.00	148.89	152.47	156.36	160.74	164.61	167.09
GOSD	M	1047	101.55	7.17	79.67	127.16	89.80	92.73	96.81	101.43	106.04	110.66	113.56
	F	1131	96.16	6.94	69.37	118.24	85.45	88.05	91.20	96.12	100.56	105.33	108.19
VGD	M	1047	102.69	9.46	71.66	131.59	86.51	91.02	96.56	102.51	109.05	114.81	118.13
	F	1131	99.11	8.75	74.37	135.62	85.10	88.34	93.28	99.17	104.80	110.04	112.90
VTD	M	1047	139.36	7.51	112.10	166.12	126.99	130.16	134.40	139.34	144.03	148.85	151.85
	F	1131	135.09	7.06	109.10	163.62	123.41	126.05	130.73	135.01	139.45	143.98	147.11

3.3 Comparative analysis of eye features

Tab.3 provides detailed statistics related to infraorbital point distance, glabella-infraorbital point distance, outer canthus distance, inner canthal distance, inter-pupillary distance, supra-auricular point-inter-pupillary distance of the gender groups. Among eye-related items measured, the averages of the six features of men are all larger than women's ($p<0.05$). Moreover, all of the measured features of men at every percentile (5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles) are larger than the same features of women at the corresponding percentiles.

Tab.3 Comparison of eye feature data (gender); unit: millimeter

Variable	Gender	N	Mean	SD	Min	Max	Percentile						
							5th	10th	25th	50th	75th	90th	95th
ID	M	1047	71.76	5.56	57.66	96.81	63.28	64.72	67.87	71.74	75.27	78.73	81.00
	F	1131	68.21	5.22	56.01	84.84	60.08	61.51	64.52	67.99	71.76	75.36	77.11
GID	M	1047	36.63	4.86	19.84	54.95	28.92	30.69	33.30	36.50	39.85	42.68	44.98
	F	1131	36.16	4.07	21.07	51.57	30.09	31.42	33.26	35.95	38.85	41.52	42.87
BD	M	1047	91.97	4.49	78.11	108.36	84.83	86.23	89.02	91.73	94.79	98.04	99.53
	F	1131	88.63	4.27	74.43	105.23	81.74	83.08	85.66	88.52	91.48	94.10	95.66
ID	M	1047	40.11	3.52	29.94	54.44	34.84	35.69	37.77	39.89	42.38	44.72	46.29
	F	1131	38.63	3.14	28.21	52.75	33.57	34.65	36.53	38.60	40.68	42.63	43.76
IND	M	1047	65.42	3.38	56.75	78.82	59.99	61.36	63.08	65.20	67.66	69.67	71.07
	F	1131	62.61	3.17	52.61	75.75	57.54	58.45	60.54	62.64	64.64	66.65	67.56
OSPD	M	1047	91.27	6.57	71.48	113.83	80.97	83.12	86.67	90.65	95.57	100.19	102.54
	F	1131	88.02	6.49	60.77	109.60	78.19	79.90	83.70	87.85	91.98	96.25	98.95

3.4 Comparative analysis of nose features

Tab.4 offers statistics of nose bridge-nasal tip distance, nose bridge-subnasal point distance, nasal tip- subnasal point distance and interalar distance of the groups by gender. The averages of the four features among nose-related features measured of men are all larger than that of women ($p<0.01$). In addition, measured features of men at every percentile (5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles) are all larger than corresponding female characteristics.

Tab.4 Comparison of nose feature data (gender); unit: millimeter

Variable	Gender	N	Mean	SD	Min	Max	Percentile						
							5th	10th	25th	50th	75th	90th	95th
SP	M	1047	38.85	4.25	26.58	56.49	32.13	33.42	36.04	38.57	41.67	44.25	46.09
	F	1131	36.49	3.91	25.27	49.42	29.93	31.55	33.99	36.45	39.00	41.66	42.75
SS	M	1047	51.39	4.02	34.89	68.25	45.08	46.47	48.71	51.39	53.80	56.64	58.03
	F	1131	48.52	3.68	32.25	62.42	42.76	44.03	46.12	48.34	50.87	53.36	54.63
PSD	M	1047	17.63	2.28	10.98	24.44	13.67	14.63	16.17	17.68	19.11	20.57	21.25
	F	1131	16.47	2.12	10.12	23.63	12.96	13.71	15.01	16.52	17.90	19.19	20.02
AD	M	1047	39.41	3.06	30.08	49.94	34.16	35.60	37.57	39.38	41.37	43.22	44.37
	F	1131	36.16	2.88	24.11	46.24	31.42	32.61	34.33	36.15	37.96	39.80	40.98

3.5 Comparative analysis of ear features

Tab.5 shows ear-related features measured, among nine features of men, the averages of their superaurale-subnasale distance, ear width(left/right Y), right ear length (left/right X), postaurale-preaurale distance (left/right Y), preaurale-superaurale distance (left/right X) are

larger than women's ($p<0.01$). Meanwhile, measured features of men at each percentile (5th, 10th, 25th, 50th, 75th, 90th and 95th percentiles) are larger than that of women at the same percentiles.

Tab.5 Comparison of ear feature data (gender); unit: millimetre

Variable	Gender	N	Mean	SD	Min	Max	Percentile						
							5th	10th	25th	50th	75th	90th	95th
OSOID	M	1047	54.92	4.63	42.37	70.53	47.59	49.05	51.82	54.51	57.96	61.20	62.75
	F	1131	52.51	4.55	39.24	67.38	45.32	46.93	49.29	52.44	55.47	58.58	60.25
EB_R	M	301	31.76	2.98	21.26	41.99	26.64	28.28	29.81	31.77	33.80	35.55	36.08
	F	305	29.99	2.91	18.18	38.30	25.03	26.22	28.22	30.24	31.97	33.51	34.49
EL_R	M	301	61.87	4.49	51.33	76.67	55.01	56.38	58.50	61.67	64.97	68.00	69.33
	F	305	58.94	4.26	49.03	69.52	51.71	53.13	56.10	58.84	61.74	64.74	66.42
PCACCL_R	M	301	14.52	2.87	6.10	22.50	9.91	10.91	12.43	14.41	16.40	18.32	19.13
	F	305	13.35	2.79	7.04	20.64	8.71	9.65	11.39	13.42	15.46	16.87	17.73
SCCACCL_R	M	301	11.49	1.54	7.06	16.80	8.87	9.55	10.61	11.45	12.42	13.58	14.10
	F	305	10.94	1.41	5.98	15.63	8.77	9.32	9.95	10.91	11.80	12.68	13.46
EB_L	M	301	31.79	3.27	23.27	43.85	26.03	27.57	29.74	31.86	33.77	35.87	37.06
	F	305	29.53	3.31	17.24	39.44	23.46	25.25	27.68	29.86	31.77	33.47	34.08
EL_L	M	301	61.81	4.60	49.81	73.75	53.83	55.80	58.84	61.60	64.96	67.74	69.38
	F	305	58.84	4.17	48.12	71.13	52.29	53.35	55.93	59.02	61.81	64.67	65.90
PCACCL_L	M	301	14.23	2.82	5.82	24.28	10.09	10.75	12.19	14.12	16.05	17.77	18.79
	F	305	12.94	2.78	5.77	24.15	8.86	9.52	11.04	12.67	14.63	16.61	17.90
SCCACCL_L	M	301	11.60	1.66	6.35	17.40	8.78	9.51	10.51	11.54	12.71	13.69	14.26
	F	305	11.16	1.58	6.35	17.58	9.00	9.38	10.13	10.91	12.14	13.19	14.15

4. Correlation coefficient

According to physiological characteristics of the human body, the indexes of all the body parts are not completely independent, as all the characteristic parameters are highly correlated (Li, 2013). This study conducted a correlation analysis of 33 items measured, Pearson correlation coefficient can effectively calculate the correlation between different characteristics: 0.8—1.0 is highly strong correlation; 0.6—0.8 is strong correlation; 0.4—0.6 is moderate correlation; 0.2—0.4 is weak correlation; 0.0—0.2 is highly weak correlation or non-correlation. This article highlights 18 features whose correlation is between 0.6 to 1.0. The results are shown in Fig.4.

	HC	HL	HB	GPD	IPD	TD	ZD	GOSD	VGD	BD	SP	OSOID	EB_R	EL_R	PCACCL_R
HC	1														
HL	0.806	1													
HB	0.723	0.394	1												
TD	0.73	0.506	0.784	0.189	0.083	1									
OSD	0.708	0.395	0.85	0.204	0.032	0.865	0.464								
VTD	0.411	0.297	0.435	0.138	0.126	0.355	0.254	0.213	0.706						
ID	0.478	0.354	0.34	0.077	0.019	0.408	0.611	0.218	0.22						
IND	0.532	0.437	0.442	0.166	0.129	0.544	0.451	0.357	0.269	0.767					
OSPD	0.307	0.299	0.208	0.157	0.084	0.349	0.054	0.749	0.108	0.203					
SP	0.233	0.223	0.285	0.663	0.621	0.311	-0.079	0.287	0.224	0.224	1				
SS	0.335	0.313	0.311	0.627	0.381	0.36	0.085	0.268	0.115	0.283	0.809				
EL_R	0.329	0.315	0.191	0.179	0.025	0.346	0.209	0.229	0.053	0.19	0.186	0.67	0.468	1	
PCACCL_R	0.253	0.244	0.168	0.07	0.026	0.231	0.111	0.034	0.094	0.224	0.111	0.071	0.414	0.272	1
EL_L	0.387	0.361	0.24	0.169	-0.009	0.379	0.234	0.229	0.032	0.184	0.157	0.616	0.47	0.84	0.239

Figure4. correlation coefficient.

5. 3D head model fitting

To further estimate sexual dimorphism, this research utilized a new facial framework analysis: a Frankfurt plane (Borman, et al, 1998) was used as a XOY plane to establish a dimensional coordinate system where the x-axis signifies nose tip, y-axis signifies tragion and z-axis signifies head vertex. The XYZ coordinates of 33 facial feature points were extracted. Then, the P-th percentile of XYZ coordinates of each feature point was calculated, and their spatial positioning was determined using the 3D software. Features were finally connected to establish the facial framework (Dong, et al, 2011) of the P-th percentile. 3D facial frameworks of different percentiles for both genders were established using the above method. Gender-wise models of the same percentile were superposed, and the absolute differences of features indicate facial size differences between Chinese male and female adults. Additionally, comparative differences in different percentile models for each gender are also of reference value as single-gender feature data.

Based on early-stage data, this research employed a fitting method of layer-by-layer circular scanning to divide human face into 4 feature regions; after that, layer-by-layer circular scanning sampling and contour sampling were conducted, followed by calculation of distance and layer percentiles and construction of curved surface of head using the point sets comprised of point coordinates exported from the software; finally, male and female head models ranging from the 5th through 95th percentiles were fitted. Diversified head statistical models are significant as they provide designers with more effective data and anthropometric features, which play a positive role in advancing the development and manufacturing of new wearable products targeting Chinese users (Fig.5).

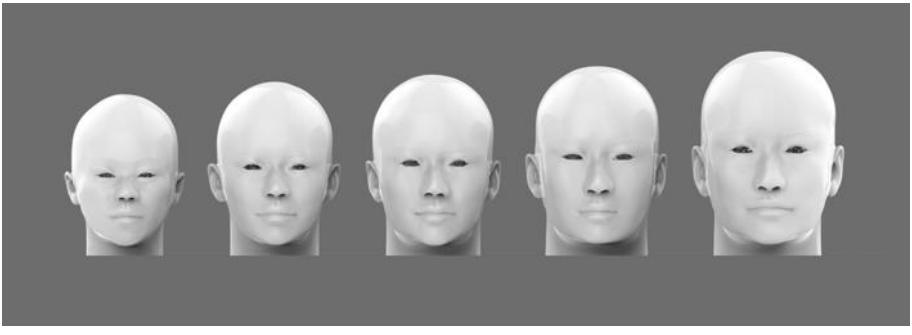

Figure5. 3D fitting model.

Conclusion

Wearable products represented by VR headsets entail a high requirement on adaptability, and products failing to perfectly fit to users' face often have problems like concentrated pressure, light leak and slippage. The standard Chinese male and female 3D head models and anthropometric measurement data obtained in this research can be used to test wearable products in a virtual CAD environment using simulation methods, and thus are of guiding significance for designing and developing headsets adaptable to different features of male and female.

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Acknowledgements: We wish to express our gratitude to the School of Design Hunan University for their support.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Speculative Physical Models Created Through a Robotic Process.

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Abstract | New opportunities exist to imagine the architectural model in a digital era. Rather than view the physical and digital as oppositional, both model types possess qualities of operation, performance, and mediation. This paper discusses the speculative physical model as the driving motivation for a three-credit elective seminar: Introduction to Robotic Fabrication. The undergraduate/graduate course did so with students without any previous robotic exposure. Speculative architectural models confront material, production, sequence, and gravity. Models are surrogates, as all forms of design must confront translating ideas to reality. Typically, designers specify, while others build those designs. Designers' models translate issues of scale and production. The course operates in opposition to digital fabrication courses where furniture-scale prototypes result. Speculative scale-models utilized the robot as a mediator in a speculative construction process. By building models, students understood their work to be at a large-scale, which would then require robots to be construction tools.

KEYWORDS | ROBOTICS, DIGITAL FABRICATION, SCALE-MODELS, HIGHER EDUCATION, FOURTH INDUSTRIAL REVOLUTION

1. Introduction: cultural background

Contemporary design takes place within the framework of a global change that simultaneously affects the manufacturing, education, and research sectors known as the Fourth Industrial Revolution (Schwab, 2017). The Fourth Industrial Revolution is based on the spread of cyber-physical machines/systems interconnected through the internet of things that allow the automation of the tasks necessary to carry out complex processes. In other words, this technological era is represented by the diffusion of production tools that impact the professional skills needed to govern them.

The computer, democratized as part of the digital revolution, is not only a design tool but a mediator that translates digital models into programming languages readable by 3D printers, numerical control machines, laser cutters, and robots (Picon, 2010). The consequence in architecture lies in the openness to new design languages that encourage the development of innovative construction techniques for the rapid production of technological elements, disconnected from the impositions of prefabrication.

In architecture, the compression between design and construction has been theorized by Mario Carpo as Digital Turn, which develops in two consequential phases. With the first Digital Turn, new possibilities opened up through computational thinking in design processes (Carpo, 2013). With the Second Digital Turn, more in line with the shift dictated by the Fourth Industrial Revolution, robotic proliferation leads to a synthesis of algorithmic and parametric design informed by advanced forms of making. Robots can process and cut material while also assembling discrete, heterogeneous parts. Parametric thinking allows designers to understand projects as a set of operations, and the robot can support this type of production where parameters result in accurate iterations controlled by robotic making.

The robotics course presented in this paper, which has as its output the definition of architectural scale-models, is based on the realization that the current system of higher education is conditioned by dynamics that disadvantage students' cognitive opportunities. In the academic field, within the design workflows, the cost of making models progressively goes up, while on the contrary the cost of making digital models goes down. This trend causes students to move away from the cognitive and tactile experience of making physical models. From this, a loss of physical modeling occurs, which follows a loss of kinesthetic knowledge and rigor in the design process. The loss of physical models has already been witnessed in professional contexts. The possibilities dictated by the digital era encourage morphological explorations through 3D printing. However, 3D printing exists more as direct output biasing geometry over performance. While an essential tool, there is an inherent lack of materiality in 3D printing to date.

The realization of analog physical models has several advantages. First, the models are configured as a medium to make the process explicit and to make the understanding of the project accessible to both the student and the educator (Voulgarelis & Morkel, 2010).

Moreover, maquettes represent a graphic form defined by a material dimension where surfaces are informed by a tactile knowledge (Ingold, 2013).

The knowledge gained by making can only occur through doing. Marty Neumeier, in the book *Meta Skills, Five Talents for the Robotic Age*, articulates: "500 years after the Renaissance, academic education in the West has been successful in separating the hand from the brain. We've decided that making things is less valuable than knowing things, and therefore making has a less place in the classroom. This is not only wrong, but it denies the very evolutionary advantage of being human". Neumeier also adds that to cultivate the necessary skills in the contemporary world, "making is rejoined with knowing" (Neumeier, 2012). This is fundamental especially in the discipline of architecture, which in the Vitruvian definition results from the fusion of theory and practice. In his *Ten Books on Architecture*, Vitruvius advocates for architects to possess theoretical and practical knowledge, to combine manual skills with profound scholarship. In particular, practice is described as "the frequent and continued contemplation of the mode of executing any given work, or of the mere operation of the hands, for the conversion of the material in the best and readiest way" (Pollio, 1914).

In the construction tradition, craftspeople are those professional figures who embody the synthesis between theoretical knowledge and practical experience, manifesting the approach learning-by-doing and thinking-through-making, "rather than acquiring theoretical precepts for subsequent application in practice" (Ingold, 2013). An interpretation of the concept of learning-by-doing is inherent in the theorization of *Il Discorso Mentale*, the mental conversation, raised by Leonardo Da Vinci in reference to the creative process for the creation of works of art such as paintings: "to Leonardo, an artist didn't learn to paint. He painted to learn" (Neumeier, 2012).

Therefore, through the teaching activity, the course emphasizes making as an attitude to study material and focus attention to the detail. The course attempts to recover the sense of materiality that is lost with simple BIM models and additive rapid prototyping. The production of architectural models is a good opportunity to explore the cultural implications and the transposition of the skills of future operators of the Fourth Industrial Revolution. In contrast to the simple output afforded by 3D printing, robots operate as mediators building the students' translational skills. By exploring the robotic possibilities to make scale-models, it is possible to refine the skills of digital fabrication while exploring matter, which informs the programming of design algorithms in an iterative way.

2. Relevance of the subject: making scale-models

This course balanced theoretical and instrumental aspects through readings that introduced topics, demonstrations of software, and hands-on sessions for introducing robotic-student interactions and protocols. This approach highlighted that production is no longer solely the last step of the design process. The technical knowledge taught was used to understand the potential and operational limits of the robot - considering both the workcell and the limit angles of the axis kinematics - in order to approach the design process accordingly. In parallel, theoretical knowledge laid the foundations to open a dialogue on the speculative value of architectural models.

The concept of scale-model as machine (Smith, 2007) was introduced to explain the evocative quality of architectural models, not only as objects of study but as an expression of a deep disciplinary value system. The first example discussed was Gaudi's approach to the creation of scale-models. Although the architect worked at the end of the nineteenth century, his "reference standards" were those of the Middle Ages, a period in which making architecture was guided by the master-builder, a craftsperson who, without the need to produce drawings, directed the day-to-day construction. In the same way, Gaudi in his professional life did not make any written notation to represent his projects. For Gaudi the realization of scale-models served not only to explain to the craftspeople his complex geometric ideas, but above all to recall the moral and religious social order of the past, as an example to be pursued. Among the methods used by the architect to understand the systems of forces in the load-bearing structures, there is the process of hanging chains upside down above a mirror. In this way, he created real "machines" to explore nature and to understand the truth of invisible reality, or in other words, God.

The search for the unknown also belongs to Louis Kahn's work. As Albert Smith explains in his book *Architectural Model as Machine*, in developing his design processes, Kahn discovered that "the scale-model machine presents not only the possibility of seeing and defining the narrative of the myth, but also seeing its failing" (Smith, 2007). It is part of this narrative to find out what the future appearance of a building will look like or how the scale-model will contribute to the advancement of design towards construction, whether by suggesting a different approach to materials or changing proportional ratios. Since in Kahn’s poetics, as in Gaudi's, there was a profound spirituality underlying it, he saw in the order that springs from architecture, an allegory of the universe unifying all things. In both instances, the architect saw great intellectual value in the creation of physical models.

From an educational point of view, we tried to convey the fact that an architectural model is a prototype that serves to convey an idea and transform it during the design process. Like a prop in the theatrical lexicon, the scale-model is an object that serves to build a concept and make it explicit through its materialization. Students were also exposed to the idea that direct experience has cognitive benefits on learning. Just as Leonardo Da Vinci used painting as a means of knowledge, the architect can take the same path through the creation of study models. This knowledge-building activity through direct tactile experience, through the

medium of the hand touching material, is human learning and "will proceed without respect to any prediction of normative measures of intelligence" (Wilson, 1999). Paraphrasing Frank Wilson's words in *The Hand: How Its Use Shapes the Brain, Language, and Human Culture*, the hand, through external interactions, trains the brain to understand reality. In material exploration, "both the hand and the eye develop as sense organs through practice, which means that the brain teaches itself to synthesize visual and tactile perceptions by making the hand and eye learn to work together" (Wilson, 1999).

A physical model is an important cognitive part of the design process. It represents the connection point between thought and action, between tactile experience and the brain. In this course, the robot exists as the translator between mind, digital conceptualization, and the material world. The designer's workspace extends, as does the cognitive space. The use of industrial robots and design software allows mutual communication between the parts and does not render the robot as a simple executor. Moreover, the use of robots introduces us to a new process model in which a new aesthetics is inherent, both from the point of view of the possible geometrical results and of the speculative value related to them.

3. Methodology: the digital (robo)fabrication class

A recent article, "8 Things Every School Must Do to Prepare for the 4th Industrial Revolution" published in Forbes, presents an analysis of what higher education should offer to make future professionals more responsive to the quickly evolving dynamics of the market. On the basis of future trends that will occur in the world of work,[1] it will be necessary to emphasize, alongside humanities, the STEM (science, technology, engineering, and mathematics) disciplines, as together with the critical thinking, "there's no doubt every worker in the future will need some tech skills."[2] A further point that is touched upon is the updating of teaching methods and themes. The rapid changes in technology make traditional models obsolete, which require a large part of learning to take place by the end of university graduation. The acquisition of skills is driven by the ability to use the tools that require more than basic knowledge or the simple ability to follow instructions. These tools, as summarized by Darrell West in *The Future of Work*, fall within the macro-categories of automation, robotics, AI, machine learning, and IoT (West, 2018). They are the key to updating higher

[1] "The Future of Jobs Report 2018", by *The World Economic Forum*. In the introduction, the executive chairman Klaus Schwab states: "a particular focus of this new edition of the report is on arriving at a better understanding of the potential of new technologies, including automation and algorithms, to create new high-quality jobs and vastly improve the job quality and productivity of the existing work of human employees."

[2] "8 Things Every School Must Do to Prepare for the 4th Industrial Revolution" in *Forbes*. Article by Bernard Marr, published on May 22nd, 2019.

education through a non-static approach, so that the university education offer does not prepare for the future professionals that "we needed 50 years ago."[3]

By adopting this innovative approach to models, the Lawrence Technological University - College of Architecture and Design has defined the methodology for teaching an introductory course in robotic digital fabrication. The course is taught during one semester and is offered to a small group of undergrad and grad students, with no prior exposure on the topic. The students used a Kuka Kr6 six-axis industrial robot, previously deployed in an automotive production chain and then absorbed by the university, which benefited from a lower investment, instead of purchasing a new tool just released on the market. The robot was provided by Ballard International, a company that takes used robots from the automotive industry and resells them. Ballard International's business model is to connect tools and the culture of manufacturing to multiple sectors, including schools.

The use of "retired robots", or downcycled, or used, is currently a growing trend. Teaching and academic research are part of one of the areas where it is possible to use retired robots in the post factory years, after the assembly line. The *Economist*'s 2014 special report "Immigrants from the Future" mentions the startup company Bot and Dolly, later acquired by Google, which used industrial robots in new settings like art projects and the film industry. The robot-afterlife is a condition that is generated when manufacturing industries upgrade their production lines with more competitive and advanced instrumentation. However, robots can operate for many years after they are displaced from assembly lines, making them affordable to subsequent customers, who usually make targeted and less intensive use of them. These sectors do not have the capital purchasing power of the industries that originally purchased the robots. The reduced cost of used robots (Keramas, 1998) defines in parallel an exponential growth of technical and operational knowledge in the automation sector. In the case described in this paper, necessary expertise for the Fourth Industrial Revolution can be achieved through university education.

In the digital (robo)fabrication class, the teaching approach has been to consider the robot as a mediator to translate ideas into reality. Through robotic fabrication it is possible to transfer digital information into materiality through an instant connection between digital three-dimensional models and physical space. The course led students through a series of assignments that started with basic robotic programming, with various exercises along the way, to the culmination where the robot hotwire cut precision formwork for a series of plaster models. The flexibility allowed for the use of a single robotic process given different tools to perform additive, subtractive, hybrid, and assembly processes.

The most effective entry level mode to program a robot is to combine 3D modeling with custom made plugins to control machine operations through a digital interface. In this case,

[3] "Andrew McAfee: The Second Machine Age Is Approaching. Here's How We Can Prepare", in *Huffpost*. Article by Dawn Nakagawa, published on February 24th, 2015.

Rhinoceros and Grasshopper have been implemented with Kuka|Prc, an add-on that converts geometry into robot-readable lines of code. The most effective workflow to program the robot kinematics consists in drawing the machine-path, or toolpath, in three-dimensional space. This, within the limits of the workcell, is the maximum extension that the robot axes can reach. The toolpath is then broken down into target points described through polar coordinates that constitute the instructions to be given to the robot, importing the file into its operating system. Different end-effectors can be installed on the robot to perform different tasks, making the robot flexible and adaptable to different functions. This functionality allows the students to increase complexity of robotic operations through iterative optimizations. The digital interface visualizes the robot and its movements to detect and correct errors before execution in the physical world. Kuka|Prc is widespread in the academic world for programming Kuka robots because of the popularity and student familiarity with Rhino. Kuku|Prc's diffusion in academia is the result of its effectiveness of an online community active on the development of the theme, through which access to knowledge is reverberated to the non-experts.

An early assignment in the course was to produce long exposure photographs drawn with light where the robot did not touch material. To perform the exercise, students installed a LED light on the robot. Then, they took a photo in bulb mode for the duration of the kinematics (Figure 1). The result is a geometric composition through which to visualize the effects of algorithmic programming. Association was made with the themes of technological production between the exercise and the motion studies of the industrial engineers Frank Bunker Gilbreth and Lillian Evelyn Moller, who was also a psychologist. Gilbreth developed a study method to analyze the movements of workers on assembly lines in the 1910's. By taking long exposure photos, the mechanical sequence and timing of repetitive tasks was possible, in order to intervene on their rationalization, instead of making changes to the work environment to improve the efficiency of the production process. With the same logic, students were able to rework the code and set the software deciding whether to optimize the execution time or the number of axial rotations to complete a given action. Time is therefore the fourth dimension in three-dimensional space to be taken into account in the production phase, dictated by mechanical motions.

For teaching purposes, exercises have been structured to manage the complexity of design in three-dimensional space. One of these consisted in using the robot to perform a repetitive task on a variable volume, i.e. to guide the insertion of nails at regular intervals in the normal direction to a doubly curved high density foam surface (Figures 2-3). The same exercise was implemented by requiring the robot not only to reach single target points but to draw a path with continuous lines (Figure 4). Using robotic fabrication, the concept of iteration and repetition no longer requires standardization. Students explored flexibility afforded by robots through the development of their own custom end-effectors (Figure 5). The robot held and positioned custom tools with dexterity and precision.

Once the technical foundations were laid for the course through simple and direct exercises, it was possible to approach the exploration of speculative architectural models. For this more complex work, a hot wire cutter was installed on the robot as an end-effector. The purpose of the assignment was to explore through concept tests the study of stereotomy at the scale of architectural models. Students were asked to design cutting plans to be performed on 10 by 10 by 10 cm cubes. Each cube had to be cut at least 5 times. No indication was given on the characteristics of the cutting plans, which could be single, composite, straight, or curved. Through algorithmic design, it was possible to iterate the formal generation process, change the cutting sequences, and simulate the result. Each working group produced 20 models and each iteration was informed by the model scale previously created (Figure 6). Acting directly with the hot wire on the high density foam, the students also had feedback from the material itself. Based on the result obtained, they were able to optimize the robotic programming by modifying the cutting temperature or the kinematics speed. From the volume, we moved on to the design of the production sequences, which took place without a privileged direction, from bottom to top or from outside to inside, but according to the logic of process efficiency, to confirm the quality of the result. Robotic fabrication made it possible to quickly produce repetitive or non-standard complex shapes that are difficult to produce by hand, with no limits to creativity.

Building on the previous assignment, the final project required the students to use the hot-wire cutter to produce formwork for casting a plaster model (Figure 7). Not only was there an inversion of solid and void, but the assignment added a secondary material process of casting. The students generated multiple complex models, always starting from a solid cube and working on doubly intersected voids. The models were displayed as part of a final exhibition of work (Figure 8) with human scale figures emphasizing the desire to view the work not as desktop objects but proto-architectural explorations.

The intense connectivity between design software and robotic output creates an instantaneous workflow. Designers are able to continue designing right up to the point they export robotic code for the production process. The design also goes beyond the limits of geometry and includes a schedule of new design parameters. In the context of the course, students limited themselves to the creation of speculative models, but the methodology is scalable and in so doing, it challenges traditional design approaches. Through robotic digital fabrication we can exit the drawing sheet in order to make things, not only drawings of things (Gramazio et al., 2017).

4. Conclusions

In the design and construction scenario that lies ahead, the master-builder/designer will take care of the entire production chain. This professional will be able to summarize the complexity of the workflows within The Fourth Industrial Revolution with respect to the logic that governs manufacturing processes. The master-builder will investigate issues related to

the synthesis of computation and digital fabrication as elements capable of triggering innovation to an area of study increasingly oriented towards architecture and construction, involving industrial processes and academic training.

Through this class, students had the opportunity to understand the value of upstream and downstream processes. The upstream process includes design, i.e. the early-stage phase where the morphological decisions are taken and the design strategy defined. In the future of construction, the downstream phases will be digitally connected and inevitably include tools such as robots. The downstream design process is informed by production methods, enriching the creative phase with data through the knowledge of tools that allow upstream cognitive integration. In this context, the algorithmic language is the link between the different phases of the workflow from design to construction.

In the class, a loose analogy between robots and contractors emerged and if one could explain intentions and constraints to a robot, an emerging designer must be able to describe their intentions and instructions to a contractor or manufacturer. Architects can use digital technology to better understand downstream production processes. As a result, technical complexity can be handled early in the design process to make better informed decisions and achieve better operations.

Students learned physical aspects of prototyping, with the aim of bringing digital fabrication back to a material dimension, combining architectural design and production process in a hybrid workflow. The same workspace in which the robot operates is hybrid, by continuously exchanging information between real and digital and vice versa.

The course focused on process analysis and cultural implications. Since it was an introductory course for robotic digital fabrication, students did not have to deal with design aspects such as functional program, occupancy, static operation, or placement on a project site. The work focused on the design phase, avoiding to follow the rules that professional determinism imposes. Mediating design and material was a key skill to utilize speculative models based on the new forms of digital models that define an emerging relationship between designer and tools. Students practiced working out formal concepts and thinking about the tools that were used to produce them. Borrowing the words of Louis Kahn, "form has nothing to do with circumstantial conditions" (Kahn, 2003). As a result, students were able to start building their own "reference standards" in anticipation of becoming the next professionals in architecture to embrace the Fourth Industrial Revolution, with the socio-cultural consequences that it entails.

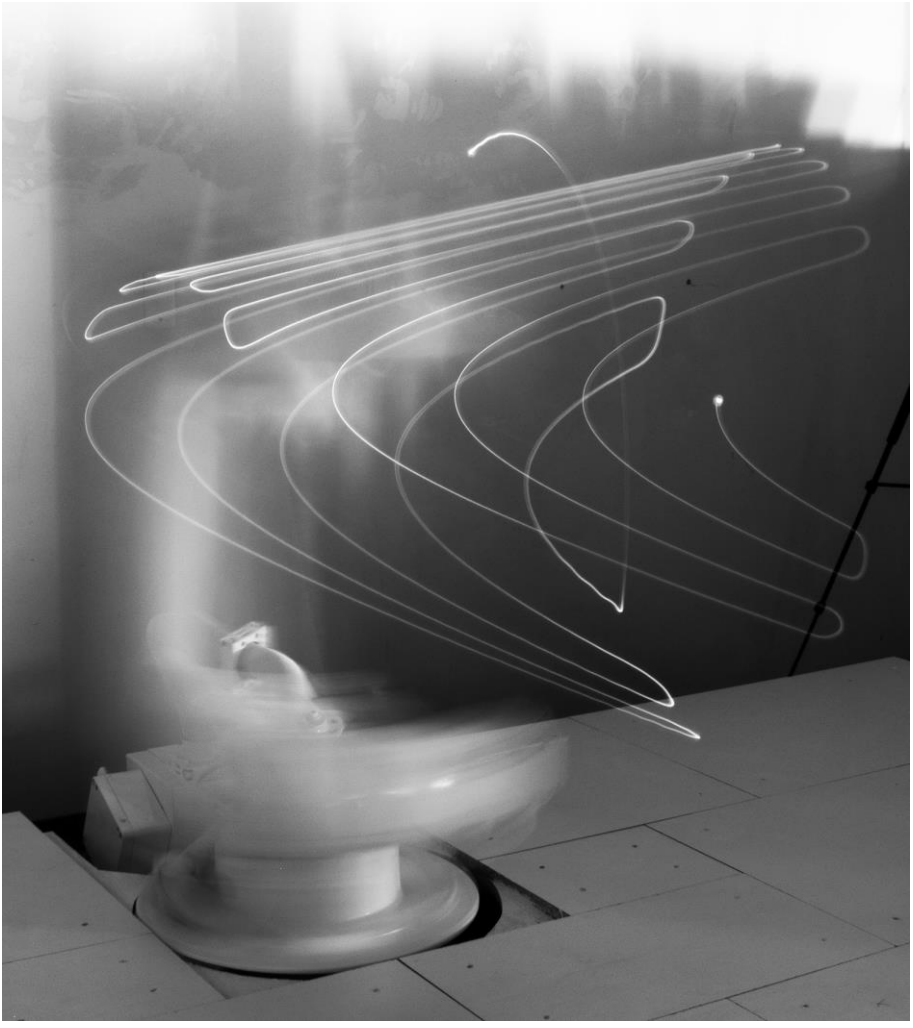
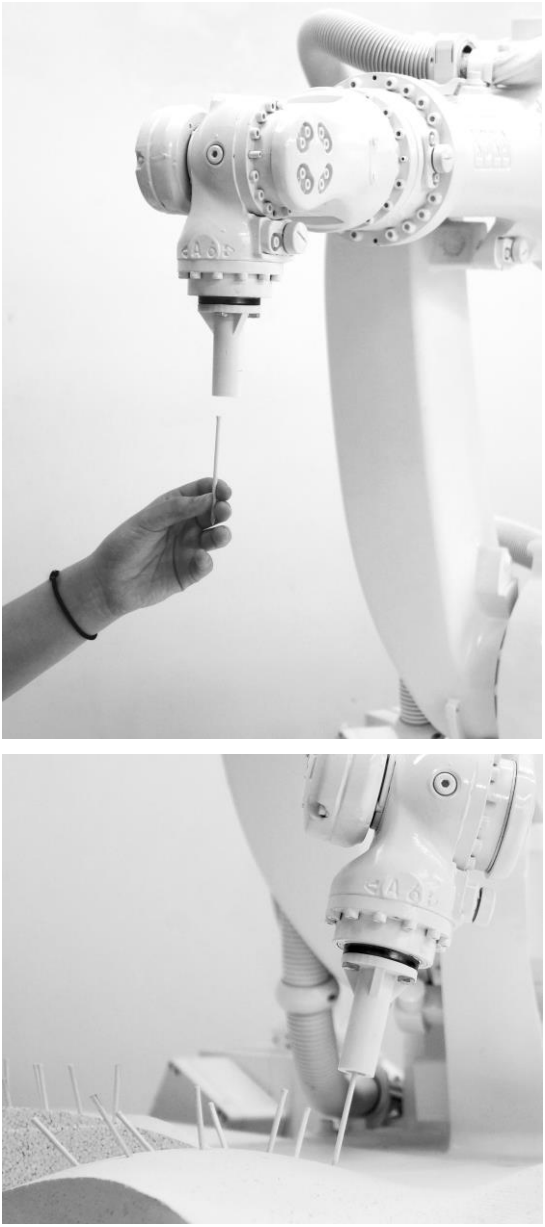


Figure 1. The robo-lightpainting assignment within the Introduction to Digital (robo) Fabrication class at Lawrence Technological University – College of Architecture and Design. Work by students: Francisco Landeros, Zakia Hunt, Aaron Wrubel, and Michael Zonca. Instructors: Karl Daubmann and Sara Codarin.



Figures 2-3. The "pin-head" assignment. Work by students: Irene Missler, Matthew Weyhmiller, Trent James, and Eunpyeong Kim. Insertion of nails in the normal direction to a double-curved high density foam surface.



Figure 4. The flow-lines assignment. The students designed their own end-effector using digital fabrication, so that they could draw in three-dimensional space on a doubly curved surface. Work by students: Francisco Landeros, Zakia Hunt, Aaron Wrubel, and Michael Zonca.



Figure 5. The end-effectors used during the robo-class. Each of them can be installed on the robot and act as an actuator to perform customized tasks.

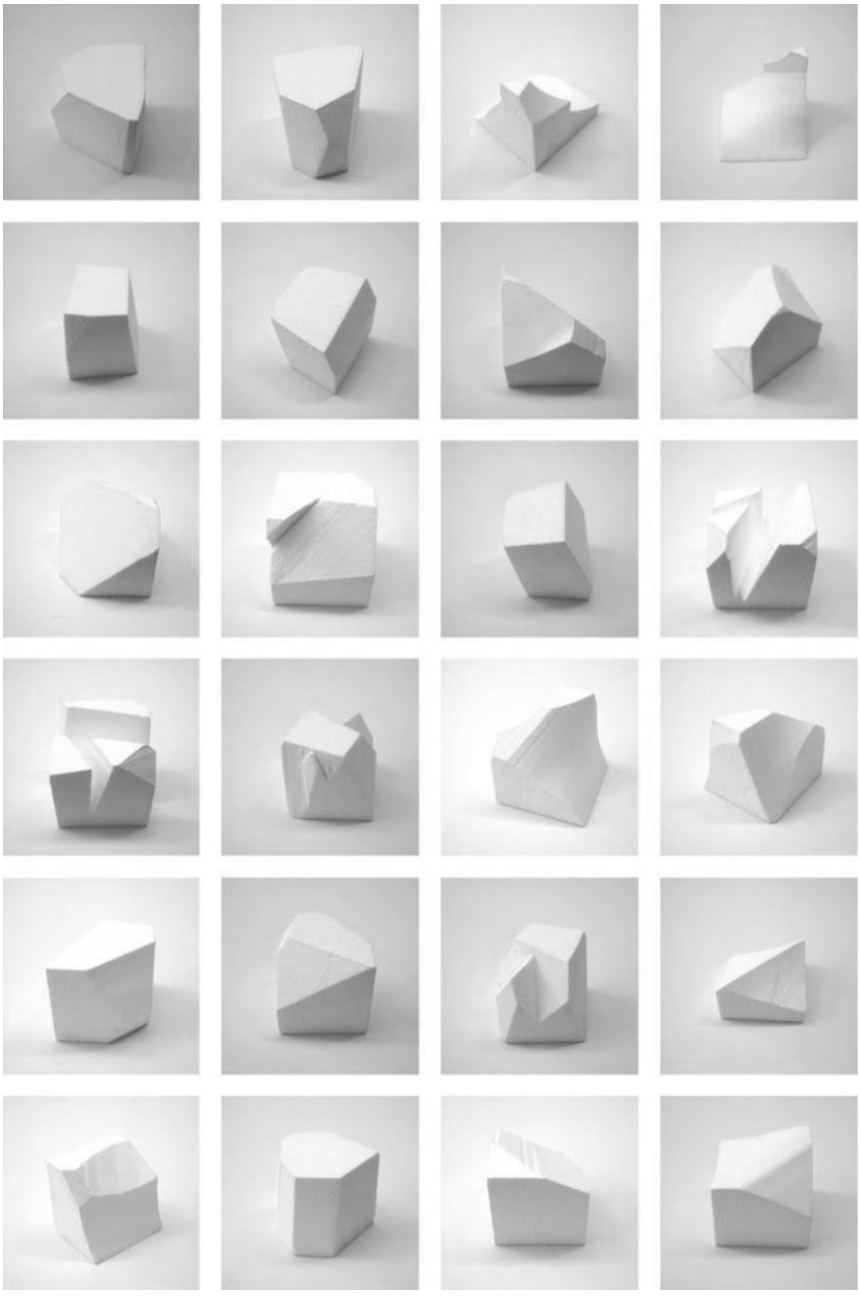


Figure 6. Iterative foam scale-models made by students through robotic hot wire cutting.

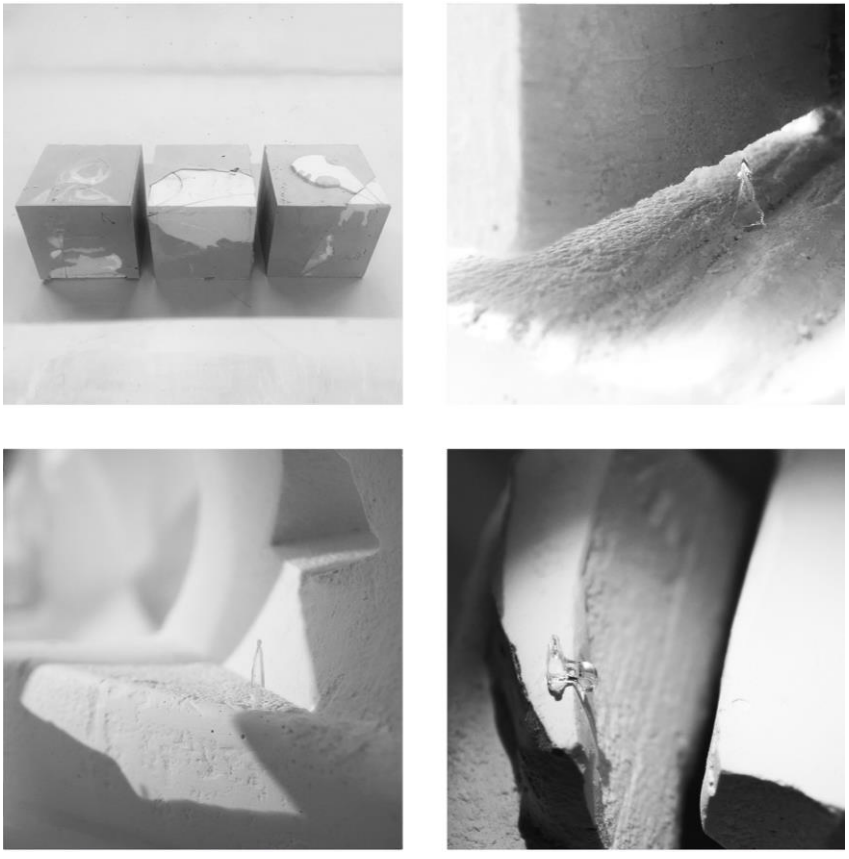


Figure 7. Plaster models made using foam formwork produced through robotic hot wire cutting. Work by: Eunpyeong Kim, Michael Zonca, and Irene Missler.



Figure 8. Final exhibition. Work produced by students throughout the digital (robo)fabrication class.

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Acknowledgements: our robot Bianco and the class of robofab'ers at Lawrence Technological University - College of Architecture and Design composed of Jacob Croop, Zakia Hunt, Nathan Ickes, Trent James, Eunpyeong Kim, Francisco Landeros, Irene Missler, Matthew Weyhmiller, Aaron Wrubel and Michael Zonca.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Teaching Design in the Age of Platforms: A Framework for Platform Education

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Abstract | Our contemporary social, cultural, and political experiences are increasingly mediated and shaped by digital platforms, such as search engines, content intermediaries, and networked communications tools. A digital platform is the provider of software, sometimes hardware, and service that uses computational architecture to mediate social activities strategically. Contemporary communication design practice is largely in service of and circulates through digital platforms. Design education needs to be responsive to the rise of platforms as the latest transformation of the internet on both practical and theoretical levels. This paper situates a *platform education* within and beyond communication design to help develop understandings of the mechanisms of platforms, values influenced by platformization, and design implications. The author presents a framework of relevant knowledge structured in a triangular model of *design practice*, *platform literacy*, and *design experiment*, aiming at functioning as a tool for teaching, framing, and making critical inquiries into platforms.

KEYWORDS | PLATFORM LITERACY, PLATFORM EDUCATION, DESIGN EDUCATION, COMMUNICATION DESIGN, FRAMEWORK

1. Introduction

In the post-internet condition, our contemporary social, cultural, and political activities are increasingly platformized — digital platforms are becoming the primary mode of access to the internet, shaping frameworks of networked communications and mediating content and information distribution. A digital platform provides software, sometimes hardware, and service that uses computational architecture to mediate social activities strategically. Platforms crowdsource content production, turn products into services, outsource infrastructures to seemingly light "clouds." By doing so, platforms capture and control enormous amounts of information and model them into data forms usually out of commercial interests. While contemporary communication design practice is largely in service of platform capitalism, prioritizing the marketing values of platforms, online platforms are also venues for political collectives and activism and have been used as the *medium* and *subject matter* for artistic practice to comment and critique. Scholarships of platform studies have been growing, sharing approaches mostly with science and technology studies and media studies. Design education needs to be responsive to the rise of platforms as the latest transformation of the internet on both practical and theoretical levels.

The need for teaching multi-platform design is a consensus view of the discipline. However, new technologies and creation tools are often celebrated without criticality. There has not been a sufficient common understanding of what content and skills would contribute to an adequate platform education. Developing an appropriate approach for design discipline to engage with platform literacy and platform education is imperative. What skills and literacy are required to make informed design, challenge conventions, or subvert platforms? How might we question the value underpinning and consequences of digital platforms? How would practice-based projects investigate the mechanisms, ethical issues, environmental costs influenced by platformization? This paper situates platform education within and beyond communication design and proposes a framework of how relevant knowledge and skills can be structured and extended.

2. A New Literacy in the Age of Platforms

While education has long been advocating media literacy regarding interactions with mass media, the internet has transformed information distribution modes. The post-digital, post-net culture has dissolved the difference between mass distribution and limited distribution (Manovich, 2001) — mass culture and subculture can circulate in a similar way now that digital content has the potential to reach a mass audience. With Web 2.0, the consumption of information and culture is no longer limited to passive viewership as in monolithic mass media. The involvement modes have expanded: we are both the audience and the driver of the media (Vierkant, 2010).

The term "platform" has emerged since the first decade of this century, describing online services of content intermediaries such as YouTube and Google, which provide storage, navigation, and delivery of digital content (Gillespie, 2010). Technology companies

strategically chose to use the term “platform” for their services, benefiting from its etymological and metaphorical characterizations of flat, neutral, and open to all (Gillespie, 2010); however, platforms are not just distribution channels. They are mediators that produce social interactions and structures and are ideological by design. Platformization had granted the platform owners much social, political, economic, and cultural power, and caused controversies around their datafication, commodification, and selection practices (van Dijck et al., 2018). The relatively recent academic field *platform studies* has gained popularity after the MIT Press published a book series named after it. The book series conceptualizes a form of investigation into “the foundations of digital media, […] both hardware and software, that developers and users depend upon for artistic, literary, and gaming development” (The MIT Press, n.d.).

The evolving media landscape prompts educators at various levels to advocate for new forms of literacies, even though these concepts in existing literature are still ambivalent. *Media literacy* expands to include new strains such as *digital media literacy*, *social media literacy*, adapting to changing communication technology, and intersecting with *digital literacy*. To be literate entails the ability to “critically consume and creatively produce” content in these digital environments (Smith & Kumi-Yeboah, 2015). Digital media literacy can be defined as “the acquired ability to understand, access, evaluate, and analyze types and avenues of information created online or with available software and hardware to communicate and participate in civic life as competent media consumer, contributor, and creator of media in the online community”(Chilsen, 2015). *Platform literacy* is used interchangeably with media literacy, digital literacy, and social media literacy in an adult education context (Creelman, 2018), emphasizing digital technologies usage and participation on platforms. The term platform literacy occurs in the literature of cultural studies and digital scholarship (Christie, 2016; Jules et al., 2018) but lacks elaboration and definition. Annette Vee argues that every communication form relying on digital media is built on a platform involving computer code and refers to both writing and programming as platform literacies that provide contemporary communication foundations (Vee, 2017). Expressions of the urgency of platform literacy also appear in informal communications such as blog posts produced by scholars and educators with aspirational goals (Caines, 2018; Carrigan, 2018; Varis, 2017).

This paper argues that platform literacy goes beyond the level of participation to include critical understandings and potential interventional and subversive usages of platforms. Despite becoming marketing venues, online platforms are also venues for activism. Social networking sites and the hashtag’s aggregative function have attracted both marketing campaigns and political collectives to coordinate the publics through these digital platforms (Bernard, 2019; Bruns & Burgess, 2011). Though with different intentions, by sharing the adoption of hashtags, ironically, as communication theorist Nathan Rambukkana states, “at least in this one way, neoliberalism and activism might be speaking the same language”(2015, p.42). Jonathon Hutchinson argues that digital activism needs to learn from its commercial counterpart and adopt similar strategies (Hutchinson, 2019).

The configurations of platforms also shape knowledge production, as computational power has been incorporated into fields other than computer science, such as biology, data journalism, digital humanities, digital activism. Proprietary platforms permeate everyday teaching practice — communication, file organization and sharing, and slide-aided lectures. Tailored learning management systems and other academic computing tools involve platform-building by the education sector. Educators should engage in platform literacy and become aware of the values embodied, and address accessibility, equity, and inclusion issues.

To develop such platform literacy involves understanding platforms':

- The intended use, actors involved, values embodied, and the conflicts of interest;
- Operational principles and mechanisms;
- Material and human resources involved in production and operation, issues of ethics, labor, and the ecological cost;
- Governance through technical features and terms of usages;
- Algorithmic content moderation, how certain types of content are amplified and others are suppressed or censored;
- Datafication practice, how activities are encoded into data and users' control over what has been collected and shared;
- Commodification practice, what is monetized and awarded;
- Influences over values such as privacy, accuracy, and safety.

With these understandings, informed participation and resistance to power become possible. Design practice in a platform society is not limited to the delivery of pragmatic legibility and functionality and can engage more actively and critically in the discourse and shape alternative visions. This paper proposes a platform education that prepares designers for working within and from the system and civic engagement. A platform education for design rethinks the role of design in the system, uses design to render the systemic power and authorities visible, and additionally examines the impact of design choices. Designers are obliged to understand the cultural and political underpinning of the service, interaction, and interface design; feature landscape shared across different platforms and the norms formed as a result; expected use environment and unexpected usages; assumptions the design embodies.

3. A Framework for Platform Education

This framework incorporates precedent sources from social-scientific and media-theoretical studies into an area called *platform literacy*, emphasizing a design perspective. *Design* practice and *design experiment* address the practicalities and speculations with design-specific concerns. The three areas of studies form a triangular model, inspired by the Fallman triangle for interaction design research (Fallman, 2008). The following sections introduce the content and learning activities involved in each area.

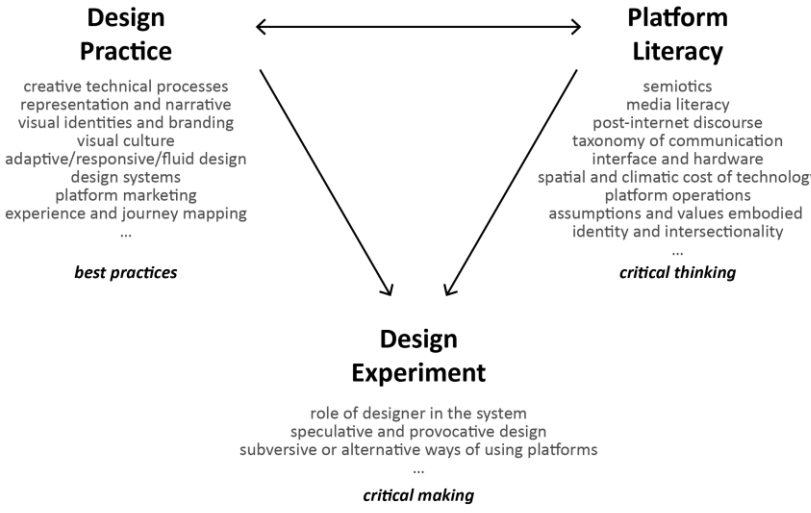

Figure 1. The triangular framework and key areas of discussion.

3.1. Design Practice

This area is concerned with foundational skills and the implications for professional design practice. The learning activities in this area are mainly *understanding* and *applying* the tools, processes, and strategies relating to designing for platforms. The design language of representation and narrative is addressed. Students explore emerging creative technical processes and move beyond visual forms to think about the multidimensions of narrative media: linguistic, acoustic, visual, static, kinetic, spatial, and temporal (Ryan, 2003). Concepts related to experience design, such as continuity and consistency, are introduced. Students build understandings of design systems, adaptive, responsive, fluid design, and experience and journey mapping.

This area also reflects on platforms' consequential influences on design rationale, visual identities, and visual culture. Google redesigned its visual identity in 2015, for instance, to achieve efficiency and cross-platform consistency even under limited internet connections. The geometric forms of the logo allow for algorithmic image generation based on screen scenarios and significantly reduce the file size (Cook et al., 2015). Data constraint became a design logic. Additionally, visual systems of technology companies do not operate discretely; they embed within each other. Apple News and other services using Accelerated Mobile Pages distill content from sources and display outputs in their own styles. Identity design faces a new set of relationships, as "platforms subsume and dictate other brands' signifiers" (Viloro & Hamamoto, 2017). As platforms create unstable and complex communication environments, some identity design practitioners assert that launching a static style guide

with a reductive approach of modernism is obsolete and that identities should be reconceived in terms of adaptivity and flexibility. An alternative bottom-up approach recurs in these discourses, in which a visual language is developed over time, and the brand is collectively built (Other Means, 2017; Viloro & Hamamoto, 2017).
Activities in this area are less concerned about being subversive and more about learning best practices and practicalities of working within the constraints of platforms.

3.2. Platform Literacy

While *design practice* develops literacy to design *for* platforms, *platform literacy* instigates literacy to unpack the mechanisms of platforms and make critical inquiries. Influences from other disciplines are most visible in this area, especially from science and technology studies and media studies. Referencing and adopting other disciplines' theories, methods, and techniques, this area lays the foundations of understanding and develops a vocabulary to enable participation and contribution to the ongoing discourse on platforms. The cognitive skills in this area typically encompass *understanding, describing*, and *analyzing*.
Starting with introducing fundamental concepts of communication, media literacy, and semiotics, this area's content moves from mass media to post-internet discourse, and finally, to platforms and impacts. Concepts in media studies such as media language, representation, consideration about the audience, and institutional influences are still relevant today with expanded participation modes in communication. The traditional notion of *medium* used to describe the material used in artwork — painting, works on paper, sculpture, video — is not sufficient to categorize contemporary work. New genres, such as multimedia and net art, generalize the work by the technologies involved and provide no additional context. Lev Manovich emphasizes the role of software in the creation and perception condition of a message in the communication chain, treating software as objects of cultural analysis (Manovich, 2001). With creation and perception condition in mind, students explore the taxonomies of communication beyond medium labeling, finding ways to describe the attributes through these example dimensions:

- *Creator and audience size* — one to one, one to few, one to many, few to many, many to many;
- *Distribution mechanism* — the TV network, museum and gallery exhibition, online video, podcast;
- *Active senses* — sight, hear, smell, touch;
- *Action types* — active, passive, interactive;
- *Roles* — producer, consumer, facilitator, performer;
- *Level of control* — the ability to skip the advertisement, pause, or rewatch.

Integrating perspectives from platform studies (Bogost & Montfort, 2007), feminist platform studies (Anable, 2018), and critical technocultural discourse analysis (as cited in Davis, 2020), platform literacy looks into both the *things* and the *bodies* involved, and the *meanings* produced. The study will reveal the often-overlooked physical consequences of infrastructures: submarine fiber-optic wires, dispersed data centers, energy consumption for running and climate-controlling the servers, spaces designed not for human occupancy but

hosting machines. Then by placing humans back into the systems, we can discuss the labor involved in platform development and electronic assembly and introduce concepts of identity and intersectionality.

Besides unveiling the underlying material and human resources, students examine platforms as design and cultural artifacts. For example, the short video sharing platform TikTok's home screen is filled with content to watch even without following any creator. The algorithmic recommendation mechanism is actively learning about user engagement and instantly flows the feed with content. With an endless scroll, the platform is designed to increase interaction, attention, and time spent. While these observations are reflected on by cultural journalism (Herrman, 2019; Tolentino, 2019), a design specific approach borrows the walkthrough method, App feature analysis, and value reflection (Davis, 2020) to interrogate the design choices, such as the choice architecture and dark patterns. Students reflect on the operating model, datafication and commodification practice, and the underpinning values. Platforms can simultaneously have characteristics of two conceptual extremes and paradoxical positions. The following attributes demonstrate standpoints from which to interpret platforms:

- **Platform as *centralization* and *decentralization.***

  After the release of smartphones and app stores, internet access has been dominated by mobile devices, and the decentralized early web has been replaced by hegemonic platforms and apps with specific functions. Information produced on the platforms tends to stay within the platforms as they are not indexed by search engines and thus not openly accessible. The information centralized on proprietary platforms is unstable and difficult to archive. These challenges of long-term storage and preservation of information lead to the creation of a digital dark age. Online platforms often employ user rating and algorithm-driven recommendations, which seem more democratic and can be seen as a challenge to centralized institutional power. However, the selection and sequencing strategies are also based on commercial reasons and controlled by often black-boxed algorithms.

- **Platform as *empowering* and *disempowering.***

  Platforms provide frameworks that give people space for public voice. Features such as hashtags, TikTok challenges, and memes provide structures and invitations allowing the exchange and aggregation of individual messages. Format limitations also create shared syntaxes, which in turn facilitate circulation. This phenomenon is not entirely new to the digital world. The "John & Paul & Ringo & George" t-shirt designed by Experimental Jetset commemorating Beatles members has become an archetype, causing many bootlegged versions tributing to other groups. These structures and formats can help with the formation of the public sphere, bringing statements together, and forming collectives. While raising visibilities to individual statements, such a format has a risk of leveling individual experiences. Over the course of the #MeToo movement, the usage of

the hashtag has raised criticisms for homogenization and suppression of unique voices (Bernard, 2019).

Customization capacity alludes to a sense of empowerment. According to YouTube CEO Chad Hurley, "the online video experience is about empowerment." Content owners, consumers, and advertisers are empowered through tools of data and the ability to customize to their needs (Hurley, 2008). Platforms can shift economic powers from legacy institutions to individual users by allowing individuals to market personal assets and profit from them (van Dijck et al., 2018). On the other hand, user-generated-content platforms rely on users' contributions of time, labor, and risk-taking. While people have quit their day jobs to become full-time bloggers, the platforms share little risk but have much power over controlling the terms, interface, and algorithms. Participating in this economy as influencers, drivers, or hosts, could bring economic returns. At the same time, the user-contributors bring more traffic to the platforms, which ultimately benefits the platforms and leads to a concentration of power in the hands of the platforms.

- **Platform as *neutral* and *ideological.***

The word platform's connotations of flat and neutral are of advantage to actual value-laden platforms. Even though content intermediary platforms position themselves as "empowering all but choosing none" (Gillespie, 2010), platforms govern their users by user agreements and policies. Sometimes, the actions can be contradictory to their statements. For example, YouTube videos with LGBT content trigger the algorithm to restrict and demonetize the posts, stopping them from earning ad-based revenue. Since platform operation relies on computational power, many aspects of the world that have never been quantified before are now facing *datafication* (van Dijck et al., 2018). While often considered as an impartial representation of reality, data can hardly be objective, as one common critique for big data says: "'Raw data' is an oxymoron" (Gitelman, 2013). When setting up the gathering mechanisms on a platform, data are already prefigured (van Dijck et al., 2018). The collected data must be interpreted where specific interests come into play. When it comes to cataloging, filtering, and presenting the data, algorithms are created by humans who can bring their implicit biases and values into the code (Noble, 2018). For example, Facebook adopted a spectrum of gender identities for its users to customize their profiles. While its user-facing interface allows nonbinary identities, at the database level, this information is still kept as a male–female binary for the use of advertisers (Anable, 2018). Platform operators are also increasingly vocal in policy and law-making (Gillespie, 2010) and can influence social–political movements in various ways.

- **Platform as *private* and *public spaces.***

Platforms are often private-owned entities acting like public spaces. They appear to be a barometer of public sentiments, especially with hashtags, to create ad hoc channels (Bruns & Burgess, 2011). Platform operators control the interface and algorithm that facilitate information exchange, expressions, and discussions and could shape public opinions — take the Facebook–Cambridge Analytica data scandal, for example. The firm collected personal information of millions of Facebook users without their consent and modeled voter profiles, which became subjected to targeted political campaigns.

Awareness of the need for the protection of the digital public space has been growing. In October 2017, Snapchat partnered with artists to create geo-tagged 3D sculptures to be viewed in augmented reality at specific locations via the Snapchat app. The project launched featuring Jeff Koon's Balloon Dog in Central Park, New York. Although the AR work is presented in physical public space, the work and the digital public space are still protected within a space controlled by a corporation. The corporation received criticisms for contributing little to maintaining public spaces but benefiting from the publics formed at these spaces and the marketing effect. Within a day of the launch, artist Sebastian Errazuriz and the Crosslab team released a standalone free app with a vandalized version of the Balloon Dog covered with graffiti as an act of protest. The vandalized identical Balloon Dog accentuates the private nature of the digital public spaces. The artist sees this as a "symbolic stance against an imminent AR corporate invasion"(Errazuriz, 2017).

This area engages with current societal and ethical issues, such as authority, power, labor, climatic cost of technology, security and privacy, and cyberbullying. Ultimately, this area aims to build an intellectual tradition and form a unique approach appropriate to the design discipline.

3.3. Design Experiment

Design experiment reflects on the responsibilities of the designer and focuses on the propositional power of design — the construction of a different reality that challenges colonization, makes space for speculation, and provides possibilities for powershift. The activities in this area require synthetic skills to *evaluate* and to *create*. Integrating thinking informed by platform literacy and practical skills acquired through design practice, design experiment uses discourses around platforms as the subject matter or uses it as a medium of practice to produce artifacts, experience, or systems as provocations. In contrast to design practice, which works within the system, design experiment involves expanded and emerging modes of practice, sitting at the fringe or outside of conventional commercial design. Instead of being market-driven and following the paramount of best practice, works in this area are more exploratory, producing critiques of the current state and experimenting with subversive or alternative ways of using platforms. While speculative design and critical

design are precedents of alternative modes of practice, design experiment is not limited to producing tangible techno-critical objects. The outcome of this area can take the form of visualization, social campaign, design for advocacy, installation, and participatory activity, and can situate within the context of platforms as the medium of dissemination.
The activities are problem-setting rather than problem-solving. While experimental projects cannot solve the dilemmas present in the platform age, by engaging in various creative actions such as treating platforms as performance venues or developing tools for misuse and subversion, design can reach the audience in original means and build awareness, frame discussions, and promote engagement. Ultimately, these efforts can influence design practice at large to be "calibrated towards a systematic redistribution of power and wealth" (Viloro & Hamamoto, 2017).

4. Application of the Framework

The different sets of goals in these areas ask students to change their perspectives and challenge them with different works while exposing them to various modes of practice. In using the framework, teaching activities move in-between areas. Learning about design practice and platform literacy informs each other and is synthesized towards design experiment. Through the lens of reflective practice and research through design (Frayling, 1994; Schön, 2017), what is learned in the design experiment area will contribute to the cumulative knowledge of platform literacy.
The framework presented has been formulated when developing a junior-level studio course in a Communications Design curriculum. As a tool, a draft version was used during conversations among faculty when coordinating multiple course sections. The framework has guided the planning for projects, reading materials, and in-class activities. It has also been used as a student-facing roadmap to the course, helping establish connections between different course content areas. It can guide rubrics for course assessment and student work evaluation. It has proven useful for establishing a common ground and articulating and clarifying terms and skills relating to "platform."
The framework has been integrated into the class as a series of workshops, lectures, and three major projects: design *for*, *with*, and *about* platforms. "Design *for* platforms" follows the constraints and specifics of platforms like how they would be used in the industry. "Design *with* platforms" interrogates the functions and paradoxes of platforms. Students use and subvert a platform, experimenting with assigning the platform a characteristic that was not a part of its original design and employing the platform as the *medium* to manifest the concept. "Design *about* platforms" reflects on the impact of technology, media, and platforms and uses the related contemporary issues as content to design for advocacy and public engagement. The outcome is a social campaign with participatory and installation components.
The first run of the assignments tested that there are overlaps between "designing *with"* and "designing *about."* When subverting the platform, it is still "designing *for,"* in the same way as digital activism using platform marketing techniques. The design experiment could have

been pushed to include speculation of new platforms and alternative ways to operate current ones. From class observation, although students are critically engaging the discourse, the technical and intellectual skills desired are hard to acquire from one single course. These concepts introduced are not contained in one course and can build continuity and knowledge transfer between courses. At the departmental level, platform education could inform larger curriculum updates, incorporating learning goals into multiple courses and advancing over time.

The framework is still under experimentation and refining, and the projects observed will inform further iterations. Future development of the framework involves analyzing past class versions and stimulating conversations around platform education and soliciting feedback. The framework provides scaffolding for a platform education in design. It aims to clarify terms and produce an organizational structure of skills related to consumption, evaluation, and creation in the age of platforms. Advocating for a platform education to respond to the intricate contemporary media landscape, this paper aspires to begin a conversation and foster discourse about teaching, framing, and making critical inquiries into platforms.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The body as an artefact: a case of hand prosthesis

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Abstract | The tension of overcoming our biological limits - as human beings - is the driving force in our evolutionary history. Since ancient times , we have used technology as a solution to overcome our limitations: the invention of clothes allows us to adapt to any climate, the spectacles empower our sight.
Today, technology is even more powerful: technical suits support us in visiting extreme environments, including the emptiness of space, where humans cannot survive. We are surrounded by artefacts placed *on the body* (i.e., wearables, oculus), *in the body* (i.e., endo-prosthesis, diagnostic and therapeutic aids) and *in the extended body area* (i.e. non-invasive medical devices, robots for surgery etc.)
This paper aims to highlight some of the challenges raised by the relation between the human body and extra and intra-corporeal technologies, focusing on the design of a multi-jointed prosthetic hand, discussed with regards not just to functionality, but also to aesthetic and mode of use.

KEYWORDS | EMBODIED TECHNOLOGY, CYBERNETIC BODY, PROSTHESIS DESIGN

1. Introduction

Today's technological progress has extended the capabilities of human body, for instance by enhancing our senses or our strength. Novel applications in the fields of ICT, biotechnology and AI are giving life to unexpected scenarios and possibilities. Also, a new advanced generation of prostheses seems to promote an evolution toward *empowered* bodies. So, while the advancement of the digital world seems to suggest surpassing the body's materiality, dissolving it into virtual realities, we are also assisting to a revaluation of physicality. Indeed, the development in fields such as bioengineering and aesthetic surgery has brought into question the organic nature of the human being, paving the way to the advent of a *hybrid being* with inedited technological characteristics. In this scenario, the body becomes the outcome of a project: it becomes an *artefact*.

In the light of this evolution, the role of design is challenged by devices that integrate with the body in different manners, from inside to outside. In the inner body area, we find invasive biomedical devices such as endo-prosthesis, diagnostic and therapeutic aids. In the external area, instead, there are devices that interact with the body in such a way that users are aware of them: eso-prosthesis, diagnostic and rehabilitative aids. Finally, in the extended body area, there are non-invasive medical devices that integrate biosensors, telemedicine communication systems and so on.

This paper focuses on the design challenges faced by designers who deal with such "human tech-empowered" artefacts, while aiming at fulfilling the requirements of aesthetics, mode of use and performance, but also considering ethical issues.

We analyse as a case study the awarded design of a multi-jointed prosthetic hand, called *Hannes*, developed by DDPstudio in collaboration with Istituto Italiano di Tecnologia (IIT) and INAIL Centro Protesi. Hannes is able to give amputated users more than 90% of the functions, thanks to the naturalness of shape, movements and orientation of the rotation and posture axes. The control system implements both traditional strategies and new strategies based on AI algorithms, with which people can command movements simply by thinking of what they would naturally do. The personalization of the operating parameters takes place through a specially developed software which interfaces with the prosthesis.

The prostheses of hands, together with those of legs, well represent the complexity of these design challenges. On one side, they have extremely intricate functionalities to perform. They play, indeed, a crucial role in the replacement of lost abilities, but also - and possibly most crucially - in the definition of individuals' identities. As a result, designers have to always fulfil the highest requirements of users with regards to both functions and performance from one side, aesthetics, experience and meaning from the other.

Nonetheless, as designers, we ask ourselves what role we should play in this fascinating path and which ethical limits we should set to it.

2. Human Beings and Technology: A Contrasted Relation

The tension of going beyond ourselves, to overcome our biological limitations is the driving force that has guided all the technological progress in human history. Since ancient times , indeed, the application of technology serves the purpose of modifying and mastering the external world for our benefit.

Donald Schön (1967) defined the "extension of human capabilities" as the main goal of technology itself. Verbeek (2005) added the principle that technology is not something that humans work with, but something that is part of being human. It is therefore not surprising that, after producing a large mass of external instruments, we aim now to perfection and to extend the capacities of the body itself. A lot of us are already walking, manipulating objects, or just being alive, thanks to external prostheses and internal installations, such as metallic bones, artificial veins, microcomputer and similar devices installed in our organism. (fig. 1)

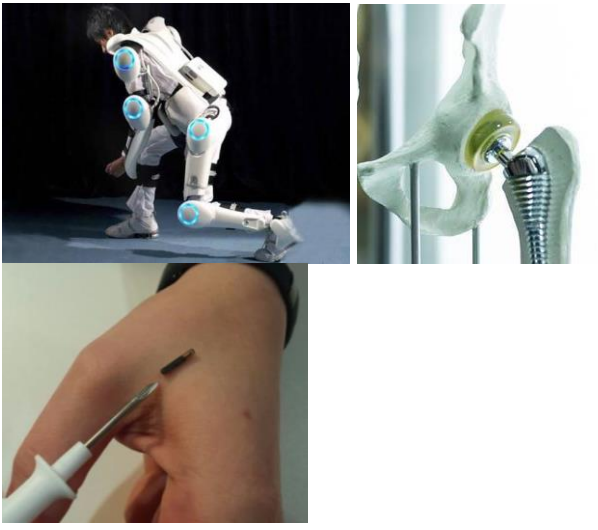

Figure 1. On the left: Hyundai Exoskeleton; In the center: Reconstruction of a hip through metallic bone; On the right: an example of human microchip implant.

Today, neurostimulators can be surgically placed under the skin, so to control movement symptoms such as tremor, slowed movement and stiffness due to Parkinson. At the same time, exoskeleton powered by motors and pneumatics allow limb movements with increased endurance. Our bodies are being permeated by technologies, becoming a mixture of natural and artificial (Fortunati et al., 2003). Nevertheless, this pervasion of technology into the human body has always been one of the most difficult steps of our evolution to be accepted.

Emblematic in this respect is the dystopian narrative of technology proposed in the novel "Frankenstein" by Mary Wollstonecraft Shelley, edited for the first time in 1818. Victor Frankenstein can be seen as the modern incarnation of Prometheus: he, as Prometheus, is fascinated by the power of the modern version of fire, electricity. Right after the birth of his creature, Victor is both fascinated and tortured by the power of his creation, ill with disgust for what he has done. "Frankenstein" is the first novel that reflected the characteristic condition of modernity, that had capsized the temporal perspective centralized on the past, typical of the pre-modern societies, to promote and emphasize the drive to the future, that had its fundament in the idea of progress. However, Victor Frankenstein represented the wicked scientist who used new techniques to overcome death, the ultimate of human limits. The outcome of his experiment was, at that time, inhuman and unacceptable: Victor's torture mirrors that of Prometheus, guilty of having stolen the fire from gods: a torture that, for both of them, has to be undying and eternal.

Nowadays, we are perhaps ready to embrace the technologization of our body, at least as long as such technologization replaces/cures/supports/monitors us for a better living. Following this, captivating is the story of Neil Harbisson, recognized in 2004 by the British government as the *first cyborg* in history. Born with *acromatopsia*, he is uncapable of seeing the full spectrum of colours. Today, thanks to an antenna- *the eyeborg*- implanted in his skull, he is able to hear the colours transformed into sounds.



Figure 2. Harbisson's eyeborg.

Technology has finally entered us. It penetrated our mental and physical structures, interbreeding the body. We are shifting to an updated image of "cyborgs", where – thanks to an embodied technology - the human body is wholly engaged. (Hollinger V., 1999).

3. Redefining our Identity: The Updated Cybernetic Body

Technology has the task to provide for the inadequacy and imperfections of the human being, not only to substitute missing organs, but also to boost them up (Gehlen, 1980).The resulting "mutant" body (Fiorani, 2004) is a communication-body, amplified and dilated by external and internal prostheses, shells and shelters. It is a body extended until it becomes a sensing network, a body empowered by sensors and digital archives inside its clothes and prostheses (Pacifici and Girardi, 2001).

In this perspective, identity itself is being re-defined. We are indeed witnessing the evolution of our identity from a body that uses technological instruments, to a body that *becomes technology* (Pecchinenda, 2010). In this mix of body and technology, the body becomes an instrument by itself. Even better, the body re-designs itself into a hybrid bio-technological being. A human being that co-habits and interacts with technology, so much so that it integrates it in its own perceptive and sensorial apparatus up to the point of fusing completely together. A human being that doesn't abandon her body but elaborates it in the name of an artificial ideal that allows her to overtake her biological limits. (Bell et all. 2004)

We can therefore affirm that our digital society finds itself facing two opposites but complementary trends: on one side, a devaluation of the body in the affirmation of our identities in the virtual realm; on the other side, a revaluation of the body that - thanks to the development of medical and technological research - opens the door to novel perspectives. From biogenetics to plastic surgery and body-art, the biological body is questioned, but not to be abandoned. On the contrary, to be improved and perfected. (Kastrup, 2018)

Paralympic athletes can today compete thanks to the availability of advanced prosthesis. These devices are sometimes so performing to enable them to achieve results like able-bodied athletes.

We all remember the notorious controversial case of Oscar Pistorius who, although had both legs amputated, was hypothetically able to compete with able-bodied runners, thanks to a set of special carbon fibres prostheses. The South African athlete even asked to join the Olympic games, but he was not allowed to, because such prosthesis might enhance his performance beyond human range. So, the prosthesis allowed him, not only to "repair" his disadvantage, but also to "increase" his performance. (fig. 3) Had him been allowed to join the Olympic games, it is likely that able-bodied runners would have liked to (or would have had to) enhance them-selves too with carbon fibres prostheses, starting a new rush toward

becoming super-athletes. In this perspective, the competition would be based more on technology than on human performance.



Figure 3. Pistorius Prothesis

In this specific case, something crucial would be lost of sport competitions which, being based on the same context conditions, try the different human characteristics. These kinds of conditions highlight how different we are, one to another, and how important is the role played by our body in this comparison. It is thanks to the body that everyone is exactly who she is: a specific individual that enters in relation with others, a unique "me" that recognizes in the other a "you" equally unique. Would it still be possible to be "unique" in a world of super-heroes, made of bionic bodies and perfection? In the basic postulate of post-humanism, the selection of the physical characteristics, that we desire to develop, would be better than letting nature go its way (Ferrando, 2016).

We do not just permeate our body with devices, but we change it with aesthetic surgery, and other techniques (not always as invasive and permanent), because of the illusion of stopping time and its effects on our natural physical deterioration. We follow an ideal of a perfect organism, as if imperfections, that makes us who we are, were inconveniences to be solved (Putrov, Galina, 2018).

Technological evolution enables this race toward the continue redesign of our bodies. Will that lead us to the point where we will be given the choice to replace our body's parts not just because of accidents or diseases, but just to constantly improve our aesthetic and performance, in a sort of continuous update of ourselves?

In the light of this open question - the answer to which is yet to come- being experts in design and technology we wonder which kind of approaches should we take on while facing this class of artefacts.

For sure, designers have (and should have) the sensitivity to address issues by meeting not only technological requirements, but also user needs with a human-centred approach. Indeed, nowadays, we can find products designed to be *placed on the body* or for the *extended body area* that consider aesthetics, functionality and - even more importantly – the human perception of technology. These are products in which the technology enhances users in a pleasant, acceptable way, rather than just replying human abilities (Ferraro, 2012). Examples are *wearables* that can be worn unobtrusively on the body as clothes or devices that, substituting traditional products, become real extensions of our body. (fig.4)

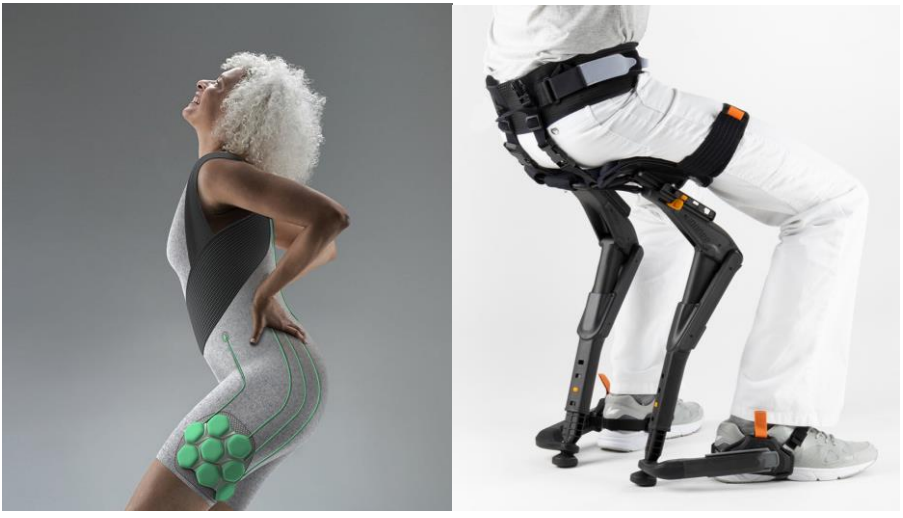

Figure 4. On the left: Superflex Skeleton (augments different level of mobility in older people); On the right: Chairless Chair (enhance healthy position)

As designers, we don't believe into a technology that substitutes "humans" making us "inhuman" (dystopian view). We prefer instead a positive view, where *humans become (acceptably) augmented* (utopian view). (Bernat, 2013)

4. Hannes, a multi-jointed prosthetic hand

While we face these issues about the human relation with technology and its future perspectives, we can detect what are the latest achievements when it comes to products designed to be placed "intrabody" and see if they confirm or not our assumptions.

As a case study, we analysed a multi-jointed prosthetic hand, called Hannes that in 2020 was awarded the international industrial design prize Compasso d'Oro. Hannes is able to give users, who had the limb amputated, more than 90% of the functions, thanks to the naturalness of shape, movements and orientation of the rotation and posture axes.

The control system implements both traditional strategies and innovative strategies based on AI algorithms, with which people can command movements simply by thinking of what they would naturally do. The personalization of the operating parameters takes place through a specially developed software which interfaces with the prosthesis via a Bluetooth connection. Hannes was developed by DDPstudio in collaboration with Istituto Italiano di Tecnologia (IIT) and INAIL Centro Protesi. We interviewed Gabriele Diamanti, member of the design team together with Lorenzo De Bartolomeis and Filippo Poli, to find out the characteristics of the device and more.

Question (Q): “What is the level of development in this field of myoelectric prosthesis?”

GD: “There are many of them on the market, but not really satisfactory. When they are functional, they are disproportionate or ugly, while, when they are more aesthetically pleasing, they are not as functional. That is, they are usually too unnatural in the movements, sometimes too weak or too heavy to be really used in everyday life in a profitable way”.

Q: “What are the improvements of Hannes compared to other devices?”

GD: “With just one engine for all the fingers (and therefore less weight and lower production costs), Hannes manages to be compact, slim, light and beautiful. It can adapt to the shape of objects with a unique naturalness and when necessary, exert a high force”.

Q: “What is the role of designers in such a technological product development?”

GD: “The pivotal understanding that technology alone is not enough is thanks to IIT and Inail. They realized that they needed design to make a robotic arm “human”, so that an object that is very useful but usually not accepted by users for aesthetic/ergonomic reasons, may finally become desirable and really used every day, changing people lives. It is for this reason that we, DDPstudio, were asked to collaborate with the Rehab Technologies INAIL - IIT Lab, something which we are very proud of.”

Q: “In which stage of the development your studio was asked to interact and collaborate with the engineering team?

GD: “The hand for which the mechanics were developed was originally for robots. It was then transferred, as a spin-off, to the idea of prosthesis. At that point we, designers, were involved in the project. From that moment on, we worked together with the engineers through an iterative and collaborative approach.”

Q: “While working in such a multidisciplinary team did you find yourself struggling with technicality? If yes, how did you face it?

GD: “Our collaboration with engineers has been very close and positive. Indeed, the success of Hannes originates also from the way we worked. We took the best of the different disciplinary inputs.”



Figure 4. The hand Prothesis “Hannes”.

Q.: “Hannes robotic hand is aesthetically very well-finished, but does not imitate the real hand (skin, hair, etc.). Why is that? Is it easier to accept?”

DG: “All robotic hands – Hannes too – are covered with a customized glove (usually made of silicone or PVC) which acts as a skin. The glove simulates the skin tone of the user and it can have realistic nails, even the hairs. Yet, Hannes imitates the human hand in the most important aspects: the shape, the proportions, the dimensions, the postures it can assume, the resting position, the movements it makes (axis of rotation, range of motion), and the response to the grip (which is adaptive). As regards for aesthetics, these are all factors that - in everyday use - count much more than simple cosmetics. Nevertheless, while typically users prefer a hyper-realistic prosthesis with human looks, there is now an emerging tendency (especially in the Anglo-Saxon countries) not to conceal the prosthesis anymore, but to show it as it is, enhancing its technical appearance. Therefore, having an aesthetically nice robotics hand, which explicitly declares itself for what it is, constitutes an added value and makes it possible to satisfy the demands of this emerging slice of the market. Indeed, even our “patient zero” (a man who is using Hannes to test it), likes to wear Hannes as it is, without the glove. So, for this reason, we gave him a transparent glove, that protects Hannes during intense or wet usages, but shows its high-tech aesthetics. Finally, we believe that a well-done design should be beautiful even *under the skin*, literally.”

Q.: “Then, how did you design the aesthetic of a robotic hand?”

GD: “To develop the Hannes hand, we studied the shapes and proportions of the “ideal hand”, starting from scratch: from research into the world of artistic representation, to an in-depth study of the anthropomorphism of the natural hand, up to the comparison with the producers of high fashion mannequins, as a reference for the most up-to-date aesthetic standards.”

Q: “While studying the shapes and proportions of Hannes did you develop and test intermediate prototype(s)?

“Yes, there have been six main phases of development. For each phase, we had a specific prototype that helped us to first integrate the design and engineering proposals and then to test the integrated version.”



Figure 5. The several stages of development of Hannes.

Q: “In doing a robotic hand, have you not been tempted to give it better (than a real hand) performance? Make it stronger, for example?”

GD: “There are still huge technical limitations in increasing the potential of the real hand by making it a hand with “superpowers”. The first is that a larger engine would have to be used, thus exceeding the dimensions of the natural hand. The second is that the life of the batteries, which is a fundamental requirement for everyday use, would have been severely limited. Of course, we had that temptation, but the real hand is such a perfect thing, robust and functional (despite its slender structure), which is already a miracle if we managed to give Hannes a similar force. Most of the other hand prostheses are indeed much weaker than a real hand. Yet, another interesting concept would be to increase the number of

fingers, or to decrease it, or to attribute to fingers some movements that are impossible to real fingers. These are all possibilities that emerged in the brainstorming phase and have been useful for carrying out the work, but they never passed the conceptual stage because the anthropomorphic requirement is too important for users. Indeed, 99% of them would not accept something clearly different. We must remember that we are talking about people who are already used to feeling different because of a disability, so, typically they wish to go back to normal, not to be more different.

Another opportunity, that was discussed in focus-groups with potential users, is to integrate the prosthesis with existing electronic devices. For example, if you have an arm amputation in the forearm, there is an extra space in the prosthesis where it could be possible to put a smartphone, a smartwatch, etc. Hypothetically, users are interested in interacting with everyday electronical devices, but this option is extremely secondary to the practical needs they really have. Thus, research is still focusing on making the prosthesis performs at best the complex functions of the human body."

Q: "It seems to us that we are expecting a future in which various forms of devices will integrate ever more effectively with our bodies. Through the Hannes experience, what is your idea about the future? I mean, do you think it will be normal and accepted that our bodies will become "cybernetic"? What role will this evolution play in the definition of our individual identity?"

GD: "It will be absolutely normal for our bodies to be cybernetic. This is not even an anticipation of the future, but the observation of a consolidated reality. After all, isn't a pacemaker carrier already a cyborg? We never think about it, just because we do not see it with our eyes, but it is so. The eyeglasses, on the other hand, are an example of "put on and off" prosthesis not integrated with the body, but which is a proper prosthesis: it gives back power and effectiveness to a weakened function. And they have existed for centuries. In this sense, they are not different from cheetah legs (the one wore by Pistorious) or a myoelectric prosthesis. The fact that we perceive them as normal is simply a matter of cultural evolution, that always takes place through everyday use. Thus, the more these plug-ins will be useful for carrying out essential daily tasks, the greater and faster will be their acceptance by the users. That is: being a "cyborg" will be perfectly normal, when it will allow users to have a normal life. At that point, there will be (and the first signs of this tendency are already present) the wish to play with a prosthesis, to personalize it, to make it closer to one's taste. Like for the eyeglasses frame, the arms and legs are becoming a field of aesthetic, of use and constructive experimentation. That is, a design field.

Completely different is the topic of body augmentation, that is the implant of prosthetic by able-bodied users to add functionalities that the body would not have in nature. We believe that, in the near future, this theme will remain in the field of cyberpunk mythology and experimentation by some avant-gardes (*like the case of Harbisson, who – to be fair – is not an able-body*). It is not just a problem of social acceptance, but personal: it requires a very strong motivation and real needs."

We have described the design of an advanced robotic hand that reaches the highest requirements of a typical user - as regards for functions, performance and aesthetics – but also fulfil a new trend, where the user displays her prosthesis proudly. In our understanding, this new trend anticipates a turning point where users will not hide their cybernetic body anymore, they will rather show it, customize it, improve it.

5. Conclusions

The development of increasingly sophisticated solutions for repairing/enhancing the human body is based on the progress in all the fields of technology and – more in general – in applied medical sciences, but it has repercussions - on a more philosophical and ethical level - on the fundamentals of human existence.

The possibility not just to heal our body, but to increase its performances, challenges the way we determine our identity, our essence. Yet, we do not abandon our own "physical container", rather we revaluate it and hybridize it through technology itself, in pursuit of new standards of perfection and uniqueness. This way, the human body becomes a working artefact that embraces the use of prostheses and other instruments that extend our motoric, manual, intellectual and sensorial skills.

In this perspective, all devices that start to become part of it (the body), are likely to evolve towards a system of physical prostheses, also able to elaborate data and to supply services. It is a body to re-consider and to re-design.

Eventually, we can nowadays experience what Wiener defined as "cybernetics" in his influential 1948 book: the convergence of digital, mechanical and biological. While emerging technology is rapidly getting intimate to the human body in shape of various artefacts, design researchers and practitioners are facing several challenges, all pointing towards ethics, since nowadays two opposite approaches toward technology coexist, the utopian and the dystopian one.

In the light of this perspective, while dealing with technological artifacts and working into multidisciplinary teams, designers have the role of reasoning on a broader view of technology encompassing aesthetics, user experience, meaning and social acceptability of such newly designed artificial bodies.

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Acknowledgements: we would like to sincerely thank Gabriele Diamanti of DDPstudio for answering all our questions on the design process of the prothesis Hannes.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The design of human machine interfaces: from data to risk prevention.

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Abstract
The paper focuses on interactive design with a specific focus on the human machine interfaces for the risk communication. The paper shows the results of an going research based on a double approach: a critical approach addressed to the definition of a cultural perspective for the design discipline in the context of the Informatic environment; an experimental research project based on risk revelation and communication. In the first part the paper gives a perspective based on the comparison, management and organization of the principal theories meaningful for the language and sense of the artifacts. In the second part we referrer to the human centre design method. Through a case study the paper exposes the theme of data derived from devices in order to detection of risk and communication. Good for risk prevention will be detected by the effective role of the human machine interface, by a complex and multilevel communication strategy.

KEYWORDS | PRODUCT DESIGN, INFORMATION DESIGN, RISK PREVENTION, HUMAN CENTER DESIGN, HUMAN DATA DESIGN

1. A cultural perspective for post digital design

The culture of design that focuses the artifacts in their technological dimension, during the second industrial revolution, has addressed the attention of design towards the theme of the “utility”. The artifacts have been designed in order to respond to the "use on demand" and the technical-physical devices are defined to correspond to this condition. The formal language is articulated properly for suggesting the interaction between man and the artifact on the basis of a predilection for the sensory stimuli of the visual area.

The post-technological culture has, also, enhanced the ability to allocate electronics in the physical body of the artifacts and has, thus, expanded the interest of design towards the theme of the "functions". The artifacts have been designed in order to correspond to such expectations of functioning, going through a human-artifact mediation based on a cognitive approach. The attention of design towards the proximal areas of computer science and cognitive psychology is mainly activated in order to give answers to users’ needs, enhancing the theme of the human-artifact and / or human-machine interface.

The miniaturization of electronic components, then, identifies new constraints in artifacts and high technological content, shifting the focus of the project from the physical apparatus of the envelope of the technological component to their "synthetic" interface, in direct mediation with the user and his capacity to interact with it.

Today, the outcomes of the digital revolution in the IOT are leading the attention of the project towards the theme of the "experience" of use, that is the conception of artifacts that offers new interactive modes between the technical - physical devices (increasingly controlled in the dimensions and material interfaces) and the immaterial dimension. At this connection Krippendorff (2007) discussing on the “experience product” affirms:

> “English dictionaries trace the origin of the word, ‘experience’ to knowledge of or skill in making experiments. Its etymology suggests an important conceptual truth: experiences are not merely personal and subjective but crucially related to interacting with something of interest, an artifact, an activity, or a situation involving other people. What we will explore here must therefore overcome the objective/subjective Cartesian dichotomy and be concerned instead with how humans experience the world by acting on it and creating it.
>
> The prefix ‘ex-’ also suggests that ex-periences require ex-ternalization, ex-pression, or ex-planations. We cannot know what others experience unless they let us know by whatever means are at their disposal. We cannot discuss or theorize experiences without using words. Thus, while the sharing of experiences is impossible, when we talk with each other of what we experience we do so con-sensually, that is, in reference to something jointly attended to – naturally including the discourse by which we coordinate our under- standing and actions. It makes sense, therefore, to say that we shared a taxi ride or listened jointly to a concert, but not that we shared the experiences of these events. The latter may be different for each of us. Similarly, we can hear each other speaking, we may even talk about what we mean to say, but

> we cannot share meanings. Moreover, while our experiences are not only shaped and conceptualized by the categories provided to us by our use of language, we cannot help but talking about them in the expectation of being understood, which implicates the interests of sympathetic listeners or the community in which talking of certain experiences is valued. Inasmuch as the use of language is essentially social, what we know of each other's experiences is, hence, fundamentally social as well, not entirely subjective." (Krippendorff, Butter, 2007)

This leads to an intersubjective dynamic built on the basis of networks that include both humans and computers in a relational dynamic. Furthermore, in this perspective the artifacts begin to be conceived in order to give answers to that needs not already explicitly expressed by the user, defining a dimension of design culture that puts in direct dialogue the various relevant areas of science responsible for the development of "digital environment", both that hard and that soft areas. In this context, the design of devices dedicated to the needs of "doing" in a broad sense finds space. Think of the devices created to hybridize functions and define new types of systems: the smart watch in its intelligent extension becomes a system capable of relating the user with the community of devices that connect and are able to offer help in real time. The satellite navigator is a clear example of the application of these technologies: when we move from one city to another, what we see our path with the navigator, we increase the reality we perceive.

Design in the post-digital era therefore proposes a new way of interacting with the environment through artifacts capable of numerically enhancing and expanding the range of human sensory perception through nano-electronic devices - sensors interconnected to systems with computational capacity. The attention that the designer pays to the technical-physical devices is increasingly moving towards the possibility of adequately allocating the computational capacity in things by establishing new forms of intersubjective dialogue between man, artifacts and the environment, both in its size digital (Floridi, 2017) both in its physical and metaphysical dimension.

The research presented in this paper concerns the devices for personal and collective security, as will be read in paragraph 4.

Finally, the cultural perspective that is argued here focuses on the epochal passage, in gnoseological terms, of the meaning of the artifacts and of the symbolic values that express it: to theories that take into consideration the language of artifacts on a socio-semiotic basis (Ellinger, 1966; Burdek, 1997; Gibson, 1979; Barthes, 1983; Norman, 1988; Habermass, 1991; Maldonado, 1961, 1993; Eco, 1968, 1976, 1980, 1984; Krippendorff, 1986, 1989, 1997, 2018) are joining the theories that implement computer programming languages, focusing on data communicability. If the characteristics of the materials, the color, the weight, etc. they are, in fact, part of a structured, non-verbal language, intended to intercept the user's personal interpretation, intended as a synthesis of the cognitive sphere influenced by the socio-cultural environment and the subjective intuitive remarry on a perceptual-sensorial basis,

the dynamic dialogue of human data with the devices responsible for interpretation and processing on an IT basis opens up a new need for coding languages.

2. Design with human data

The perspective introduced by Big Data in the context of the project of intelligent artifacts pertains, therefore, not only and not so much to the communication capacity of the single device with the single user, as to the wider and more complex communication perspective in the complex of interconnected networks. From the commodity product, which responds to concrete needs of the user (such as computers, tools and appliances), the design integrates and includes the artificial intelligence functions in order to guarantee new safety and well-being standards. In this regard, Norman summarizes three different types of design: industrial, user interaction and experience. Industrial design deals with the creation and development of concepts and specifications to optimize the functionality, value and appearance of products and systems, with the mutual benefit of users and manufacturers. The design of the interaction instead focuses on the way people interact with technology. The aim is to improve their understanding of what can be done, what happens and what has just happened, based on psychological, technical and aesthetic principles. The design of the user experience, which deals with the design of products, processes, services and environments, aiming above all at the quality and pleasantness of the overall experience (Norman, 2014, p.23).

So, for the IoT we take, here, into consideration the so-called smartness applied to objects and places, mainly giving relevance to the possibility to monitoring, control and transfer information for safety sake, as far as so as to be ability to carry out the appropriate consequent actions. In recent years, the use of objects connected to the Internet has become increasingly widespread, both in people's daily lives (wearable devices, connected appliances, etc.) and in the working life (digitized production lines, Industry 4.0, etc.). One of the protagonist segments of this IoT revolution is the industrial one, so much so that we speak specifically of Industrial IoT, which is nothing more than the application of the Internet of Things to the industrial world (Floridi, 2015). Today, wearable computers represent the new world of electronic devices. If worn directly by man, they create the so-called human-machine interaction. Their main purpose is to minimize the number of devices to be worn by man, concentrating as many functions as possible in a single device. In this way, if each person has at least one, it is possible to facilitate his interaction with the outside world and other users.

The epochal passage that includes the dynamics of human data in design constraints opens up a new perspective:

> “If in the past we had to think about how people would interact with technology; today we must also consider the point of view of the machine. Creating intelligent machines means creating interaction, symbiosis and cooperation, both with people

> and with other intelligent machines. If in the past we limited ourselves to using our products, in the future we will have them more and more often as collaborators, sometimes as it happens, sometimes as servants and servants. We will find ourselves increasingly supervising and controlling, while we ourselves will be increasingly controlled and supervised." (Norman, 2008, p.168)

The wearable computing technology applied directly to humans, through external devices, does nothing but improve the interaction phase that exists between the user and device. Through their use, the user also involuntarily changes his habits and his behaviour with those around him. The opportunity to make the user able to interact with this device, simply and quickly during every moment of their day and in every place, leads to the creation of a new design method: the persuasive technology (Fogg, 2003).

Persuasive technology is used for the purpose of changing and/or improving human habits and behaviour. Today it is used in various sectors such as politics, health, advertising and marketing, but also in simple everyday life, also interfering with simple interpersonal relationships. This is aimed at changing the way users act and think, through the design and development of IT products. This means that everyday life will be managed by intelligent objects including wearable devices, included in smart fabrics and clothing (e-textiles). Commonly used objects such as sportswear, watches and shoes continue to evolve, as if enriched with intelligent control devices such as sensors, they manage to monitor and control human life, without the latter noticing. Most of these smart devices worn by humans are not developed and created to be used alone, but only work if associated with an App and websites dedicated to it. Wearable devices, objects that are spreading more and more in the current market, can be classified into three groups: complex accessories, smart accessories and smart wearables. Complex accessories are those devices that require connection to another device, such as bracelets used for monitoring physical activity, whose data are readable only after being downloaded to other hardware. Smart accessories are those more autonomous devices that connect to the network and that can perform some functions without the support of other devices. Finally, there are the smart wearables, or those devices that work in complete autonomy. They can autonomously connect to the Internet and have the ability to connect directly to the App with the aim of expanding their functionality, such as Google Glass.

3. Risk Society

Today a person, before leaving home, consults some application on his phone to check the weather conditions, and decide whether to take the car or not, or to simply choose what to wear. Before embarking on a trip, or to go to work, check the traffic map, to plan alternative routes that will ensure easier road conditions, or ensure you arrive on time.

The contemporary person, in moments of decision making with respect to the daily actions of living, needs tools that transmit safety, technologies useful to face the continuous risks that can be encountered. Seismic or hydrogeological risk; nuclear risk; banking risk; terrorist risk; road, railway, airplane accident risk; risk of ingestion, sunstroke, intoxication. Today the risk takes infinite forms, but no definitive definition.

Risk is characterized by its immateriality, it is a concept that manifests itself as invisible, imperceptible, and becomes real and tangible when it manifests itself and translates into effect. It is often represented by a number, a percentage, which defines the probability that an adverse event will occur. The uncertainty of person in front of the risk derives precisely from its unpredictable nature, not calculable, entrusted to probability. This induces today's society to an ever-increasing search for security, through the demand for guarantees, answers, reliability.

In 1986 the German sociologist Ulrich Beck wrote Risikogesellschaft - Auf dem weg in eine andere modern (Risk Society: Towards a New Modernity, 1992). In this book, he attributes this new definition to contemporary western society, the result of the same processes of modernization that determined its development. Although it was already present in some research at the end of the seventies, the attention to Risk Studies in the sociological field began with this book, until it became a fundamental field of research for the cultural interpretation of late modernity and not only in the social field.

According to Beck, the production of wealth generated by advances in science and technology, together with social, cultural and economic change, has led to an increase in risks. What has really changed is the relationship between individual and risk, his knowledge, his perception. Paradoxically, the conquest of well-being has produced a growing sense of insecurity and uncertainty, particularly about what is new, because it is unknown and therefore not governable. To the natural risk (earthquakes, floods, volcanic eruptions), traditionally attributed to chance, to a sort of fatality, during the second half of the 20th century technological risk was added, which is instead attributable to the development of industrial processes and therefore to humans. In some cases, the conscious choices of some people towards such risks have caused epochal tragedies.

Very well-known are the events related to the strong pollution from radioactive waste or toxic clouds, including those of Sellafield in 1957, Love Canal in 1976, Bopal in 1984 and Chernobyl in 1986.

Among the most relevant episodes, in the chemical and pharmaceutical industry, there are the cases of Thalidomide and Manimata. The first example describes the effects due to the spread of the drug Thalidomide among pregnant women in the period between 1958 and 1963, which caused serious damage and malformations in newborns, particularly in Germany; the second case concerns the methylmercury contamination of marine waters of a small Japanese centre, between 1956 and 1972, due to the spill of a chemical industry, which caused intoxications and serious neurological syndromes on its inhabitants.

To these are added health epidemics, such as Mad Cow of 1986, avian influenza of 2003, the current Corona Virus (2019).

People are always guilty of the spread of these phenomena and the damage they cause. These disasters have led to a deep crisis in civil society with regard to science and technology, particularly in relation to environmental and health damage. This new type of risk is no longer attributed to the unpredictability of nature. Political governance becomes the scapegoat, together with experts and scientists, for their inability to ensure the safety of their own communities.

The System of Risk Governance is in crisis, especially for issues related to the incommunicability between experts and laymen. The communication model adopted is in crisis, because it is linear and unidirectional, not attentive to the interpretative processes of the public that receives and interprets its messages.

The scientific community is beginning to realize that society has changed, it no longer has faith in political and/or academic institutions (Renn & Levine, 1991), its anxiety translates into activism, with the birth of environmentalist movements of revolt.

Risk can no longer be represented as something real and measurable, rational, defined by the evaluation of costs and benefits, and the statistical calculation of probabilities (Knight, 1921). With the growth of fear, insecurity, and the desire for knowledge in relation to risk, it is necessary to consider and evaluate other less objective conditions, which relate to psychology, culture, politics and ethics.

Risk Communication was born, an increasingly autonomous discipline, which bases its research on a multidisciplinary approach and the centrality of Human and Social Sciences (Kasperson & Stallen, 1991; Eppler & Aeschimann, 2008; Lundgren & McMakin, 2009; Sturloni, 2018). Risk Communication, in addition to defining coherent and effective communication strategies, is a useful and available tool for the community, to facilitate processes of participation, supporting open exchange and two-way and interactive dialogue. This paradigm shift in the communicative approach is even more necessary in the contemporary, chaotic and noisy context, characterized by the multiplicity of messages and the overlapping of channels, among which today the Social Media are also shown.

From a strictly communicative point of view, Risk Communication can be understood at the same time as a branch of scientific communication, public and institutional communication

and social and public utility communication (Cerase, 2017). With each of them, Risk Communication can share the scope, or the objectives, or the approaches. In any case, its fundamental mission is to inform the people, allowing them to decide autonomously, especially in real risk situations.

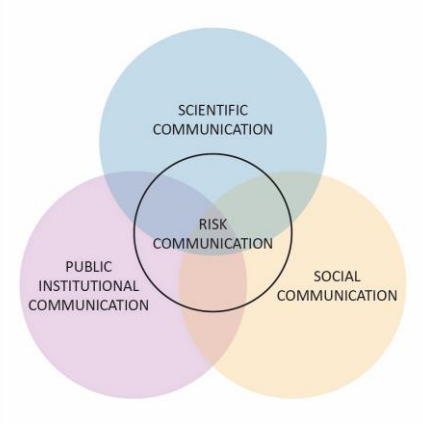

Figure 1. Relations between different aspect of Communication and Risk Communication.

From the design point of view, in the project of risk communication, transversal skills are needed in different areas, from information design to interaction design, from co-design to service design. However, the decision-making tables of Risk Governance, although so largely multidisciplinary, rarely require these specific and highly qualified skills. Wrongly so, considering that communication activities always take the form of printed documents, websites and apps, maps and charts, diagrams and others data visualisations (Lickiss & Cumiskey, 2019).

Among these areas, information design can be fundamental in the construction of risk communication, as it deals with language (Jacobson, 1999). Operationally, it carries out two actions:

- translation, through the analysis of signs and language related to the cultural context of origin of the message and that of the final recipient, to add new levels of meaning;
- information, through the representation of messages (textual, graphic, numerical) in comprehensible visual forms, within structures consistent with the system that must decode them (Tufte, 1990).

4. Data and Risk

Among the little known and relatively recently acquired environmental risks is Radon gas. It is a natural gas, which comes from underground and is widespread in many countries. The risk associated with Radon gas is health-related, and derives from unintentional exposure to the radiation that the gas emits under certain conditions. Prolonged exposure to the gas can cause serious health damage and genetic repercussions. The World Health Organization claims that Radon gas is a substance carcinogenic to humans, and for The Italian Higher Institute of Health it is the second leading cause of lung cancer, after cigarette smoking. The European Atomic Energy Community has issued some directives (Directive 2013/59/Euratom) in which there are clear indications for the Member States of the European Community on how to take regulatory action, setting environmental limits, measurement and intervention procedures. Italy has accepted these directives with Legislative Decree n.230/1995 and with Radon National Plan for the reduction of lung cancer (CCM 23 May 2005), which refers to the individual regions for control, monitoring and verification procedures on the application of the rules. However, today not all Italian regions have yet adopted precautions, and in some cases the strategies undertaken are not exhaustive.

Once again there is a problem of communication. Between several levels. And there is a problem of priority order.

In the manner in which it is presented, environmental risk is interpreted as legislative risk in the event of non-compliance with the standard. It becomes more important to respect the law in order not to incur in judicial troubles than to understand the real extent of the risk to avoid damage to health.

Individual behaviour is the result of a choice, closely related to the understanding of a given phenomenon and the relative risk. It is not possible to direct towards good practices without targeted communication that is attentive to personal needs.

The Radon project – research project funded within the framework of the Regione Puglia Living Labs programme, with the European Regional Development Fund – was born on these premises, defining as a mission the construction of an active participatory system for raising awareness among communities of issues related to exposure to Radon (Amato et al., 2019). On the one hand, the project involved the development of an innovative product, based on ICT technologies, for Radon gas detection and alarm communication, to be placed in public and private buildings; on the other hand, the multi-level information of users, through products and specialized communication processes. In all project cases, specific interfaces were developed.

To implement these objectives, the project has put together a multidisciplinary team, aware of the need for an articulated system of specific and complementary skills: experts in technology, physics and biology, communication. This team actively collaborated with the

social base, through discussion panels, workshops and focus groups, according to a Human Centred Design approach.

The data at the heart of the communication process are manifold and complex.

There are measurements of the amount of radiation emitted, detected in real time through electronic sensors, which present a numerical data expressed in Bequerel. They depend on the environmental conditions and the material characteristics of the space. There are the values of radiation exposure, detected through personal dosimeters, which depend on the physical characteristics of the individual and the space in which the exposure takes place. They are expressed in milliSievert. There is the radiation exposure time, which depends on the physical presence of the individual in a given environment. There are georeferenced data (GIS) expressed by thematic maps, which collect environmental data of Radon gas concentrations over a larger territory (fig. 2). There are threshold levels, which set regulatory and health-related limits. And finally, there are the human variables, which concern the psychology of the individual and the culture of a social group.

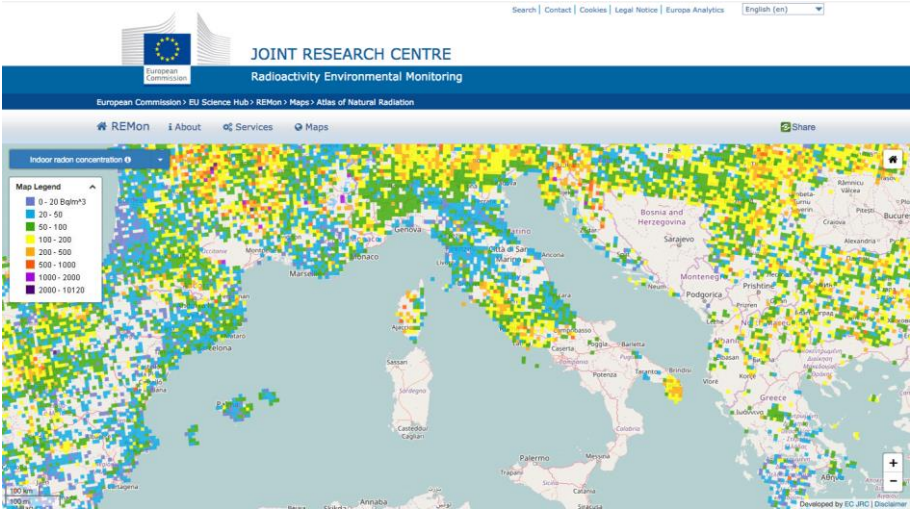

Figure 2. European map about Indoor radon concentration (https://remap.jrc.ec.europa.eu/Atlas.aspx#).

Sensors and other technological devices are able to collect all these data and process them through precision algorithms. In particular, an innovative personal dosimeter for ionising radiations, obtained using a multilevel approach based on Smartphones, artificial intelligence (AI) and data fusion, was developed for the Radon project (Scarcelli et al., 2020). The interfaces designed for communicating the risk of radon exposure translated the

complexity of scientific data into visual information, understandable by the non-expert user and useful for decision making (Fig. 3).

The design process was carried out in phases:

- research, through the analysis of requirements and needs during the discussion tables with the community;
- design, according to the methods of information design and risk communication;
- testing, with real users experimenting working physical prototypes and giving feedback.

These phases were repeated until the final prototyping of the interface, which was the common result and then shared collectively. Co-design with the end user ensured the validity of the device and the language adopted in the interface. The collaborative processes were also training moments, in which the complexity of the risk phenomena dissolved, reducing the level of uncertainty and insecurity.

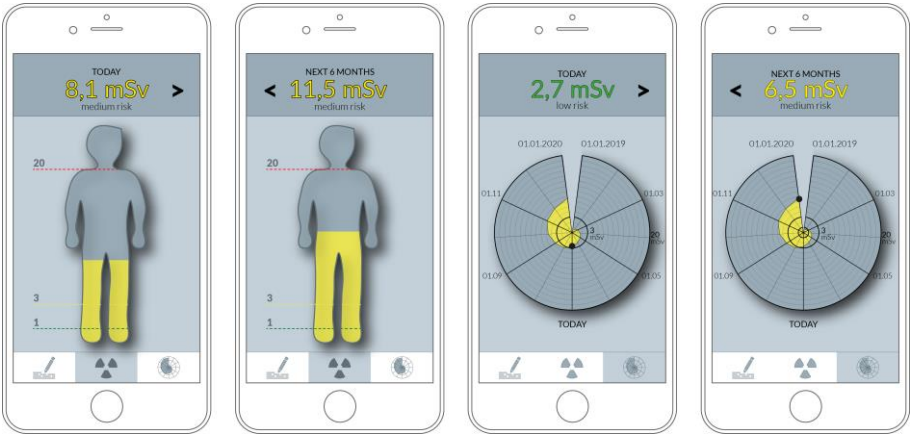

Figure 3. Prototype interface for the smartphone application.

5. Conclusions

The development of digital technologies, the so-called smart and wearable technology, sensor technology, the study of network architectures and communication protocols in the IoT field, makes it possible to organize services and design products dedicated to user needs on the basis of a new virtual dynamic, human-data experience. This happens through the extrapolation of relevant statistics, suitably processed through the so-called Semantic Web of Things procedures, directly from the inputs coming from things worn, used, present in the environment (from clothing, footwear, work tools, machine interfaces, environmental

surfaces, etc.). These aspects open to new, methodological relevant ways of approaching design (advanced) that tend: on the one hand towards the development of a technical specialization, with implementation of technology, for "traditional" artifacts; on the other hand towards the birth of new cultural contexts able to define classes of new generation artifacts in response to emerging needs related with the new social challenge. Among these needs emerges a growing demand for security, determined by the spread of environmental and technological risks, characteristic of the so-called Risk Society.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Designer in the AI/Machine Learning Creation Process

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Abstract | Beyond the utopian and dystopian hype of artificial intelligence (AI) lies the sobering, narrow, pragmatic reality that is Machine Learning (ML). ML's recent, highly publicized ethical failures have raised alarm at the bias that can creep-in through data, algorithms and design specifications, made even more problematic by ML's aura of neutral rationality. Homogenous ML development teams described as a white male monoculture are now expected to practice ethics without specific training along with their computer science skills; however, moral philosophy is radically different to the abstract, computational thinking required for programming and optimizing code. Diversifying ML production teams (through gender, ethnicity, age, ability, etc.) has been proposed as a solution for this dilemma, but this approach is limited by systemic ICT (Information and Communication Technology) pipeline issues. One way to rapidly address lack of diversity in ICT is by bringing in other disciplines' different value systems in the ML creation process. Larger companies can afford a larger, heterogenous team with social scientists, legal experts and ethicists joining their research and development teams; however, start-ups often begin with just a handful of data scientists and engineers, a lean structure made more perilous by the entrepreneurial catchphrase: "move fast and break things." This is where the opportunity lies — to bring in designers into ML development teams – in a critical role that improves the ML creation process. User experience (UX) designers are trained to define stakeholder needs and goals, analyze situations and incorporate theories and methods from other disciplines like social science, engineering and management. UX designers that are trained in future/critical design, impact analysis, and system design are ideal candidates to diversify ML development teams, but first, UX methods for the specificities of ML production need to be established. This paper looks at an approach called MLUX (Machine Learning User Experience) design and proposes a two semester MLUX curriculum .

KEYWORDS | ARTIFICIAL INTELLIGENCE, DESIGN, UX, MACHINE LEARNING, MLUX, ETHICS

1. AI is a Wicked Problem

Artificial intelligence (AI) is an area of computer science that emphasizes the creation of intelligent systems that strive to work and react like humans. More hype than reality, AI falls under the definition of Richard Buchanan's (1992) "wicked problems" that are ambiguous, difficult or impossible to solve. Arthur Samuel (1959) defined Machine Learning (ML) as giving "… computers the ability to learn without being explicitly programmed." ML is an important subset of AI because intelligent behavior requires considerable knowledge, and ML is one way to acquire that knowledge. Neural networks in Deep Learning (DL) are a subset of Machine Learning. François Cholet (2020), engineer at Google and creator of the widely used Keras neural network library, best presents the conceptual misalignment of artificial intelligence with the *cognitive automation* achieved by machine learning:

> "**Our field isn't quite "artificial intelligence" -- it's "*cognitive automation*"**: the encoding and operationalization of human-generated abstractions/behaviors/skills. The "intelligence" label is a category error. Cognitive automation can happen via explicitly hard-coding human-generated rules (GOFAI), or via collecting a dense sampling of labeled inputs and training… a deep learning model. The second form is especially powerful, since encoding implicit abstractions only via labeled training examples is far more practical and versatile than explicitly programming abstractions by hand, for all kinds of historically difficult problems.
>
> Cognitive automation is incredibly useful. But autonomous abstraction generation is a different creature altogether. As new lifeforms are to animated cartoon characters -- whether the cartoon character is modeled by hand or captured via examples. "If the cartoon is drawn with sufficient realism and covers sufficiently many scenes, what's the difference?", you may ask. *Adaptability to the unknown*. A lifeform will autonomously adapt to a changing future. An automaton will perform the scenes you planned for. **Intelligence is adaption to unknown unknowns across an unknown range of tasks and domains. Automation is, at best, robustly handling *known* unknowns over known tasks** (which is already incredibly difficult and resource-intensive in the real world -- whether engineering or data). The resource-intensiveness, naturally, comes from the lack of adaptability: you need to plan for every possible unknown, whether explicitly or via a dense sampling of possible situations (assuming a fixed distribution)." Chollet (07/01/2020)

ML models are created in a process that is more prosaic. An algorithm processes data in successive stages of quantitative transformations looking for features or patterns. This process creates a model that gets iterative refinements of the model's parameters (weights) - by processing yet more data. The dataset quality is primordial. ML is not magic, just fastidious, energy-and-time-consuming calculations that gradually refine an ML model.

Teams of data scientists and engineers focus on this algorithmic pipeline, by cleaning and transforming the data and by avoiding traps of over-fitting or under-fitting the model to this data. These predictive ML models have trickled into our daily existence through

recommender systems on websites, personalized ads, financial and legal dealings, and more. Public trust — that these ML models were well executed and present an advantage over individual human bias — is a prominent concern for the industry (Hengstler & Als. 2016, Valor 2017, Floridi 2018, Winfield & Als 2018); however, public skepticism of AI seems well warranted.

ML's spectacular ethical failures (O'Neil 2016, Wachter-Boettcher 2017, Broussard 2018, Eubanks 2018, Simonite 2018, Benjamin 2019, Zuboff 2019, Webb 2019) have raised alarm at the bias that can creep-in through data, algorithms and black box models, made even more problematic by AI technology's aura of neutral benevolence and charisma (Robinette & Als. 2016). Government, think-tank and professional institutions have rushed in with ethical considerations and voluntary guidelines to help companies develop ethical AI (Jobin & Als. 2019); however, these recommendations have no legally binding obligations that could be construed as fostering an anti-innovation, anti-business environment. No legislative body wants to be accused of stifling innovation, leaving individual "losers" in ML systems with no other recourse than to seek legal action. With no institution setting the ground rules beyond the EU's GDPR (General Data Protection Regulation 2016/679), conflictual matters get resolved in the slow gears of judicial systems *years* after the injurious "disruption" occurs.

2. Why Do We Need MLUX?

ICT (Information and Communication Technology) is a notoriously homogenous field which can be described as a white male monoculture. (Krupa 2018) Data scientists and engineers specializing in ML are often the products of highly selective schools and relatively privileged social classes. In other words, people making our AI are the least likely to suffer negative consequences from unfair or biased ML. Therefore, diversity in the ML development team is a crucial, but low hanging-fruit to bring competing visions, values and methods to a team, and hopefully foster a more sensitive consideration of ML's social impact. Team diversity does need to reach around 30% for minority members to feel secure in expressing minority opinion and not be ineffectual tokens meant to check off diversity statistics (Krupa 2018).

Like entering the "magic circle" in a game, there is so much ML complexity to master and optimize that data scientists tend to focus on the *algorithmic pipeline*. Data is often considered the time-consuming, dull material that needs to get through the algorithm to tease out its true potential. Data scientist and engineers are not out to insert bias into their models, but they are not specifically trained to understand or detect it beyond statistical distribution. There is no discussion about hegemonic values inherent in categories like "gender" or "race," or how social bias can enter the ML workflow.

In 2018, Yang & Als. looked at the practices of experienced User Experience (UX) designers in designing AI products and services and found that these designers expressed a heavy

reliance on data scientists without actually understanding the technology underpinning their designs. Data scientists serve as proxy for the designer's technical expertise, leaving UX designers unable to anticipate and contest problems in biased, poor-quality data and algorithms and their repercussions on edge-cases in their stakeholder networks. In other words, by relinquishing their technical understanding to others, designers may perpetuate the disenfranchisement of minorities and the poor without even realizing it. UX designers' over-reliance on data scientist's technical understanding is a dangerous posture. Data scientists do not ensure and are not responsible for making sure that AI products and services are fair, accountable, ethical or trustworthy.

Certain AI Ethics workgroups recommend diversifying disciplines by inserting a "bias officer" on development teams. Large companies like the GAFAMs have their brand values at stake, serving as a deterrent to the most egregious abuses of public trust. They also have deeper pockets to support larger, more diversified teams. However, most start-ups begin quite lean, making the overhead of a social scientist/bias officer who cannot contribute to the ML algorithmic workflow economically unfeasible on a small team with two or three engineers.

This is where the opportunity lies to bring in UX designers into the ML development team – in a critical role to improve the ML creation process by bringing stakeholder-centered needs and goals as a central value. UX designers are trained to define needs and goals, analyze situations and incorporate theories and methods from other disciplines like social science, engineering and management. (Preece & Als 2011, Hartson & Pyla 2012) They understand and can measure the impact of their interventions. UX designers can intervene on the initial data, looking not just for poor quality data, one of the most time-consuming tasks for data scientists, but looking for what data is *under-and-over-represented*. UX designers can also intervene on the understandability of the resulting models and predictions and on its interactions with human decision-makers. They are trained to incorporate big picture considerations like product lifecycles and social and environmental impact using speculative design methods such as design fiction and critical design. UX designers are pragmatists used to dealing with the constraints and limitations of a particular context, field or technology. In other words, an MLUX designer's role is to be a ML *generalist,* to identify critical issues before final production or public product release.

Where can the MLUX designer fit into the ML development process?

- In defining the design brief for the project and all the stakeholders' needs and goals (Amershi & Als. 2019), keeping an eye on abusive end-user scenarios and problems that may arise from certain priorities and decisions in the initial Minimum Viable Product (MVP);
- In the intensive data gathering, analysis and cleaning process, ensuring appropriate distribution and quality in the final dataset, respecting the privacy and consent of data subjects;

- In the development process, testing the accuracy, fairness and explainability (when possible) of its results; and
- In testing the resulting weighted model for its impact on edge-cases and the disenfranchised.

Each ML project has technical constraints requiring a basic level of technical ML competence to follow the development process and understand data processing and its extractive values. An MLUX designers is not in competition with data scientist or engineer but augments the team by keeping an eye on social impact of its decisions, enhancing understandability, fairness, accuracy and trustworthiness, and testing the results.

2.1. MLUX Speculative Design Methods

Designing evolving complex systems that may include non-human stakeholders (e.g. avatars, robots, and non-human living systems) may cause some UX designers to doubt the validity of their existing design methods. This increased systemic complexity has lead a number of design researchers and practitioners to propose new UX design approaches for AI and ML development. Van Allen (2017) proposes animistic design that moves away from human-centered design toward ecology-centered design. Bardzell & Als (2012, 2013, 2014), Malpass (2013), and Pilling & Als (2019) look at critical design and design fiction methods to explore both utopian and dystopian technological development and applications. A set of 18 design heuristics for human-AI interaction established through a user study of 49 design practitioners are proposed by Amershi & als (2019). Google's *People + AI Guidebook* (PAIR 2019) aims to help UX designers and product managers bring a human-centered approach to AI development teams.

2.2. MLUX for Datasets

To complement the work of data scientists, new UX methods need to be developed to analyze the fairness and accuracy of datasets, particularly if it pertains to people. Some ethical issues that must be known about a dataset before its use in ML training:

- How was the dataset specified and financed?
- How was data gathered? Manually, through gradual accrual, aggregated from separate sources, or scraped for the web?
- Are dataset subjects known or willing participants? Is the data being used as it was originally intended?
- Who is over-or-under-represented in the data (against statistics and quantitative social science)? Should this be mitigated in the dataset? If so, using what techniques?
- What are the constraints or limitations on the dataset's use?

- Who labelled the data for supervised learning? How were they recruited, trained and remunerated?

An initial concrete proposition for accompanying ML datasets can be found in the proposal "Datasheets for Datasets" (Gebru & Al. 2018).

2.3. MLUX by Intuitive Analysis for Accuracy, Fairness and Explainability

After the data cleaning process, the algorithmic process requires digging down into its mathematical transformation: understanding how data gets interpreted, how values are extracted, how activation functions work, etc. This stage is often the most intimidating, fastidious part of ML mastery for non-programmers, but accomplishing this allows designers to play a useful role in the development process, testing the model's progress based on how the models *should* be performing from an end-user's point of view. This skill set development is the goal of the first year MLUX curriculum detailed in section 3.

To complement this approach, Google AI (Mitchell & Als 2019) proposes a framework, Models Cards, to describe trained machine learning models. Model cards are meant to encourage transparent model reporting through benchmarked evaluations across different cultural, demographic, or phenotypic groups (e.g., race, geographic location, sex, Fitzpatrick (1988) skin type) and intersectional groups (e.g., age and race, or sex and Fitzpatrick skin type).

2.4. MLUX for End-User Testing

Once a weighted model is created, MLUX designers can test end-users for explicability of the model, fairness for under-represented groups, validity of results for accuracy, and hopefully, a reduction of abhorrent results, especially if sensitive human issues have been identified. A terrible example of failing this step is Google's Photo app that labelled African Americans as gorillas (Simonite 2018). Beyond the terrible MVP release, the image recognition problem proved so complex to resolve that Google Photo's workaround was to simply remove the "gorilla," "chimp," "chimpanzee," and "monkey" categories from its ML image recognition model. Other MLUX end-user testing techniques can be drawn from existing UX methods. (Preece & Als 2011, Hartson & Pyla 2012)

3. Proposition: Develop Core ML Competency and Understanding in an MLUX Curriculum for UX Designers

While programming is not be a core skill of MLUX design, basics programming concepts must be acquired to be able to reverse-engineer and discuss code with a development team. 42 (https://www.42.fr and http://www.42ai.fr) and the DIGITAL Design Lab (formerly Human

Machine) (https://en.lecolededesign.com/research-design-labs/digital-design-lab/) work primarily in Python and its common ML packages like Numpy, Pandas, Keras, Tensorflow, Sci-Kit Learn, and create workflows in Jupyter Notebook or Google Colaboratory. While user-friendly options like RunwayML may be easier to master, using pre-existing black-box ML is to be avoided. This reverse-engineering component differs from existing MLUX curricular approaches that develop primarily theoretical and ethical approaches to ML understanding.

3.1 MLUX Origins: Michelle Carney and the Stanford d.School

Stanford University's d.School (https://dschool.stanford.edu) has implemented a MLUX course since 2018 created and taught by Michelle Carney, computational neuroscientist and senior UX researcher at Google AI. Entitled "Designing Machine Learning: A Multidisciplinary Approach," the d.School curriculum's first iteration was an 8 week ML theory course (Carney 2018), followed up by a 10-week theoretical curriculum proposed this year (Carney 2019). Michelle Carney's MLUX curriculum serves an as influence to Digital Design's 5th year MLUX curriculum presented in section 3.3, and we are grateful for her highly-engaged, open-source approach to MLUX best practices.

3.2 MLUX 1st Year MA Curriculum

In addition to acquiring programming knowledge, MLUX designers needs to learn key ML and Deep Learning (DL) concepts, methods, applications, workflows and approaches — stressing pragmatic and conceptual understanding of feature extraction and developing intuition for the development process. Based on 42's 14 week ML curriculum, MLUX students are introduces to supervised, unsupervised and reinforcement learning algorithms using **practice-based reverse-engineering** that gradually increases in complexity.

1. Intro to ML + Python;
2. Simple Linear Regression + Linear Algebra + Numpy;
3. Multiple Linear Regression + Derivatives/Gradient + Pandas;
4. Logistic Regression;
5. Support Vector Machines;
6. Decision Trees + Random Forest + Boosted Tree;
7. Naive Bayes;
8. Unsupervised (PCA & K-Means);
9. Recommend Systems;
10. Neural Networks (Intro);
11. Convolutional Neural Networks (CNN);
12. Recurrent Neural Networks (RNN);
13. Reinforcement Learning + Q-learning;
14. Deep Reinforcement learning (DQN + Policy Gradients).

This sequence has the benefit of gradually building on acquired skills and allows the designer to develop autodidactic methods for learning new ML algorithms.

3.3 MLUX 2nd Year MA Curriculum

Once a technical understanding of the ML workflow is acquired, the second year focuses on ML's theoretical and ethical underpinnings and its link to UX design practice, through scientific literature, creative coding exercises and reflexive thinking.

1. Data Collection and Data Science Workflows;
2. Data Visualization and Exploration;
3. Recommender Systems and UX;
4. Natural Language Processing and Voice Interfaces (Chatbots and VUI);
5. Computer Vision (Neural Networks and High Dimensional Classifiers);
6. Image & Video Processing, Transfer Learning;
7. Generative Design & GANs;
8. Disruption, Innovation, Ethics and Bias.

The second year has fewer sessions with increased time spans to allow more creative student exploration.

4. Conclusion: MLUX for Ethical AI

In conclusion, the most useful role for a UX designer on a ML development team is as a reality-check when the charisma of numbers proves too intoxicating. UX designers that develop critical and speculative design skills learn to imagine both benevolent and malevolent appropriations of technology. Understanding a technology's simultaneous potential and danger is a UX designer's most useful discipline-diversity contribution — fostering a more context-sensitive approach to ML research and development. The MLUX designer ideally steers the development team onto the right path.

Design adage: simply because one *can* does not mean one *should.*

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The encounter between Design and Artificial Intelligence: how do we frame new approaches?

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Abstract | Artificial Intelligence is promising to change people's lives, either by replacing human activities or by augmenting human capacities. Affecting society, AI will also help rethink notions and characteristics of what we design; however, as developments have just begun, potentialities and risks are not straightforward: what will the characteristics and logic of design be in an era in which *learning systems* will be the centre of attention?
The paper frames this question offering a critical discussion about the role and logic of design when AI is "the material" of the project. It explores the issue drawing on AI-Cities, an initiative that has designed digital services applying AI in three public administrations.
The paper proposes two main changes: the need to design constantly evolving, ill-defined interactive systems both in terms of problem and solution with AI as one of the users; the need for *undisciplined* design approaches to develop AI-based design objects.

KEYWORDS | DESIGN, ARTIFICIAL INTELLIGENCE, HUMAN-CENTRED APPROACH, DIGITAL SERVICES, UNDISCIPLINARITY

1. Introduction

Artificial Intelligence (AI) is promising to considerably change people's lives, by replacing or augmenting human capacities in tasks as varied as safety management and diseases diagnosis. It is also transforming the notion of machine, from static problem solver to creative generator of other machines and future decision maker of what people will like, wish, consume, think. This is also changing the way people interact with each other and with machines, as these last are envisaged to begin to think and learn by themselves. In both public and private sectors, the spectre of applications is already wide and encompasses city dashboards, chatbots, smart advertising systems, intelligent driving vehicles, equipment for human-machine collaborative surgeries, and many more. Beyond this, what organisations seem to be valuing is also the data collected on human behaviours and wishes, that is then used and analysed through algorithms of intelligent data processing as well as other predictive technologies to design and propose new offerings (Zuboff, 2018).

These applications can be at the same time exciting and frightening: how much will life be determined by algorithmic predictions of actions and emotions? Will humans be able to use AI to augment their own intelligence and perimeter machine learning into a tool to handle increasingly complex tasks and larger amounts of data? Whether answers will be optimistic or not, AI will undoubtedly help rethink the current notions of what we design, including products, services, interactions, experiences, systems and organizations. However, as the new hype around AI has only begun to emerge and its impacts on society are still unknown, potentialities and risks are not straightforward. Consequently, at present we need to engage in as much discussion and reflection as possible to develop a critical approach to designing AI for the present and the future.

Here, design is asked to modify its logics and complement competences if it wants to remain relevant in this discourse: on the one hand, some continue to propose an ethical and fair design mainly used to advocate for the people (Margolin & Margolin, 2002; Manzini, 2015); on the other, some are exploring the shift in the competences and logic of design to become a full part of the new market of human behaviours (especially big corporations are working on this perspective, rather than individual experts[1]).

Building on this, the future of design seems to pose new questions, that is, what will the characteristics and logics of design be in an era in which *learning systems* will be the centre of attention?

[1] Examples include the work developed by Google (https://ai.google/) and Microsoft (https://www.microsoft.com/en-us/ai?activetab=pivot1%3aprimaryr5), that for instance have established not only specific teams to investigate the development of the topic, but also created ecosystems of start-ups, universities and researchers (https://openlearning.mit.edu/news/met-microsoft-and-mit-explore-impact-artificial-intelligence-how-global-audiences-connect-art) that are helping these big corporations evolve their knowledge as fast as possible.

This question opens new avenues of reflection, referring both at how the process of design could be modified integrating new tools to frame the needs of people, and at the outcomes of this process when new technologies are used in the final solution. When design meets AI, we must consider a double-sided perspective: AI as a tool in the design process, AI as material to be shaped into design projects.

If the first perspective is less explored, the second is already receiving attention especially from big corporations (e.g. Google, Microsoft, etc.). In this paper, we will focus on this second perspective, leaving the other part of the discourse opened for future reflections. Specifically, the paper aims at offering a critical discussion about the meeting between Design and AI when the second is "the material" of the project. It explores the issue describing a specific case in which AI has been designed in new digital services within three European municipalities (Bologna, Strasbourg, Tallinn). In particular, it draws on an initiative called *AI-Cities*, that has envisioned AI through the blended use of interaction and service design, where the first (interaction) was used to understand how the integration of disruptive technologies is changing the relationships and interactions between citizens, government and services; the second (service) focused on the best tools to guarantee wide participation in the creative process and understand workflows for the meaningful integration of technology. This integrated approach could offer a new mindset to the design and adoption of disruptive technologies; however, it is not immune by criticalities and limitations. In particular, we discuss two aspects:

- The relationship between AI-based experiences and users, and their design – how to design constantly evolving, ill-defined interactive systems?
- The need for *undisciplined* design approaches (Bremner and Rodgers, 2013) rather than inter-disciplinary ones, to respond to the complexity of new AI-based design objects – how should diverse design disciplines merge to meet this challenge?

The paper is organized as follow: first, it gives a brief overview of the relationship between AI and design; then, it describes the AI-Cities project, the method used in the project and its results; finally, it offers a critical discussion about the topic, declares the limits of the research presented and underlines potential avenues for further research.

2. Design and Artificial Intelligence

Today's technological progress has extended the capabilities of humans and has begun modifying activities and daily tasks: indeed, novel technological applications in fields like ICT, biotechnology and AI are promising to give life to unexpected possibilities. Focusing on AI, this is already applied to automate many tasks that had previously been regarded as impossible or impractical for machines to perform. For instance, computers and applications can now diagnose disease, create digital humans to perform realistically, or help people with disabilities perform tasks and be more independent (i.e., the application "Seeing AI" from Microsoft transforms the smart phone into a device capable of scanning the environment for identifying other people or finding specific objects).

Although exciting, this progress poses many questions linked for example to understanding how people should approach (cognitively and emotionally) the massive change envisioned, where machines will begin to think and learn by themselves. For scholars and experts, the answer is controversial. For instance, according to Stephen Hawking "the development of full artificial intelligence could spell the end of the human race." Elon Musk, the CEO of Tesla Motors, also noted in Twitter in August 2014, that "we must pay the closest attention to AI because it would bear more danger than nuclear weapons." As opposite, Wired[2] released in 2019 a documentary film on AI and machine learning examining the applications and potential impacts of AI, underlining its great potential to change human life for the better. In the movie, Nicholas Thompson, Editor in Chief at Wired states: "My instinct is that AI is going to help us: it will expand our capabilities, it will create new things for us to do, it will free up time (…) the most important task for AI to accomplish in the next 8-10 years is to free up humanity from repetitive work". Additionally, Kai-Fu Lee author of "AI superpowers" states: "a lot of the dystopia, doom-talking, is not really based on facts. People are looking at things they don't understand."

Scholars advocate for different scenarios, too. Makridakis (2017) explores four possibilities regarding the role that humans will have in the development of AI: the optimist, the pessimist, the pragmatist, the doubter. In the first case, a utopian future is foreseen where Genetics, Nanotechnology and Robotics will allow humans to harness computer capabilities directly into their brains; in the second case, humans become an endangered species as machines will grow to control everything; the third scenario believes that AI will complement and expand human capabilities for the benefit of everyone; the fourth one does not believe that AI is possible at all, and therefore it will never become a threat to humanity.

As discipline concerned with the artificial man-made world (Simon, 1969), design will also undergo changes following the progressive integration of AI in the society, and according both to the new nature of objects, and the resulting human behaviours.

[2] The full documentary can be watched at: https://www.youtube.com/watch?v=ZJixNvx9BAc

Intriguingly, design (both as discipline and practice) will be concerned with and affected by the majority of changes that AI will bring. Google has begun exploring this issue talking about human-centred AI, and essentially working on developing tactics that designers can use to mould AI as if this was a new material[3]. As proposed by Google, the core in the activity of designers remains the understanding of users' needs and their translation into meaningful experiences, while AI becomes the medium that can help answer needs revolutionizing experiences and creating new relationships between customer and product. In this case, the novelty that designers will need to learn to deal with is the possibility of never-ending modifications and improvements that AI-based experiences promise: just like algorithms keep learning, so the system will continue to evolve; accordingly, designers will need to deal not only with ill-defined problems but also with ill-defined systems and experiences. The designed interactions will thus be just the beginning of the ongoing conversation between a system and its users, where intelligent products and services might change overtime according to feedback and circumstances.

How can designers deal with this new layer of uncertainty? Which scenario (the optimist, the pessimist, the pragmatist, the doubter) should we embrace? What tactics and competences can designers use? How can a new approach be framed to deal with this new "design material"?

According to Bremner and Rogers (2013) design is undergoing a transformation: due to global financialization and the rapid adoption of digital technologies, the models of design thought and action have been modified, superseding the historic disciplines. Building on this, the authors suggest the need to move from "a convention domesticated by practice to a responsive reformulation of practices" where the boundaries of design disciplines are blurred and reconfigured according to needs. They call this *undisciplined design*, "an ability to mash together jumbled ideas and methods from a number of different, distinct disciplinary practices that can be brought together to create new unexpected ways of working and new projects" (p.12). Other scholars have also discussed the blurring of the boundaries of design disciplines. Rodgers and Smyth in 2010 edited a book called *Digital blur*, describing how the practice of design modified by the digital world cannot fit into orderly categories, but should rather be seen as a hybrid of art, engineer, design, entrepreneurship, anthropology. In 2008, also the Design Research Society had identified this issue and underlined a discussion about challenging existing design specialisms. Finally, Blackwell (2008) distinguished design from other disciplines because the second are recognised for their rigour in addressing well-formulated problems through agreed methods of inquiry, while design mainly builds on subjective intuitions; he thus acknowledged design as *undisciplined*, identifying a more radical approach to creating and circulating knowledge

[3] Google has developed the "People + AI Guidebook" (https://pair.withgoogle.com/) for designers dealing with AI, and published interviews to explore the topic (i.e., https://design.google/library/ai-design-roundtable-discussion/).

that transcends boundaries and can thus deal with uncertain and ill-defined issues (Buchanan, 1992).

The encounter between AI and design strongly reconnects to this discourse: once again design practice and research will need to be *undisciplined* to be able to deal with uncertainty in problem and solution. Building on these premises, the AI-Cities initiative (hereafter described and discussed) explores the introduction of AI *as design material* shaped in digital services, by means of a blurred (or undisciplined) design approach.

3. The project: AI-Cities

AI-Cities is a collaborative effort lead by Politecnico di Milano, where three cities (Bologna, Strasbourg and Tallinn) have been consulted to co-design and envision the introduction of AI in one of their services to make them digital and intelligent. In the next paragraphs, we describe the activities developed and the main learnings emerged from the project.

3.1 Method

AI-Cities has involved three municipalities to help them proceed in their path toward Digital Government (OECD, 2016) through envisioning the adoption of AI in one of their services. The approach has been designed around a ladder useful to map and frame local strategies according to three steps: (i) **Digitization**: public services are government-centred and users are passive receivers of digitally delivered information; (ii) **E-government**: public services are citizen-centred and users can participate in service delivery through digital channels; (iii) **Digital government**: public services are people-driven and thanks to digital tools, users can voice their demands and needs, contribute to shaping political priorities and public services. This ladder has been the starting point to set individual goals of each local project: Bologna was assigned the goal to reach step 1, because it had only recently launched digital transformation initiatives; the Eurometropolis of Strasbourg was considered suitable for the second step, as the city started experimenting on digitization in 2013 with initiatives related to open data and health services and in 2018 established the citizen digital platform for public consultation. Finally, Tallinn in Estonia represents the so-called digital republic (it already launched several digital services starting from 2008), thus meeting the objectives of the third step.

After setting goals, the cities were engaged in a process of co-design to identify the most suited inclusion of AI for their local priorities and interests, thus choosing to integrate algorithms on different types of public services in each site. Virtual co-design sessions were run to identify and explore city problems and priorities, share documentation and ambitions, map internal processes and understand digital literacy, imagine together the potentialities of the technology and check the existence of appropriate databases and datasets useful to run the future experimentation. More in details, three sessions were run with each city: the first

to collect the starting evidences on the local initiatives dedicated to digital transformation, involving mainly design experts and Chief Technology Officer locally; the second and third have been larger sessions that have involved a higher mix of profiles and experts (designers, city managers and civil servants from different departments, AI experts) to first identify the service/policy area in which the experimentation could take place thus sharing related existing data and people's needs, to then envision together the potential implementation of the technology.

3.2 Results: Using AI as material for digital services in local government

The digital services envisioned are hereafter described.

The Metropolitan city of Bologna – working on digitization for information acquisition – decided to use AI in a service aimed at efficiency and data management. Bologna decided to support the local increase of employment, by matching people seeking jobs to the most appropriate job offer using and integrating a range of current services.

The Eurometropolis of Strasbourg – working on e-government for decision making – focused on the application of AI to improve the interaction between government and population. Strasbourg decided to work on mobility and health as policy areas to test AI as knowledge organizer and advisor; the algorithm in this case is envisioned to receive and process citizens' inputs, prioritizing them, advising civil servants on wished changes and learning about citizens' priorities on diverse topics.

Tallinn municipality – working on digital government through co-design – focused on the use of AI for the co-creation of public value. Tallinn decided to experiment the introduction of machine learning (jointly with virtual reality) in the process of public deliberation and test it as aid to public decision making for ranking and sorting suggestions coming from the citizens.

4. Analysis and Discussion

The AI-Cities initiative – despite remaining an exercise of concept development – helped raise several considerations about constraints and role of design when working with AI, challenging our perspective as researchers and experts that could be summarised as follows:

- The need to design constantly evolving, ill-defined interactive systems both in terms of problem and solution, with AI as one of the users acting in the system;
- The need for *undisciplined* design approaches (Bremner and Rodgers, 2013) to respond to the complexity of AI-based experiences.

AI-based experiences are alive; they are not static but evolve over time because the system learns from each new data captured. This – from an engineering point of view – means that the system becomes sharper and less fallible; from a design point of view, it makes AI one of the active users of the system. As such, AI needs to be treated like any person during the design process, that is, an actor with evolving characteristics and needs. These encompass not only technical needs, for example concerned with maintenance, but also needs linked to growth and expansion of capabilities, that could lead to new applications and unexpected modifications. Building on this – beyond the ethical implications that this might bare (i.e., are AI systems living things? If so, of what kind?) – AI-based experiences should be considered as completely new types of design objects needing a blend of diverse approaches to be devised and preferring those already accustomed with relationships and interactions.

In our short field experience, we experimented the blend of service and interaction design, both traditionally dealing with mixed (tangible and intangible) systems that evolve overtime, based on the relationships and knowledge created between the actors and objects involved.

In our approach, service design was central to give users the right tools to participate in the creative process while providing infrastructures to facilitate dialogue, inclusion, and transparency. This was especially useful in the initial part of the process, when user needs (including system's needs) had to be identified, aligned with AI potentialities, and translated into sets of data to feed the technology. Here, service design provided tools to analyse workflows, methods to find opportunities for AI and identify potential scenarios of use. AI currently offers to automate or augment human capacities; therefore, it is crucial to understand where in the process this can meaningfully happen according to local situations. Here, questions to drive the process could be: is the task something that humans really enjoy doing? Or is it something repetitive and boring, and at the same time standardised, thus transferable to a machine? Furthermore, when translating user needs into datasets important design tasks are connected to labelling data (together with the quality and representativeness of the dataset itself) as this could easily lead to biased algorithms[4].

Interaction design was central in the experimentation to understand how the integration of AI is changing the relationships and interactions between people, artefacts, environments and systems, thus defining new behaviours for both (Forlizzi et al., 2004). When dealing with AI-based experiences for example, an important step in the design process is about working on the mental models of end users to help them build the right expectations and trust for AI. Mental models, intended as a person's understanding of how something works, play an

[4] Examples provided in the Google "People + AI Guidebook" include: Representational harm, when a system amplifies or reflects negative stereotypes about particular groups; Opportunity denial, when systems make predictions and decisions that have real-life consequences and lasting impacts on individuals' access to opportunities, resources, and overall quality of life; Disproportionate product failure, when a product doesn't work or gives skewed outputs more frequently for certain groups of users; Harm by disadvantage, when a system infers disadvantageous associations between certain demographic characteristics and user behaviors or interests (source: https://pair.withgoogle.com/chapter/data-collection/).

important role here, because of the need to prepare the user to co-learn together with the system as both evolve together. Feedback and co-learning are thus important elements to manage, going further than responsive products: AI not only receives and adapts response according to feedback, but learns from the experience, meaning that it develops new knowledge and ways of understanding an issue to expand its own features. Furthermore, mental models need to be built also for the AI component that should learn how to adjust to user feedback, interpreting all kinds of feedback received.

These insights show the importance of breaking the silos in individual disciplinary viewpoints. Our experience showed that none of the two disciplinary approaches involved could comprehensively cover all aspects needed, leading us to advocate for the importance of using a blurred approach that could also be described as *undisciplined*. According to John Marshall and Julian Bleecker (2010), *undisciplinarity* is both a way of doing work and a departure from ways of doing work. It is a process for creating knowledge that doesn't need to worry about the traditional silos established by disciplines, but it can go middle ways to create new understanding altogether. That is why it is called *undisciplined*; as such, it appropriately represents what design is called upon to do when considering AI as a new material or even a new user in a project.

5. Concluding Remarks

Nicholas Thompson, Editor in Chief at Wired states: "we are building this incredible technology (machine learning, AI) and we are setting rules for it right now, and one of the big questions, one of the most important questions is: will we set the rules right? AI will have all kinds of massive benefits, it will make us richer, it will make our lives broader, but it can also be used to create filter bubbles that will only give us certain information, it can be used to monitor our behaviour, sell our personal information (…) a lot of the stuff that is happening now, we need to think carefully about to understand how we develop this technology and figure the role we want AI to play in society". This includes also reflecting upon and discussing the role of design in the application of this technology, and this discourse is especially central now that design has reached a mature inclusion in many industries. In this paper, we have tried to offer initial points for discussion on this topic, mainly linked to designing with AI, and providing learnings coming from our direct experience. Based on this, we have highlighted the main points in which including AI is making a difference for design, thus proposing two main topics: the need to design ill-defined solutions as well as for ill-defined problems, where the system is itself a learning actor; the need to adopt a blurred design approach, where competences coming from different disciplines can merge and evolve outside of the traditional disciplinary boundaries.

Furthermore, we have proposed few specific moments and tools coming from service and interaction design that could be matched in a more comprehensive approach to

designing with AI. This *undisciplined* approach – if developed further – could offer a new mindset to application and adoption of disruptive technologies more in general, that should find broader arenas for experimentation and discussion in the design community to be fully developed. Further developments are also needed to verify the characteristics and logics of design for AI proposed in the paper, that should only be considered initial rather than exhaustive.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Perceptual and Dialogical Form of Design between Time, Space and Technologies.

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Abstract | In a continuously evolving society, where time, space and technologies meet, the individual is no longer satisfied with preconfigured routes, traditional models of knowledge transfer are no longer sufficient and there is an increasing necessity for developing new ones. The advent of technologies and the evolution of the relationship between Design and Cultural assets have called attention to the possibility of personalizing fruition. The person transforms from simple user/consumer into an active participant in creative processes for knowledge acquisition and production. In this context, also the learning and culture dissemination process needs to undertake new forms, from passive to interactive, making use of contemporary tools and techniques. Therefore, architecture and design have a decisive role in the way information is received, starting from the morphology of the space where the individual finds himself while connecting with knowledge, until designing the smallest details of the systems used for its transfer.

KEYWORDS | HIGH TECHNOLOGY, SPACE INTERACTION, PERCEPTUAL DESIGN, CULTURAL PLACES, MULTISENSORIAL EXPERIENCE

1. The hyper-connected society between progress and denial

We live in a world of contradictions, where progress is beginning to induce fear and eagerness at the same time. We do not know yet how to deal with the entire amount of information "attacking" from all directions with a velocity that not long ago was even hard to imagine. A query that has been tormenting scientists in a while now is how to keep all this knowledge from getting lost. In a society constantly evolving towards the digital world, the changes regarding the relationship between human beings and memory are stirring scientists and designers to further study and research.

We are not yet able to completely understand what technologies can offer. Thus, we often behave as children in front of a new toy: the enthusiasm of the discovery gets contrasted by the fear of getting hurt. Any transformation comes as an outcome of a crisis, when traditional concepts turn out to be obsolescent and they are limited to responding cultural, social and economic dynamics. At this point, the awareness of how only design culture can establish a new meaningful equilibrium and imagine more appropriate scenarios for the current transformations, comes along (Irace, 2013, p.7). This is the real challenge: how to bring innovation in a field that is under continuous change.

We think we know so much since we find ourselves in front of an infinite amount of information, but we do not know anymore how to record all this, how to put it inside our human "hard disks", so we use the artificial ones instead. Where does all this knowledge go? Is this how it's supposed to be? Technologies should be a support for the developing society and should not block human development in order to make space to the machines. We need to face this challenge in order to be able to conserve the positive parts and therefore we must count on interaction.

Interaction is a concept that has always existed, but it did not receive the proper relevance, maybe until we understood that machines can completely modify the persons' approach towards one another and towards the surrounding environment (Mancini, 2013, p.28). This is a critical aspect, since everything gets modified: from the simple "intrusion" of smartphones into our lives to the connections inside the city and to the way we manage to acquire information. Human nature is defined by interaction and technologies can help people to interact with the surrounding environment in ways that were not possible before.

How can we enjoy the great advantages of an era where technology seems to enable an evolution without precedents? Maybe we are, in the end, too "little" to face this progress. Or maybe not. One thing is certain: we need to do everything we can in order to keep up with this evolution. We need to face this "technoliquidity" (Cantelmi, 2013, p.7) with the appropriate tools and to transform it into "matter" or, better said, into something that "matters". Design and culture, put together, enable us to at least dare thinking forward, to imagine a future, not that far, when progress will not be feared anymore, because we will have gotten equipped with the necessary tools to deal with it.

The necessity of thinking and designing new ways of interaction with cultural heritage, considering its different connotations as tangible and intangible cultural heritage, leads us to new models of enjoyment. These imply a strong component linked to the experiential factor, to memory, to the "dynamics of return", to the possibility to explore and reach different levels of knowledge of the asset, be it a work of art, an architectural piece, or a complex system such as a city or even a territory with a perimeter that is more difficult to read and define.

> "The liquid modernity has brought not only to the creation of *non-places* (Augé, 1995 and Bauman, 2002) and *non-spaces* that contribute to the creation of a historical collective memory, but also to the creation of *virtual non-spaces*." (freely translated from Zannoni, 2018, p.17)

Cultural heritage has a fundamental role in producing positive stimuli, however new "metalanguages" must be found in order to provide it with the potential to transform "non-places" in "new places". From interactive learning environments to immersive systems or augmented reality, these are all intents of knowledge dissemination for all, in a society where time is always "less".

Technologies become an instrument that can favour the entire process, but they risk staying part of an "other" reality if their potential is not used in order to highlight the capacity to satisfy the continuously updating human needs. However, technologies do not have to be used in order to tell a story, to narrate art or culture. These should instead be interpreted with the support of technology. It is only then that the visitor will really be attracted by the meaning and the message that he could learn.

> "There is a development of a new way to design and understand the contemporary artefact: not only just physical, neither just intangible nor digital, but a hybrid of these two components of the contemporaneous. Sometimes it becomes very complex to properly distinguish subject and object in the cognitive process." (freely translated from Greco, 2019, p.16)

The machines have introduced the possibility to delegate the recording of information, maybe by underestimating the transformations that these processes produce for the human body, therefore modifying the dynamics regarding individual and collective memory. Consequently, in the future, designers will reshape the relationships between human being and artefact at various scales.

On the contrary to what one might expect, there is a risk that this permanent connection and the massive amount of information could in fact result in "*non-communication*", because often these connections do not create individual or collective memory and there seems to be a lack of identity. Under continuous movement, information becomes flat, without assuming real value for the human being, therefore generating only "excessive background noise" (Zannoni, 2018, p.17).

2. Dematerializing space between imagination and perception

Space also gets transformed and new configurations are being researched in order to satisfy the person's continuously transforming needs. "In this *always connect* dimension, designers must have a critical approach to find solutions and organize spaces that go beyond physicality and become the appendix of a bigger system" (Zannoni, 2018, p.18). As proved by Ulrich Kirk from University College London, the aesthetical judgment depends on the context (Kirk, 2008, p.6).

Interaction with the architectural space and its impact on the human experience becomes therefore of fundamental importance. How should we deal with this? There are numerous facets of the problem and, at least until now, no universal solution, but maybe this is in fact the main mistake: we tend to universalize everything, we want global solutions, but we tend to forget that each person is different from another one. The themes of customization and inclusion belong to the present and to the future. Experience can be improved by considering the individual necessities as much as possible and by trying to satisfy them with the means at our disposal (which are multiple).

Lev Vygotsky (1896 – 1934) highlights the fundamental importance of social interaction for the construction of personal meanings out of experiences. Through the "Zone of Proximal Development", he explains that there are understanding capacities and skills that go beyond the individual and that he can reach due to the social support and interaction. For Vygotsky, language, which is fundamental in the cognitive development, is considered a medium through which the individual can represent the experiences and the concepts to himself and to others (Lehnes & Carter, 2016, p.8).

Once the space abandons its abstract dimension and gets related to time, contacting reality, it becomes a place. The reality of a place is represented by the human being that inhabits it, that fills it with memory and determines its temporality (Branzi & Chalmers, 2007). Architecture cannot exist without a human dimension, as an object totally emarginated from the context.

The position inside space and time, together with the chosen perspective, determine the way how reality is perceived, a perception that is actually different for each person, even though it takes place in identical conditions. On the other side, empathy development can depend on transposing into a different spatial-temporal condition. Despite all this, an object which is more or less "steady", meaning that does not suffer sudden or rapid changes, as in the case of cultural heritage, will be perceived similarly by various persons. The interpretation of cultural heritage creates links between the imagination and perception of reality through direct experimentation of a site or an object belonging to the past, thus increasing imagination and empathy (Lehnes & Carter, 2016, p.26).

In his studies, Lefebvre identifies three elements for the definition of space: the physical, natural one, the mental one and the combination of the two, which results in the social space (Lefebvre, 1991, p.11). Nowadays however, technologies interfere with these

dimensions, since they can "reduce the individual's sense of presence within the space that he occupies" (Barra, 2019). Nowadays we cannot think from just one perspective, but we need to combine instead multiple views in order to better understand the context.

The eye of the machine produces a look that is also a space, overlapped and hybridised with the real one and determining therefore two perspectives regarding the computational sight, one related to the environment and the other to the user experience. Referring to the environment, there is an augmented space derived from augmented reality and understood as a result of various actions that enable to fill the physical space with levels of data (Arcagni, 2018).

> "Another fundamental aspect is to understand how all these technologies act, not only by creating magnificent visualizations of collections but also by giving rise to new observing subjects within us." (freely translated from Geismar, 2019, p.24)

A holistic approach could be a solution, even though proper experimentations must still be done. The neurosciences have achieved a role in design in order to find solutions for various problems of the contemporary society. Design uses neurosciences and neurosciences use design to prove how people can be brought closer to the project and how can interaction affect the overall experience.

We are dealing with a complex neuronal network for spatial encoding, situated inside the hippocampus and composed by various types of cells, such as: "place cells", "grid cells", "head direction cells", "border cells", which contribute together to the perception of space and to the construction of the so-called cognitive maps. The discovery of the "place cells" has in fact brought to awarding the Nobel Prize in 2014 to the scientists O'Keefe and the Mosers, for finding "a positioning system in the brain" (Grieves & Jeffery, 2017). Research continues to find out how can brain cells contribute to the cognitive representation of space and their connection with memory processes.

Specifically referring to art and aesthetics, neurosciences deal both with the study of the experience components, and with understanding the visitor's aesthetic preferences, the subjective perception of beauty. On one side, the rational component is studied, while on the other one, the emotional dimension is investigated to discover any universal rules for the perception of beauty (Ovadia, 2019, p.25).

Therefore, multisensoriality becomes fundamental, even more when considering that the neuroscientific studies have proved how any experience of the environment is not only perceived through one of the senses, but through their combination. This kind of cultural experience will be able to get the brain involved and will determine major levels of empathy and understanding of the artefacts in times and spaces different from ours (Axel & Feldman in Levent & Pascual-Leone, 2014, p.353).

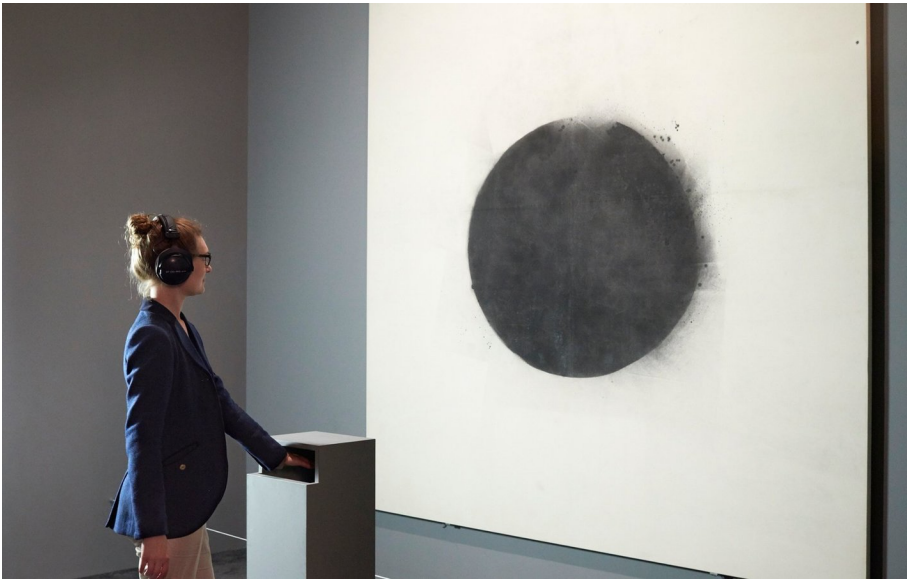

Figure 1. Tate Sensorium (Tate London, 2020)

According to Changeux, from a cognitive perspective, both the artistic contemplation and creation can be considered subjective, conscious experiences that give access to conscience. Theoretical models and objective measurements, such as the ones using brain imaging, have been used to study the complex mechanisms of this kind of experiences, which can be considered an endogenous process contributing to the access of both internal and external information through a distributed network of neurons. The artistic experience can therefore be considered a conscious and unique synthesis of external perceptions, internal memories and archived emotions that gives birth to emotions in harmony with reason (Ovadia, 2019, p.27).

Nowadays, the connections and complex ramifications developed between people, objects, buildings and cities bring about the synapses that ensure the continuity of the nervous stimuli (Zannoni, 2018, p.16). There is a neurological characteristic named “mirror-touch synaesthesia” that enables the person to feel empathy while observing the touch of another person or object (Martin, 2017).

Regarding the sensorial perception and the “other” interaction with the work of art, the immersive experimentation “Tate Sensorium” (Figure 1) has been made in 2015. The capacity of the person to interact and observe through senses different from the sight has been explored, while as well enabling the recording through technological tools. Thus, memory and imagination have been stimulated (Tate London, 2020).



Figure 2. Daan Rosegaarde Presence exhibition (Aouf, 2019a)

The perception of their own presence and influence, transmitted through the humans' contribution to the creation of art, can also bring changes in the daily behaviour. This is the theme that inspired the Dutch designer Daan Roosegaarde for the realisation of the *Presence* exhibit at the Groninger museum in 2019 (Figure 2). The visitors are encouraged to do various actions inside the space, by leaving footprints for the ones that follow. Oriented towards the sustainable development topic, the designer manages to increase awareness of own presence by stimulating the senses through touch, movement and by playing with colours and textures. Direct interaction with our "traces" contributes decisively to a major cognition (Aouf, 2019a).

3. Expanding the technological dialogue into the polysensory dimension of design

In this dense network of virtual connections, where machines increasingly replace the individual in the performance of various activities, a fundamental question emerges: what is the relationship between the new technologies and the human body? These technologies assume the form of objects, clothes, prostheses, fabrics, surfaces, interfaces, in a process of contiguity and hybridization with the body itself, which strongly affects the definition of each person's identity.

A mask, a garment, a disguise, cosmetic surgery, artificial skin, interface, are all various applications of the same phenomenon, fascinating and terrifying at the same time.

The interaction human being-machine, artificial intelligence, the multilanguage of the digital culture, open unexpected but ever more present scenarios with the creation of works where the analogical and digital dimensions unite themselves in order to emphasize experience.

From this point of view, design, integrated to an ergonomic approach and with an anthropocentric vision, becomes the key for understanding the modern complexity, which needs multidisciplinary knowledge to comprehend the necessities and then design proper solutions (Anselmi, 2009). It is a space for comparison between the sensitive and the intelligible, between illusion and shared beliefs, based on the relationship between the sensitive subject and the perceived object blending both into a horizon of sensations.

Therefore, design uses hints coming from other study fields connected to the theme of the body and it can contribute to enhancing the relationship between technologies and users, through a calibrated and conscious design.

As Norman highlights, the users interact with artefacts through the synergy of three different mental images. The first is the image inside the designer's mind, "model of the designer", then there is the one the user has of the asset and its functioning, "model of the user", while the last one is the image of the entire system. In an ideal world the two models should be identical and therefore the user should understand and use the object in an appropriate manner. Unfortunately, not always designers communicate with the final users (Capece, 2017).

Besides undertaking the role of interpreter in order to offer proper answers, design becomes a strategic element for the interaction project, and it is capable to receive and satisfy not only the needs but also the desires of the target users. The designer must be able to completely integrate real and virtual dimensions to ensure that there is hybrid interaction between user, personal media and environment, while the information dynamics defines the interaction space at the intersection with daily experience.

Recently, virtual immersive reality has allowed users to experience the same sensations of property on an "other" body inside an immersive virtual environment that enables virtual reality users to experience the sensation of being "embodied" into a virtual body, the so-called "embodiment", taking into consideration all the corresponding psychological and cognitive problems. It refers to being present and capable to interact in a space different from the real one, with the possibility to define oneself (Slater & Sanchez-Vives, 2016).

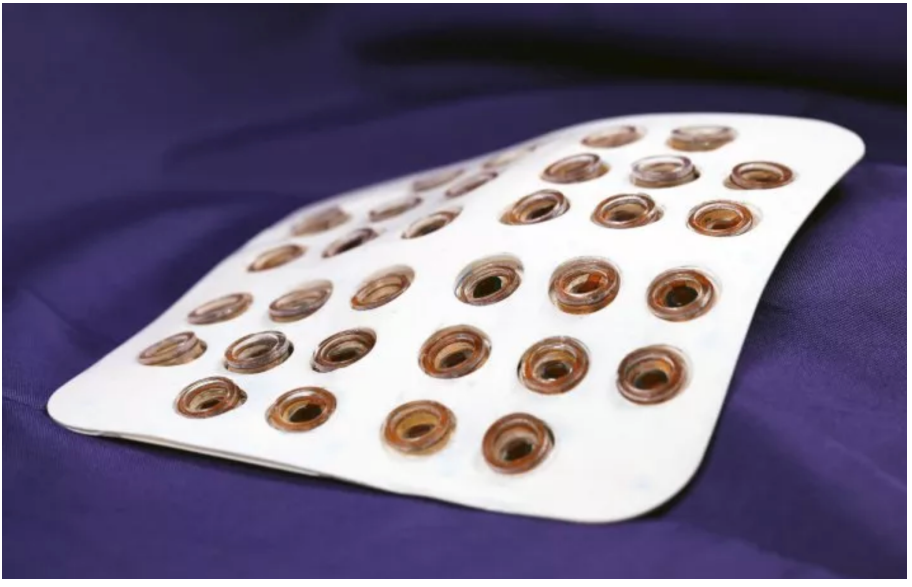

Figure 3. Haptic skin, Northwestern University (Craig, 2019)

> "We are at a moment when we can produce devices capable to induce sensations such as tactile perception of virtual objects, to simulate their presence and their movements and to increase the perception of the body itself as a mediator of movements and sensations. We can use infrared, optical sound, video, heat, movement and light sensors to provide sensitivity to the environment and we can determine the environment to react to the person's needs by updating displays, activating engines, memorising data, guiding actuators, controllers, valves and by creating spaces where common objects acquire electronic features without losing the physical ones." (freely translated from Arcagni, 2018).

Visual space gets amplified with the intention of directing different information and stimuli towards "the eye of the machine". It seems that the entire building of the visual device is built around a deep hybridisation of different senses and sensoriality.

Research goes beyond sight and sound and we talk today about the "haptic skin" (Figure 3), able to translate virtual signals into physical sensations (Yu, Xie, Yu, et. al., 2019). Communication between user and machine is enabled due to the integration of technology in the skin, applying pressure, vibration or movement to the user due to an adherent electronic sheet that takes the shape of the body in a non-invasive, reversible way. Consequently, the sense of touch is induced to the person that wears the "skin" through vibrational actuators that reach a yellow or red color based on their levels of activation (Figure 4). There is a tendency towards the miniaturization of these elements in order to simulate the real sensations as much as possible (Tao, 2019).

The interfaces to be developed in the future will include more senses and will use technology to create multi-layered narrations. The interface becomes an area of experience and multidimensional encounter. Such dialogue can be considered active inside the interaction space, in a continuous retroactive feedback that affects the spectator's behaviour.

While Turing claims that it would be enough to equip a machine with all senses in order to provide it with intelligence, according to Melvin Slater "an intelligent computer can be an immersive and sensory vision where the person gets introjected into a 360° visual universe. Thus, it acquires a complex view that includes a new sense of orientation and a new multisensoriality proper to the different experiential space" (freely translated from Arcagni, 2018).

With the intention to explore how can the variation of visual stimuli modify the perception of the surrounding environment and by analysing the mental and physical limits created by the human body in the physical reality, the Lumina project has been realized (Figure 5). Light has a fundamental role in interactive modelling made by the body that moves inside space, so that the users' personal and peri-personal space are being explored.

Light reflection and refraction can create an intangible environment where the person can experience major self-awareness. 3D technologies and tracking systems have been used to determine the user's position inside space. Through this project, the relationship between conscious and unconscious states of seeing/observing and the possibility to manipulate visual perception have been studied. Both the individual and the collective dimensions have been explored, with the support of both professional dancers and novices (Barra, 2019).

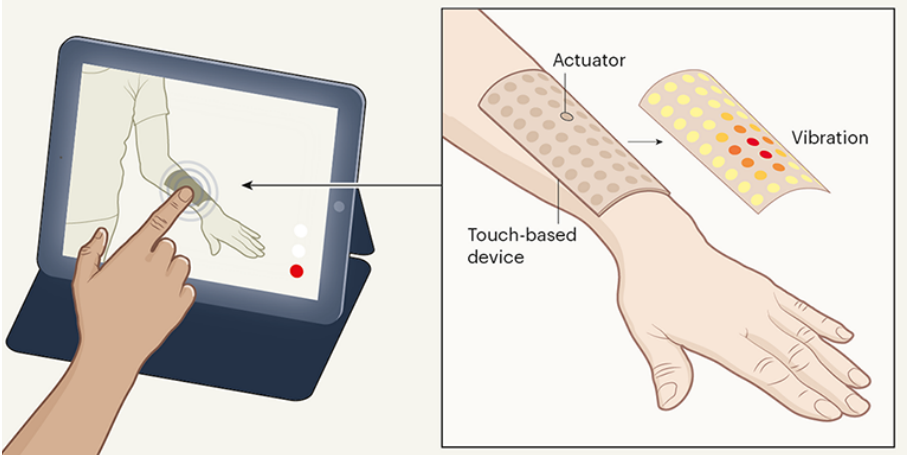

Figure 4. Sense of Virtual Touch (Tao, 2019)



Figure 5. "Lumina in performance" (Barra, 2019)

The narration of technology, as proposed by Uchida, curator of the Mirajkan Museum in Tokyo, represents a valuable stimulus to go beyond the overlapping between human being and machine and to identify an imagined coexistence oriented towards innovative aesthetics and original forms of interaction. The relationship between user and technology is supposed to evolve through a deep understanding of the artificial intelligence and its capacity to express feelings. The space becomes a fluid place/non-place to be explored, a real design element, an actor capable of stirring a physical and sensitive dialogue with the user, guiding him towards new emotional and perceptive experiences.

Different illuminated shapes are used to imitate the person's movements ("Awakening") and to increase the sensory awareness by providing the individual with the occasion to interact with technology in an unconventional way ("Autonomous"). The human presence activates the mechanical arm situated in the middle by transforming therefore the individual into main actor of the scene and by simulating a "dialogue" between technology and the human being. Various spheres of different dimensions that move in harmony by answering the visitor's movements are subject of the "Accordance" area (Figure 6), while "Affiliation" and "Association" highlight the possible future intellectual and emotional interaction between human being and technologies, providing the occasion to express personal thoughts regarding the future of this relationship (Aouf, 2019b).



Figure 6. "Affinity in Autonomy" exhibition - The "Accordance" zone (Aouf, 2019b)

4. Designing a multi-layered interaction

We will live more and more restricted physical and virtual spaces, accelerating time and everyday life in search of fluid destinies through the "non-places of surmodernity" (Augé, 1995) to explore and rethink-redesign through the project and the design disciplines.

We will need to think about a new humanism keeping together works, innovation, techno-scientific thought, the capacities of the new intelligent machines and choosing which interactive model of social inclusion we tend to put into practice (Capece, 2017).

The models of interaction and the case-studies illustrated bring about an image of the different dynamics of the design world in order to respond to the new ways to enjoy cultural heritage. The complexity and articulation of the cultural offer imposes new design trends.

To this purpose, the digital language represents an interesting tool to favour the customizing fruition process by interpreting the human needs and transforming spaces into narrative places and work matter to define new immersive and experiential ways to know the territory and the cultural assets. The relationship human being-cultural asset is today mediated by technologies that can transform an inert connection into an interactive multi-layered journey, with outcomes that vary from learning to entertaining, being amazed or relaxing. It

is necessary to take into consideration the contribution of neurosciences by orienting towards a multi-disciplinarity of thought in order to better understand the complexity of this relationship. This will allow reaching the "human technology oriented" model as a reference guide for the future, by putting, once again, technology at the service of the person (Matsushima, 2017).

Design can systematise the directing, technological and technical components and it can shape multimedia artefacts able to change the dynamics of communication of the cultural heritage at its different scales, from territory to artistic artefact.

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Acknowledgements: In this paper, the second paragraph was written by Camelia Chivăran, the third paragraph was elaborated by Sonia Capece, while the first and the fourth were curated by both authors.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
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The role of Design in telepresence robotics experience.

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Abstract | The emerging role of telepresence robotics has led to increased interest on the subject, opening reflections on man-machine-man relationship and their acceptance in the contexts of application. The nature of telepresence robotics lies in the condition offered to users "to be there", in a place, although not physically, through a body, which allows the user to move freely in the spaces. The flexibility of this technology has extended its introduction and testing in high-impact social contexts, such as school, where the remote user for serious reasons may contact the individual or the community in a natural way. For this reason, it is necessary to investigate the perceptual and communicative aspects connected to this interaction and the technological ones, in order to outline an innovative design scenario both for the telepresence service and for the physical and digital artefact, where the robot will perform a very expected social task.

KEYWORDS | TELEPRESENCE, ROBOETHICS, INTERACTION DESIGN, UX DESIGN, SOCIAL INNOVATION

1. Introduction

Telepresence is a technology that integrates video conferencing and robotics systems, allowing one to be present in an environment, even if one is not physically there (Marvin, 1980). This offers the possibility to connect two remote locations, adding the value of movement and presence in that place to traditional systems. Many studies have revealed that a person's quality of life is affected by their inability to participate in activities of daily living with family, friends, colleagues, which is often the case for people with special needs. Telepresence is a technology with great social potential, allowing one to be "virtually" present for people at a distance (Newhart, Warschauer & Sender, 2016). The promise of these robots is that they will be tools that can mediate communication in real time, in different contexts and enable accessibility on different scales. Although these systems have been around for several years and are mature in some areas such as the world of teleconferencing for businesses, there is still evolving research in some areas, especially in understanding their functional/behavioural potential and level of acceptance (Tsui, Desai, Yanco, & Uhlik, 2011). The use of telepresence robotics has attracted particular interest due to its ability to make places accessible that were not, either because of geographical and/or architectural barriers, or because of the special needs of certain individuals (Tsui et al., 2011). Examples of this new open dimension, aimed at overcoming barriers, speak to us of experiments in the context of schools, health care and support for the elderly. This experimentation scenario has given rise to actions capable of overcoming problems such as isolation and social exclusion of weak individuals (Bamoallem, Wodehouse, & Mair, 2014).

An interesting application in this sense, which still needs in-depth study, is in the world of education, where students who cannot participate in school activities have telepresence systems at their disposal. This allows them to watch the class, access content, communicate and interact with teachers and classmates. The use of telepresence robots can improve the life of the telepresence student by watching, listening, moving and interacting in a realistic, independent and live way. Despite the continuous development of technology, capable of supporting these new types of communication, there are still challenges to be faced, starting with a study of the application context and the users with whom to interface (Rae, Venolia, Tang & Molnar, 2015). In general, these robots are designed for a wide range of users and contexts: businesses, hotels, museums, hospitals and schools; this does not allow a distinction according to the context they are intended for, to the detriment of the effectiveness and engagement of the interaction (Figure 1). The impossibility of robots to make non-verbal gestures in support of communication also places a limit on the effectiveness of the message and interaction, but above all on the social presence of the remote user. The contribution aims to analyse human-robot-human interaction and the factors involved, with the potential to be developed. In this it will address in methodological terms the aspects to be applied to a project of experimentation of telepresence robotics in a university context. The aim is to arrive at a robotics project in which there is full knowledge

and awareness of the needs of the user and the reference context, through ethnographic research.



Figure 1. The most used telepresence robot models on the market: Double Robot, Beam, Beam Pro, Ohmni, VGo, Padbot.

2. Robots as a communication technology

The role of robots in everyday life is becoming increasingly important and their numbers will increase significantly in the near future. Service robotics in this regard aims to develop new solutions that can collaborate positively with humans. Telepresence robotics is an application of service robotics, which provides a virtual presence from a remote location, using a videoconferencing system (Kristoffersson, Coradeschi & Loutfi, 2013). Telepresence robotics represents a reference of particular interest in the field of social robots, especially in the field of socially assistive robotics (SAR) through interaction driven by user need through multimodal interfaces. In telepresence, interaction is not only between man-machine, but represents the means of human-machine-human connection, linking two or more individuals. Their nature is halfway between social and physical presence, which is why it is called co-presence in the literature (Nowak, 2001).

With this orientation, telepresence robotics has developed different levels of interaction: the first, between humans and the space to be explored or controlled through the machine, where the robot is an ocular prosthesis, although there is no shortage of examples that equip the body with prehensile arms or other aids; at the second level are those models that integrate camera and screen, using the tablet as an example, bringing people into visual and

auditory connection; while the third level, of more recent configuration, in addition to connecting people through live digital images, aims at the possibility of being directly piloted by both people, in a form that we might now call co-piloting (Desai, et al., 2011). Some features are common to all levels of telepresence: the ability to move, to connect, to videoconference, and to be equipped with sensors. Each of these can be important in reinforcing the human presence in distance communication, enriched also by that set of elements that can characterise and increase the sense of closeness, just as happens between people in face-to-face communication. And it is also by working on the elements proper to social presence that this perception can be improved: by implementing the video and audio system and the ability of the robot to move in the coverage paths, and not only this dimension, because we already have robots capable of moving with a certain level of naturalness of human memory (Vu, Rissanen, Pang & Foo, 2012). In a telepresence system it is therefore essential to consider the ways in which we are able to reinforce a real perception of closeness with the remote user, including through non-verbal communication. In fact, research, such as that of Mehrabian (1980), claims the non-verbal language of communication to be more important than the mere reproduction of words.

3. Robotics project definition

The possibility of connecting people remotely and having them participate in everyday activities has allowed telepresence robotics to be used in experimental activities in different social contexts, allowing issues such as inclusion and accessibility to be addressed (Moyle, Jones, Dwan, Ownsworth & Sung, 2018). The robots used in these experimental and research contexts are the same as those intended for work environments, for which they were born, and for this reason satisfactory results are not returned in terms of a User Centered Design approach. What is needed is a design in which the user is at the centre of the project with his or her own needs and the context for which the robot is intended (Casiddu & Micheli, 2011). The continuous evolution of these artefacts, mainly from a functional point of view, has led to unresolved issues such as the acceptance and ethics of the robot.

Consequently, it is necessary for a robotics project to be explored and compared by different competences, which no longer include only mechatronic and computer engineering, but also disciplines from the humanistic sphere. This leads to a simplification of the highly sophisticated engineering approach to have artefacts that reflect social and cultural changes. The different disciplines (anthropology, psychology, design, engineering) can contribute to the development of answers in terms of robot adoption and perception, through a holistic approach to the topic, in which Design assumes the role of knowledge mediator (Germak, Lupetti & Giuliano, 2015).

Design is among the disciplines that can make a significant contribution at different levels of the robotic project: expressive (in terms of appearance and morphology), passing through language, behaviours and interactions with the user. The contribution can be consolidated

and extended by adopting a co-design approach, in which the actors of the system are involved, bringing knowledge for a shared and accepted robotics project (Freeman, 1984). Through design, robotics can expand its competences to generate value and meaning, creating continuous relationships between technology, human needs and context.

Consequently, telepresence robotics products need further reflection based on the actors and the context of interaction (Stappers & Sanders, 2003). Indeed, in the literature there are more and more experiments in which robots are personalised by the user, even simply through a garment, to identify who is representing the robot.

3.1 Acceptance factors

The concept of acceptance is central to human-robot interaction, as users must be enabled to interact with the tool in a natural and intuitive way. Acceptance of robots depends on several variables and is defined as the robot's ability to fit into a person's life and willingness to be used in the long term (Broadbent et al., 2009).

When designing these artefacts and their interaction with humans, reference is always made to the human body, which is the starting point. However, the continuous search for the resemblance of machines to humans faces several challenges, including Uncanny Valley (Mori, 2012). In general, people are more likely to interact with humanoid robots, but there is a limit beyond which a sense of proxemic insecurity is created in humans as the distances between the two decrease. Assessments are therefore required regarding the physical, expressive and empathic clarity through which the technology becomes recognisable and acceptable (Salvini, Laschi & Dario, 2010), because it is assumed that people's attitudes towards robots are influenced by their appearance and personality, which in turn influence their acceptance (Kiesler & Goetz, 2002). Conceiving, planning and designing robots therefore also requires an effort to anticipate the future, to simulate ideal scenarios, in which pervasive technologies find a balance with the social and cultural dimension of humans, made up above all of relationships with other individuals and with the context (Šabanović, 2010). For this reason, the role and effect of human resemblance must be investigated in different cases and in the final rendering, especially when the morphology of the robot differs from the human one, albeit with a new language, as in the case of telepresence robotics. Precisely in this area, it is necessary to investigate body language and non-verbal gestures, which play an essential role in communication between individuals, enhancing the remote user's sense of presence. Telepresence robots need a deeper investigation into the possibility of extending the language and communication they express.

3.2 Robots as a somatic configuration

Gestures represent an extremely important communication mechanism that allows people to accompany speech and contribute to interaction (Stahl, Anastasiou & Latour, 2018). What is missing in telepresence robots today is the ability to express hand gestures and body posture. Several studies show that the acquisition and mastery of gestures is an essential aspect of human cognitive development, and that gestures not only express their thought, but can also be considered a factor influencing the development of thought itself. Gestures facilitate group communication, as pointing or moving shared objects during a discussion provides a clear spatial relationship for the communicator and group members (Björnfot & Kaptelinin, 2017).

The telepresence robots we find on the market today have very specific morphological characteristics: the head represented by a camera/display (usually a tablet), the body by a vertical rod and the feet by a base with wheels. With a few minimal design gestures, these robots allude to the morphology of the human skeleton, becoming humanised machines with a new language. However, their new morphology still needs some improvements, including non-verbal communication, which is currently absent. Some have tried to equip these robots with arms to overcome these limitations, such as ProP, an experimental telepresence robot equipped with a pointing device resembling a human arm. Another example is the QB robot (Slack et al., 2018), equipped with an anthropomorphic hand manipulator to allow interaction closer to the local user, and have a positive social experience. Moreover, on movement it worked a lot, as it represents a characterizing element of the interaction with the robot, both in terms of naturalness and fluidity, as it represents the biological nature of human characters (Kupferberg, Glasauer, Huber, Knoll & Brandt, 2001). However, if these performances fail and the variety of gestures is limited and repetitive, to highlight the mechanical origin of the robot, the user tends to become detached and uninvolved in the interaction. Human-robot communication codes will therefore assume great importance, implementing those that telepresence already guarantees through the display.

4. Telepresence: an ethical issue

With the advent of service robotics, ethical considerations regarding the privacy and security of users have been raised. An increasing number of robots are entering spaces lived in by humans: private or public spaces, often equipped with cameras and sensors, such as telepresence robots, capable of collecting data (Niemelä, van Aerschot, Tammela, Aaltonen & Lammi, 2019). Telepresence robotics still raises some concerns especially due to the presence of the camera that can collect sensitive data. This is precisely why privacy and security are considered the main barriers for the continued growth in the adoption of these technologies. The ability of telepresence systems to move within remote spaces, even if guided by cameras, raises questions about the physical safety of the user, the environment,

and the robot itself. The robot must be designed to be safe in the environment in which it moves, with the right technological devices. For example, whenever the robot moves, it should provide some form of feedback to people, thus improving interaction with users and ensuring a way to prevent harm. At the same time, the robot should be able to avoid collisions, either against static obstacles or other people. Giving the remote user a physical body equipped with a camera raises additional privacy issues related to the subjects participating in the conversation and the environments being filmed (Krupp, Rueben, Grimm & Smart, 2017).

Regarding the issue of privacy, Calo (2010) in his book Robot Ethics writes the chapter Robot and Privacy where he summarises the rapid trend of robots towards ubiquity and identifies three main dangers posed by robots in relation to privacy: surveillance, access to private living and working spaces and social impact. These issues translate into the continuous search to solutions for the disclosure of sensitive data related to the user who is not always aware of what is going on. Compromise systems between privacy and the usefulness of robots in the context of their application, for the performance of activities for the creation of human well-being, must therefore be developed. Having a mobile robot equipped with a camera within an environment raises several concerns. Among these is that the robot can be guided, after authorised access by the remote user, to visit and retrieve location data. This also means that unauthorised access is possible and that software security can be circumvented. The data collected by the robot for its operations in the environment must remain inaccessible from the outside, remaining encrypted and authenticated. Unfortunately, these conditions of uncertainty and instability of the technology make its adoption limited despite its great potential in different application contexts. An ethical project must consider these issues from the earliest stages, to arrive at a final product that is accepted by the user who establishes a relationship of trust in its use.

5. Robotics in Education

The education sector, like many others, has faced several changes with the rapid growth of digital technologies and robotics. Education systems have been able to exploit the new opportunities of robotics, which have made the sector more collaborative and accessible to students with different needs. Indeed, robots are considered useful tools to include those with learning difficulties and disabilities in classroom activities, especially with the use of social robotics (Robins, Dautenhahn & Dickerson, 2009). Robots in these environments are used in different ways: from robots as tutors or classmates, to telepresence robots as assistants and teachers (Sharkey, 2016). In the education environment, experiences managed through telepresence support school learning for students who cannot reach school, but also experiences of cultural and language exchange between different groups, where for example new languages are learned with telepresent native teachers. Noteworthy is the fact that the robot can promote collaboration between different actors interacting with each other, with a view to achieve a common goal; this especially in the educational

field allows learning not only by interacting with the artefacts themselves, but by sharing common goals among students, improving their social and relational skills among them. The robot responds to the needs of modern society and manages to be an important tool to increase the motivation of users who interact with it, to be protagonists of the learning process (Benitti, 2012). But even in this context it is clear how the perception of the robot changes according to the different age groups of students and therefore how different measures are needed for a successful interaction. For example, a school-age child does not perceive the robot as a mechatronic device but gives it a set of characteristics that are generally associated with living beings, animism (Piaget, 1929), contrary to what an adult perceives. Most telepresence robots have an industrial appearance, and this affects the developmental needs of different users such as children, who have particular needs relating to the expression of their identity. just think of the personalisation of technology that takes place all the time, through mobile phone covers, tablets.

5.1 Telepresence in education system: case study in university spaces

The school is a social environment of development and growth, where different groups (teachers, students, administrators, and parents) interact to shape the student's life experiences. In the school context we are confronted with different needs, ranging from the development of the student's identity, image, integration, and affirmation within the group. Attending school has positive effects on the student's self-esteem and contributes to making him an individual capable of relating to society.

In many situations, students find themselves having to leave school for short or long periods of time for health reasons. The provision of training services must be the preventive factor with negative psychosocial consequences. Data emerging from the literature show that students who are unable to attend school face learning difficulties and subsequent problems with social integration (Reis, Martins, Martins, Sousa & Barroso, 2018). Few experiments attempt to address this problem by adopting telepresence robots, with which absent students can go to school, albeit at a distance, finding themselves in a wide variety of situations that change daily. This has made it possible to ensure the physical accessibility of classes and content offered by teachers to distant students. This type of intervention occurs mainly in the early grades of education (primary and secondary), to the detriment of the university context which is still little investigated (Reis et al. 2017). Some solutions for the university are those related to e-learning courses, which offer the possibility of autonomously managing the times and modes of their study, but at the expense of the interaction between student and teacher that fails. Telepresence could therefore eliminate this distance and create new opportunities. The few research on telepresence robots in the university context are those for cultural exchanges with other universities and distance learning for professionals. This is the case at Duke University, where telepresence robots have been used as a teaching tool to engage nursing students in clinical simulations to be passed on to early college students (Shaw et al. 2018).

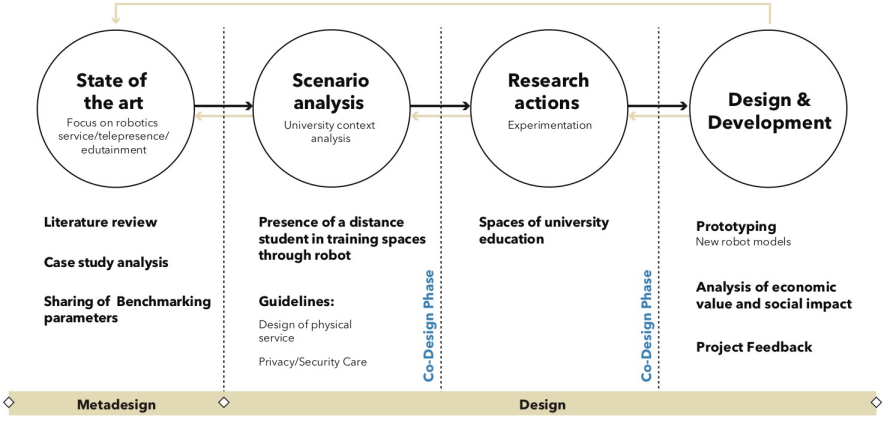

Figure 2. Methodology applied to research on the university context, through an iterative process, in which different professional figures collaborate to arrive at a new product accepted by users. In the process, users take part in the design on different levels.

From this analysis of telepresence robotics in education, new challenges, and research on the context of the university that we intend to investigate and analyse arise. An analysis that involves observing the interaction of students within environments with telepresence robots. The latter will have to be tested by users and evaluated, based on the market offer of existing models, through a multi-criteria methodology to understand the limitations and opportunities for the development of new applications (Elara, Rojas & Chua, 2014). Observation with shadowing techniques will allow to collect data on the interaction between the user and robot, to obtain an understanding of the factors that influence it. As already introduced, a co-design approach is necessary for the success of a user-accepted product, where users are involved in each phase of experimentation and design, where needs are interpreted by different figures. Participatory design succeeds in bringing out the continuous changes between society and technology. With a co-design approach, it is possible to consider the context for which a project is designed with user observation as a tool to investigate the scenario and develop a new proposal. For example, the possibility of co-piloting from both places of these robots, or the possibility of being able to transmit the communication message through body signals. A telepresence robot should be able to express the emotions and moods of the user it is impersonating, thus creating interaction scenarios that are more natural and closer to other users. Emotional design helps to support the design of such artefacts and the creation of innovative interaction scenarios, in which communication must be in a language alluding to that of human beings.

Designing robots for specific environments, such as the educational context, therefore means considering different variables involved in the process to avoid failures, ranging from the perception of the usefulness of the tool, to the level of complexity in terms of usability,

to the study of the robot's own forms of communication (expressivity, movement, speech), because it is known that its acceptance also depends on its appearance and personality (Kiesler & Goetz, 2002).

6. Conclusion and future works

The reflections reported on the technological development of telepresence robotics and the creation of new strategies, capable of managing the relationship between man and machine, are necessary to increase the level of acceptance of these robots, in order to improve their coexistence with man. In this direction, design plays a key role in shifting the focus from a technology-driven process to one in which an ethical approach and acceptance are characteristic. This means putting people, the community, their needs and the social context at the centre of design, to achieve the main requirements of interaction: empathy, involvement and collaboration (Fitter et al., 2018). Evaluating. As with all interactive systems, the experience of the user interacting with the robot needs to achieve benefits, so it needs to be intelligently designed. UX with social robots, such as telepresence robots, must be a central issue in the development of such artefacts (Germak, Lupetti & Giuliano, 2015). The paper introduces several issues related to telepresence, such as the context of use of telepresence, the target user groups and the lack of non-verbal communication to support the interaction. Security and privacy aspects that are still present in these robots and that need an adequate and conscious design must also be considered. Through a co-design approach with the different actors and entities, which take part in the project, it is possible to create a collaborative system, where the maximum transparency and the purpose of the intervention itself is present. Therefore, this study intends to promote and continue the experimentation of a service robotics in situations of discomfort or impossibility of physical encounter of the university student at a distance, where the robot is a tool for inclusion and social progress, through the creation of a new physical service.

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The Venice Backup: Case studies on the use of Virtual Preservation Techniques on Architectural Heritage sites in Venice, Italy.

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Abstract | The paper documents three case studies researching techniques of 'Virtual Preservation' upon heritage sites in Venice, Italy. The case studies had the goal of determining whether mixed-reality techniques offer a viable solution to the potential loss of heritage sites which in the near future could be irreparably damaged by the impact of climate change. While many studies of 3D-scanning of heritage sites exist, the study attempted to be the first comprehensive study to both look at their reproduction in mixed-reality and further to look at the possibility of digitally recreating the "atmosphere" of an entire city, in this case that of Venice, which is one of the most historically valuable cities in the world, and also one of the most precariously exposed to climate change. The use of this mixed-reality technology included 'reality capturing' through 3D-scanning data, which then were transferred to 'virtual reality' through various point-cloud data processing tools and through the use of the gaming engine Unity with a custom software plugin to display the point-cloud data. In order to test this hypothesis, the studies tested various conditions and atmospheres of the city and therefore the case studies were performed over several months, and vary in scale, light conditions, and type; from the Nordic Pavilion in the Giardini, to the streets of Cannaregio at night, to the Island of San Servolo during the day. These digital replicas were then tested upon various audiences, ranging from heritage experts, students, and the lay public. The article concludes on illustrating the limitations and strengths of these methods while foreseeing how such case studies could help experts to establish guidelines on integrating mixed-reality into traditional practice of architectural heritage and preservation, government guidelines, and partnerships with the technology sector, with the ultimate goal of suggesting such case studies provide evidence for the viability of producing realistic alternatives to mass cultural heritage loss due to climate change in the near future.

KEYWORDS | VIRTUAL PRESERVATION, MIXED-REALITY, ARCHITECTURAL HERITAGE, VENICE, CLIMATE CHANGE

1. Introduction

1.1 Mixed-reality in Architecture

Recent technological developments within 'mixed-reality' technology have the potential to significantly impact the architectural profession. These recent technological developments have been analyzed and theorized in part by the architectural community through their capacity to provide new knowledge and tools regarding the layering of digital and physical space (Bratton, 2014), their applicability to "intelligent" spatial practice (Picon, 2015) and through a general strategy of working on the "smart city" (de Lange, et alii, 2019). Others have noticed how this technology will impact architectural preservation and heritage studies, especially within the field of 'experimental preservation' (Otero-Pailos, Fenstad Langdalen and Arrhenius, 2016), and more specifically how these working methods may apply to architectural heritage practice more generally (Buthke et alii, 2020). Scholars additionally have noticed how using mixed-reality in urban planning will be "affect community and place-making efforts" (Berck, 2017), with even organizations like the UN Habitat recommending such tools for public participation in urban and public space design (UN Habitat, 2019). Together this signals a broad range of recent scholarship claiming the relevance of mixed-reality to architecture.



Figure 1. Example of Mixed-reality application to healthcare scenario. Top right, top left and bottom left: Users in laboratory setting. Bottom right: Inside of the digital architectural replica. Source: Haptiq – Facebook post, 2020.

Expanding upon this rich and rapidly developing research territory, the primary framework of the research for this paper regards the potential for this 'mixed-reality' technology to be applied to various aspects of the architectural profession in hope of both understanding the technologies in their current development while identifying relevant uses within a framework of architectural activities in urban planning, city design and other relevant professional tasks such as heritage studies. Here, 'mixed-reality' is used as a blanket term to describe several new terms and techniques including augmented reality, virtual reality, 3d-scanning and photogrammetry (also known as reality capturing), which for the purpose of the study can be framed as an overall development of technology becoming increasingly "spatial" (Barford, 2015). The term 'architectural profession' is meant to describe the various professional tasks performed by architects, including architectural design, city planning, construction management, architectural research, teaching, and architectural heritage and preservation. The goal of this study is then to provide case study data on the potential benefits and/or downfalls of these 'mixed-reality' technologies upon a defined scope of professional architectural responsibilities.

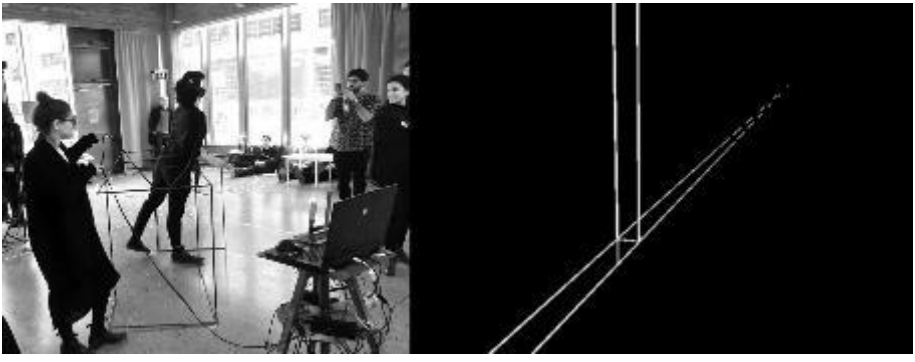

Figure 2. Mixed-reality when applied to Architectural research in an academic setting. Left: Instructors within student-design Mixed-reality project. Right: View from inside the space. Source: Author, 2017.

1.2 Use Cases for Mixed-Reality

One of the primary interests of the research is thus to understand how various claims regarding the possibilities of these mixed-reality technologies coincide with their potential use cases. If the possibilities of mixed-reality indeed are true, the technologies could allow physical space to be digitized with a very high degree of accuracy, and to be recreated in a manner which allows people to experience such a digital replica as a full-body spatial experience. This is to be made possible on the one hand due to a range of techniques within 'reality capturing', which uses 3d laser scanners, photogrammetry, and other methods which claim to create 3d-models with highly accurate positional data in addition to highly accurate

color data. With high-end hardware and state-of-the-art software, such reality capturing portrays the creation of 3d models with near perfect, millimeter accuracy, and highly realistic color representation. Using sound recording techniques known as field recording, one may also capture highly accurate sound data. On the other hand, virtual reality and augmented reality technologies, including headsets, sensors, and mobile devices, claim to produce highly accurate 1:1 bodily experiences of such digital space. This is demonstrated to be made possible due to the virtual and augmented reality hardware being able to position itself accurately in relation to a digital model within a physical environment.



Figure 3. Mixed-reality when applied to Architectural research in an academic setting. Source: Author, 2017.

1.3 Architectural Heritage as Use Case

One of the more promising developments within this research framework is the potential usefulness in using such mixed-reality techniques when working with architectural heritage sites. Specifically, 3D scanning, virtual and augmented reality provide new opportunities to catalogue and archive buildings and physical spaces even in/at full scale (Buthke et alii, 2020) The possibility for technology to create digital copies of physical heritage sites which also can be experienced at full scale within a virtual exhibition or archive has numerous benefits to existing working methods within architectural heritage, while simultaneously opening potential new use cases entirely. This is due to architects requiring a high degree of accuracy required when working with heritage sites, often experiencing challenges due to the often

precarious state of material aspects of heritage sites, the difficulties related to the costs and difficulty of travel to and from heritage sites, and difficulties in coordinating accurate and precise data about a site. This is further exacerbated by tourists and the public's interest in visiting heritage sites, limited economic resources in maintaining heritage sites, and experts and maintenance needs for a enclosed and undisturbed working area when performing maintenance, conducting studies or building modifications or support structures for a site.



Figure 4. Mixed-reality when applied to Architectural Heritage in an academic setting. Student views a 3d-scanned Heritage site through the HTC Vive Headset. Source: Author, 2019.

1.4 Architectural Heritage and Climate Change

All of these aforementioned issues meet a particularly challenging extreme when confronted by erosion, material decay, and extreme weather events which can be particularly destructive to historical sites. There is now broad consensus among international scientists and NGOs that climate change poses a severe threat to the Cultural Heritage sites (Gruber, 2011). Numerous international reports document how climate change will further escalate these effects, with potentially disastrous consequences for heritage sites along coastal and equatorial areas in the near future. This is due to both the predicted escalation in frequency and strength of weather events in general, and the effects of sea rise and its effects upon communities which maintain heritage sites due to climate migration forcing the likely abandonment of heritage sites. These extreme effects have the potential to abandon large amounts of heritage sites globally both by their local communities and by tourists and other groups which previously would provide cultural and economic incentive for maintenance of the sites. In this we see that climate change poses a unique threat to heritage sites which seek new methods and strategies for adaptation and survival.



Figure 5. Demonstration of Mixed-Reality prototype using Photogrammetry technology to digitally replicate and manipulate existing physical material. Source: Author, 2018.

While several actions have been contemplated in the short term to prevent the impacts of Climate Change on World Heritage properties, according to interviews with experts on the topic, there is limited experimental research accomplished to date on the process of adaptation of cultural heritage to climate change (Sesana et alii, 2018). Already in the 2007 World Heritage Committee report it was claimed that there is a need for more research on the effects of Climate Change on both the physical heritage and the social and cultural processes that they are a part of (Colette, 2007). The report subsequently suggested that case studies could be used as experimental pilot sites for the development of appropriate strategies. From these examples a number of key principles can be derived on which sustainable adaptive responses to Climate Change can be developed, including «[…] designing flexible management planning objectives to enable priorities to be re-evaluated in response to Climate Change» (Colette, 2007)..It is particularly noteworthy that there is still little research to date on how virtual preservation techniques may be utilized to archive potential heritage loss before its destruction.



Figure 6. Mixed-reality when used in a Museum setting. Left: User in physical exhibition space. Right: Depiction of the interior of the architectural proposal. Source: Norwegian Museum of Architecture, 2018.

1.5 Mixed-Reality applied to Climate Change

As recent reports document how heritage requires more experimental solutions to climate change, we find here a growing acknowledgement within heritage experts and preservationists to find new, experimental methods to stop and prevent cultural heritage destruction, specifically through research applied to case studies (Negussie, 2012). Within architectural education and research, the field of 'experimental preservation' has recently opened to the opportunity to evaluate new methods, technologies, and pedagogical strategies in relation to both climate change. Thus, although such 'Virtual Preservation' techniques demand a substantial change of established working methods and tools within architectural heritage, the realism obtained through such methods could compensate for the loss of the original material site, and still allow future generations to experience heritage sites in the future through digital means.



Figure 7. Mixed-reality, point-cloud model used in Architectural Heritage in an academic setting. This site was lost due to erosion shortly after the 3d-scanning was performed. Source: Author, 2017.

2. Methodology

2.1 Goals for the experimentation

The article's introduction to the topic of 'Virtual Preservation' and its relevance to mixed-reality technology development, architectural use cases, the field of architectural heritage, and the problems regarding loss of heritage sites due to climate change, provide the overall goal of evaluating whether virtual preservation replicas of heritage sites have sufficient accuracy and user experience to compensate for the high possibility that climate change and other environmental factors will destroy a vast amount of cultural heritage sites globally during the coming future. For this goal to be tested, heritage sites of relevant interest needed to be identified, and ways in which to technically achieve the studies had to be researched, and equipment acquired and planned out. Finally, relevant venues and methods for testing these cases upon users needed to be identified and planned.

2.2 Equipment

Between 2016-2019 the research tested various equipment. For this specific study, the best possible equipment within realistic means was utilized. This included the Leica BLK 360 3d scanner, the software package of Autodesk Recap, the iPad Pro (2019 model), and the newest software versions of Unity, including a custom plugin for converting large point-clouds to virtual reality. For the implementation of virtual reality, the case studies utilized the HTC Vive and HTC Vive 2 headsets, with corresponding sensors and trackers.

2.3 Case studies

The case study site of the city of Venice, Italy was chosen due to Venice' heritage status as well as its precarious situation due to climate change in its lagoon setting. Venice in general is also one of Europe's most endangered cities with flooding and sea rise due to climate change becoming a rampant problem. This, in combination with the endangered state of the heritage sites itself, presented a highly relevant context in which to experiment with the virtual preservation topic.

The study researched thus the application of virtual preservation to architectural heritage sites in Venice. As initial research revealed that such research had yet to be done in a structured manner, the study was executed as a research-by-design study involving the design, execution, and evaluation of prototypical case studies within scenarios in Venice. The case studies focused on the following main points: i) the capacity to identify applicable sites to perform virtual preservation methods upon; ii) the capacity to transfer physical data from heritage sites into virtual reality through 3d scanning, surveying and modelling; iii) the

capacity to experience the heritage sites at full body scale in to virtual reality and then to evaluate to what degree they provide a fair representation of the archived space.



Figure 8. Flooding in Venice during the research period, February 2019. Credit: Author

2.4 Choice of Case Studies

The study was conducted through 3 case studies: 1) Nordic Pavilion in the Giardini, during daytime; 2) San Servolo Island at daytime; and; 3) The streets of Cannaregio at night time. These case studies were chosen due to their ability to represent a "totally" of typical venetian scenarios: Singular buildings, streets and alleys, and buildings with connections to water. The case studies were relevant to the research topic of climate change in various manners. All case studies were challenged by a context that presented some form of erosion of other environmental stress. Finally, all case studies were of a scale that was possible to perform a study within a few days period and to be replicated within a feasible framework in terms of file size, equipment, and manpower.

3. Case Studies

3.1 Format for each case study

In each case study, the scanned models were recreated at full-scale using mixed reality methods to create an exhibition of the site. For this, the point cloud models and had to be processed and documented, and then imported into the software engine of Unity. Within Unity, the models were then reconstructed as virtual reality experiences through the SteamVR plugin. This was then exported to the HTC Vive VR headset with the attached equipment. Each case study was presented in a setting with expert participants experiencing the virtual exhibitions of the archived spaces. The results allowed to the studies to produce a

high definition representation of the heritage site in a virtual environment. The virtual environments were used as a means to increase dialogue with the public and heritage authorities as well as to experiment with historic restoration. The participants within each case study provided feedback on the extent to which the experience resembled a physical experience. In several case studies, participants experienced both the physical and virtual spaces, allowing for comparison. The feedback was documented and processed for further research and to draw initial conclusions as to whether the experiments could provide guidelines for further implementation of virtual presentation in addressing the aforementioned challenges to climate change.

3.2 Case Study 1: The Nordic Pavilion, Giardini, Venice

The first case study was a highly ambitious endeavour. The manpower provided for the site included a group of 8 students within a research course dedicated to the preservation studies of the Nordic Pavilion in Giardini in Venice, in addition to 3 dedicated staff members on the heritage site charged with caretaking and maintenance of the site. This provided critical assistance in cleaning the site and removing rubbish, access to various rooms and spaces, etc.



Figure 9. On-site scanning of the Nordic Pavilion. Note the vacancy required for the scan to be performed. Credit: Author

The case study was technically and physically ambitious in multiple ways. The case study was the first attempt at creating an entire, full resolution virtual exhibition of a large building at this scale, with high enough density of the point cloud to recreate material quality in a state-of-the-art manner, ie to be reproduced digitally as an exact replica. It was also the first to integrate live, multi-input sound. Due to the size of the site, the 3d scanning had to be

executed over two days and consisted of 25 scanning points. At around 10 minutes per scan, this involved a significant time span. The point cloud which was then generated consisted of a large amount of data which required an extensive amount of time dedicated to post-processing and recreated in Unity and compiled into virtual reality. The study was then recreated in an exhibition format in Oslo, Norway for heritage experts and preservationists. The virtual experience was presented to a range of experts discussing various topics regarding the history and restoration of the building.



Figure 10. Initial testing of the Point-cloud data in the Autodesk Recap interface. Here, the point cloud is reduced to 100mmx100mm density. Credit: Author



Figure 11. Initial testing of the Point-cloud data in Unity, when processed with textures. This is accomplished using a "point-cloud to mesh" plug-in for Unity. Credit: Author

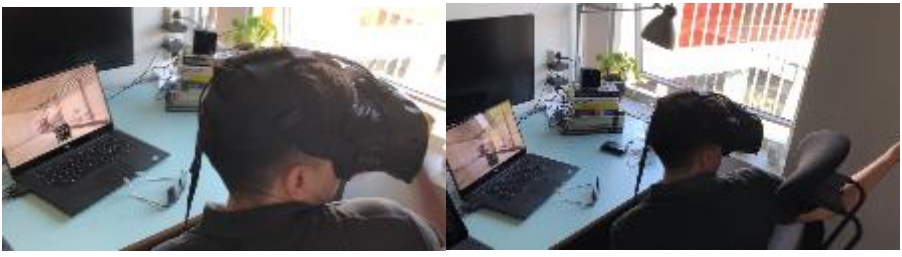

Figure 12. Testing of the Point-cloud data in the HTC Vive Virtual Reality environment, before setting up full-scale exhibition. Photo: Author

Among primary drawbacks from the study was learning that point cloud scan of such magnitude produces a very large amount of data, emphasizing the importance of either reducing point cloud data in early stages, or acquiring sufficiently powerful hardware in which to operate with the point-cloud afterward. In this instance, only 8 of the original 25 scans could be utilized with the available hardware, though all 25 scans can indeed be used provided a powerful enough computer.

The study also produced the acute observation of difficulty of entering active heritage sites as maintenance personnel and other crew members had to either be removed from the site to perform the study, or removed digitally afterwards. This meant that several "ghosts" had to be deleted from the point-cloud after the fact. Finally, weather conditions for the study proved to be (luckily) favourable, though had the weather been more difficult the study would likely not have been feasible within the provided time frame. This is due to the color and reflection of the materials, when scanned, provide a more of less exact representation of the shadow and light conditions when scanned, and when scanned over two full days, require relatively similar conditions of this time period for the point-cloud to appear cohesive. Luckily, the weather was overcast sky for nearly two consecutive days, providing nearly optimal conditions.



Figure 13. Virtual Exhibition of the model in Heritage discourse event with full-scale exhibition. Photo: Author

The primary developments of the study was that a realistic, nearly perfect copy of the site was indeed achieved – generating rich dialogue between heritage experts, students and the public about the history and the future of the pavilion. In particular, the data was used for several studies related to a temporary exhibition in the space for the 2020 Venice biennale. This realization - combined with the knowledge that the technology could provide an accurate and high-resolution experience, further elevated the capacity that virtual preservation could provide unique opportunities to the field.

3.3. Case study 2: San Servolo Island

The second case study expanded on the first case study in numerous ways. It was performed on the Island of San Servolo, during the daytime, for a period of roughly 6 hours. The study consisted of roughly 25 scans points. As the site consisted of an island typology with a ferry landing, a large building interior and several courtyards between the building mass, the site was therefore interesting because it included a waterfront in close connection to the edge of the building, a large building complex, and several outdoor areas. It was also chosen because it was largely uninhabited during the daytime, allowing the study to be performed without much disruption from the public or other authorities within the site.



Figure 14. Performing the case study in San Servolo. A typical scan takes 10 minutes. Credit: Author.

The weather conditions and other practical considerations for the study were favourable – providing generally good scan data. The equipment had to be moved in rapid succession between indoor and outdoor areas. This proved to be successful – offering an interesting data set of an entire spatial transition between different spaces of varying scale, material quality, color, connection to water and the exterior, etc.

One difficulty which arose was a transition between a central lobby area into the courtyard. Here, a lobby area with a heavy door which could not be left open broke the scan into two separate components. This meant that the scan consisted of two final outputs: the ferry exterior area and the interior and courtyard areas on the other side of the lobby. This highlighted some of the difficulties in created entire scans of a complex building configuration suggesting that such studies require a large degree of control and planning when moving across large areas in hope of documenting an entire continuous area.

Upon experience in the virtual reality model of the site, students and heritage experts in the lab reported on the accuracy of the study being of sufficient accuracy to recreate a authentic and valuable heritage study. Particularly, the ability to pass through multiple rooms from indoor to outdoor provided interesting feedback. Here, the size of the study meant that users had to “teleport” between vantage points rather than simply meander around like in the previous study. This suggests that possibilities for movement in large virtual spaces will require further study and likely new technical solutions.



Figure 15. Point-cloud model of San Servolo Site. Notice how multiple spaces are recorded by moving the scanner to multiple points. Credit: Author



Figure 16. Student studying the San Servolo project in the lab. Note how the size of the lab reduces the ability to walk within the entire model, requiring users to "teleport" to different areas of the space. Credit: Author

3.3 Case Study 3: Cannaregio streets at night time.

The first two studies documented scenes in Venice during the daytime. This prompted this interest in attempting to perform a study of Venice during the night time. One of the reasons for this interest is that many of the unique qualities of Venice streets are indeed most prevalent during the evening, especially when the unique qualities of darkness and street lights are noticed. This also provided a good opportunity to test the technologies' ability to capture such a scene accurately during the night. Finally, the night environment allowed to have more quiet and less disturbance than would normally occur during the day.



Figure 17. Performing the case study in Cannaregio at night time. Note the quality of the typical Venice street scene during the night.

Cannaregio was chosen as a site as it is often characterized as one of the more beautiful areas of Venice with a coherent network of buildings, piazzas and canals offering a typical and cohesive study of typical Venetian street environments. The study had the goal of documenting a typical stretch of streets during the night, and was therefore performed during a period of approximately 5 hours and consisted of 22 scan points over a territory of roughly 200 meters, from roughly 21:00 at night to 02:00 in the morning. The study started near Calle Zancani, crossed the Campo san Marziale, and ended near Calle Trevisan. The scan points were between 5 and 15 meters apart depending on the context. The scan was performed by two persons. The night time context provided much less difficulty that daytime scans as there was much less public activity in the streets.

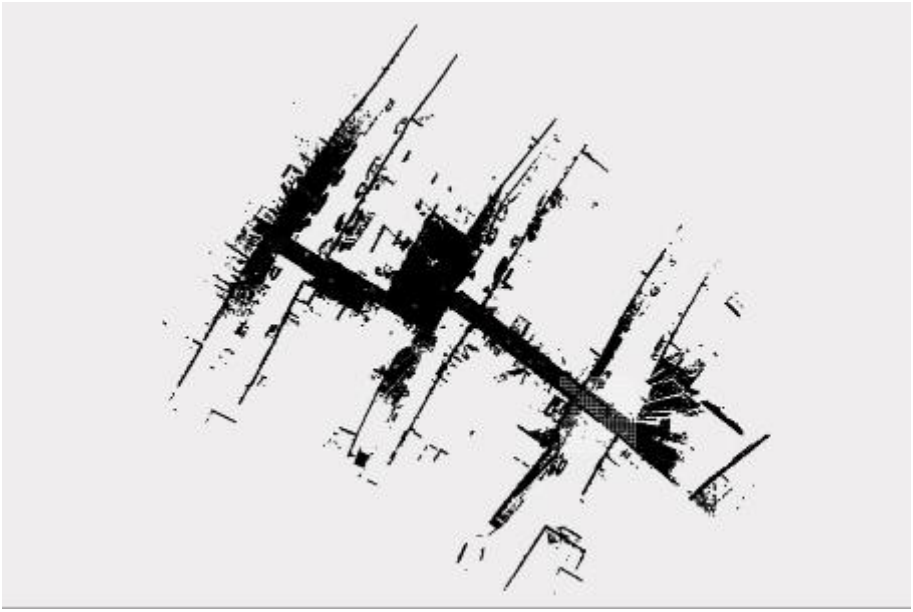

Figure 18. Resulting map created through the Cannaregio case study. Black areas represent collected data. Credit: Author

The study was collected in the Autodesk Recap software and compiled into a 3d model. Initial inspections of the data showed that the study had been successful in scanning a long stretch of streets with a comprehensive network of canals, buildings, and piazzas with a high degree of accuracy in the scan. Particularly, light and color data was remarkably accurately portrayed. This seemed to verify the hypothesis that it would be possible to perform such a study during the night.

The data with further compiled and brought into virtual reality for further study. Experts, students, and visitors from the lay public were invited into the lab to experience the scan. Initial feedback from the audiences consisted of the scan being both highly experiential and beautiful. Particularly, the street lights combined with the high level of darkness was reported as especially intriguing and beautiful. It was also pointed out that the long stretch of space the scan contained allowed for a short “walk” through Venice. Multiple users reported this aspect to be an interesting experience. Feedback regarding teleportation was similar to the second case study. This suggests that some of the unique qualities of Venetian street life during the night time could indeed be captured and recreated in virtual reality with such methods, but will require new techniques for virtual movement.



Figure 19. Students study the Cannaregio case study. Note the space requirements for a large vacant area compared to traditional architectural studio settings. Credit: Author

4. Conclusions

4.1 Workflow

This study was able to demonstrate that significant improvements in the technology have happened in the past years which likely would not have made such a study feasible previous. In 2016, there were several limitations the virtual preservation. One of the primary limitations of previous studies is that in many cases the information collected was not be accurate enough to be recreated as a full historically correct documentation of a heritage site. The technical capacity was often a limit in the collection of data. Upon inspection of the data collection with this selection of hardware and software, it seems that this accuracy is no longer an issue.

4.2 Significant difficulties

The study was limited to a total of three sites which had the purpose of documenting what types of difficulties and benefits such methods could have. In particular, monetary costs and technology competence are likely to be significant challenges in performing this type of

work. The Leica BLK360 scanner was an expensive piece of hardware that is not available for mass use, and requires specific supervision and care. Additionally, comprehensive and precise virtual preservation studies of this manner cultural involve much travelling, which places stress on budgets and time constraints. In addition, completing accurate renderings of a site demand storage capacity of large-sized files, and specific competence on how to transfer data, handle point clouds, convert geometry, etc, which due to their highly technical nature places such studies within a specialist discipline. These findings in large portray the field as likely too dependent on specific competence, and too expensive, to be utilized en mass.

4.3 Significant findings, overall

The study had several significant findings. The most significant breakthrough of the study is that it illustrated that available technologies today allow for full-scale digital copies of heritage sites to be transported into virtual reality and recreated in a full-scale exhibition to be experienced by an audience. It also, importantly, and perhaps for the first time, demonstrated that such studies could be performed on a variety of sites and with different lighting conditions with the ability to capture both daytime and nighttime atmospheres in order to capture a variety of environments encapsulating an entire “feeling” of a city. This offers the potential to create experiences of an entire city such as Venice, demonstrating the capacity for such techniques the create strategies not only for a specific heritage site, but possibly for an entire city. This offered an interesting way to understand how such techniques can be used beyond mere technical documentation and towards the ability to recreate specific, historically valuable experiences.

4.4 Significant findings related to User feedback

Displaying virtual reality representations of heritage sites to audiences is a highly intimate experience, creating unique opportunities and challenges. As the technology in its beginning stages, some users get very dizzy, which creates a significant challenge for inclusivity. The virtual reality representations require a high degree of trust between users, as they may end up looking foolish in front of each other. The highly technical aspect of the technology requires additional supervision and dedicated staff with sufficient expertise. The spatial and economic properties of the technology require exhibition review formats and demand new approaches to studio space. Virtual reality requires a dedicated lab with a designated space for optimal comfort. This has the potential to create a class divide among users, which should be avoided. The use of proprietary software requires practitioners to familiarize themselves with different software packages and to make informed choices about the correct software to use. These combined challenges signalize the need for increased research into multidisciplinary applications of technology.

Through polling the audiences and in dialogue with experts during the exhibitions of the sites, it was established that the virtual preservation studies recreated heritage sites in sufficient resolution for the experiences of the sites to be recreated in a manner that was representative of the physical space. Overall the feedback from the study, despite several difficulties, allude towards a position that verifies the initial research hypothesis that these methods could propose viable answers to the problems of potential mass loss to built heritage due to climate change. In addition, the use of virtual reality technology within preservation gave the opportunity to speculate upon a new form of emerging preservation practice which can work directly with the preservation of heritage sites as a full-scale medium, fostering new relationships between preservationists, architects, and the public.



Figure 20. Interior of Case study 1, currently being used for a proposal within the building for the 2020 Venice Biennale. This shows the applicable uses for such techniques in current architectural practice. Credit: Author

4.5 Significant findings related to Climate Change

As our cultural heritage sites are threatened due to climate change, preservation in the digital age demands for a development of new techniques. As we become increasingly aware of the coming devastation upon the built environment due to climate change, we must confront such challenges with realistic proposals for adaptation and mitigation for architectural heritage. The findings demonstrated through the experimentation in this article suggest that the use of Virtual Preservation methods and techniques could provide a viable solution to the mass physical loss of architectural heritage sites due to climate change by making full-scale digital experiences of a site's physical counterpart before it is lost. While requiring a radical shift from current understandings and techniques within the field of preservation, the results from these experiments show that the user experience of such a digital experience holds a high pedagogical and experiential value with a high degree of

accuracy compared to their physical counterparts. Current technology developments suggest further that these methods will only become easier in the future.

4.6 Final Remarks

This study represents an initial, specific effort at evaluating the aforementioned hypothesis of the study. Further research and additional case studies must of course be performed in order to evaluate these possibilities further. However, the present results should document adequate evidence to propose that such methods be implemented into architectural heritage and preservation studies quickly in order to begin production of such Virtual experiences to a broad number of sites globally. And hopefully, this study will stimulate research funding into these areas further while contributing to international discourse. While several independent and state actors indeed are performing such studies currently, there lacks a broad consensus and understanding among preservationist and heritage experts regarding the mass loss of physical heritage sites due to climate change. This article therefore to have documented the viability and urgent need for such a discussion, in hope that such a disciplinary turn may soon take shape.

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Towards a visual-based survey on explainable machine learning.

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Abstract | The increasing use of Machine Learning in people's everyday life raised the need for solutions aimed to reveal the work done by those models when transforming an input into an output. In the field of Computer Science, techniques of Explainable Machine Learning have been developed for unveiling algorithms' inner workings at different degrees of sophistication. The current status of the research on Machine Learning Explainability is still empowering the creators of those models but is not informing the people affected by them. Being information visualisation considered a good mean to show these processes, it is legitimate that tools able to help designers to browse visual models used in the past are designed. The paper proposes a visual-based methodology for displaying and analysing images in-groups as a support for designers in the observation, investigation and selection of visual models and solutions to be adopted in the area of Explainable Machine Learning.

KEYWORDS | INFORMATION DESIGN, VISUAL MODELS, EXPLAINABLE MACHINE LEARNING, DATA VISUALISATION, VISUAL DEVICE

1. Introduction

Explaining machine learning is the ability to present in understandable terms machine learning models to a human (Doshi-Velez & Kim, 2017). In the field of Computer Science, techniques of *Explainable Machine Learning* have been developed for unveiling and analysing algorithms' inner workings at different degrees of sophistication. However, the current status of the research on *Machine Learning Explainability* is still empowering the creators of Machine Learning models but is not informing the people affected by these models (Correll, 2019). After a few years that Explainable Machine Learning techniques have emerged in the field of Computer Science (Lipton, 2016), the need to explain the internal functioning of Machine Learning algorithms has spread and amplified, starting to involve other fields, such as information design and ethics (Mittelstadt, Allo, Taddeo, Wachter, & Floridi, 2016). In the Computer Science field, different surveys (Garcia, Telea, Castro da Silva, Tørresen, & Dihl Comba, 2018; Hohman, Kahng, Pienta, & Chau, 2018) have been carried out to investigate and evaluate the state of the art and future research directions, especially for *deep learning* and *neural networks techniques* (Garcia et al., 2018; Hohman et al., 2018; Yu & Shi, 2018). Indeed, data visualization and visual analytics are considered good means (El-assady, Jentner, Kehlbeck, & Schlegel, 2019; Offert, 2017) for both communicating and explaining internal states of machine learning models. However, in the examined literature there does not seem to be a collection showing all the visual models used to represent processes regardless of the type of machine learning model.

The paper presents the initial phase of a research process that aims to investigate how information visualisation and design can be exploited to communicate to a lay audience the internal processes of machine learning algorithms that impact society. The presented stage of the research proposes a visual-based methodology for displaying and analysing groups of data visualisations as a support for designers in the observation, investigation and selection of visual models when dealing with machine learning explainability.

For distantly investigating the aesthetic patterns of visualisations in the field of explainable Machine Learning, in the paper, a method coming from the study of digital platforms has been used, leveraging tools from Digital Methods (Rogers, 2017). Digital Methods are a collection of tools and techniques that have been originally designed to analyze online text content with a sociological approach by experimenting on different online platforms — Twitter, Facebook, and Google –. Indeed, in the last years, the increasing dissemination of visual content on the web has driven the desire to develop techniques related to the study of images *en groupe* by using Digital Methods (Niederer & Colombo, 2019; Ricci, Colombo, Meunier, & Brilli, 2017). Most of the efforts have been made to study images from social networks and search engines to create *networked images systems* able to display multiple images connected by common attributes.

Since scientific articles, usually associated with images displaying visualisations and screenshots of interactive interfaces, are available on the web, this paper proposes an

experimental approach for studying visual models in groups, for distantly investigating the aesthetic patterns of visualisations in the field of explainable machine learning by using techniques coming from the study of digital platforms (Pearce et al., 2018).

As machine learning spreads across domains, the aim is to draft a method that can help designers understand how visual patterns, colours, and shapes and other visual variables (Bertin, 1967) are used trying to visually foment and answer the question: *How to visualise explainable machine learning process.*

The intention of the paper is not to propose an alternative system for performing surveys, but to promote an integrative device that supports the exploration of case study collections and help information designers in browsing visual models during the design process.

In Section 2 related works will be presented, considering both existing surveys presenting explainable machine learning examples supported by visual analytics tools and image-based research; Section 3 presents a list summarising the design requirements; Section 4 describes the process that led from the construction of the dataset to the development of experimental visual devices; Section 5 briefly summarises results coming from the performed visual network analysis and in Section 6 strengths and weaknesses of the presented methodology are listed.

Being this ongoing research the result of an interdisciplinary approach to the study of aesthetics and visual patterns in the field of Interpretable Machine Learning, related works will be analysed by following both:

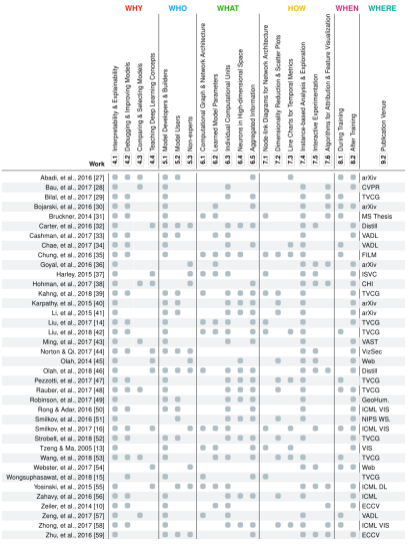
- *surveys* presented as tools for clarifying and systematising the state of the art on techniques and visual analytics for Interpretable Machine Learning. (Section 2.1)
- *research* carried out for analysing visual content (images) coming from the web presented in the form of networked images. (Section 2.2)

In the last two years, many surveys on Explainable Machine Learning techniques have been presented and discussed. Among these, some are specific to a group of machine learning models, while others differ by applying a more general approach. Moreover, examples of visual-based surveys coming from neighbouring areas will be taken into consideration.

2.1 Surveys on Explainable Machine Learning

While there is a substantial literature of surveys for visualisation and visual analytics applied in predictive analytics (Lu, Wang, Landis, & Maciejewski, 2018) and deep learning (Hohman et al., 2018; Yu & Shi, 2018) that takes into account: the reason why visualisation is used as a tool, the type of user to which it is addressed and in which context is visualisation applied, however, it seems that there is a gap in presenting a comprehensive and visual survey on visual models adopted in visual analytics for Explainable Machine Learning.

Often, evaluation grids and evaluation matrices (Garcia et al., 2018; Hohman et al., 2018; Lu, Garcia, Hansen, Gleicher, & Maciejewski, 2017)are proposed as tools for browsing case studies and evaluation parameters can vary according to researchers' own interests.



Technique	Taxonomy: Tasks: Architecture understanding	Tasks: Training analysis	Tasks: Feature understanding	Networks: DFN	Networks: CNN	Networks: RNN
Zeiler and Fergus, 2014 [6]			FE		•	
CNNVis, 2017 [10]	AVis and AVal		FE	•	•	
Samek et al., 2017 [12]			FE		•	•
Montavon et al., 2018 [28]			FE		•	•
FeatureVis, 2016 [33]			FE		•	
Erhan et al., 2009 [51]			MI		•	
Rauber et al., 2017 [52]		EMM	MI	•		
Zahavy et al., 2016 [07]			MI	•	•	
DGMTracker, 2018 [68]	AVis and AVal	EMM	FE	•	•	•
RNNVis, 2017 [71]			MI and FE			•
CNNComparator, 2017 [72]	AVal and MC			•	•	•
Activis, 2018 [58]	AVis		FE	•	•	
TensorFlow GraphVis, 2018 [75]	AVis			•	•	
TensorFlow Playground, 2017 [76]	AVis and AVal	RTA	MI	•		
RetVisCNN, 2016 [77]	AVis	RTA	FE	•	•	
Harley, 2015 [78]	AVis		FE	•	•	
BEHVis, 2017 [79]		RTA and EMM		•	•	•
DeepEyes, 2018 [80]	AVal		MI and FE	•	•	
Deep View, 2017 [81]	AVal	EMM	FE	•	•	
Grad-CAM, 2016 [82]			FE		•	
RNNbow, 2017 [83]		EMM				•
Yosinski et al., 2015 [84]			MI and FE		•	
Alsallakh et al., 2018 [85]			MI	•	•	•
Nguyen et al., 2016–1 [86]			MI		•	
Nguyen et al., 2016–2 [87]			MI		•	
Aubry and Russell, 2015 [88]			MI		•	
Simonyan et al., 2013 [89]			MI and FE		•	
Wei et al., 2015 [90]			MI and FE		•	
Mahendran and Vedaldi, 2015 [91]			FE		•	
Mahendran and Vedaldi, 2016 [92]			FE		•	
Zintgraf et al., 2016 [93]			FE		•	
Dosovitskiy and Brox, 2016 [94]			FE		•	
Zintgraf et al., 2017 [95]			FE		•	
Heyi Li et al., 2017 [96]			FE		•	
VisualBackProp, 2016 [97]			FE		•	
LSTMVis, 2018 [98]			MI and FE			•
Jiwei Li et al., 2015 [99]			MI and FE			•
LAMVI, 2016 [100]			FE			•
Ding et al., 2017 [101]			FE			•
Karpathy et al., 2015 [102]			FE			•

Figure 1. Two examples of evaluation matrices used for displaying case studies of visual analytics in deep learning. From the left: (Garcia et al., 2018; Hohman et al., 2018).

One of the most effective functional feature of evaluation matrices is that they provide a detailed and systematic vision ensuring a good exploration of contents, however, when it is necessary to list the visual models used to display explanations, they are presented through labels referring to visual model names (for instance "scatterplot", "line chart" or "networks") (left - Figure 1) together with screenshots of relevant use cases.

Surveys related to other fields propose diverse and interactive tools for browsing projects, Liu et al. (Liu et al., 2018) propose a comprehensive, interactive task-driven survey on text visualisation taking into account tasks, visual models and data mining techniques and how their use has changed over time. Unlike the latter, Kucher (Kucher, 2014)presents his ongoing, collaborative survey on text visualisation as an interactive browser that allows users to study and inspect research and projects by using a wide spectrum of filters that enhance the analytical process of the users.

Similarly, Isenberg et al. (Isenberg et al., 2017) are working on the *Vispubdata* project which provides free access to metadata and statistics on IEEE Visualization publications (IEEE VIS) from 1990-2018. From this repository, researchers can work on data and design tools for exploring them.

Nonetheless, as far as the literature related to explainable machine learning is concerned, the production of visual-driven survey methods seems to be still lacking.

The experiment presented in the paper provides a visual-based approach for collecting and displaying used visual models, proposing a method of representation, display and reading that departs from the evaluation matrix and the interactive browser proposed by Kutcher.

2.2 Visualising and analysing images *en groupe*

As mentioned in the Introduction, the described design approach leverages Digital Methods Tools. Although Digital Methods have been initially designed for allowing domain-experts in the field of STS (Science and Technology Studies) to investigate textual content on the web, in recent years they have been used also for analysing and exploring visual content — such as images and memes — coming from the web (Social Network, Online News, Search engines results).

According to the theory of composite images (Niederer & Colombo, 2019) observing relationships among digital images deals with the study of them *en group*e and a recent approach for studying images *en groupe* refers to the use of existing metadata such as hashtag on Twitter or metadata attributed by Vision APIs Services as semantic tags. (Niederer & Colombo, 2019; Ricci et al., 2017) (Figure 3)

Vision APIs offer image content recognition based on predictions by returning a list of concepts with corresponding probabilities of how likely some concepts are contained within each image. (Figure 2)

When studying images *en groupe*, networks and networked images are the most adopted visual models (Ricci et al., 2017). This type of representations of contents allows researchers to conduct visual network analysis which focuses on the description of the network according to the topological distribution of nodes – images – in the space. (Pattern and cluster recognition, identification of bridging nodes, the relation between centre and periphery of the resulting network). (Venturini, Jacomy, & Pereira, 2016)

	A	B	C
1	**url**	**concept**	**confidence**
2	https://github.c	calendar	0.9903412
3	https://github.c	planner	0.9880015
4	https://github.c	date	0.98659444
5	https://github.c	daily occurence	0.9848956
6	https://github.c	monthly	0.9832363
7	https://github.c	almanac	0.9815499
8	https://github.c	schedule	0.97923803
9	https://github.c	agenda	0.9755267
10	https://github.c	vector	0.96764016
11	https://github.c	journal	0.96008015
22	https://github.c	time	0.9824935

Figure 2. Vision API Service (Clarifai) results. Images are labeled with concepts according to their visual content. The confidence value shows how likely some concepts are contained within each image.

In declaring their limits and peculiarities, we used Clarifai (Clarifai Inc., 2013) a free Vision APIs Service for automatically tagging images of visualizations extracted from databases of peer-reviewed scientific articles — Scopus (Elsevier, 2004), Google Scholar (Google, 2004) and Web of Science (Clarivate Analytics, 1997) –.

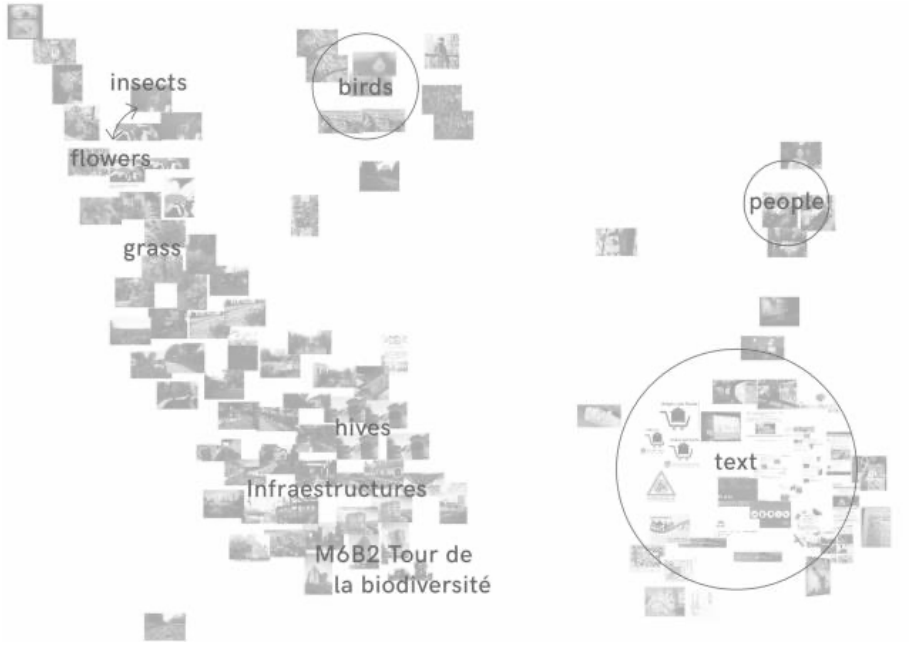


Figure 3. An example of visual network analysis on a network coming from the literature (Niederer, 2019) related to the analysis of pictures shared on Twitter about the topic of "nature" in Paris.

3. Design Requirements

Part of the process of choosing the most appropriate visual model to represent machine learning models' inner working is usually dictated by literature analysis, experimentation and evaluation.

The design of the tool was then guided by three points:

- **R1 - Visual-based approach:** Design a system able to provide information about the aesthetics and visual appearance of visualisation adopted for visualising Explaining Machine Learning processes.
- **R2 - A visual-based representation:** Design a method for visually representing a survey which differs from the evaluation matrix and the interactive browser.
- **R3 - A repeatable approach**: Design a system and a method that can be applied on similar conditions but referring to other (or filtered) data. (for instance, for analysing a specific group of machine learning models).

Final users involved are designers, whose aim is to provide new tools for explaining machine learning models' inner workings, with an experience both in the field of design and in the field of computer science.

Below, the defined action to demonstrate the effectiveness of the methodology:

- **T1 - Pattern recognition**: Recognise cluster of contents and identify visual peculiarities.
- **T2 - Inference**: Inferring by exploring, annotating and browsing the visualisation which type of machine learning models are presented.

4. Methodology

The presented experiment has been carried on with the intention of ensuring its reproducibility, also thanks to the support of the protocol diagram (Figure 5) that, acting like a visual recipe, shows progressively each step needed to achieve the final visualization: from data gathering to final results. **(Design Requirement n° 3)**

4.1 Data Gathering

Scientific articles have been gathered from three databases of peer-reviewed scientific articles (Scopus, Google Scholar and Web of Science) by using a consistent methodology. Each platform has been queried using *"explainable machine learning" OR "interpretable machine learning" AND "visual analytics*" and for each article the following information — if present — has been recorded:

- *Metadata* (title, authors, year, venue, link to the original document)
- *Images* including visualisations, illustrations, graphs, schemata.

While *Scopus* and *Web of Science* offer the possibility to perform advanced searches and download files in .csv format containing the aforementioned metadata (images excluded), for gathering data from *Google Scholar* the *WebScraper* (Magnetic Latvia, n.d.) an extension of *Google Chrome* has been used. Following this gathering process, a corpus of *238* articles has been obtained (*82* results from *Google Scholar*, *96* results from *Scopus* and *60* results from *Web of Science*). Among these, only *6* papers are shared by all the three sources, *40* papers are shared by two of them and the remaining *192* are univocal.

By qualitatively browsing the results, emerged that some of these papers contain surveys and state of the art analysis, while others describe single case studies.

Then, scientific articles listed in the gathered surveys (Adadi & Berrada, 2018; Garcia et al., 2018; Hohman et al., 2018; Ming, 2017) have been added to the corpus and following this process a final collection of *257* scientific articles has been built.

However, not all the papers contained images, thus an additional filter was applied, allowing only papers containing images to be selected.

The final body of articles to be analysed contained a total amount of *194* documents whose pictures have been extracted using *Adobe Reader*. A final collection of *1059* images has been obtained. The final dataset is open source and available at this link.

4.2 Image tagging

Starting from the collection of images obtained through the qualitative and quantitative data gathering process, images have been tagged by Clarifai's Vision APIs Service. Clarifai offers ready-to-use image recognition models which allow to recognize different classes of semantic content in images to suit researchers' specific needs and, in declaring their limits and peculiarities, the general model has been tested being images contained in the corpus mainly visualisations and graphs. (An image recognition model for visual models and data visualisation has not yet been designed and would be the subject of further works).

To accelerate the process of image tagging, an interface[1] of Clarifai API has been used. By uploading a .csv file containing the list of URLs referring to each single image of the corpus the interface output another .csv with the results of the predictive model on each image. As mentioned in Section 2.2, observing and representing relations among digital images is practiced by using networks and networked images. Moreover, generating image-keywords networks using descriptive tags provided by the vision APIs has become a common approach. Starting from the .csv output file a network where images are connected by the same descriptive tag has been generated (.gexf file) and visualised using the open-source software Gephi by setting *ForceAtlas2* as spatialisation algorithm (Jacomy, Venturini, Heymann, & Bastian, 2014) and running modularity statistics to identify communities of nodes. Thanks to the Gephi's *ImagePreview* plugin (Chrisxue815, 2019) nodes have been replaced with images and the network has been printed out on paper to be annotated with pens by data visualisation designers.

[1] "This tool is an easier interface to the *Clarifai* API. What this API does in short is that it takes a list of images (in the form of URLs) and outputs what an algorithm, also called a model, sees in these images"

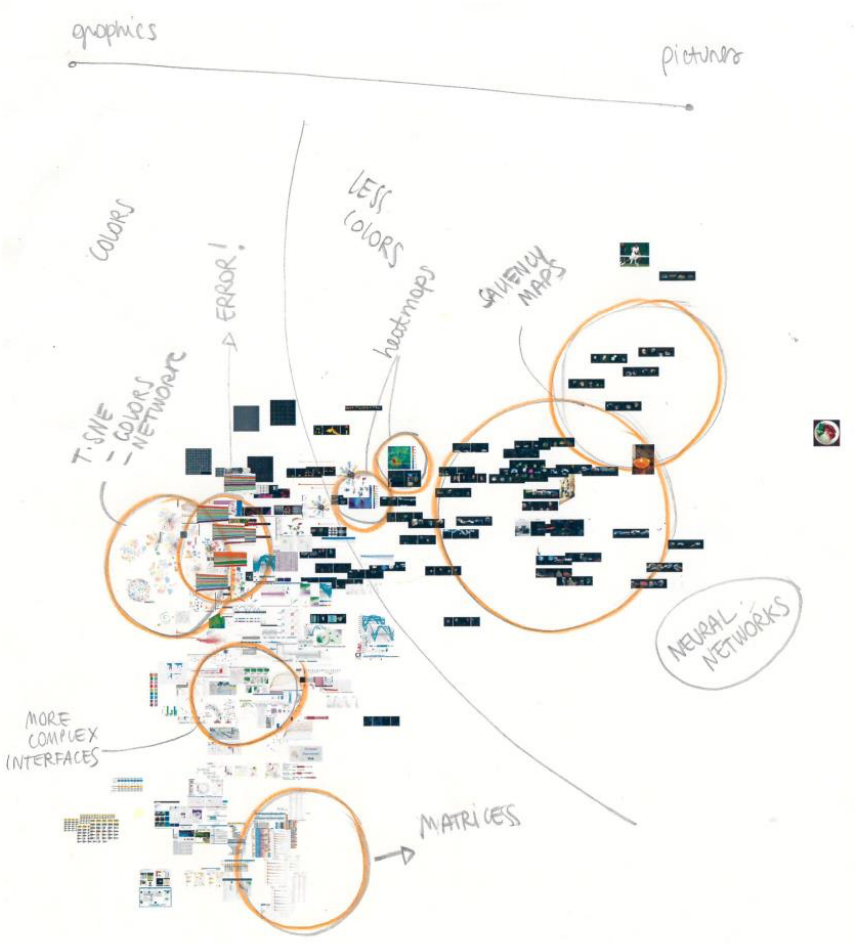


Figure 4. An example of visual network analysis performed by a designer on a network displaying images retrieved from a selection of the corpus

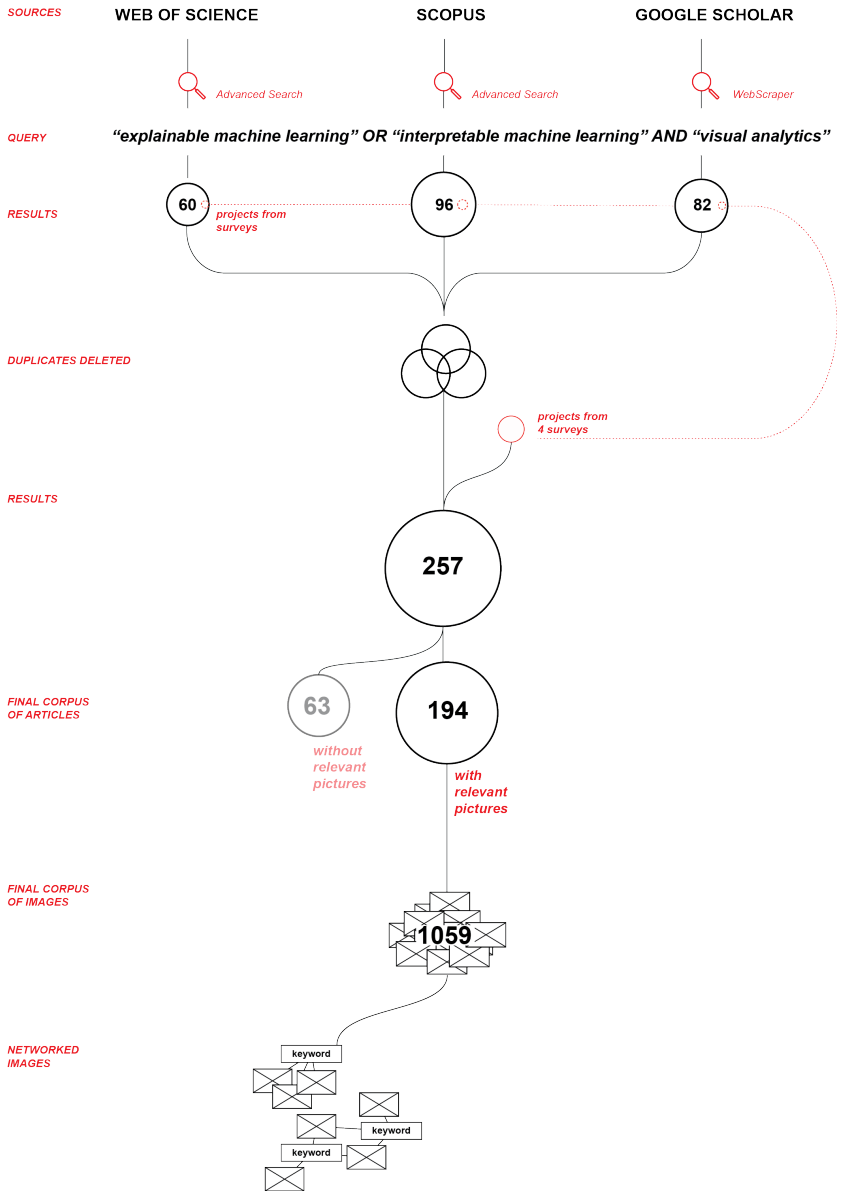


Figure 5. The visual protocol explaining the methodology.

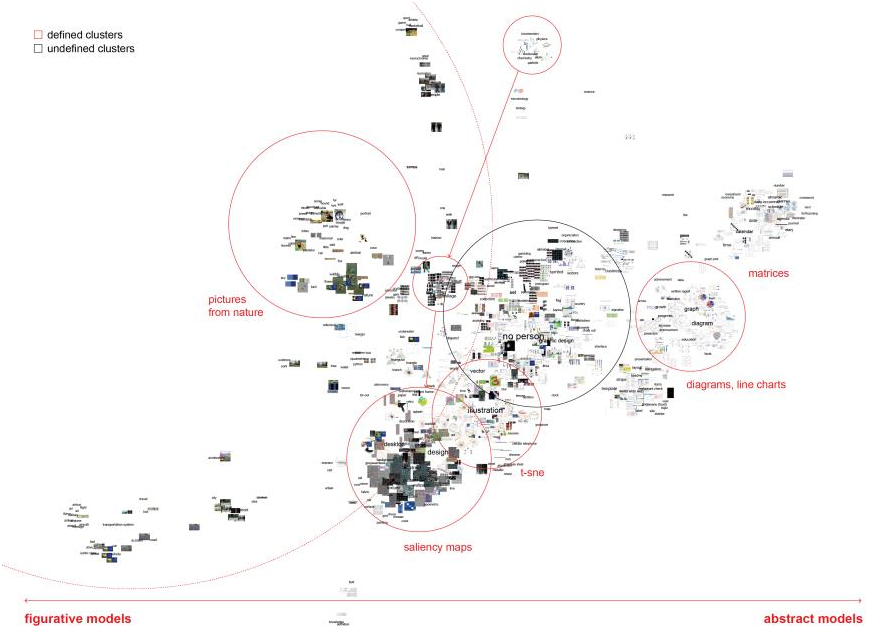


*Figure 6: A bipartite network showing the relations among pictures and corresponding labels gathered from scientific articles filtered by tags whose confidence is greater than 0.98 (Figure 2). The network can be divided in two main areas: the right side where **figurative models** are grouped and the left side where chart and graph models are clustered (**abstract models**).*

5. Results

The presented methodology has been tested on bipartite networks since they show connection between semantic tags and images. As the API module is not yet specifically designed to identify visual models, semantic tags are not very precise, however, it is possible to identify some clear clusters grouping similar visual models.

By observing the bipartite network (Figure 6) immediately emerges its bipolarity being the left-side populated by figurative visual models (pictures and saliency maps) while the right side is occupied by chart and graphs. Therefore, at first glance, emerges a central and generic cluster around the tag “no person” which is extremely generic, revealing the limits of the adopted vision APIs model but, at the same time, identifying a group of images to be tested with other vision APIs services. (Figure 7)

By looking more closely appears that the right side is populated by two well defined clusters: the first, on the top-right (Figure 7 and 8b) which mainly displays matrices that the Vision APIs Service recognised as calendar", "crosswords", while the latter, slightly below, (Figure 7 and 8a) contains charts and graphs.

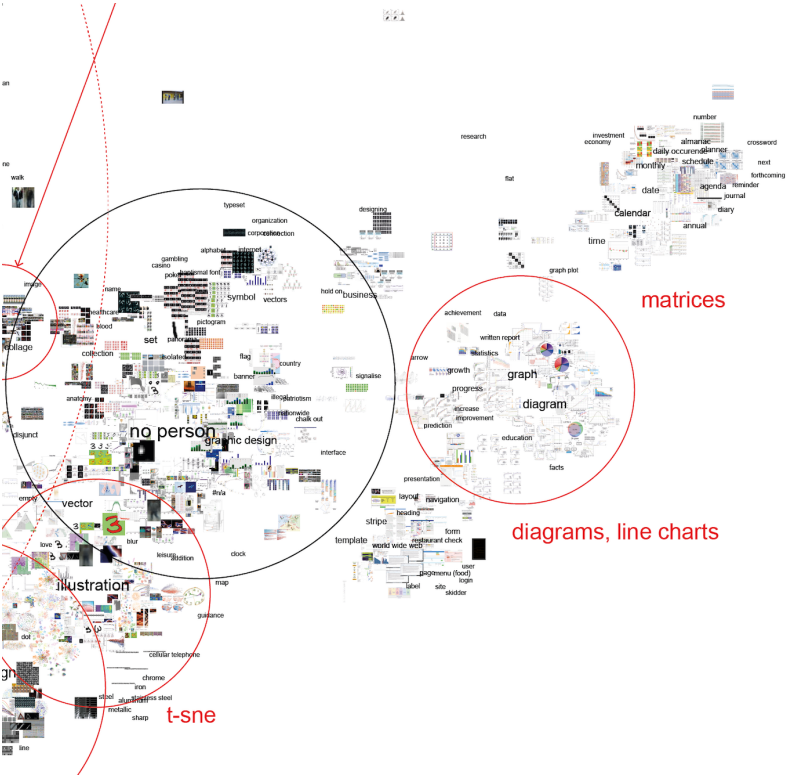


Figure 7: In a bipartite network, two different types of nodes — images and keywords — are connected. Here a portion of Figure 6 is shown, highlighting the most evident clusters.

Moving to the left side, even the cluster of t-SNe2 representation is evident (Figure 7 and 9a) where visual models containing “dots” are clustered. Instead, in Figure 9b which is located in the figurative side of the bipartite network, users can browse picture portraying animals and objects.

Moreover, the bipolar structure of the network also allows the observer to jump from one side to the other. For instance, users can see how the saliency maps cluster could be ideally

linked to the one related to graphical representations of neural networks on the top (Figure 6, circles connected by the straight line).

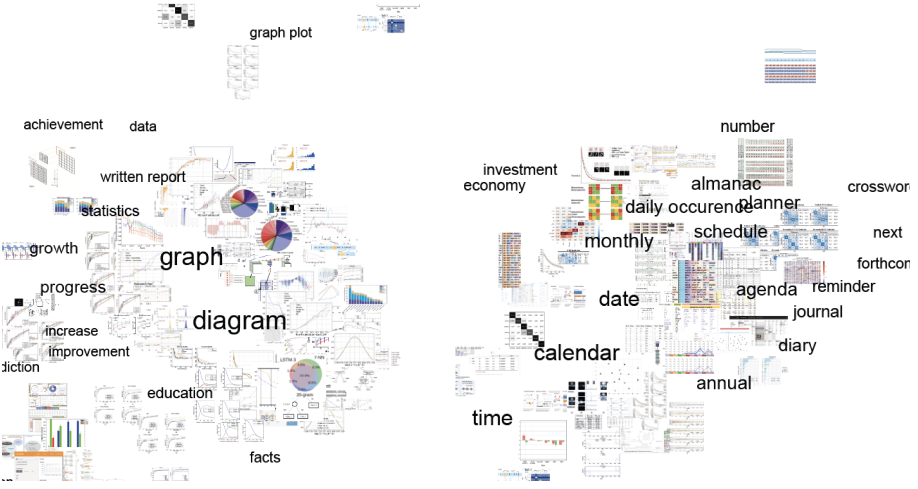


Figure 8: This is a zoom of Figure 6. On the left the group of bar charts and line charts. On the right, the cluster of matrices.

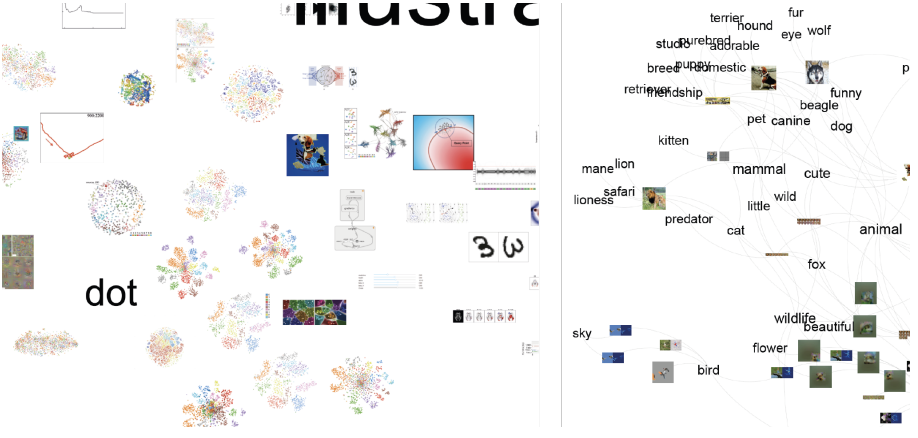


Figure 9: This is a zoom of Figure 6. On the left the group of t-SNe. On the right the cluster of animals.

6. Discussion

In this paper, we propose an experimental and interdisciplinary methodology for supporting designers in the action of browsing and choosing visual models through the presentation of a visual-based survey displaying images.

To our knowledge, this is the first attempt to design a data visualisation for showing metadata collections and images related to scientific publications.

The intention of the paper is not to propose an alternative system to the evaluation matrices seen in the literature but to promote an integrative device that supports the exploration of surveys and help designers in the choice of visual models**. (R1).**

A visual-based representation of contents **(R2)** helps designers in entering and integrating into the explainable machine learning field.

Moreover, the visual protocol allows designers to repeat the operation and apply the methodology even on other bibliographic collections. **(R3)**

However, we want to point out some weaknesses that may be addressed and fixed in the future.

- The paper selection has been carried out both qualitatively and quantitatively. Thus, the final corpus is subjective but what is relevant for this research is the methodology applied and its flexibility.
- The number of images for each scientific article is slightly different.
- The Vision API Service selected is biased too, the same process could be run on
- different APIs services (for instance: *Google Vision APIs, Microsoft Azure, IBM Watson, Imagga*) being their results potentially different. In the future could be interesting to design a training dataset able to identify visual models.
- The final networked images visual model could be interactive, allowing a dynamic browsing of contents and an augmented visual network analysis.

The presented organic and complete representations of visual models help designers in the act of browsing visual contents contained in scientific articles, and give the possibility to have, at first sight, an overall picture of the state of the art.

Moreover, visual network analysis helps in understanding relations between clusters and immediately identify relevant visual references in the design process

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Acknowledgements: the author would like to thank all the members of the density design research lab: Paolo Ciuccarelli, Michele Mauri, Gabriele Colombo, Angeles Briones, Andrea Benedetti and Tommaso Elli for their support and help in revising the paper.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Toys and Play, Weapons and Warfare: Militarizing the Xbox Controller

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Abstract | In this paper I examine the cultural implications of the United States military's use of commercial video game controllers as contemporary battle equipment. My research draws on analysis of the academic literature on militarism and video games, controller studies, and media theory, as well as industry sources and mainstream media reporting. The paper is organized into three sections: a history of the relationship between the military and the video game industry, a discussion of the military's use of Xbox controllers, and an exploration of the causes and consequences of the increasingly blurry line between toys and weapons.

KEYWORDS | VIDEO GAMES, TOYS, PLAY, WEAPONS, MILITARY



Figure 1. Sailor using an Xbox 360 controller to operate a new Virginia-class submarine's photonic masts. Photo: Steven Hoskins/U.S. Navy (AP)

1. Introduction

In 2017, the U.S. Navy made headlines for using Microsoft Xbox video game controllers to operate its newest submarines. Officials touted the ergonomic and cost savings advantages of the $30 off-the-shelf controllers compared to the clunky $38,000 helicopter-style sticks they used previously. They also cited a training advantage—crew members grew up playing Xbox and were able to teach themselves to use the controllers within minutes (Vergakis). In this paper I examine the cultural implications of the United States military's use of commercial video game controllers as contemporary battle equipment. My research draws on analysis of the academic literature on militarism and video games, controller studies, and media theory, as well as industry sources and mainstream media reporting. The paper is organized into three sections: a history of the relationship between the military and the video game industry, a discussion of the military's use of Xbox controllers, and an exploration of the causes and consequences of the increasingly blurry line between toys and weapons.

2. The Military-Entertainment Complex

Some of the oldest games are war games. Go was invented more than 2,500 years ago. Chess is 1,500 years old. In the 1960s, with the advent of video games, the military took the lead in financing and developing the new technology, becoming the subject of games and sponsor of gaming technology. *Spacewar!* (1962), considered the first video game, was a war game developed by graduate students at MIT and funded by the Pentagon. In *Joystick Nation,* video game historian J.C. Herz notes:

> "*When you trace back the patents, it's virtually impossible to find an arcade or console component that evolved in the absence of a Defense Department grant.*" (Herz, 1997, p.205)

In the ensuing decades, game developers and the military joined in an informal cross-industry partnership known as the military-entertainment complex. They shared technological resources, recruits, and costs, and sought to standardize the visual style and play elements between war-themed video games and the military's virtual training experiences. The military began applying video game technology and aesthetics to its own simulation trainings in the 1980s. A military think tank paid Atari to adapt its popular arcade game *Battlezone* (1980) for use as a gunnery trainer. In the 1990s, when the Defense Department's game development capabilities fell behind the private sector's, DoD began directly modifying off-the-shelf software for training purposes. The United States Marine Corps modified the popular first-person shooter *Doom II* (1994) to become the trainer known as *Marine Doom* (1997).

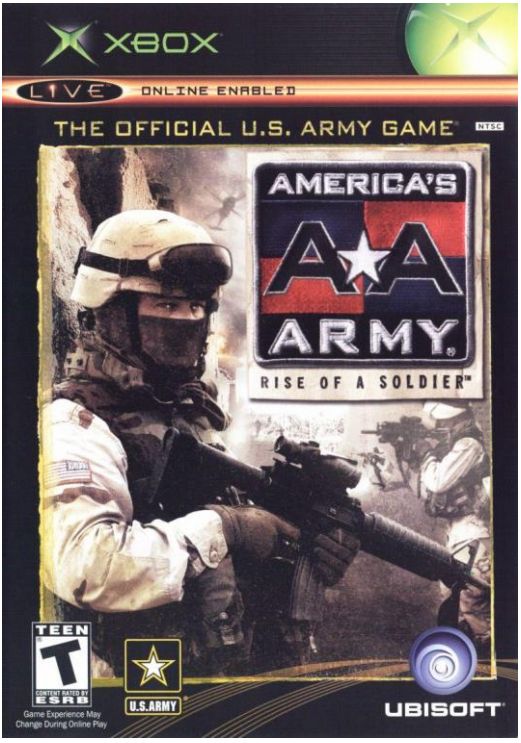

Figure 2. Packaging for America's Army: Rise of a Soldier for Xbox. Graphics include an image of a soldier in full battle gear, the U.S. Army logo, and the Teen rating symbol. Photo: qwertyuiop, mobygames.com.

A high-water mark of this relationship was the release of *America's Army* (2002), a shooter game developed and financed by the U.S. Army and distributed by free download. *America's Army* was the brainchild of Colonel Casey Wardynski, who saw it as an opportunity to reconnect the army with popular culture and "youth decision space" (Wardynski quoted in Huntemann, 2010a, p.178). Wardynski recognized the power of video games to engage and educate young people: "It's vivid, it's active, you're learning, you're experience, you're communicating" (Wardynski quoted in Huntemann, 2010a, pp.184–185). The game was a success, with more than five hundred thousand downloads in its first month. Console versions for Xbox and Sony Playstation followed in 2005. In 2007, the army opened the Virtual Army Experience, a giant, fully immersive version of the *America's Army* game that toured air shows, amusement parks, NASCAR races, and music festivals.
During the 2008 recession, recruitment rose, and the military stopped updating *America's Army.* Though the game has faded, the military-entertainment complex continues. War-themed first person shooters dominate the market, and scholars have noted their structural similarity to the Global War on Terror—a perpetual war with unclear enemies, a constant state of alert, and endless replay (Huntemann, 2010b; Chien, 2010). The military has embraced new technologies like virtual and augmented reality for training, combat, and weapons prototyping. In 2019, the army launched a competitive e-sports team. The military's use of Microsoft Xbox controllers, which began in the mid-2000s, is a crucial and under-examined feature of the military-entertainment complex. The paper's next section focuses on it.

3. The Military and the Xbox Controller

3.1 Overview

The United States military and its contractors have been integrating Xbox controllers into battle equipment for more than a decade.



Figure 3. Soldiers with remote SUGVs (Small Unmanned Ground Vehicles) and an Xbox 360 controller in 2007. Photo: technabob.com.

In 2007, technology bloggers noted the presence of Xbox 360 controllers in a photograph showcasing the army's newest remote SUGVs (Small Unmanned Ground Vehicles). Part of the Army's Future Combat Systems Initiative, the vehicles would allow ground troops to explore intense areas with minimal risk to life (Hickey). In 2008, WIRED magazine published a round-up of military use of video game equipment including a British army recruiting advertisement featuring troops using an Xbox 360 controller to pilot drones (Hambling). In 2014, WIRED reported that Boeing was building a laser cannon controlled by an Xbox 360 controller (Golson). The laser produced a beam of heat sufficient to disrupt rockets, artillery and mortar strikes, and drones. Evan Narcisse, covering the story for gaming website Kotaku, noted the irony that, "one could imagine conflicts where a 360 controller-steered laser will be shooting down drones piloted by the same input device."

In 2017, the U.S. Navy began using Xbox 360 controllers to operate the photonic masts in its newest submarines. Each of these nuclear-powered vessels costs up to $2.7 billion dollars to manufacture and includes a number of cutting edge features (Knobeloch, 2018). Typical missile launch tubes have been replaced with two large-diameter payload tubes capable of launching six Tomahawk cruise missiles each. Sonar arrays are backed with water instead of air, resulting in a simplified, more cost-efficient mechanism. The Navy commissioned a custom joystick for the submarines, but soon abandoned it in favor of the Xbox controller (Vergakis).

For the military, the Xbox controller's design offers significant benefits. Microsoft invested tens of millions of dollars into the ergonomics of the Xbox controllers, far more than the military would ever spend. Unlike the military's clumsy, purpose-built joysticks, the commercial controllers are small, highly portable, and have limitless applications. The

controllers represent an enormous savings of money: $30 versus $38,000 for the original joystick. As discussed in the previous section, military use of video game technology is nothing new. The use of off-the-shelf hardware in battle equipment is simply a logical if dramatic extension of an established impulse.

Proponents of the military's use of Xbox controllers favor terms like "instinctive," "intuitive," and "automatic" to describe soldiers' adoption of the hardware (Schultz, 2014; Saletan, 2008; Singer, 2010). Indeed, in lab tests, sailors who would have required hours of training to use the submarine joystick taught themselves to use the controller in minutes (Vergakis). They were able to achieve this not because the controller's 16-button, dual analogue console gamepad is easy to master, but because, having spent hundreds of hours playing with the controller as children, they had *already* mastered it. The sailors found the controller to be intuitive because of its familiarity, not its simplicity.

Maintaining that familiarity, even at the expense of functionality, appears to be an aspect of the military's strategy in its use of Xbox controllers. The Xbox One, a more advanced version of the controller, was released in 2013, yet the military continues to use Xbox 360 controllers, which have been on the market since 2005. This departs from the military's usual focus on cutting edge technology, favoring instead the more familiar, ubiquitous, even nostalgic option.

The military's preference for the legacy controller reflects the general "counterrevolutionary" nature of console controller design, whereby Xbox's base of hard core gamers threaten to revolt at the slightest update to its controller design (Parisi, 2015). Microsoft was so averse to jeopardizing its relationship with existing users that the Xbox One controller looks almost identical to the original, despite a $100 million investment in its redesign (Hsu, 2013). In fall 2020, Microsoft released the Xbox Series X console. Again, the controller design barely changed, "ensuring the muscle memory players have built up over the years remains intact" (Tuttle). This market-driven conservatism runs counter to persistent narratives projecting "revolutionary" technological change in the video game industry—and the military.

3.2 Survey of Scholarship

Critical study of the military-entertainment complex tends to focus on software. Despite its name, *Joystick Soldiers* (2010), an important scholarly collection exploring the relationship between modern warfare and video games, barely addresses controllers' role in blurring the line between war and play. The book's discussion of war games' transition from analogue (board games) to digital (video games) focuses on changes in game play, cognition, and immersion, rather than material artifacts. Essays that consider the effects of screens on our understanding of war ignore the haptic in favor of the ocular. Scott Lukas's piece on the relationship between virtual guns in games and real guns in the world hardly discusses the controller. This seems like a missed opportunity, given that the controller is the material object that enables the virtual fantasy.

This matches a general trend in the field of game studies, which tends to focus on software, not hardware. Standard controllers for standard consoles are particularly absent from

critical discourse. Viewed as "a constant of hardware" (Kirkpatrick, 2009), controllers are "seemingly immune from the fetishization of the new that has continually surrounded other types of game hardware" (Parisi, 2015). As the point of connection between player and game, the controller is indispensable *to* the act of play, yet forgotten *in* the act of play (Blomberg, 2018). The qualities that make controllers successful as design—stability, longevity, invisibility—largely remove them from consideration as objects of scholarly attention.

Since game studies offers a limited literature on controllers, other scholarly approaches must be considered. Perspectives from the study of media, digital culture, embodied interaction, and performance provide supplemental frameworks for consideration. These disciplines re-center the body in the gaming experience.

Josh Smicker characterizes video games as "ensembles of technological and embodied performances" (2010, p.108). David Parisi understands gaming to be a process of bodily education and emphasizes the significance of haptic learning in game play:

> "*Learning does not happen only through the eyes and ears, but also in the fingers, hands, legs, and feet, and in the skin, muscles and joints.*" (Parisi, 2009, p.112)

Irene Chien observes that players repeat battles "until attack movements become embedded in muscle memory" (2010, p.242). Simon Penny goes further, describing war games as software that trains the body to produce automatic reflexes instead of conscious interpretation and decision-making (2004). These scholars assert the importance of the body in video game play, and by inference, the importance of the controller, which functions as an extension of a player's body (Crick, 2011).

4. Blurred Lines

4.1 Defining Terms

TOY: an object for a child to play with

WEAPON: an object designed or used for inflicting bodily harm or physical damage

TOY WEAPON: an object for a child to play with by pretending to inflict harm or damage

An Xbox video game console is a toy. Children star in its advertisements. Bright, primary colors feature on its iconic buttons. Upgrades and game launches are timed around the holidays to encourage gifting. But it's a particular kind of toy. Because of its close association with popular shooter games like *Halo,* Xbox is also known as "Shooter Box." Xbox serves as a bridge between military and commercial games. It was the first console to offer commercial versions of *America's Army* and *Full Spectrum Warrior.* It's the home of many other popular military-themed titles like Tom Clancy's *Rainbow Six* series.

In 1928, Walter Benjamin defined toys as:

> "*Primitive technology combined with cruder materials imitat[ing] sophisticated technology combined with expensive materials.*" (Benjamin, p.118)

Toy weapons fit Benjamin's definition. They are cheaper, smaller versions of the real thing. They are intended to charge the imagination, not inflict harm. Does Xbox fit his definition? Not easily. Benjamin focuses on the form toys take—their imitative nature, their crudeness

relative to the real. Xbox games are imitative by nature of their virtuality, but Xbox technology is not primitive, its materials are not crude. Benjamin helps us differentiate a toy gun from a gun, and Nintendo's Duck Hunt game, played with a light gun controller, from real duck hunting. But hard care gamers negatively review Nintendo for its ease of use and lighter subject matter—for being too toy-like (Payne, 2010). From what are we to differentiate Xbox? Its technology is more sophisticated, its materials are more refined, than many of the worlds it imitates.

Much attention is paid to the perceived dangers of toy weapons and violent video games. Though politicians and parents worry that these playthings encourage violent behavior among children, there is no scientific consensus on that. Children understand the difference between simulation and reality. They can differentiate pretend actions from real ones, toys from the objects they represent (Woolley and Ghossainy, 2013). They know that real guns are more powerful than toy guns: they can kill. Conversely, toy guns have virtual powers that real guns lack: They never run out of ammunition. They have perfect aim. People they "kill" can come back to life.

4.2 Causes of Blurring: Military Use of Video Games

Soldiers use video games at every stage of their journey through the military, from recruitment to training to treatment. These ludic acts, despite centering on engagement with virtual worlds, have real-world impacts. Rather than attempting to draw a line between real and virtual, it is more accurate to view the two as engaged in dialogue (Lukas, 2010), to acknowledge that gamers play "between worlds" (Taylor, 2006). In this way, the virtual bleeds into the real, and the real bleeds back.

America's Army is an example of the military's use of games as a recruiting tool. The game was explicitly marketed to children and younger recruits, designed with mild violence and no swearing to ensure a Teen rating. Michael Zyda a USC professor who helped develop *America's Army* recalled:

> "*Mothers would meet me and complain that 'my son is playing America's Army five to six hours a day, seven days a week. What is going to become of him?' I would usually answer that these children would be twice as likely to consider a career in the US Army.*" (Zyda, 2005, p.27)

America's Army was hugely successful, netting more than 10 million registered users and a significant bump in recruits. The game—a virtual army—motivated people to join the real army.

The modern military is increasingly reliant on video games as simulation training tools (Nichols, 2010). Jeffrey Leser and James Sterrett, former leaders of the Simulation Division at the U.S. Army Command & General Staff College, explained:

> "*Games create venues that allow students to learn from mistakes, building experience without the cost of combat.*" (Leser & Sterrett, 2010, p.146)

Michael Macedonia, another simulation training leader, takes it a step further: "'A lot of what we're doing in [Army simulation] training is creating memories' that can be recalled and triggered in combat." (qtd. In Halter, 2006, p.198) Leser, Sterrett, and Macedonia deploy

the language of the actual—"building experience," "creating memories,"—to describe virtual experiences.



Figure 4. Dr. Michael J. Roy, who oversees the "Virtual Iraq" exposure therapy at Walter Reed Army Medical Center, conducts a demonstration of a life-like simulator that represents a new form of post-traumatic stress disorder treatment with Army Sgt. Lenearo Ashford, Technical Services Branch, Uniformed Services University, on Sept. 16, 2008, in Washington, D.C. Photo: U.S. Army.

The military uses video games to treat soldiers when they are suffering from mental trauma. The USC Institute for Creative Technologies, the same group that produces many of the military's training simulators, created the virtual reality simulator *Virtual Iraq* (2005). The simulator provides exposure therapy for veterans, placing them in a recreation of the world where they had a traumatic experience. According to Professor Skip Rizzo, who runs the project, "it helps the patient repeatedly confront and process very difficult emotional memories" (qtd. in Murgia, 2015).

4.3 Causes of Blurring: Technological Change

Advances in technology have further blurred the boundary between games and war. Changing approaches to television news coverage and video game content have altered the way civilians experience and understand war. Console-based video game technology has become less toy-like. The military is investing in new technologies that increasingly mediate and virtualize war.

Television coverage of the first Gulf War represented a turning point in the mediation of war. General Normal Schwarzkopf famously referred to it as the "first Nintendo war" (qtd. in Jenkins, 2003). 24/7 coverage brought the unremitting, yet highly mediated, violence happening in distant places directly into American homes. In this way, "our consumption or understanding or vision of battle [was] reduced to a series of images on screen" (King & Leonard, 2010, p.96). War-themed video games proliferated after the Gulf War, militarizing domestic spaces and normalizing global war. The online wargame *Kuma\War* (2004), deliberately blurred the boundaries between fantasy and reality, mixing actual and fictional news clips with digital recreations, and offering just-in-time "ripped from the headlines" missions that allowed players to participate in real military battles right after or as they occurred (Smicker, 2010). War, long understood by the American people to be a bodily horror, had become software.

In the decades since the first Gulf War, video game hardware and software have evolved along different paths: hardware has become more abstract and generic, while software has become more realistic and specific. Early consoles offered a range of specialized input devices besides the classic controller: light guns, steering wheels, and flight-sticks, even fishing rods and maracas. Xbox and PlayStation, today's leading consoles, have converged on a similar all-in-one controller, with a complex combination of thumbsticks, d-pads, buttons, bumpers, and triggers. Its form is no longer a metaphor for anything but itself. As such, it does not conform to Benjamin's definition of toy. Slipping the bounds of the virtual, it claims an unnamed space between worlds.

As controllers have become more abstract, the experiences they facilitate have become increasingly realistic. Today's war-themed games are extremely vivid, with obsessively detailed sets, high fidelity weapons, and hyper-realistic audio and atmospheric effects (Lukas, 2010; Smicker, 2010). Game producers, in partnership with the Department of Defense, aim to "transport players into spaces where the difference between virtual warfare and real-life military destruction is indistinguishable" (King & Leonard, 2010).

The military has been investing in new technology that increasingly mediates and virtualizes a soldier's experience of war. For example, military contractor L3Harris is developing the ENVG-B (Enhanced Night Vision Goggle – Binocular), a heads-up display that augments reality with digital elements to enhance soldiers' lethality in the battlefield. Cutting-edge thermal and night vision capabilities let them "see through dust and smoke" (South, 2019). A weapon-mounted camera allows them to see what their gun sees and shoot around corners or over barriers, completing the transformation of the soldier's view into a simulation of a first person shooter game interface.

4.4 Consequences of Blurring

War-themed video games, despite their apparent realism, provide a sanitized version of war. Colonel Casey Wardynski, the mastermind behind *America's Army,* claims, "We own realism" (Wardynski quoted in Huntemann, 2010a, p.184). *America's Army* may provide a virtual replica of aspects of Army life, but it lacks anything resembling a realistic version of death. In

America's Army, a player's virtual death is noiseless, shown only by a small red circle, and followed by an immediate return to life (Nichols, 2010). Game producers, particularly those seeking a broader content rating, minimize the blood, carnage, and civilian death present in real combat (Nichols, 2010). As a result, war games are "cleaned up, void of horrific consequences, civilian casualties, and psychic devastation" (Huntemann, 2010b). Death may be a horror of war, but it is also a core mechanism of video games—to improve their play, gamers must die innumerable deaths. In *Virtuous War* (2001), security scholar James Der Derian asks whether virtual warfare's erasure of carnage and bloodshed makes warring easier and thus peace more difficult.

Real war is not only bloodier than video games, it is more boring. War-themed shooter games tend to be structured around the experience of a soldier in the army's Special Forces, an elite group that accounts for a mere 5% of the total armed forces. Most soldiers are more likely to be engaged in tedious paperwork than thrilling small-scale combat missions. The logics of most mainstream wargames cannot accommodate the tedium, anxiety, and trauma of combat, so they deemphasize them by over-representing other aspects of war (Smicker, 2010). Stories that present a more nuanced picture of war are not completely absent from the gaming discourse. They show up in critical machinima movies like *Red vs. Blue: The Blood Gulch Chronicles,* indie games like Molleindustria's *Unmanned,* and Hideo Kojima's iconoclastic *Metal Gear* game series.

In the Global War on Terror, America's most popular war-themed games serve as vehicles for ideology, expressing what foreign relations expert Walter Russell Mead calls "sweet power" (Mead, 2004). For example, World War II-themed shooter games like *Call of Duty* make a case for aggressive action in the Middle East by emphasizing "the greatness the United States can achieve through the use of military force" (Penney, 2010, p.201). Games sited in the Middle East, like *Conflict: Desert Storm,* alter real geographies to serve ideological ends. King and Leonard (2010) describe games that:

> "Construct and imagine places like Iraq and Afghanistan as barren wastelands devoid of civilians and infrastructure in need of saving and U.S. intervention." (p.91)

Other games offer crude, culturally ignorant representations of "the other," or force all players to assume the perspective of an American soldier (Leopard, 2010; Nieborg, 2010). In *America's Digital Army: Games at Work and War* (2017), Robertson Allen notes that the *Conflict* series, celebrating the first Gulf War, was deliberately released during the period immediately surrounding the 2003 Iraq invasion.

4.5 Boundary Dissolved

WEAPONIZED TOY: an object designed for a child to play with, but used to inflict real bodily harm or physical damage

The military-entertainment complex, from *Spacewar!* to *America's Army* to *Virtual Iraq,* is a sordid economy, feeding games with war and war with games. Compared to the frightful promise of new technologies like the ENVG-B, the military's use of Xbox 360 controllers might seem innocuous. After all, Xbox has no advanced weapons system. It's a mainstay of

dens and dorm rooms, representing camaraderie and competition. On the contrary, the Xbox controller's seeming innocence is the key to its danger—its use by the military represents the final dissolution of the fragile boundary separating toy from weapon and game from war.

The military's reasons for using the controllers are eminently practical. Soldiers are already highly skilled users. The cost savings are tremendous. The technology's ergonomics, design, and functionality are better than anything the military could create (Vergakis, 2017). The Xbox controller is all these things. It is also a designed object that operates in a complex web of associations that precede and inflect its use by the soldiers who fight America's wars. In *Discursive Design* (2018) Bruce and Stephanie Tharp explain the significance of designed objects:

> "*Designed objects are never semantically sterile or ideologically inert; they are always inscribed—intentionally or unintentionally—with meanings and values of the cultures that produced them and the cultures in which they eventually exist or are consumed.*" (p.10)

The Xbox controller was designed to be a toy, an object for a child to play with. Video game systems like Xbox are an integral part of millions of American homes, routines, and relationships. A central source of entertainment, friendship, competition, and learning, video games are "woven into the fabric of contemporary existence" (Huntemann, 2010b, p.242). The Xbox controller is "intuitive" to soldiers because it is a beloved childhood toy. Soldiers "automatically" know how to use it because they have spent hundreds of hours cradling it in their hands, and associate it with embodied memories of play (Parisi, 2015).

The Xbox controller was also designed to disappear. As in Mark Wigley's description of the computer mouse, "its relentless smoothness in shape and frictionless movement…fuse the gap between human and machine" (2010, p.50). The controller's constancy renders it nearly invisible—the skilled gamer must forget the controller's presence to immerse in play (Parisi, 2015; Blomberg, 2018). It also disappears by deflecting attention. Unlike a mimetic controller, it doesn't look like a weapon. Unlike a motion-tracked controller, its use doesn't require violent or aggressive movements (Parisi, 2009).

5. Conclusion

Ultimately, the military's reasons for repurposing the controllers are a smoke screen. Soldiers can be trained. The cost savings are a tiny fraction of the overall cost of a nuclear submarine. The Xbox is unnecessarily sophisticated for the military's purposes.

By virtue of its status as a designed object, the Xbox controller is inscribed with far more consequential meanings and values than the military acknowledges. In a chilling echo of the simulator that turns out to be real in Orson Scott Card's science fiction novel *Ender's Game,* the military is cynically tapping a beloved object from the childhood of the gamer generation, and repurposing it for the American war machine.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Wearing the smart city: Supporting older adults to exercise by combining age-friendly environments and tailored digital public data

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Abstract | In response to the call on supporting aging populations, this research focused on wearable health technology. Semi-structured interviews were conducted with eight older adults who were using wearable devices to self-manage their health. Three thematic frames were applied to analyse transcripts focussing on emotional, quality and functional goals that users would like to experience during technology use. It was found that participants wanted to feel motivated when using the technology. In addition to being a reference point, they wanted the wearable to support the management of their health. While the potential design for future wearable devices can consider these goals, the built environment can present barriers in achieving them. It is argued that more research needs to take place to better understand how the holistic goals of older adults when using wearable devices in their neighbourhood can be reinforced by the urban environment. By doing so, insights into strategic development for the design of age friendlier cities can be gained.

KEYWORDS | WEARABLE HEALTH TECHNOLOGY, AGE FRIENDLY CITIES, HEALTH SELF-MANAGEMENT, URBAN AGEING, MOTIVATIONAL MODELLING.

1. Introduction

It is widely known that the world's population is ageing and will continue to grow at an unprecedented rate. According to the World Health Organisation (WHO), the proportion of the global population aged 60 will double from 11% in 2006 to 22% by 2050 (WHO, 2012). In Australia, in 2017, 15% of Australia's population of 25.3m million people were over 65 years of age. By 2047, this proportion is projected to increase to 22%. As Australia's current population of 65-year olds can expect to live on average another 21 years, there will be proportionally more 'older-old' adults >85 years (Australian Institute of Health and Welfare, 2020).

Due to the global trend of population ageing, there has been great emphasis placed on 'healthy ageing' which is defined as a lifelong process of optimising opportunities for improving and preserving health and physical, social and mental wellness, independence, quality of life and enhancing successful life-course transitions (Health Canada, 2002). In particular, an urgent need has been highlighted to develop strategies to ensure that older people enjoy life in their years and not just extra years in their life (Alley, Liebig, Pynoos, Banerjee, & Choi, 2007). This gives rise to the question of how we can better support the parameters of healthy ageing.

In response to this question, the WHO developed the concept of 'age-friendly cities' to optimise opportunities for preserving and improving wellness and quality of life. As identified by Alley and colleagues (2017), age-friendly cities should ideally provide a supportive environment, enabling residents to grow older actively within their families, neighbourhoods, and civic society and present opportunities for their participation in the community. To assist with the implementation of age-friendly cities, the WHO gathered representatives from 22 countries with the aim of determining key elements of the urban environment which can assist with active and healthy ageing. This resulted in a framework for assessing the "age friendliness" of a city and included eight domains of city life: 1. outdoor spaces and buildings; 2. transportation; 3. housing; 4. social participation; 5. respect and social inclusion; 6. civic participation and employment; 7. communication and information; and 8. community support and health services (WHO, 2009).

The convergences of ageing, residing within cities, and age-friendliness, are rapidly producing new modalities to better identify the challenges, such as the notion of 'urban ageing', defined as the population of older people living in cities (Van Hoof, Kazak, Perek-Białas, & Peek, 2018). Such challenges include the creation of inclusive neighbourhoods and the implementation of technology for ageing-in-place and independent living.

According to Kestens and colleagues (2016), few studies have considered older adults' daily mobility to better understand how local urban and social environments may contribute to healthy aging. However, one way in which a better understanding can be gained is through the use of wearable sensors and software applications as they can offer novel means for gathering information on mobility and levels of physical activity (Kestens et al., 2016).

Smart health technologies are increasingly being considered as supporting interventions in dealing with some of the challenges associated with urban ageing. In line with Kestens and colleagues (2016), the use of wearable devices in the support and management of independent older adults is becoming more widely advocated (Barnett, Barnett, Nathan, Van Cauwenberg, & Cerin, 2017) and a growing number of seniors are using wearable devices to self-monitor and manage their health (McMahon et al., 2016). In this context, we define wearable devices as those that can be "worn or mated with human skin to continuously and closely monitor an individual's activities, without interrupting or limiting the user's motions.'' (Gao et al., 2016, p. 509).

To maximise the uptake of such devices, we argue that more research needs to take place in order to better understand the functional, quality and emotional goals of older adults when using wearable technology to maximum benefit within their urban environment. Collectively, these goals form the basis of motivational modelling which not only focuses upon the functionality of designed solutions, such as what technology should do, but also considers the social context in which technology is being used. As such, by also modelling the quality goals (i.e., how the technology should be) and the emotional goals (i.e., how it should feel), the holistic needs of the end users can be identified which will enable the development of socio-technical systems that support people in their everyday lives (Miller, Pedell, Sterling, Vetere, & Howard, 2012).

2. Method

2.1 Participant Interviews

Forming part of a larger study, this study involved a total of eight older adults who were aged 55 years or older who are using wearable device(s) to self-manage or self-monitor their health (Borda et al., 2018). Semi-structured interviews were conducted with participants via Skype, phone and/or email. Interview questions were centred around participant experiences and aspirations towards self-management of health using wearable devices. While a guideline was used with key questions to ensure comparability the format allowed the participants to guide the conversation and to express their opinions, and tell stories in relation to the use of the technology (Wengraf, 2001). The questions included: How long have you used a wearable device(s) to monitor your health? Can you tell me a bit more about when and why you started using the device? What was the motivation? Will your future 'healthy self' include wearable devices? Each interview took approximately 60 minutes to complete. All data was audio-recorded and transcribed into Microsoft Word documents. The research received approval by the University of Melbourne Human Research Ethics Committee (Ethics ID: 1646991.1).

2.2 Data analysis

A content analysis of interview transcripts was conducted. Content analysis enables researchers to go through a large volume of gathered data, from identifying key themes to emerging patterns (Cavanagh, 1997). Patton (2002) suggests that "content analysis is used to refer to any qualitative data reduction and sense-making effort that takes a volume of qualitative material and attempts to identify core consistencies and meanings" (p. 453). Themes were extracted and categorised according to the perceived value of the different goal categories. Hence, the analysis was done through the lens of the three thematic frames. These frames are the individual user emotions (i.e., how the wearable technology should feel), the qualities of the wearable technology (i.e., what the wearable technology should be) and the functional aspects of the wearable technology (i.e., what the wearable technology should do). This approach is known as motivational goal modelling and the notation of functional and quality goals has been developed by (Sterling & Taveter (2009). The focus on emotional goals has been added by Marshall (2014).

In order to increase the credibility of the qualitative data analysis and ensure a high level of commonality for the interpretations made, several researchers (authors of the paper) analysed the data (investigator triangulation) (Guion, Diekl, & McDonald, 2011) and themes were confirmed when shared by the analysing researchers.

3. Findings3.1 The individual user emotions

A common emotion experienced across all users was a feeling of *motivation* afforded by the wearable health technologies. This finding aligns with comparable studies (e.g., Kononova et al., 2019). Here, motivation was described by participants as the core driver to use their technology. For example, one participant described their 'Fitbit' device as the motivator to reach a certain number of steps each day. Here, they shared their thoughts about wearable technology as a motivator.

> "I think it's the motivation. I think it created this thing for me it was the motivation to make sure that pedometer showed a lot of steps at the end of the day".

Another participant described how the presence of the device motivated them to get up from their desk and go for a walk.

> "I just wanted to get a little bit more active. I work in an office. A semi sedentary job and I've found it encouraging me to get up from a desk and walk around to get my steps up. And if I was wearing one, I would be conscious that I had it on and therefore I'd be more conscious of getting up and doing something and being active".

3.2 The qualities of wearable health technology

While a feeling of motivation was expressed as a core emotion when using wearable health technology, participants described the technology as being a *reference point* or providing feedback of their participation in exercise which attributed to their motivation. For example:

> "And then I found that I'd be sitting there till 10:00 or 11:00 in the morning doing some work. And then I realized I'd only done a thousand steps tonight and that would horrify me. So, I'd be out there and make sure if I had a class or lunch time, I did some activity after work and I was much more motivated knowing that I was needing to do more activity."

An awareness about reaching ten thousand steps each day motivated the participants to exercise. Here, one participant described how they use their wearable device to monitor their steps progress.

> "It was more just to monitor my level of physical activity and because I was aware of the you know the guidelines for 10,000 steps a day and all that sort of stuff".

It is common that emotional and quality goals complement each other. Here the quality of being a reference point was often related to the motivation – the feeling of achieving a certain amount of steps.

3.3 The functions of wearable health technology

The primary functional aspects for which participants described their wearable health technology is to *manage* their health. Managing one's health ranged from gaining insight into sleeping behaviours, blood pressure, weight and pain. For example:

> "First [goal] was weight loss. I understood that making 10,000 steps a day is you know – that will help keep you healthy and lose some weight" and,

> "I've had a flare up of rheumatoid arthritis in the last month, so I haven't been doing those things. So, it's that means that the Fitbit and steps is sort of at the top of my aim each week".

Again there is a relationship between the functional goal and the other two goal categories. The information a person desires and requires to manage their individual health has an influence on the reference points and the motivation experienced.

3.4 Wearable health technology and the urban environment

Several participants directly discussed their interactions with the urban environment. This took various forms. For example, the use of wearable health technology was a motivator for more city walking.

> "If we don't have much on and we need to go into the city my husband and I will walk into the city so that is 3.5 kilometres. You know I just like to record that".

In two cases wearable health technology was a motivator in urban mobility in combination with other interventions, for example.

> "The minimum exercise I have every day is walking to the bus stop and I get off the bus a few stops early and walk up the back streets to the hospital. And that's even more now because of the changes with the roadworks. Sometimes I'll get the bus in the morning and walk home at night. I just have to monitor how my hip [is doing] and bailout if it it's not up to it".

> "And it was an alarm that went off telling me you know you have to... And so when it comes to the number of steps, I still take them. But I had to get a dog to make sure that I did those numbers. **…** So, I took a dog; a living creature to help me make my steps".

In a unique case, one participant who took part in the study from outside Australia (Sweden) became increasingly involved in the use of multiple wearable health devices for health self-management, including the use of a chip implanted in his hand. The latter enabled the participant to engage in a smart city scenario.

> "We use it in our office to open doors and get the printers running and I can use it when I check in to the gym. I can use it when I travel by Swedish railroad. The railroad company can read the chip with their Android phones."

The motivational goals in this case are also tempered by emotional ones, perhaps, due to the uncommon nature of the adoption of the technology.

> "I have it [the chip] in my hand. So that's sort of a real -you know -a discussion starter. Half of the people – no, one third say "oh that's terrible". I would never do that. And it's really very emotional. It's not like you know they thought about the pros and cons".

4. Discussion

A content analysis of interview transcripts was conducted through the lens of three thematic frames. The first frame was user *emotions*; all participants reported the wearable technology motivated them to exercise each day. The second frame was *qualities*; the wearable technology was a reference point which gave them a competitive edge to reach guidelines for 10,000 steps per day. The third frame was *functionality*; the wearable technology allowed participants to manage their health, such as maintaining a healthy weight. These frames form the basis of motivational modelling by which the holistic needs of the end-user are identified, enabling the development of products, systems and services to better support people in their everyday lives (Miller et al., 2012).

However, while the potential design for future wearable health technologies can consider the emotional, quality and functional needs, the environment in which older people experience these attributes is paramount (Ehn et al., 2019). For example, consider an older

person who requires access to public toilets. Their motivation to walk may be present but following through with the action (of walking) may be limited in environments where there are few public toilets. Likewise, consider an older person who would like to rest under shaded areas on a sunny day. Using their wearable device as a reference point to compare how many steps they did for the day before becomes impractical because again, they are unlikely to go for a walk within environments where shaded areas are scarce. Within the present study context, the emotional, quality and functional goals become obsolete when there are environmental barriers within the community, resulting in activity goals unable to be achieved. Supporting studies have shown that safe, walkable, and aesthetically designed neighbourhoods, with access to specific destinations and services positively influenced older adults' physical activity participation (Barnett et al., 2018).

As acknowledged by WHO (2007), “active ageing depends on a variety of influences or determinants that surround individuals, families and nations. They include material conditions as well as social factors that affect individual types of behaviour and feelings” (p. 5). Hence, there are an array of factors, and interactions between them, that can play a pivotal role in determining how well people age.

In line with the ‘age friendly’ cities framework in which outdoor spaces and buildings were identified as a domain of city life and which can assist with active and healthy ageing, it is argued that there is a clear need for public infrastructure data sets. Specifically, if a digital city layer showing, for example where facilities such as public toilets, water fountains and shaded rest stops were located on exercise routes in communities, it is possible that this would support older people in achieving their exercise goals. Ultimately, it could also optimise opportunities for preserving and improving wellness and quality of life. This public infrastructure data could be available as an app which would allow older people to download directly to their smart wearable device and customise the information, depending on where they are located and their preferences to show the information needed (Kestens et al., 2016; Cuignet et al., 2020). Given the continual advancements in wearable technology, the ability to tailor this information for each older person and integrate this information in an easy to understand way on their smart device is achievable. However, this means that the digital information layer about the environment needs to exist and can connect to the wearable device. Here we argue that in the context of age-friendly cities, there is a need to connect to the smart city discussion by breaking up silos of technology, the environment and human-centred design. In putting forward the goals of different user groups, in our case older adults, we acknowledge the existence of different needs and how they can be accomplished through knowledge about the environment. This data can not only inform the user about the best route to take in order to achieve their goals but can also feed back into city planning for shaping these environments. Given that wearable devices are increasingly being used by older adults, it is important to take the next step to connect environment, technology and the user to create a holistic system that supports the quality of life of an ageing person. For a more detailed discussion on opportunities of informing ‘age friendly’

cities through combining digital, social and physical data according to the WHO framework please refer to Pedell et al. (2021).

5. Limitations

The present study was not intended to provide a comprehensive approach to understanding the use of smart wearable devices by older adults but rather, an exploratory one that highlights the opportunities in considering the potential relationship of urban environmental factors within a digital health and urban ageing context. This 'lens' has inevitably considered that there are also differing definitional boundaries across individual preferences, health technologies and determinants of health/multi-morbidities, which require a larger cohort to determine the extent and measures of correlates. Visual analyses would further provide a means to examine urban and geolocative features in more detail, giving rise to the possibility of providing more guidance for age-friendly city and neighbourhood strategies.

6. Conclusion

We suggest a convergence of motivational goal modelling and public infrastructure data sets that are conducive to age friendly cities. At this convergence, wearable health technology can be designed to support journey plans that present public infrastructure and that can enable individuals to participate, complete and reach walking goals or step targets. At the core of our research, we advocate for a digital city layer that can be accessed and individually tailored by older wearable health technology device users. By doing so, uptake and acceptance of wearable health technology devices by older adults may increase, leading to enhanced wellbeing. Insights into framework development for the design of age friendlier cities may also be gained.

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Acknowledgements: We would like to thank all the participants for sharing their experiences reported on in the two case studies.

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Nicolò Ceccarelli,
University of Sassari, Italy
“Exploring the cultural power of the visual language to engage audiences with wit, reason and passion... conveying ideas and emotions so to actually touch people and make them think.”



Chele Esteve Sendra,
Polytechnic University of Valencia, Spain
“A visual language that launch from its genesis to build its own boundaries and manage transformations towards new aesthetic proportions.”



Spartaco Paris,
Sapienza University of Rome, Italy
“Within the heterogeneous post-modern world of languages, we are looking for investigations which could still consider the materiality and consistency of things as matter of expressions and challenge of technologies and tools.”



Merav Perez,
Shenkar College of Engineering and Design, Israel
“In the detection of rising design accents, we are looking for explorations of the expressive possibilities offered by evolving mediums, technologies, and visualization tools.”

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A Sidewalk museum. Exhibiting the collective dimension of the moving image

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Abstract | A research project for a temporary exhibition about Alghero prison's historical Museum explores the intersections among the physical and virtual *mise-en-scène* of information. Structured as a set of custom-made modular exhibiting stalls the project explores how to enrich the visit experience by triggering the public's interest and participation.
Two problematic domains underly the project. First, the exploration of the extended potential of audiovisuals in a context such as the present, in which technology radically modifies the relationships between the visible boundaries – of what we, at large, consider as "screens" – and moving image products. Secondly, the investigation of the possible contaminations between the diegetic space of the audiovisual field and the narrative power of the expository medium, on the grounds of a long-established history of orchestration between spatial, visual components and storytelling. In perspective, our aim is to verify how audiovisual artifacts can enhance the collective dimension of fruition, in order to achieve memorable informative experiences.

KEYWORDS | EXHIBIT DESIGN, AUDIOVISUAL, DIEGETIC SPACE, STORYTELLING, ENVIRONMENTAL DESIGN

1. Introduction

The careful orchestration of the spatial and visual components has always been a tenet of the craft of exhibiting, a design practice in which the capacity of both domains to convey information and creating meaning finds a perfect synthesis. Despite the widespread presence of audiovisual and multimedia artifacts, having less and less an auxiliary function and playing instead an increasingly active role in the exhibiting practice, the relevance of the extension of this relationship in the realm of the moving image appears largely underestimated.

As a matter of fact, the exploitation of various forms of moving imagery within extremely sophisticated exhibition arrangements is not new and has been explored in stimulating ways well before the introduction of cinema itself.

Early traces of such an integration can be found in Athanasius Kircher's gallery of wonders in XVII Rome's Jesuit College. Here, at the height of baroque's taste to create amazement, the resourceful and multi-faceted scholar exploited on a regular basis (Findlen, 2004, p.335) a variety of 'multi-media' technical arrangements and tricks – early magic lanterns, automata, and the like – to impress his audiences.

A central space in the chronicles of 18th century's Paris was instead taken by Etienne-Gaspard Robertson, who (following the tracks of his enigmatic predecessor, Paul Philidor) orchestrated highly sophisticated – and very successful in terms of public's attendance – multimedia shows, combining in his *Phantasmagories* high-end adaptations of the magic lantern with a rich repertory of traditional theatrical effects, and enjoying extraordinary success in terms of public's attendance (Mannoni, 1999, p.144).

Much more recently, and in very different circumstances such as major international exhibitions, a similar approach can be traced to the pioneering early multimedia shows by Ray and Charles Eames – such as the multi-screen presentations *Glimpses of the US*, for 1959 Moscow World's Fair and *Think* at IBM 's 1964 Pavilion at New York World's Fair (Ince & Johnson, 2015) – or by Roman Kroitor's i*n the Labyrinth*, multiscreen presentation at Montreal's 1967 Expo Labyrinth Pavilion (Kroitor, et al., 1979).

Despite being obviously the product of very specific circumstances, of peculiar cultural and technical environments, and of the unique personalities of their authors, the above examples provide us with an inspiring reference in terms of the power that the contamination between the narrative capacity of the experience of space and its diegetic counterpart of the moving image can bring to the craft of exhibit design.

2. The project

The intersections between the physical and virtual *mise-en-scène* of information in exhibit design, a research subject that has been central to our scholarly interests over the last few years, were at the core of one of the projects in which our research unit has been busy

recently for a 'Sidewalk Museum', a temporary exhibition aimed at enhancing the visit to Alghero's prison's historic Museum. The framework in which this endeavor has taken place is that of a growing interest on the subject of the prison universe. Something that over the last few years has determined, in Italy as well as in Sardinia, to the re-discovery in terms of knowledge, memory and heritage, of abandoned institutes of imprisonment and of the documents and artifacts preserved in their archives.
Originated from an independent collaboration between our research unit and Alghero's city prison, our effort benefited last year of a grant from the Sardinia Regional Government in the domain of audiovisual experimentation, which allowed us to extend the project's original *pro-bono* core to a wider research effort.

The project for a Sidewalk Museum was sparked by a very practical matter. The museum is the only of its kind to be housed in a fully functioning prison, being therefore open to the public only for a day and a half a year, on the occasion of the "Monumenti Aperti" (Open Monuments) event. For obvious security reasons, access is severely constrained: visitors need to register and must deposit personal effects prior to entering. As the venue, with its turnout of more than fifteen hundred visitors in one and a half day, is among the most visited attractions during the event, this inevitably generates bottlenecks, long waiting times and queues at the entrance of the structure.



Figure 1. Stalls in the original core exhibit on the sidewalk outside Alghero's prison.

Our contribution has therefore taken shape as a custom-made prototype, aimed at integrating the actual visit through temporary and portable display modes. Arranged immediately outside the prison's gate, our design took the shape of a series of modular stalls meant at enriching – inside and outside the prison building – the experience before, during and after the visit.
The project, besides allowing the public to while away the time, deliberately plays on the visitor's expectations, turning the intermediate waiting time into an opportunity to enrich the overall experience.
The interplay between the physical and virtual dimensions, in which the various stalls stage some of key themes associated with the actual museum visit, is hence a key step towards the desired anticipation effect.



Figure 2-5. The original artefact which inspired the project, and various steps of the exhibition set up.

The very peculiar conditions associated with this project have, from the very beginning, had an impact on its structure. A key component of the project lies in its modular nature. Inspired by a device – part of the museum collection – used to carry food in the prison's branches, the exhibit stalls we designed are thought as stalls, to be arranged along the line of visitors waiting outside the entrance to the prison. Although apparently identical, once opened the stalls transform – to stimulate and intrigue the public – integrating physical, visual, textual and multimedia elements to deliver various presentation functions on a selection of key topics referring to the world of detention and prison life. The

metamorphosis effects that this transformation produces is not casual: the stalls are explicitly designed as some sort of wonder cabinets, each aimed at sparking curiosity and amazement through a specific register and tone, and taking advantage of a vast repertoire of re-constructions, replicas, allegories, similitudes, and of narrative approaches (Lugli, 1997).

The funding we were granted allowed us to extend the original four-piece exhibit adding new modules and pursuing ideas that could only be sketched in the original development. The audiovisual component of the project, already present from the early developments, was expanded in this second research phase.



Figure 6-7. The Museum at work during the 'Monumenti Aperti' event.

3. A research framework

Although our portable museum project was triggered by a very practical series of circumstances – the early prototype displays we created have already been successfully displayed during the Alghero Monumenti Aperti sessions of 2018 and 2019 – the project was for us also an important opportunity to explore, and test, some more general ideas.

The first deals with the exploration of the extended (Youngblood, 1970) potential of the audiovisual text in a context such as today's, in which the traditional relationships between the visible boundaries – what we, at large, consider as a "screen" (Carbone, 2016) – and the artifacts based on the moving image, are radically modified by technology. To an extent that while today almost virtually anything can be nowadays considered as a screen, each of us carries in its pocket a tiny, portable and hyper-connected cinema screen, in the shape of a smartphone.
Just as the screen-space tends therefore to become ubiquitous, as well as fragmented and rarefied, the second investigates the contaminations between the diegetic capacity of the audiovisual medium and the narrative power of space as an expository medium, to convey meaning, by narrating stories in the domain of exhibition design.

Before discussing both questions in more detail, it may be useful to limit the domain of interest of our research, which happens to be connected with a series of projects we have been recently engaged with (Ceccarelli, 2019 and 2020). We refer here to very specific forms

of audiovisual-multimedia presentations, some of which we have briefly considered above, mainly associated with large public events, exhibits and expositions, in which informative artifacts that lay between the actual fields of the moving image and of exhibit design are set to operate. This is a domain 'naturally' open to experimentation in which novelty and innovation are not only accepted, but somehow explicitly required and expected.

4. immersivity and engagement: the moving image in the exhibiting practice

A first question lies in how any 'moving image' artifact relates with the public in the context of an exhibition — and in the degree of engagement, or immersitivity achieved, in respect of the actual way in which this specific contribution is arranged or staged? The question shall be discussed from the two points of view of the physical and/or psychological components of this relationship, or engagement.

If we take under scrutiny the evolutionary steps that the moving image has experienced since its introduction we can see that the relationship between a medium's audience and the actual space in which a given 'show' was taking place has not always been stable and univocal.
Since the appearance of the first cinematographic projections by the Lumière brothers in 1895, the screen format – which is generally referred to as the proportion between the frame's height and width – has gone through a series of radical transformations.
The condition generally associated with the 'cinema show': where an audience faces a large screen while sitting in a darkened room, was in fact achieved more or less permanently only in the 20's of the XX Century. The early Lumière screenings where followed, from 1905, by the rise of the Nickelodeons (Belton, 1992, p.185), and since then a variety of practical, technological, social and ideological factors have played a part in determining this proportional relationship between the public and the moving image. The original 35mm film format, in its classic 4:3 ratio, consolidated through the following decades as a major standard for the emerging cinematic medium. In the 50's, the idea of 'passive viewing' associated with what was started to be thought as a narrow-screen format opened the way to new widescreen formats such as Cinerama Vista Vision, Panavision, Cinemascope and so on (Belton, 1992).

And yet, although we usually associate the 'cinema show' to a presentation format in which "a fixed position for both the image and the spectator to occupy and a new, more 'realistic' scale to use in defining their relationship" (Belton, 1992, p.31) solutions such as the *Kinetoscope* peep show, which was very successful at the beginning of last century, emerged as a serious competitor in offering a way to the emerging technology of the moving image.

The set of developments that through the projected frame, turned the spectator into a social subject, changing its relationship with the image from private to public and from individual

to social, the 'presentation space' itself in terms of format and even of its architecture, went through many transformations which greatly impacted the perception, participation degree of immersivity of the moving image.
Crucial shifts such in this direction include the appearance of drive-ins in suburban America in the '50's, the huge post-war diffusion of the TV and later on of cable-TV and of VHS' based home-video (which incidentally almost terminated cinema in the '70's). The overall proportions, and the viewing conditions have changed radically again, with the transformation of many original theatre halls into multiplexes or, more recently, as digital streaming services have become a prime distribution channel for the entertainment industry.

The critical part that the physiology of vision plays in this relationship is hardly arguable. Nevertheless, as the cinema theatre tends to become an increasing exotic place to digital natives, the fact that contemporary audiences keep experiencing empathy, fear, emotions… in front of the tiny screen of a smartphone, proves that engaging an audience transcends the technicalities of spatial and of physical presence offered by the technological solution of the day.

The power of the moving image and of its 'shadows and lights' also relie significantly on the subtler psychological factors determined by the sophisticated system of narrative codes which lay at the very foundations of cinema as a universal language.
Among many others, cinema historian and critic Noel Burch (Burch, 1990) has highlighted the key traits of the system, that he has defined as the 'Institutional Mode of Representation' (MRI). A set of rules on which the language of the moving image has been modeled, principally by Hollywood's mainstream cinema, in the first part of last century, soon becoming dominant in the industry. Within Burch's sophisticated argumentations on the many consequences of this step on how movies are conceived, shot and assembled (and therefore on how, as spectators, we relate to them), it is useful to focus on some aspects of his theory which are particularly relevant in our discourse. According to Burch, MRI relies on the cinematic illusion of reality based on the idea of a sensorially isolated spectator, placed at the center of the narrative (and incidentally, in the middle of a cinema theatre…or, in front of a TV set). Through the development of its systems of rules (narrative devices in fact, often even tricks), the ways through which the language of cinema engages its audience follow trajectories that go beyond the mere physical immersive dimension we have discussed earlier. In this perspective, rather than by any specific viewing condition, a key component of the immersive experience we get by going to the movies, lays in the way the 'story', the actual series of visual events, narrated from the abstract and idealized point of view characteristic of MRI, is presented to us.

In this framework, a key step for the development of our project has been exploring ways in which to combine the languages and narrative powers of space and the diegetic ones of the moving image. The unexpected development of some of our original thoughts on how to process this double relationship ended up highlighting another aspect will possibly lead the

way to future developments: the one connected with experiencing the collective dimension of the moving image.

5. Exhibiting and the collective dimension of the moving image

Released in 1973, one of Federico Fellini's most popular films, *Amarcord* ("I remember"), offers an extraordinary picture of cinema as a genuine popular spectacle.
Set in a small provincial Italian town in the 30's, the story is an auto-biographical narration of the teen-age years of a group kids (Fellini himself and his closest friends) during fascist Italy. A key place through the development of the entire story is the local movie theatre, which in Fellini's *mise-en-scène* is as an extension, almost an allegory, of the town's main square. A place where the community converges to lose itself in the magic of cinema, but also a glorious stage for the local life. Despite having gathered in the theatre mainly to watch the movie, the audience depicted in the film – the humanity so central to Fellini's cinema – laugh, smoke, loudly interacting with each other. The actual screening is continuously interrupted, as a significant part of the actual show takes place at the opposite side of the silver screen.
The atmosphere of *Amarcord*'s movie theatre relates to the very early days of the moving image, in which screenings would often take place in improvised form, on rudimentary screens hastily set up in fairgrounds and village festivals. Back then, cinema would take place in those "disjointed, open, relaxed forms liked by popular audiences" (Burch, 1990, p.46). As a show, cinema competed therefore with other forms of entertainment, with distractions and interruptions being a regular part of the program. Not infrequently, the staging presupposed the presence of a host / commentator in flesh and blood, of musicians, fighters and performers, presenting atmospheres closer to the circus, the popular theater or the *café chantant*, rather than to that of a silent darkened room we tend to associate with the idea of a cinema theatre. The movie theatre depicted in Fellini's masterpiece is a fine example of a kind of shared space, where "the spectator's gaze becomes a collective look" (Belton, p.32), and of one of the many ways in which, in its long and honorable history, the moving image and its public have interacted, or in other words of the idea of 'spectatorship'.

On these grounds, our research project's experimental perspective lies in the exploration of how the design of audiovisual artifacts of various kinds can contribute, beyond the more obvious objectives of conveying informative contents, in triggering the social, and to some extent collective, experiences evoked by Fellini in his *Amarcord*.
The context in which this endeavor has taken place is the inherently theatrical stage of the public exhibition. A very particular kind of place – in fact a very busy road in the centre of our town – where we confronted with explorin the idea of combining a non-static position of our public of visitors/spectators with the spatial power of the physical *mise-en-scène.*

6. Interplaying with contrasts

In presentation terms, the project revives many elements from the classic repertoire of the exhibit design craft. This either by taking advantage, one display after the other, of a rich toolbox of presentation tricks comprising replicas, allegories, similitudes; and, on a more conceptual ground, interplaying with contrast and paradoxes. In both cases, the goal is to spark curiosity and amazement in the audience in order to ease the transmission of sensitive meaning.

To present the topic of social life in prison life, for instance, we created a display on 'social interaction', presenting a mock table football game in which two teams confront each other. Modeled in the modular form designed for all our displays, the display appears absolutely normal from a distance, but as visitors come by along the cue something strange pops-out: the composition of the two teams is odd, as three red players confront more than twenty grey ones, to highlight the radical shift in a prison inmate's social life connected with being deprived of one's freedom.

In another display we present a selection of mug shots, part of the Museum's historic collection. The precious glass-mounted negatives, some of which go back to the end of the 19th Century, depict (front and side) the inmates on their very last day of serving their sentence. The images are presented as a slideshow on the screen of a digital tablet framed in the structure and facing a blatantly fake projector. The approach is ironic, aimed at sparking curiosity: a light in the projector, temporized in synch with the picture slideshow, simulates (in an *intentional* not too convincingly fashion) an actual projection.

A more subtle level in which the contrast factor is pursued is in the duality of the relationships that in our system of displays occurs between analogic and digital, physical and virtual, high-tech and positively no-tech. A key source of inspiration for the development of this part of our research came from experimental work carried out in the realms of video-art. Despite their specific angles, research approaches and motivations, artist such as Jeffrey Shaw, Nam June Paik, or the Studio Azzurro collective's explorations of the connections between the narrative dimensions of space and audiovisuals through technology have been for us important reference points. In this respect, that fact that the work of such authors has often been associated with the idea of environment – Shaw's *Legible City*, 'responsive environment' (1988-91), Studio Azzurro's multi-screen video installation, or 'video-environment' *The swimmer* (1983-84), for instance – is everything but incidental.

Another stimulating point of reference was the idea behind Nicolas Bourriaud's Relational Aestethics. His interpretation of the exhibition space as a promoter of dialogue and social participation has been instrumental to the attempt we have pursued in our project, by contaminating space and the moving image, and working, after Bourriaud himself, on a shared place made of relationships and capable of creating relationships (Bourriaud, 2010). Finally, Nam June Paik's assemblies – specifically his very famous Tv Cello of 1971, in which the physical persona of cello player Charlotte Moorman and its virtual video counterpart

tend to blend into a completely new performative entity (Lee & Frieling, 2019) – have represented a relevant source of inspiration in terms of how to match our research findings with the actual design of our portable museum.

This second phase of our research project is associated with the idea of enhancing the existing core group of displays with the contribution of specifically tailored audiovisual material. One of the displays designed in this new phase presents tattoos as a typical form of internal of language between the prison inmates. The presentation was developed on the grounds of the extraordinary collection of samples from the 19th Century gathered by the controversial criminologist Cesare Lombroso. We created for the scope a short audiovisual piece illustrating the historical context, with samples of classic tattoos. The short video, which runs on a digital tablet, is mounted on top of a display stall, where individual visitors can only see it through a fake visor, reminding both Edison's 'peepshow' *Kinetoscope* and a prison's cell spyhole. The physical constraint of having to bend over the visor is a key factor in this display, as it implies from the user an active and physical, individual act.



Figure 8-9. The project's audiovisual component in two of the exhibits

On the track of our 'contrast strategy' we devised the re-design of a display part of the original core of the exhibit. The display interprets the evolutions in the relationship between space-society by describing evolutions in the architecture of prisons. The display's original design, based on schematic 3D models was therefore enhanced via an Augmented Reality app, which, by interacting with the basic shapes in display, makes it possible to extend the presentation well beyond the physical constrains of the exhibit. The same set of basic shapes displayed on the stall's top, can be used as the 'tracking' reference starting point, so that multiple-users, through multiple devices, can explore the same virtual presentation in parallel.
Whereas the display about tattoos pivoted intentionally on separate individual experiences of the materials on display, this one ideally allows to share a same informative nucleu, encouraging the interaction – either in the virtual or in the physical realm – between different visitors.

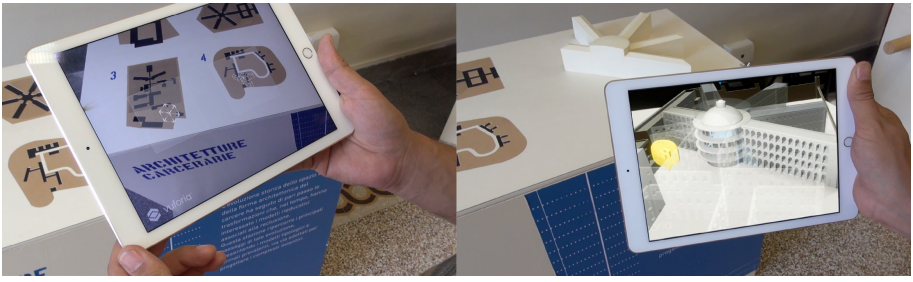

Figure 10-11. Augmented Reality was explored as a way to highlight the potential interactions between the physical and virtual dimensions of the exhibit as well as between visitors.



Figure 12. Multimedia contents developed for the display on the language of tattoos in prison.



Figure 13. Frames of an introductory documentary we created to give context to the project

7. Conclusions

Originated from an independent collaboration between our research unit and the Direction of Alghero's city prison, primarily aimed at responding to a series of very practical issues associated to the occasional visit to its small historic museum, our project for a Sidewalk Museum turned out being a unique research opportunity.

A process of conscious contamination among the narrative powers of space, tangible objects and physical arrangements and the diegetic capacity of the language of the moving image has allowed us to explore a new engaging area for the presentation of a sensitive topic such as that of life in prison.

In front of a society dominated by the technological promises of personalization, portability and social interaction, our project for a Sidewalk Museum aims at bringing a small but

refreshing contribution to the design cultures in the domain of public exhibitions. A contribution based on exploring ways in which, rather than isolating the public in endless sets of individual users, digital technology and audiovisual communication can be cross-contaminated with the materiality of the physical space to create new hybrid experiences and trigger interactions with the material on display as well as with the other visitors.

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Acknowledgements: The Sidewalk Museum project was started as a *pro-bono* effort by DADU's AnimazioneDesign research unit. A second development phase of the project was made possible by a grant from the Regional Government of Sardinia for research projects in the domain of audiovisual languages (L.R.15,2006)
Project contributors: Marco Sironi, Sabrina Melis, Massimo Pinna, Francesco Puggioni, Nada Beretic (AnimazioneDesign); Vanessa Angius, Maria Clelia Cossu, Paola Dore, Lara Marras, Simone Sanna, Sabina Selli (DADU students); Paolo Bellotti, Antonio Merella (Casa di Reclusione Alghero).
Many thanks to Francesco Indovina and Elisa Milanesi.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Abstract to figurative, and everything in between: visual design approaches and linguistic codes of a traditional form of animated product

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Abstract | Animated artefacts are demanding and successful tools to face articulated topics concisely by embracing different codes and style of representation. Among different animation techniques, stop-motion, the oldest one rooted in George Méliès trick-films in late '800AD, has recently been recognised as a valid and immediate pedagogic tool since the production process of a stop-motion film is easier to understand and handle, and animated objects are tactilely manipulated. This paper describes theoretical premises, teaching approaches and design outputs of a stop-motion workshop held in Alghero (Sardinia, Italy) in September 2019. At the end of the workshop students were expected to produce a short film about a famous tragic event related to Sardinian prisons, choosing appropriate visual styles and languages. Artefacts are very different and reveal the technique as a communication design tool highly effective through both figurative and abstract stylistic approaches, and both descriptive and metaphoric narrative languages.

KEYWORDS | STOP-MOTION ANIMATION, VISUAL DESIGN, PEDAGOGY, CODES OF REPRESENTATION, NARRATIVE LANGUAGES

1. Introduction: Theoretical assumptions

In the last few decades animated artefacts have been recognised as precious design products, very effective in answering communication and pedagogical challenges of contemporary society due to their being informative, pervasive, intrinsically capable of crossing cultural and generational boundaries, and versatile from both visual and linguistic standpoints.[1] As for any form of fictional product and communication tool, indeed, an "animated film is clearly a product of its time", conceived, produced and released into a cultural scenario, with an existing technology, delivering certain messages for a specific target (Milligan, 2016, p.3). Animated artefacts have dealt with a broad spectrum of contents, ranging from social to psychological issues, with informative and pedagogical objectives. Not by chance animation and motion design artefacts have been successfully chosen as visual communication tools to deal with scientific contents, staging different codes of representation according to the targeted audience: from the fictional scientific anime "cells at work!" (2018), to the informative motion graphics produced by the Australian communication design agency "Animate Your Science".

Animated films, furthermore, hold a pedagogical function as socializers, teach social values and moral lessons (Giroux, 1999; King, et al., 2010), and deeply influence "children's culture and their everyday lives" (Giroux, p.2). In 1973 Bob Heyman acknowledged entertainment as an educational force and coined the term "edutainment", today largely used to address media culture power to educate and regulate meanings and values. Even when animated narratives take place in fictional worlds and stage imaginary events, animation, better than any other fictional medium, inspires opinions, stretches the imagination, creates space for new experimentations and has a critical impact.

> "The dynamic of Animation art lies in the narrative structure of non-existing world, while the events that take place are imaginary as well. The creator constructs his own world for taking aim at projecting his opinion, criticizing and developing his beliefs through the symbols and abstraction." (Mouri, 2014, p. 26)

The strength of animation language, indeed, is its extraordinary ability to evoke meanings using symbols encoded in a collective imagery, and its dimension of abstraction. In this paper we will distinguish visual codes and narrative languages by applying concepts stemming from the theory of representation, media literacy, narratology and semiotics and we'll briefly explain how we engage them for analytical purposes.

[1] To deepen concepts of pervasiveness, versatility and communication qualities applied to the design of animated artefacts, we suggest consulting Laura Marks' text *The Skin of the Film: Intercultural Cinema, Embodiment, and the Senses* (2000), Nicolò Ceccarelli and Carlo Turri's book *Progettazione in movimento* (2010), Suzanne Buchan's book *Pervasive Animation* (2013).

Animated films stage different languages and visual codes and allow dealing with articulated and complex issues in both symbolic and abstract ways. Animated visual codes, therefore, do not just "merely reflect a world outside the bounds of the text, but [can] rewrite and reconstruct them" (Khun, 1985, p.48) as they play with shapes, forms, proportion, manipulate elements and provide an altered and modified representation of images that in first place aim at making an event or an action understandable and intelligible. The fluidity of animated visual codes makes the medium particularly suited as a model for analysing the production process of audio-visual artefacts engaging different codes of representation, narrative languages, design approaches, and eliciting unique synesthetic experiences. The 'unit of measure' that we will use to interpret visual aspects of kinetic products stems from the classification of motion graphic products' visual categories theorised by two American scholars: Bruce Block (2008) and Matt Woolman (2004), who, after identifying those categories (shape, spatiality, volume, colour, surface, movement, complexity), evaluated them according to a dualistic approach and a logic of binary opposition. Abstraction is the visual parameter that we will investigate, and, by following mentioned logic of binary opposition between two extremes, an animated artefact will be defined as more abstract (or simply abstract) or less abstract (or figurative). In animation the concept of abstraction refers to a type of filmic style that experiment with shapes, colours, narration. Mohamed Fauzi Naeim defines abstract animation in this way:

> "Abstract animation forgoes story plot and character development but focuses on gesture, imageries and techniques. The images exhibited do not necessarily have to be consistent with each other, though there is a rhythmic pattern (...) In abstract animation, what the author's trying to say is more important than the actual execution of the animation itself." (Fauzi Naeim, 2017, p.1)

Since animated artefacts move between abstract and figurative visual representations, the Italian researcher Carlo Turri (2010) recognised in the medium a natural flexibility and the ability of staging different levels of abstraction using signs and symbols already encoded in the collective imagery. The flexibility interests both visual codes and the narrative language at the diegetic level. The literary theory of *semiotics* says that language is a code that uses *signifiers* to produce meanings (the *signified*). Kinetic artefacts, and especially animation, plays with these symbolic elements at several levels starting from the structure of the storyline. Even by exploring and evaluating this further parameter we need a dualistic approach: if visual elements can be either abstract or figurative, narrative language can be either literal/descriptive or metaphoric, and these two extremes can successfully embrace either an abstract or figurative code of representation.

Stemming from these premises, we will, in the next section, describe the outputs of a stop-motion animation workshop held in Alghero (Sardinia, Italy) in September 2019, that engaged design students in experimenting with stop-motion animation as a communication design tool by using different visual styles and narrative languages.

2. The stop-motion workshop

The didactic experience outlined in this paper is an opportunity to verify the relationship between animation and communication by virtue of different languages and visual codes. The workshop was meant for architecture students with no previous knowledge of animation principles, software and techniques. The twelve participants came from either a bachelor's degree in Architecture or from a master's degree in Architecture-curriculum design, and most of them were local with the exception of an Erasmus student from the Czech Republic. The workshop aimed to combine three key aspects:

- The development of a critical thinking on how to use stop-motion animation language and visual codes in the more general framework of project communication;
- The transmission of practical knowledge through a set of exercises and an assigned project work;
- The acquisition of media literacy notions by using appropriate terminology and conventions, and by understanding and creating audio-visual texts.

2.1 Stop-motion animation technique

Stop motion is the oldest animation technique and rooted in George Méliès random discovery of camera-trick in late '800AD (Harryhausen & Dalton, 2008). Méliès realized that if the camera stopped shooting and then restarted after objects on stage were moved or replaced, an illusion of apparitions, disappearances and transformations was created. However, Méliès didn't see the potential of this discovery, and the first films using objects (toys) were made by James Stuart Balckton and Albert Edward Smith in 1897 (Maselli, 2018). This animation technique involves capturing images of:

> "something (…) manipulated, moved incrementally by hand, whether it's a puppet, a pile of sand, some clay, or paper cut-out. Another increment and another image. When the images are strung together at an appropriate speed, the viewer is fooled into thinking something has moved in a continual manner." (Purves, 2008, p.9)

But this movement is an illusion since it happens between the frames, and what the spectator really sees is what occurs when the camera takes the shot, i.e. when everything is still and nothing happens. Stop-Motion equally embraces photography, computer graphics, performing arts, sculpture, knowledge of anatomy of moving bodies and video editing. To make a stop-motion video we need a camera and an object to be photographed, following a logic of movement, direction and transformation. Stop-motion animated products are also powerful, expressive communication tools that open up possibilities of experimenting and experiencing languages and codes of representation while approaching material objects visually, for the audience, and tactilely, for the animator (Maselli, 2019). Stop motion is remarkably versatile in several ways as it can be used for many subjects, with every sort of materials and objects (plasticine, silicone, toys, legos, household objects), it can use

figurative or abstract codes of representations and, as any other form of animated artefact, it can narrate in either linear or non-linear ways. Stop-motion has been used for pedagogic purposes since the material qualities of the medium makes the production process easier to understand and to handle thanks to the direct manipulation of objects, puppets or flat figures. Stop-motion animation allows us to:

- Learn tactilely how animation principles work by applying them to real objects;
- Interact with materials and manipulate them by hand, also improving craft skills;
- Work in groups. Since stop-motion requires many skills and inclinations, from artistic and craftsmanship talent to organizational skills, collaboration and teamwork are essential.

During the workshop, students had to figure out how to practice working with others and to contribute to a team while improving their individual talents.

2.2 Workshop syllabus

During the five days workshop students had different activities, both practical and theoretical:

- They were provided with a theoretical overview about 120 years of technological and aesthetic evolution of stop-motion animation technique;
- They learned the twelve animation principles theorized by Disney's animators Ollie Johnston and Frank Thomas (1981);
- They learned how to use *Dragonframe*, the most widely used software for stop-motion animation, utilised in large production studios such as Laika entertainment and Aardman studios;
- They worked on three exercises in cut-out (the bouncing ball, the swinging chain, the walking stickman) to practice with the technique, learn the software and understand the main animation principles;
- They produced a stop-motion short film using objects, paper, fabric, photographs and any other kind of flat element shot on a flat two-dimensional background. Students were presented with two possible narratives concerning famous events that occurred in the twentieth century and related to Sardinian prisons: the tragic story of the "bandit poet" Bachisio Falconi,[2] and the murder of Maria Goretti, killed at the age of twelve by Alessandro Serenelli.[3]

[2] Bachisio Falconi, knew as Bachis, lived in the first half of the twentieth century and is remembered as the "poet bandit". In 1936, after the accidental death of a young policeman from Thiesi, Giuseppe Ferrandu, Bachisio was unfairly accused of murder and sentenced to 30 years, which he served only in part because in 1943 he escaped from Tramariglio prison. He was killed six years later, on December 1949, with a gunshot. He became famous

Students worked in teams and had to follow the main phases of an audio-visual production process:

- Pre-production: subject development, visual style definition, storyboard, puppets, objects, and backgrounds creation;
- Production: camera setting, animation process;
- Post-production: video-editing, compositing, sound effects.

3. Animated outputs

Outputs approach the selected story by treating the diegetic language and the visual codes in completely different ways, either descriptive or metaphorical as the first, either abstract or figurative as the former. By documenting the process of each produced artefact, we will now describe the different materials, visual codes and narrative languages students worked with in order to complete the assignment.

3.1 Maria Goretti and Alessandro Serenelli #1

The video tells the story of Maria Goretti raped and killed by Alessandro Serenelli and focuses on the events experienced by the male character. It was produced in silhouette animation and students used flat paper monochromatic silhouettes, props and background. The style of representation is abstract as human figures and the props' shape and appearance are extremely simplified although staged characters, objects, events and actions are perfectly recognisable. The narrative structure is linear, the language descriptive and the representation and interpretation of the events literal. The plot is divided into ten scenes that follow the chronological order of narrated events:

1. Alessandro is welcomed by the Goretti family;
2. While working in the fields, Alessandro realizes that he is in love with Maria;
3. Maria refuses Alessandro;
4. Murder of Maria;

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because, while in hiding, he wrote poetry and short stories and, after his death, his wife collected them in a book: "Sardinian song composed for the great misfortune".

[3] In July 1902, eighteen-year-old Alessandro Serenelli stabbed twelve-year-old Maria Goretti with an awl, causing her injuries that led to her death. The day of the murder, Alessandro tried to rape Maria, but, rejected, he got mad and began to hit her violently. Sentenced to prison, already in 1910 he repented and said he had dreamed of Maria in Paradise forgiving him while collecting flowers. From 1919 he was transferred to Sardinia and in the following ten years he passed from the prison in Olbia, Nuoro and Alghero. He was released from prison in 1929 after 27 years. In 1934 he asked Assunta, Maria's mother, to be forgiven for his sin and she granted her forgiveness. In June 1950 pope Pius XII canonized Maria. Serenelli died in May 1970, at the age of 87 years old, in a convent in Macerata.

5. Alessandro exposed to public judgment and called “monster”;
6. Alessandro taken to prison;
7. Alessandro dreams of Maria forgiving him and collecting flowers;
8. Alessandro is released;
9. Alessandro obtains forgiveness from Assunta for killing her daughter;
10. Alessandro obtains beatification and ascends to paradise.

Actions performed by flat characters have an immediate and literal meaning, from the homicide to the moment of forgiveness. Nevertheless, students designed a few symbolic elements:

- A beating heart symbolically represents Alessandro’s love for Maria;
- Alessandro’s sanctification process after being forgiven by Maria’s mother is visually represented as the flat puppet ascending to paradise where Maria is waiting for him. Sarcastically students placed some kinky and provocative scenes at the end of the video after the credits and justified them as a sort of humoristic making of the story.

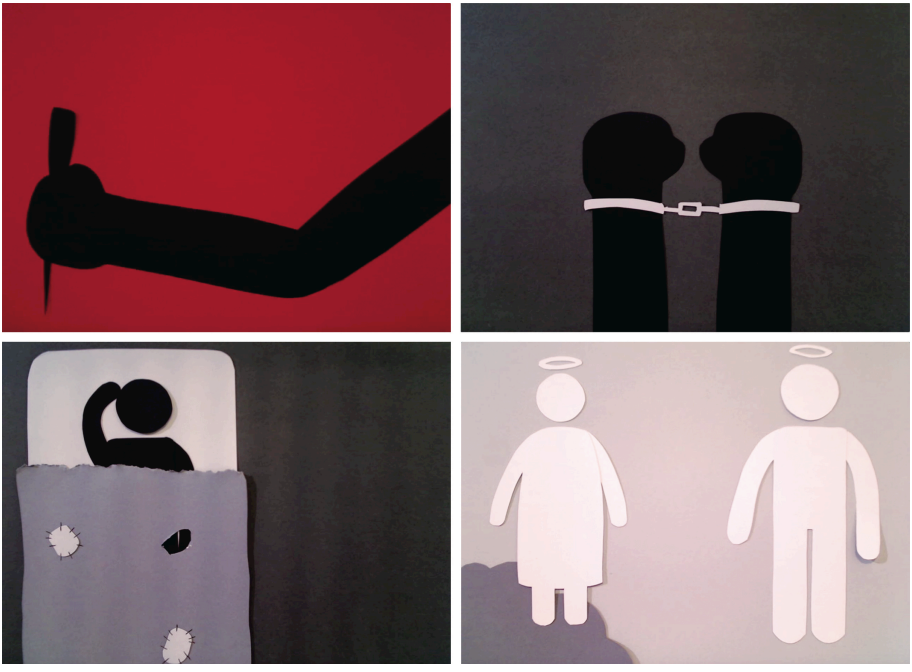

Figure 1. Still Frames | Andrea Tomasi, Sara Casu, Ilaria Prinzis | Alghero Summer School | September 2019.

3.2 Maria Goretti and Alessandro Serenelli #2

The video stages the story of Maria Goretti in a slightly different way compared to the previous. Flat elements in cut-out (pieces of paper, fabric, wool and photographs) and live actors captured frame by frame in pixilation were used. The visual code of representation is figurative, and the language is both descriptive and metaphorical since chronologically defined events are narrated either literally (e.g. the murder and raping attempting scenes) or by evoking symbolic elements. Metaphorical scenarios are shown in the first two scenes respectively staging Alessandro released from prison after dreaming that Maria forgives him, and flames arguably symbolizing Alessandro's atoned sin. The video has four main scenes all temporally placed, even though they don't follow a chronological order:

11. First scene (1927): Alessandro dreams of Maria who forgives him and gets released from prison. In this scene paper cuttings, cotton and fabric strings were used and the narrative language is predominantly metaphorical.
12. Second scene: Red and yellow fabric flames burn on a black background symbolically representing Alessandro's sin.
13. Third scene (1902): Alessandro attempts to rape Maria and kills her after rejecting him. This scene is made in pixilation with real performers (students themselves) literally simulating the action.
14. Fourth scene (1929): Beatification process of Maria begins. This last scene is made in cut-out with flat paper elements and makes use of metaphorical language.



Figure 2. Still Frames | Lara Marras, Carla Sau, Francesca Tomasi, Maurizio Zichi | Alghero Summer School | September 2019.

3.3 Maria Goretti and Alessandro Serenelli #3 (*black and white)*

The last video about Maria Goretti's murder and beatification approaches the narrative in a different way. The video "black and white" has a highly abstract visual style and a cryptic metaphoric narrative language. The video doesn't stage any event of the original storyline and focuses on the atavistic conflict between good and evil by representing these two abstracts and opposing concepts through two colours (black and white) and geometrical elements looping fighting. There are no scene changes, and passages from white to black - and vice versa - are harmonic and continuous sequences. A few symbols already encoded in the collective imagery clearly representing the addressed contraposition can be identified.

The video opening stages a collection of evocative and opposing words: innocent and guilty, angel and devil, heaven and hell. The conceptual contrast is emphasised by the colour: negative words (*guilty, devil, hell*) have a white fill on a black background, positive ones (*innocent, angel, heaven*) are in black on a white background. Right after the sequence of words, black squares appear and invade the white background by translating from right to left and from bottom to top of the scene - and vice versa - until they make the stage completely black. On the black background white squares beat and shape a cross. Squares' translation restarts but with inverted colours: white squares cross and invade the black background until it turns white. At this point on the white background an unshaped black figure appears and flatly moved onto the stage until eating a white filled square with black strokes and exploding. In the final sequence black and white backgrounds flash and a lonely square appears and shyly beats as a symbol that the fight is far from ending.

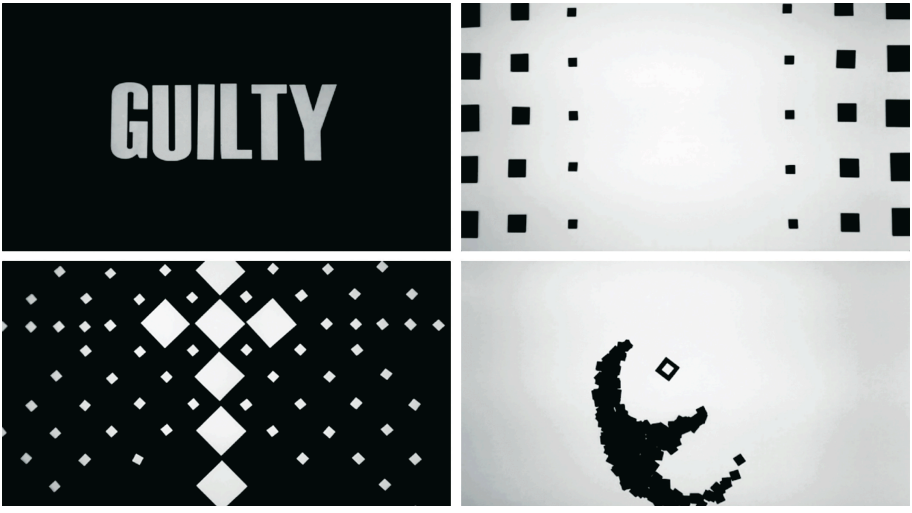

Figure 3. Still Frames | Francesco Secchi, Fulvio Serio, Ondrej Simon | Alghero Summer School | September 2019.

3.4 Bachisio Falconi “poet bandit” #4 (*su bagalliu)*

The last artefact focuses on the story of the poet Bachisio. The video is produced with both three-dimensional and flat objects, and in pixilation. [4] The narrative is metaphorical as the action turns around a symbolic element, luggage. This symbolic representation of Bachisio’s story uses both figurative and abstract visual elements. The video is a one-scene shot in which luggage is the protagonist of diverse actions. In the first part, printed objects and words and pieces of paper enter the luggage. Typologies of objects and words progressively change, and viewers observe the passage from images of everyday objects and positive words in Sardinian dialect such as *paxi* (peace), *pesau* (childhood), *trabadhu* (job), to images of weapons, chains, handcuffs and negative words, such as *morri* (death), *monstru* (monster), diaulu (devil), to crumpled paper arguably symbolizing confusion and corruption. When the luggage is full, it suddenly closes. Interestingly the more the elements filling the luggage get negative, the less saturated the scene becomes, until colours are completely missing, and the composition is in black and white. In the second part of the video, the luggage is closed and a human hand - shot in pixilation - re-opens and cleans it from the crumpled and confused pieces of paper on both the outside and the inside. The only left image represents the printed cover of Bachisio’s poetry book that he wrote while in hiding. The cleaning hand embraces a positive function and arguably pictures the hand of Bachisio’s wife, who collected his verses and stories after his death and made a book from them.



Figure 4. Still Frames | Glelia Cossu, Paola Dore | Alghero Summer School | September 2019.

[4] Pixilation is a stop motion technique in which live actors are shot frame-by-frame. After the picture is taken actors slightly move until the movement is complete.

3.5 Narrative languages and visual codes of representation in comparison

By observing the above-described outputs, several themes and aspects related to narrative language and visual codes emerged. Students' efforts, focus and creativity extraordinarily leapt out in the preproduction phase. At this stage they were challenged to scan stories, to select main elements, events and actions, to think out a plot by summarizing those narratives, to use either a metaphoric linguistic register or a descriptive one, and to design a visual style of representation. In all outputs, even when students remained tied to a figurative style of representation and a descriptive language, a relevant number of symbols and levels of interpretation are detectable. Metaphoric language is traceable both in singular elements built and captured by the camera, and in the general tone of each video.

The theme of the atavistic conflict between good and evil seems to be frequently near the surface of each artefact. The conflict is symbolized by chromatic choices and geometric components in the video "black and white" or by flames and flat flowers frequently appearing in the second afore-described video.

Another theme engaged by those narratives concerns the fairness of the penal system. The last described artefact silently criticises it and emphasises Bachisio's talent as a poet and the love of his wife who fights for clearing Bachisio's name, socially rehabilitating his life, and spreading his poetry. The first two described videos, on the other hand, address the stiffness and justice of the penal system by staging Alessandro's release from prison as something that occurred immediately after he affirmed dreaming about Maria forgiving his guilt. Historically speaking Alessandro was released in 1929, after 27 years of jail, although he declared himself sorry and he had already regretted his sin in 1910.

A topic critically approached by students concerns the spiritual dimension of the victim and sinner in the catholic religion, too. In the first described artefact, students synthetically, ironically, and critically staged the act of forgiveness as something easy to accomplish since Alessandro, after regretting his crime, was forgiven and easily socially rehabilitated. In the narrative, indeed, the sinner is placed side by side to the victim in heaven. Animation technique and narrative language reveal their critical impact by building powerful "metaphors that can lead to an overall lightening of contents" (Turri, 2010, p.30). In the briefly mentioned last two scenes, indeed, students staged two sarcastic but meaningful actions: (1) the cross turns upside down; (2) the scene of forgiveness turns into a scene of revenge and Assunta, Maria's mother, comically blows Alessandro's head.

Visual elements, as well, were meticulously designed during the preproduction phase and as illustrated, they stick with different levels of abstraction, consistent with the tone and the language of representation: flat monochromatic geometric figures, simplified flat silhouettes, cuttings of printed paper, three-dimensional objects and real actors photographed in pixilation.

4. Conclusion and evaluation

David Kolb, in 1984, theorized the effectiveness of the experiential learning model, and today this approach is widely recognised and validated specially to teach practical disciplines and skills. As a practice and material filmmaking activity stop-motion has already been explored and used in different educational fields such as architecture and design thinking. Architecture students have approached stop-motion for sketching and communicating design experiences (Zarin, et al., 2012; Al-Saati, et al., 2011). Stop motion has been used also as a tool for "motion design thinking" processes.

The described workshop experience engages stop-motion at a more basic level. The technique was explored as a way to develop communication in an immediate way regardless of the outcome, a fictional short-animated artefact in this case. As a result of the students' experience, they thought that they could use the technique in their future work since it was revealed to be a very demanding but successful design tool quick to learn and practice and useful to understand and apply animation principles and to experiment with visual styles and codes or representation. The technical quality in terms of smoothness and visual details is quite rough, since students worked in a hurry with a new software and a new technique, but the workshop successfully demonstrated that different registers of narrative languages and visual codes can be understood, used and tested with this technique even in a short time. Furthermore, students' manual ability, imagination and creativity were engaged in several manners and produced noteworthy outputs.

In conclusion this pedagogical experiment confirmed stop-motion animated products as highly effective for the representation of storylines through different stylistic approaches and visual codes. The workshop, on the other hand, failed to provide feedback about a possible relationship between students' improving their knowledge of the technique and their taste in specific languages or stylistic conventions with cultural and demographic characteristics, as eleven out of twelve students had the same studies, cultural and geographic background, analogous degree levels and approximate age.

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Acknowledgements: We want to thank the students who participated in the workshop, who showed interest, creativity and effort in learning a new technique in a short amount of time. Thanks also to Prof. Nicolò Ceccarelli and Dr. Marco Sironi for organizing the Neo-Local Design Summer School 2019 and the described workshop.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Al-Kafiye: A Symbol of Change

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Abstract | The paper presents the argument that the Kafiye (keffiyeh-pattern/scarf/headwear) is the strongest symbol to come out of the contemporary Arab World and subsequently is a valuable tool of cultural resonance. In a world where consumption has become disposable, the Kafiye has managed to withstand fading away building a powerful narrative seeded in its expression of change. The argument is made on the necessity of preserving its historical and contextual story for cultural conservation and critical discourse, applicable to any design scholarly study. My methodology consisted of secondary and primary research conducted in Palestine, Jordan, Lebanon, Syria, Iraq, UAE, KSA, Holland, France, England and the US exploring old manuscripts and scholar publications as well as observation and interviews with design practitioners, fashion designers, photographers, Middle Eastern and Arab scholars, historians, linguists, fashion scholars, culture academics over a decade. The core of the research revolves around the Hatta (black and white pattern design).

KEYWORDS | AL-KAFIYE, ICON, SYMBOL MATERIAL CULTURE, VISUAL

Note: I use the different terminology in my paper to denote relevance and authenticity – Kufiya is referencing the traditional head garb, Hatta relates to Palestine, and Shmagh to Mesopotamia. My quest in general is to define a framework- what I call the Kafiye (from Lebanese dialect.) I do not use the word Keffiyeh as officially transcribed in English. My use of Arab, Arabia, Arabs and Arab World denotes the region and countries where Arabic is the official language.

1. Introduction

Al-Kafiye is the strongest symbol to come out of the contemporary Arab World. This paper will be dedicated to explaining why that is, by setting the scene, tracing it back to its roots and establishing a contemporary definition and context. Through the lens of design, we can learn about the rich nuances of social, cultural, economic and political fabric.

The story of this powerful symbol, accessory and design detail has played many parts in diverse moments and keeps adapting with globalization and time. Treading the realms of street, politics, traditional garb, trends and catwalks, this object has transcended form and various functions to become more than just a simple item, but a global visual language denoting revolt and revolution, just as relevant today as ever.

The journey to discover and to try and contextualize *al-Kafiye*, what it stands for and what it means today is not meant to be limiting in definition, quite the contrary. Only by looking at the elements that have made this an icon, can we really start to map its role. Starting from Ancient Mesopotamia and reaching people all over the world, *al-Kafiye* constitutes a rare and noteworthy platform for a rich study in identity, design and material culture. Its influence lies in its power to adapt, evolve and exchange. As traditions are appropriated and transformed, representations and meanings adjust accordingly. The challenge and simultaneous contradictory messages – cool, street, trendy, terrorist, revolutionary, political, positive, negative --- is what makes *al-Kafiye* relevant and complex. It does not pass unnoticed, especially in contextualizing its symbolism over time and space.



(Figure 1) Various patterns and colors of the Kafiye. The bottom left is the black and white Hatta found in Palestine.

2. Origins and Spread

2.1 Rise of the Pattern: First Traces

To be able to deconstruct, understand and frame al-Kafiye, it is key to trace back its path from its inception during ancient times until today before even trying to understand its dissemination- within the Arab world and then to the West, its resonance and meaning.

The origin of the design can be traced back to Sumeria. The civilizations that developed in Ancient Mesopotamia, Bilad Ma Bayn Al Nahrayn - land between the two rivers: Tigris and Euphrates, between 3000 and 300 B.C. cultivated impressive skills for fashioning clothing and textiles. The evidence of these civilizations' clothing remains on sculptures, pottery, and in writings left on tablets and royal tombs. It indicates that a thriving textile or fabric industry existed in the early civilizations of Mesopotamia.

Mesopotamian priests, during Sumerian times, wore black during dry summer seasons, believed to signify the scarcity of agricultural wealth during those periods. During the more

prosperous and rainy seasons like winter and spring, where agriculture, hunting, and fishing prospered, high priests used to wear white from head to toe. These were religious figures responsible for nature -abundance and wealth - and denoted rituals and beliefs through their dress and costumes. Due to the proximity of the area to water and their reliance on fishing, it was very important to have great season and catch to survive. A variety of these 'holy men' wore a lot of symbols derived from fishing culture (Al-Jader, 1985). Some of those high priests used to place on their heads and over their white headpiece a black net-like piece made from wool similar to a fishing net (Band, 1980-83) symbolizing wealth and fortune in the fishing season. (Hussein, 1991)

With time, these two separate pieces evolved into one: what can be considered the precursor of the black and white pattern headwear. Merged together to create a woven fishnet-derived pattern, similar in fashion to the one recognized today. At that time, it was believed that the weavers used to also add geometric lines and abstract designs of fish fins and shells. Quite original in its conception, the initial pattern was derived from the land and sea as a clothing item with symbolic mythological value.

2.2 Al-Kufiya: Meaning and Roots

Centuries later, with the arrival of the Prophet and the beginning of the rise of Islam, the city *al-Kufa* (Iraq) became the cultural capital of Islam. It was the center of production of weapons and textiles for the region. (El-Hakim, 1989) Due to the Muslim's focus on clothing and hygiene as per the Prophet's guidance, the textile industry grew and prospered. It was during that period that the first mentions of a new item of headwear named a*l-Kufiya* started appearing, the earliest that could be traced back through ancient referential text.

(Al-Obaydi, 1981) As it appeared in James Silk Buckingham, British author and traveler also described, "Arabs of the desert stand out, are differentiated with their *Kufiyas* of silk and cotton. (Buckingham, 1969)

There is a debate around the source of the word, its meanings and genesis. Reinhart Dozy, was the first Western historian, a Dutch scholar of Arabic language, history and literature of French origins, to transcribe a dictionary of Arab dress, a reference until today. His *Dictionnaire détaillé des noms des vêtements chez les Arabes (1984)* stamped Dozy as one of the most learned and critical Arabic scholars of his era.

> In it he described the *Kufiya* as "a piece of cloth that is worn on the head. It has an equal length and a width; it can have different colors, generally dark red or light green and yellow with strips that can be wide or narrow. On both of the opposite borders it has fringes composed by soft cords and bunches. The most common *Kufiya* is entirely made with cotton while other kinds are made with silk cotton or gold silk cotton. Males wear it. The cloth is folded diagonally and is placed on the top of the head in order to have both folded sides dropped on the back and the other sides on the forehead. A piece of linen or a turban is wrapped around the head over the *Kufiya*." (Dozy, 1845)

This description still holds true today with certain traditional-wearing techniques similar to Dozy's described imagery.

Conversations with several Arab language specialists including Ghassan Shedid, argue that Dozy's inference that the word *Kufiya* was derived from the Latin word *Coiffie – Cuffia* in Italian, *Cofia* in Spanish, *Coiffe* in French) denoting hairdo (Dozy, 1845) is actually false; the opposite being true.

They explained that the Latin European word was actually a derivative of the Arab word due to interactions of merchants and sea trade across the Mediterranean. By referring back to old Arabic manuscripts, they confirmed that the *Kufiya* took its name from the city of *al-Kufa*, the first instance of the word appearing there. Origin of the word *Kufiya* comes from *Takawouf Ala al Ra'ess* which literally means "gathering on the head" in Arabic. *Al-Kufa* is said to come from *Takawouf wa al Ramel*, meaning "gathering of soldiers and/or sand." *Yatakawaf,* the verb, or "placing parts over each other" denotes the way it is worn on the head --- gathering of cloth.

Something to further highlight this point and reconfirm the outcome of the debate over the word origin was the following example in etymology --- various textiles word origins can be drawn from areas and regions from that period --- *Atabi* and *Baghdadi* come from Baghdad, a derivative of the Latin, Italian and French word *Buldaquin* or *Baldacchino*, literally meaning 'stuff from Baghdad', and from *Baldacco* meaning 'Baghdad', famous for its brocades. (Al Jader, 1985)

The popularity and widespread of the *Kufiya* was apparent; it was worn in the inner Arab Gulf states for centuries up until today. Not only was it very practical as an item, used to protect from harsh temperatures and sun, but also its pattern --- derived from ancient Mesopotamia --- was also very geometric and abstract, staying away from older mythologies or pagan religious pictures and un-Islamic representations. It communicated well the values of modesty, simplicity and piety that the Prophet and early Islam preached and that allowed it to be conserved and popularized.

Covering the head was a crucial thing at that time, not only for practical purposes but social and respectable status as well as masculine and social status. (El-Abidi, 1980) Bedouins for centuries had various head cloths, or *Amamas*, that were worn as turbans or draped on the head and shoulders. The latter usually came accompanied by the '*iqal*. The appearance of the *Kufiya* was more on the functional level, made with different production techniques and confirming the pattern we know today. Various colors - some with or without patterns - were used: white, yellow, red, black, and green to mention a few corresponding to various areas, tribes and times. The origin of the design, as established, can be drawn from early religious Mesopotamian mythology and yet was actually embraced by and during Islam. The symbolic aspect of the pattern was lost at that time, falling behind the shadow of aesthetics and weaving techniques and most of all overshadowed by the practicality of the function.

The patterns, if any, diverge according to various Arab regions, all-connoting a square head-cloth made from different material, according to wealth, position and climate conditions, and in a multitude of colors. White ones became popular in the Gulf, the black and white pattern prominent in places like Iraq and Syria while the red and white appears in countries like Saudi Arabia.

Due to the nature of Bedouin life as nomads, it was only natural that some of them reached the areas of what are known today as the Levant - Syria, Lebanon, Jordan and Palestine from the inner Arab deserts. Originally from the Arabian Peninsula, the headwear was initially worn by the people considered 'Arabs' historically. Since the time of the Arab conquests over 1300 years ago, the Bedouin have been idolized as the true fount of Arab culture – values, language and poetry. It can be deduced and traced, then, that *al-Kufiya* through its history, is inherently Arab and part of the traditional Arab culture.

2.3 Headwear and the Hatta in Palestine

Traditionally, both men and women were expected to cover their heads. Men were known to remove their headwear only to sleep. By association, the various Palestinian headwear connoted degrees of honor. Corresponding to what men were wearing on the heads, one could tell whether they were townsmen, villagers or Bedouins, creating clear social differentiators until the 1930s. (Weir, 1981) The urban villagers had a soft, small and rounded *Tarbush* accompanied with a turban or *Laffeh* made from cotton or silk and usually striped or checked in a variety of colors with a tussled fringe. The Bedouins that arrived from the inner Arab Gulf, the traditional nomads, were really differentiated by their headwear donning the *Kufiya* and *'iqal*. The *kufiya*, usually called *Hatta* in Palestine, was usually worn by the herders. (Khalidi, 1991)

The *Kufiya*, until that time, had no special connotation or specific symbolism beyond being a class and heritage indicator. It was purely a clothing item that denoted and differentiated according to social class and roots in alignment with Pierre Bourdieu's Logic of Practice theory, where he emphasizes the importance of the body and practices within the social

world. As an acclaimed French sociologist, he envisaged that working-class clothing practices were circumscribed by class and regional cultures. (Bourdieu, 1990) This was true then; the Bedouin, and *fallah* (peasant) usually was a goat herder living in rural areas. The use of the *Kufiya* and *'iqal* made sense with his lifestyle and heritage.

The area had been under Ottoman Empire rule and then part of the British colonization up until "the rebellion, which erupted in April of 1936 and ended in the summer of 1939, was the major anti---colonial insurgency of the century in Palestine – until the current Intifada." (Swedenburg, 1990) The *Hatta* was the key strategic weapon used by the resistance forces, composed mainly of peasants, to hide the faces and pass inaperçu, in the face of the big British colonizer. With the spread of the use of the cloth all over, Palestinians stood together in solidarity and protected their own – it was impossible to recognize the fighters from the

civilians then. The *Hatta* started carving a path of national collective identity at the expense of eradicating personal identity.

The story is retold – in many versions --- by many Palestinians, young and old, with romanticized nationalistic pride. The dream of the rise from the masses to the elite, from the rural to the urban, of a united nation. The *Hatta* up until that time and during its use in the 1930s was usually white. No references to the black and white pattern as prominent yet.

Photos leading up to 1948 show the eminence of the white *Hatta*. (Khalidi, 1991)

In asking an older Palestinian shop owner about the *Hatta*, he retold a story which happened during the Ottoman era in the beginning of the last century: Palestinians wore the *Hatta* in order to resist the Turks who forced them to wear *Tarbush*, especially employees who worked in governmental institutions, and this *Tarbush* represents the Turks heritage and it was odd to the people of Palestine, therefore they refused it, and insisted on keeping the Arab heritage and the Arab face of the city, by wearing the black and white *Hatta*. This story seems to date back to the Arab revolt - referencing the campaign Arab nationalists initiated in Damascus to distinguish between Turks and Arabs on the basis of *Tarbush* versus what was marketed as Arab headwear, or the *Kufiya*. (Winklehane, 1988) As a result, the *Tarbush* and *Laffeh* went out of fashion. At that time, references confirm that the *Hatta* in Palestine was white; memory can be selective, contradictory, influenced by later events or idealistic even. It was not only 'Palestinian' to wear the *Kufiya*, but it was also part of the bigger 'Arab' movement.

These events assigned a new meaning to the *Hatta* - representing unity nationalism and revolt. It would become a Palestinian symbol of togetherness, not so much related to any specific pattern, but because of its potential to be used as a mask and hiding faces and personal identity. Anthropologist Donald Pollock is concerned with how masks are able to convey meaning and identity and he aims to clarify how masking is effective in producing and altering social identities. (Pollock, 1995) This is a crucial point to keep in mind when re-looking at and trying to define *al-Kafiye*. Identifying with a design object that strips away personal identity and recognition for the greater collective belonging - who you are as a person becomes irrelevant in relevance to what you represent as a group.

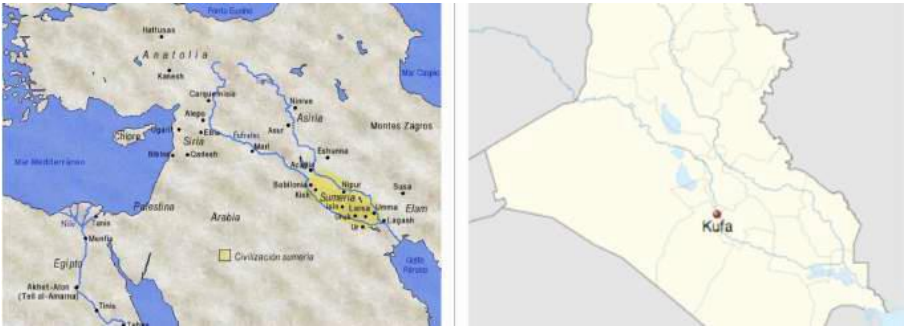
The 1960s and Yasser Arafat marked the true turning point of the *Hatta* and its final configuration into a Palestinian visual marker and sign. Arafat adopted the checkered white and black *Hatta* as his symbol, representing the Palestinian struggle, referencing nationalistic fusion not only internally, but globally. He projected the creation of such a powerful icon because its rich heritage, history and connotation were so powerful, both related to Palestine and Arabs. For the first time, the color, pattern and motif were of more significance than wear. Arafat was known never to appear in public without the Hatta; famous for the story that he used to wrap it around his head to look like the map of Palestine. He actually wore two, the other wrapped around his neck tucked under his shirt almost like a collar – potentially a precursor of the *Kufiya* as a scarf.

2.4 An Icon is Born- Nationalism, Identity and the Masculine

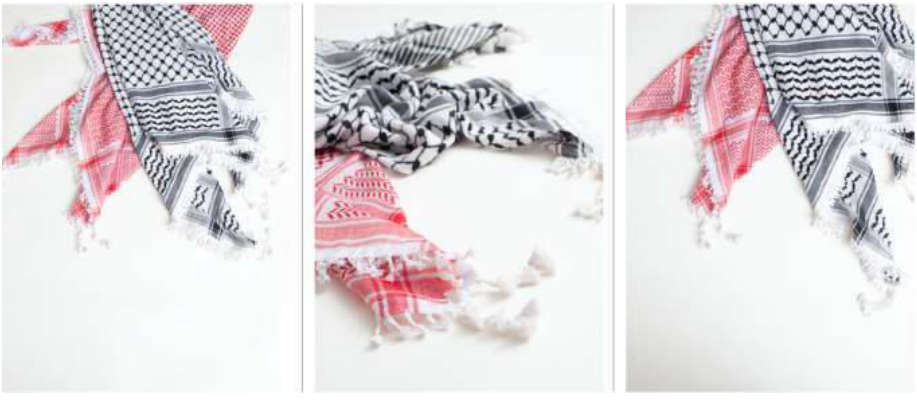
> "The Palestinian nationalist agent, in addition to being masculine and bourgeois-in-the-making, is young and able-bodied - free from the physical vulnerabilities of old age. "He" conceives (of) himself in terms of a group identity unifying him along with the *shabibah* (male youth) with whom he struggles against the occupation.
>
> The self-masking of many Palestinian young men (and some women), when confronting their occupiers (for fear of being identified and punished by the Israelis), contributes to the erasure of their individual identities and the emergence of a strong collective one. The mask itself is usually the Palestinian *Hatta* (the male headscarf or "*Kufiyyah"*), the symbol of Palestinian identity." (Massad, 2007)

This discourse tinted the *Hatta* with a masculine revolutionary edge, reaffirming the idea that it was traditionally male and emphasizing the need for powerful masculine symbols especially due to the fact that the Palestinians were emasculated by occupation.

Clothing usually helps perpetuate differences in personal identities, but this item does exactly the opposite – historically, traditionally and practically hides the individual giving it the perfect leverage to represent nationalism. In parallel to the definition of Palestinian identity and drawing similar evolutions, the *Hatta* moved into the 'Bourgeois' young circles and started being worn as a scarf in the 1970s. Joseph Massad, a Palestinian who grew up in Jordan, recalls a time in the late 1970s, when he was still in college, and his generation started wearing the *Hatta* as a scarf with Navy blue or Khaki military jackets with Velcro and felt and big army boots typical of military fashion. The trend of *Hatta* as a scarf started around then, appropriated as a symbol by the elite male Arab youth. This was a time riled with revolutionary Political activism and when it became an add-on as a symbol in that milieu. Now deployed within a nationalistic narrative, the iconography and graphic symbolism of the *Hatta* started infiltrating Political graffiti, art and posters and postcards, to mention a few from as early as the 60s and 70s.



(Figure 2) Left: Region of Sumeria; Right: In the year 17 Hijrah or 638 A.D. Al Kufa became the historical heir for the city of Heera as the center for the Islamic world



(Figure 3) Images of the traditional Kufiyas and their patterns



(Figure 4) Images of the traditional Kufiya worn by men in the Arab world today



(Figure 5) Prince Gudea of Lagash, whose statue can be found at the Louvre Museum, is said to be the first ruler to have worn the patterned headwear as one piece. He wore it in a turban style.



(Figure 6) Bedouins covering their heads from the sun



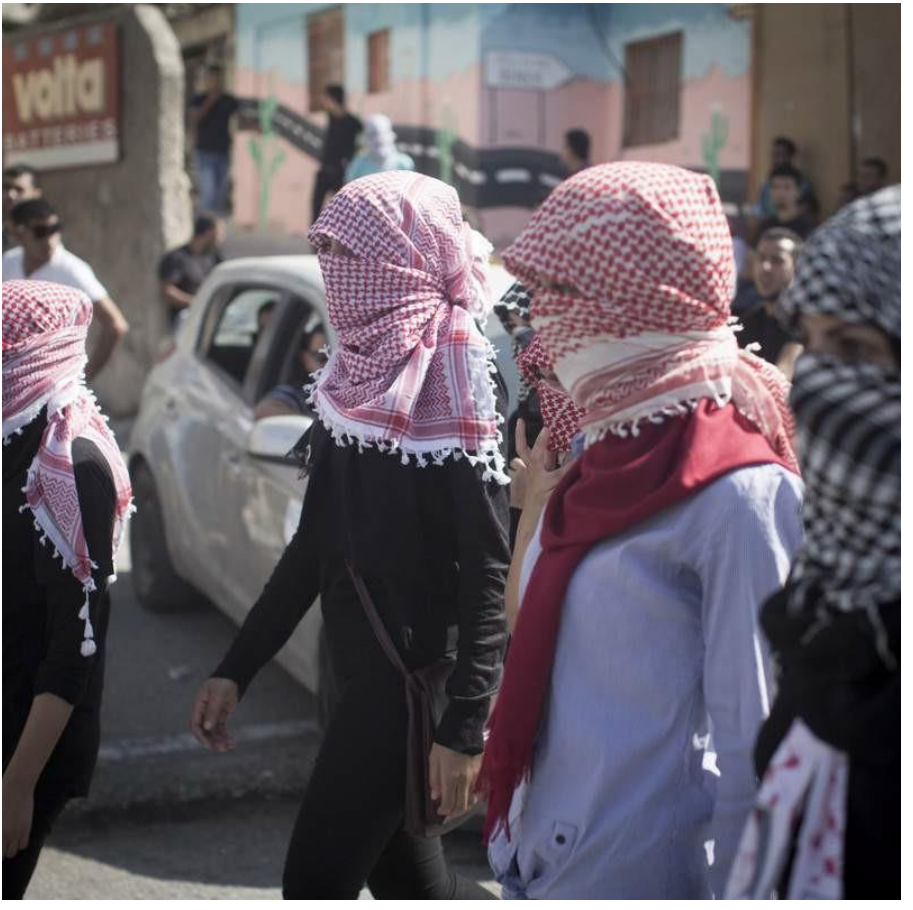
(Figure 7) White Kufiya worn by a herder with black ‘’iqal”



(Figure 8) Revolt of 1936, Palestine



(Figure 9) Yasser Arafat wearing the Hatta in his proprietary style



(Figure 10) Women hiding their faces on the streets using the Kafiye

3. Appropriation and the Scarf

As the youth in the Arab world adorned the traditional *Hatta* as a scarf in support of the Palestinian cause, it was appearing in other places around the world as well in that format. Cultural appropriation in no new concept, especially related to fashion design. As cultures exchange, societies develop, and identities grow, the *Kufiya* moved from acting as a headpiece to becoming a scarf on a functional level and the *Hatta* a symbol beyond just function. Becoming the precedent and inspiration to the modern *Kafiye*, the *Hatta* still holds its grounds.

The *Hatta* giving rise to *al-Kafiye* narrates a different experience. The core traditional item does exist, is tangible, accessible and meaning---ridden. It has given rise to a multitude of styles and variations with no name consensus not even an umbrella concept of exoticism. Perhaps the most visible common thread is its aesthetic and function, a square patterned scarf.

According to Kader Konuk, Ethnomasquerade implies the duplication of ethnic identity through the "imitation of clothes, appearance, language or other components of culture." (Kader, 2004) Through Ethnomasquerade, mass culture simultaneously exercises and hides its authority over the colonized Others, Arabs in this case. The idea of Ethnomasquerade is closely related to critical theorist Homi K. Bhabha's concept of mimicry. (Bhabha, 1984) Bhabha identifies a certain phenomenon of identity construction in the colonial context. Mimicry is an imitation that is "almost, but not quite" the same as the original. Colonial mimicry is the desire for a reconstituted, recognizable Other. *Al-Kafiye* is a perfect example– adopted as a scarf in the west it was repackaged and sold as a 'must-have accessory'.

Consumer capitalism adapted one of the most challenging propositions of Arab culture and reconstituted it as a consumable item, or tried to, for monetary gain. Today, most *keffiyehs and keffiyeh*-adjacent scarves are mass produced in China, even those worn in the Arab world.

3.1 Political Symbol Beyond the Literal

Ideals and politics are fashionable. With time, lack of knowledge and various appropriation, political symbols, groups and individuals have achieved notoriety, at least commercially. The most famed is *Che Guevara*, whose stylized face portrait by Irish artist Jim Fitzpatrick based on a famous photograph by Alberto Korda, was plastered across an array of mass-produced commercial items – from t-shirts to mugs to bags to flags to posters to bikinis and the list goes on.

There are many sides to every story, but only one that is romanticized through marketing and advertising. The general appeal of Che was his image as the "countercultural revolutionary" and his motivation to fight imperialism as a result of the widespread poverty he witnessed as a young doctor in South America. Conjuring idolized impressions of revolution, rebellion, humanitarianism, and a fight for freedom and justice, he leads on generation after generation of followers around the globe. Nicknamed the "Butcher of La Cabana" after his part in overseeing post-revolution executions in Havana, this side of Che is not publicized. Numerous Cuban exiles even insist that he developed into a ruthless killer and Fidel Castro's right hand before his death. (Humberto, 2007) In critic and designer Steve Heller's book The *Swastika: Symbol Beyond Redemption*, he tells the story of the most global negative icon ever. That did not stop "stupid applications of the Swastika today – like in 2006 when Hong Kong fashion chain, IZZUE, produced a range of T-shirts and pants with Nazi symbols printed on them." (Heller, 2008) Shock effect, lack of knowledge or ignorance leading to misappropriation?*Al-Kafiye* mirrors the Che symbol in some aspect as it rose to

represent non-conformism and embodied revolution across a range of causes– anti-war, pro-green, feminist protest, black movements or anti-globalization. Quick to be spotted in rallies around the world, *Kafiyes* were draped around shoulders and grew to become accessories and accompaniments to causes. Palestinians intrinsically link connotations between the *Hatta* and Che logo. Many proudly claim the two "go hand-in-hand." Youmna K., an American Palestinian, explains how the logo is present all over Palestine, "Che drawings can be seen on many walls here, there is even a famous picture of Che wearing the Hatta. We feel that we stand for similar issues. We want justice and change just like him."

Someone else who sought change was Barack Obama, who according to critic Naomi Klein is "the first US president who is also a superbrand." She goes on further exploring the idea of "the transformative political movements from which he has borrowed so much (the pop-art posters from Che, his cadence from King, his "Yes We Can!" slogan from the migrant farmworkers – si se puede)" are the foundation of commercialized globalization, the roots of mainstream political mainstream. (Klein, 2010)

Al-Kafiye might have similarities in uses and ideology with strong political markers but it remains an item, object, icon. It was always an object, not objectified. Arafat helped ground a new narrative for the *Hatta*; he never replaced it. There is no real face behind the cloth but the ideal concept of a culture and an ideology. There is no one to worship, love, follow or hate. It is a means rather than a personification. That is where its paradox lies, and perhaps part of its success and popularity. It is universal in its design, material and embodiment of revolution. As timely today as ever.

3.2 From Street Cred to Style on the Street

"*I speak through my clothes*" Umberto Eco

Media theorist and sociologist Dick Hebdige makes a case in his book, *Subculture: The Meaning of Style*, that the diverse subcultures in Britain of the 50s, 60s, and 70s embodied the volatility of cultural objects. (Hebdige, 2008) Subcultures – like Mods, Punks, or Skinheads – appropriate symbols, items and music from ethnically disparate groups to distinguish themselves from their original culture. Avant-garde significance of a subculture relies on the extent of objects, commodities, and signs from one culture are drastically sabotaged or altered in another. David Howes explains that mass culture and "businesses often seek to capitalize on the subversive allure of subcultures in search of 'Cool', which remains valuable in the selling of any product." (Howes, 1996) This circular process provides a constant stream of styles, which may be commercially adopted as subcultures evolve or die and its members adopt new alien non-mainstream styles.

"I spotted the black-and-white *Kufiya* way back in the 80s in London. It was worn by a group of punks and they just looked dangerous. I guess it represented a powerful statement then. Now I see it all over in bright colors, it seems more hipster." Mo Sadek, a Lebano-Iraqi creative director, has been travelling from the Middle East to London on a yearly basis for

more than 20 years. “It has been a crazy phenomenon to observe. Here is an item that my grandfather used to wear with pride and now it is around necks of Western teens. They don’t even know where it comes from and what it really symbolizes. They just want to look revolutionary.”

If the *Kufiya* did manage to infiltrate Western (US and European) Subculture at some point in the 70s and 80s, there is no question that in the last decade, in its colorful variations, it has managed to penetrate the mainstream market. It could be bought on street corners all around New York and in Portobello market, St Marks and Camden in London and sold at stores like Urban Outfitters and TopShop.

3.3 Catwalk and High Fashion

Infiltrating the world of high fashion and appearing on catwalks, the *Kafiye* was appropriated and redesigned by top notch Fashion designers both in the West and then re-appropriated in the Arab world. Although China is currently the leading mass manufacturer of the fashion scarves today, some hand-woven bespoke iterations of the *Kafiye* can be bought for thousands of dollars today.

The most acclaimed appearance was when French fashion designer Nicholas Ghesquiere used the Kafiye in his Fall 2007 fashion line for Balenciaga. He utilized multiethnic fabric references—Eastern European folk embroideries and African, Peruvian, Mongolian, and Balinese patterns in his show. The scarf was a reworked version of the *Hatta* in silk detailed with a gold fringe of coins. The scarf retailed for around 570 British pounds.

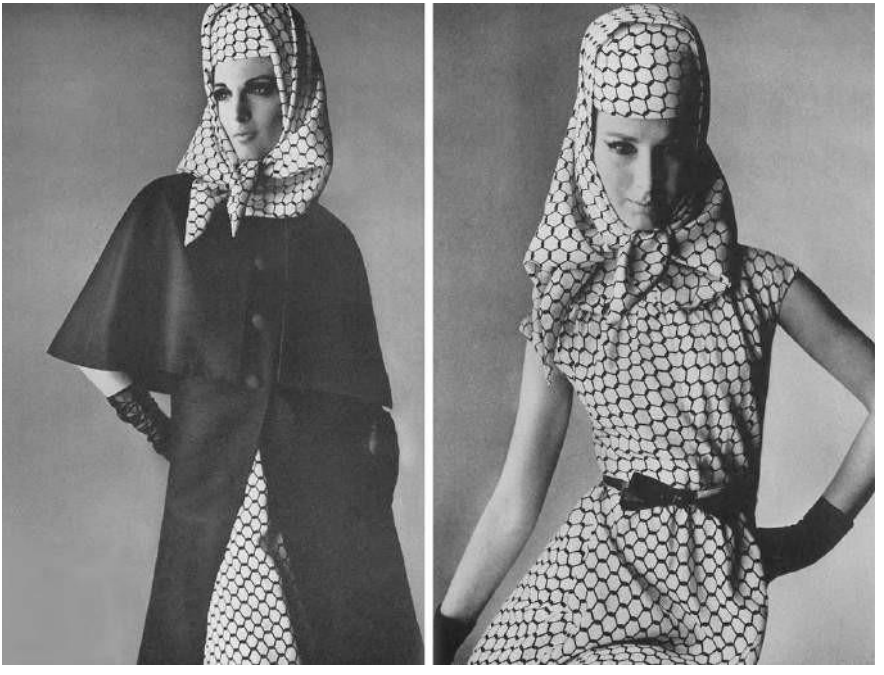
Raf Simons, controversial Belgian designer, featured it in his menswear Spring Summer 2002 show, inspired from riots, confusion and signs of silent protest expressed by “the post-millennium youth.” White oversized slogan filled t-shirts were paired with patched hooded jumpers while *Kafiyes* concealed their faces. Other notable references include a 2010 collection by Givenchy, a 2015 line by Chanel and an ongoing fashion collection by Danish designer Cecile Copenhagen.



(Figure 10) Chinese-made Kafiye style scarves on the streets of Manhattan close to Astor Place



(Figure 11) Kafiyes in protests all around the word



(Figure 12) Hatta patterns appearing in Vogue in 1965



(Figure 13) Appearing in American popular culture Left: Sarah Jessica Parker on an episode of Sex and the City; Right: Recommended scarf style in a magagine



(Figure 14) Left: Che and the hatta by Carlos Latuff; Right: Kafiye style colored scarves in Greenwich Village Manhattan 2012



(Figure 14) Nicolas Guesquiere for Balenciaga runway in 2017



(Figure15) Jeremy Scott Runway, S/S 2013



(Figure 16) ThreeAsfour Runway, Insalaam Inshalom, 2012



(Figure 17) Chanel Cruise Collection Runway, 2015



(Figure 18) Cecile Copenhagen, 2020 collection



(Figure 19) Givenchy Advertisement, S/S 2010

5. Defining al-Kafiye: The New Rules

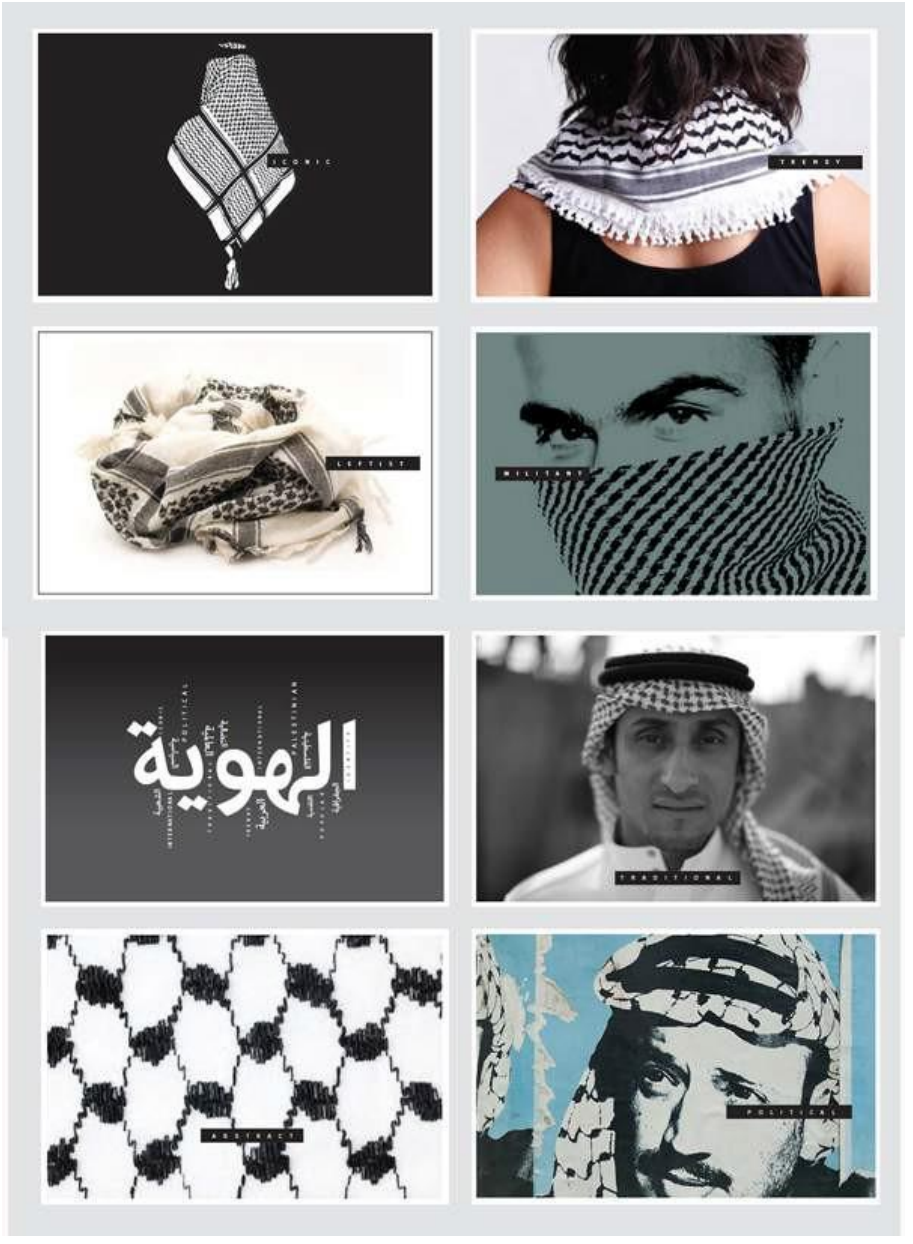
Al-Kafiye today is the face of the new young contemporary revolutionary visualized from the Arab world- from Arab Spring to protests and revolts that are emerging in waves all over the world. Just like this personification, it may have moments of identity crisis and external influences, but it always is connected to its roots and heritage. It may be appropriated, stereotyped and attacked at times and yet to be able to move forward and maintain its core, it needs to set its new rules. Reclaiming al-Kafiye is all about knowledge, education and discourse. Beyond a mere object, al-Kafiye represents a whole interconnected visual phenomenon, one that keeps on growing and morphing with political, economic and social influences. It denotes a wave of Arab revolt that is universal.

Creative dialogue is just one of the possibilities for this indisputable powerful symbol; we need to ensure its evolution through education and conversation. Its influence and 'Arabness' is key and yet the spread and understanding of these core elements are what make it an icon. In a society where consumption has become disposable, and items are being thrown out, al-Kafiye has managed to still infiltrate various levels of culture and prove it is not going anywhere. The key to its future is in its preservation– where it comes from and what that means to open up an array of possibilities on where it can go. It's time for a new narrative for Arabs, to return to the original definition of this symbol that could not silence its message of the fight for hope.

5.1 Drawing the Line: When does a Kafiye stop being a Kafiye?

A Kafiye stops being a Kafiye when the misappropriation becomes louder than its message. It is important to preserve its cultural heritage and cut through the confusion and noise. There are many experts in the Arab world yet little connection, interaction and information flow between the various countries and their information, both regionally and globally.

Preserving, studying and contextualizing cultural designs is crucial. Jean Baudrillard said, "Only an analysis that emphasizes the logic of symbolic obligation can make sense of this confrontation between the global and the singular. To understand the hatred of the rest of the world against the West, perspectives must be reversed. The hatred of non-Western people is not based on the fact that the West stole everything from them and never gave anything back. Rather, it is based on the fact that they received everything but were never allowed to give anything back. This hatred is not caused by dispossession or exploitation, but rather by humiliation." Al-Kafiye offers that chance, if anyone is willing to take it.



(Figure 20) Series of postcards developed by the author in collaboration with designer Tarek Atrissi to explore identity through the different faces of the Kafiye. These postcards were part of an exhibition Beyond the Cloth: The Kafiye Project curated by the author.

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Hala Abdel Malak is design scholar, curator, educator and strategist. Born in Beirut during the civil war, she grew up, worked, and studied in Lebanon, USA, Canada, UAE, Holland, UK, Morocco and France. Hala's multicultural background is reflected in her versatile diverse approach and interest in culture, learning, knowledge and expansion of consciousness where she has continuously transcended stereotypes and challenged the status quo. Her interdisciplinary experience combines management, strategy, content, curation, leadership, research and communication with design in the for-profit and non-profit worlds, as well as research and education across four continents. Hala is an avid art, design, nature and music lover with a passion for social change, cultural identity exploration and the power of ideas through creativity. Hala is an Assistant Professor of Design Strategies and Director of the Strategic Design and Management BBA program at Parsons School of Design in New York.

Acknowledgements:

I would like to thank first and foremost my parents George and Yvette Abdel Malak for their extraordinary belief in me and unrelenting support in every

endeavour I have embarked on over the years. Especially my father for the long nights of support in translating old texts from Arabic.
I was lucky to stumble upon the great mind of Ted Swedenburg whose input was invaluable to this work, so thank you.
A shout out to my many colleagues and friends who have heard continuous discussions and presentations about the Kafiye and the Arab World and have always listened intently and given me great constructive comments.
Thank you to every single person who helped me on my journey from librarians to journalists to historians to designers and many others. I can't express enough deep gratitude towards everyone who took time off from their busy schedule to talk to me, answer my emails and get interviewed.
Lastly, thank you to Paola Antonelli, Michelle Millar Fischer and Alexandra Midal for including my work on the Kafiye in the MOMA exhibition, abecedarium and book- *Items: Is Fashion Modern?*

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Beyondstories. People Narrative makes a Territory

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Abstract | Beyondstories is a system to rewrite the historical and becoming identity of a territory from an internal point of view, through inhabitants' experiences, voices and anecdotes. Urban stratification is revealed by translating recorded voices of citizens - the physical "human data" - through a digital visual grammar. Stories mixed with history come back to the context with cultural narrative paths that use architecture as a substrate for immersive technology.

KEYWORDS | SYSTEMIC DESIGN, COMPLEXITY STRATEGY, DIGITAL CULTURE HERITAGE, IDENTITY, TERRITORY, SELF-REPRESENTATION, NARRATIVE, LANGUAGE, GRAMMAR, CONTENT ANALYSIS, COMBINATORY, AUGMENTED REALITY, DATABASE, VOICES, AESTHETICS, EXPRESSION, VISUAL

1. Introduction

In our research, we started from the conditions of territories and the relationship between people and territories in the age of complexity. Urban areas are rapidly changing due to gentrification, globalization, and mass tourism phenomena. In a lot of cities, especially in Mediterranean, identity "is not perceived as an alive and shared feeling" (Casalini, 2016) anymore.

"Polis is a web of relations" (Lledò, 2019) and identity is related to the people that live a specific territory and to the way they connect and communicate with each other. Territory is made of language. In a complex system, "to know is always a result of a dialogic combination." (Morin, 2019). In semiology, "umwelt" is our subjective universe, a perceptive environment of my surroundings. "When two umwelten interact, this creates a semiosphere" (Semiosfera, 2019), a habitat where it is possible to reach common sense from different expressions. Territory is always an interaction between languages. We give meaning to what we perceive thanks to the encounter with the other.

Encounter is a bedrock for the development of a community. We feel belonging to our territory if we live together with other people and we socially identify with our habitat. The endurance of our relational web depends on the empathy that we feel for our neighbours. In the past, myths and classical literature let people be able to recognize neighbours' feelings. Narrative archetypes worked as other "recognition figures" (Galimberti, 2019).

Nowadays, we lost some of these narrations and we do not socially identify with each other. In order to rebuild this relationship, we need to produce new narratives about territories or to find a way to revitalize existing ones. Our design strategy therefore identified narrative as a method of regenerating urban macro and micro territories and stimulating the recovery and maintenance of identity belonging.

Narration is the act of telling a story, where the language is a medium. Narrative is rarely investigated as a way to spread a new language. In our research, we studied how narrative can develop territory belonging and diffuse a sense of recognition in a community. In a story timeline, normally there is a transformation, a passage from a state to another. The sequential nature of narrative could be a way to express identity, intangible entity in perpetual change. People are "stories-holders" (Marcolini, 2019), so territory identity can be expressed by stories of people collected within the context.

We focused on how to promote human life stories, morphing a stratified maze of data in a connected network. In the 4th Industrial Revolution era, we view big data management as a chance to weave a network of stories, people and places. Our goal was to structure a solid system that could inject some life back into cultural heritage, involving people in terms of imagination and civic participation and supporting the local economies.

The main purpose of designing a system is to design a process that could proactively involves people and fits across time and in different spaces, as a sustainable format.

Following a systemic approach, we gave birth to a grammar structured in acquisitive, compositional and compilative logics held together by a team of experts and relationships that provides cyclical interventions on the context. The results are shown up in the form of concepts able to translate the grammar and logics designed. Systemic design was used as a method capable of giving life to a project in which the technological component (digital or material whatever it is) is always accompanied by a strong human presence. Culture cannot be separated from its context and from the language of those who live the context and experience culture. Beyondstories is a project that shows how expressions from the contexts can be a driving element of the cultural process.

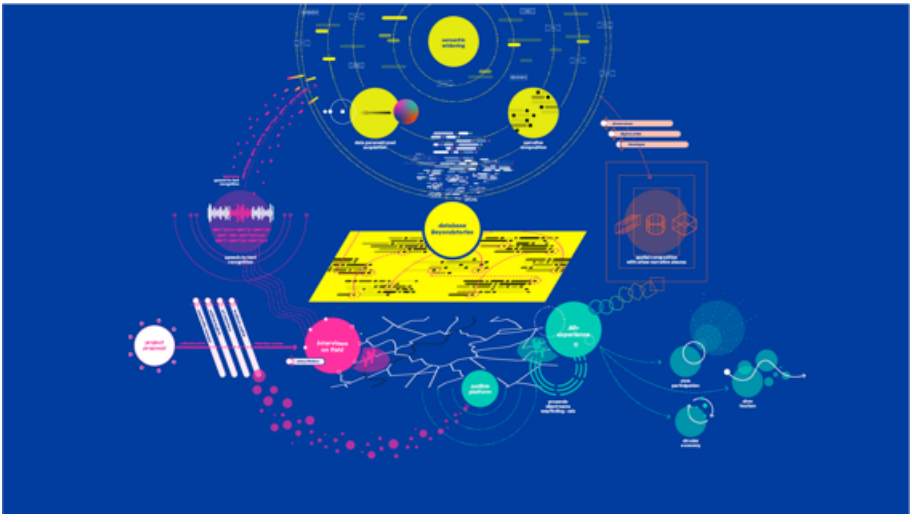

Figure 1. Beyondstories: Systemic map that shows actors, logics and the circular process from context to context.

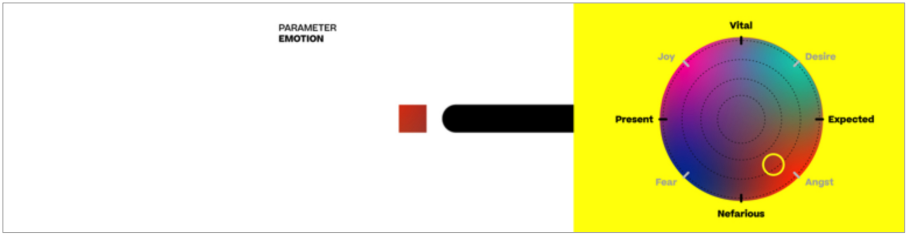

Figure 2. Beyondstories: Parameter Emotion. The poles from which the infinite emotional nuances spring up concern the perceived sensation (vital-nefarious) and the temporal connotation (present-expected) of emotions.

2. Beyondstories: A Narrative System

Beyondstories is a framework to rewrite the historical and becoming identity of a territory from an internal point of view, through inhabitants' experiences, voices and anecdotes. Urban stratification is revealed by translating the physical "human data" through a digital grammar, coming back to the context with narrative paths that can be experienced by audience through immersive channels (e.g. nowadays geo-located podcast, videomapping or augmented reality). Narratives are set up starting from a database composed of the stories told by the inhabitants of the context, collected, processed and translated according to a set of design logics.

Each people' specific stories are modules brought together in a composed collective history. As a language, every single part interacts with each other and creates new elements. The recurring and shared elements are highlighted, maintaining the heterogeneity of the singularities. The entire process must be iterative: the onward addition of new points of view will shape an open story. New looks will produce new meanings, keep track and take care of emerging behaviours.

Finally, the composed narratives are re-proposed to the inhabitants through physical-digital channels: a network of paths that can be experienced through augmented reality and an interactive geo-located podcast platform, an open use of the database to the public.

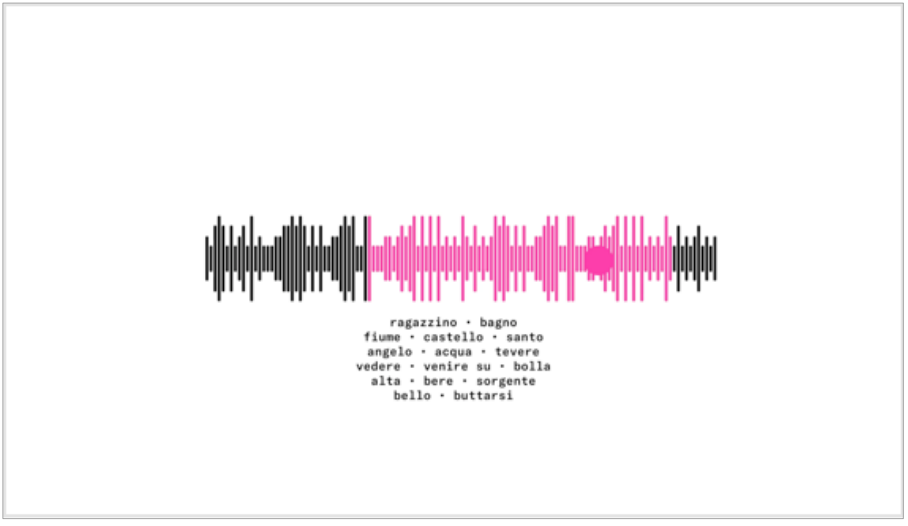

Figure 3. Beyondstories: Putting keyframes on recording audio isolates a micro-story from the entire interview.

3. Beyondstories: Territories Acquisition Through Stories

The distinctive character of a territorial context lies in its human heritage, a community that must be preserved, enhanced and narrated, in order to bequeath its peculiarities and keep its identity dynamic. Due to its nature, a context should be depicted mixing history (universal and verified facts) and stories (particular and specific anecdotes).

Beyondstories makes facts, events and people not historicized talk, enhancing the peculiarities that emerged from historiographic research and freeing the canonical tourist routes from mass crowding. The cultural use of a context would thus extend to any stratified street, square and corner, without remaining closed in the habitual monuments and points of interest.

As a first step of our research process, we focused on specific areas and topics to be explored. After that, we established that stories should be searched using a field research method, looking for direct expressions from the context and about the context itself. In the end, we looked for patterns and recurring elements from the collected data that can become parameters of a wide and structured model.

3.1 Focused field research

The Beyondstories system starts with a co-design process, in which designers have roles as mediators. Designers map the urban context chosen, in order to highlight topics and places where the research will be focused on.

Results are discussed with experts of various disciplines concerning a relationship with territory and ethnography. Art historians will help in rebuilding the historical urbanistic context, anthropologists will give advice on how to approach the context inhabitants, community managers will be the spokesman for the needs and suggestions of the neighbourhood committees or civic associations.

From this collective briefing designers draw an interview canvas out that will be assigned to the story-finders, figures who will be in charge of seeking stories through research sessions on the field. The stories from the context will be acquired as audio recorded material, through narrative interviews sessions organized in the research context.

The narrative interview is a methodology theorized by Robert Atkinson (Atkinson, 2002) based on an empathic ascetic process that establishes ever deeper levels of confidentiality with the interlocutor. Every single story is the result of a relationship that is established between the interviewer and the interviewee, and takes shape between a smile, a commotion and any other emotional nuance.

We tested narrative interviews on field, acting as story-finders in our field research prototype. Referring to the artistic design philosophy of J.M. Basquiat called Boom for real, we introduce ourselves to the people interviewed as a research group named Boom for

Rome. As Basquiat breathed and absorbed signs, smells and sounds of his city in order to express them in his artworks, we tried to enter the Roman urban substrates in order to absorb stories, emotions and cultures.

The prototype Boom for Rome was organized in several interviews sessions that have been collected in places in Rome that share a high grade of sociability, current or in decline, and historical stratification. Our choices fell on the social and habitative center Spin Time Labs in Via Santa Croce in Gerusalemme, on the area of Rione Ponte and on the areas surrounding Piazza Navona.

The questions of the interviews were designed to encourage people to tell stories about their relationship with the territory across the timeline past / present / future. As an example, we asked “Why are you here?”, “How was this place twenty years ago?”, “What does this place remind you of?”, “What would you change or add to this place?”.

Each person interviewed shared precious stories and anecdotes, which contributed to create more specific and focused questions. We worked on how to interview. Every time that we came back on field, we fixed our interview process, and we found recurring topics and patterns. Analysing the results of empirical experience, we have thus designed guidelines that can be applied to different acquisition tools and models

3.2 Qualitative voice recognition

Nowadays, automatic speech-to-text recognition and manual unwinding are the main ways to get a transcription from a recorded audio. Speech-to-text recognition is fast and increasingly precise, but it has limits in the restitution of a narrative content, not providing indications in emotional terms. The unwinding allows a more qualitative analysis of a text/audio, but it is a slow and expensive process.

In order to provide technological support to the physical action of the story-finder, we designed a model divided into steps, with the aim of obtaining qualitative and narrative data from voice recognition.

1. During the interview, the story-finder puts keyframes of fixed duration (2-3 minutes). The keyframes are parts of the entire story that become autonomous micro-stories, with narrative value and - if possible - a self-concluding sense. Each micro-story is an agglomeration of the words that composed it;
2. Each micro-story is analyzed by voice recognition, enhanced by the addition of three parameters: Time, Narrator and Emotion.

- **Time:** Compared to the time x of the interview, what time y does the narration refer to? The “present” axis is not at the centre because - based on field research results - it emerged that memories are prevalent within an interview;
- **Narrator:** Does the person talk about himself (selfdiegetic), his context (homodiegetic) or with an observer's eye (heterodiegetic)?

- **Emotion:** Towards which axes does the emotional substrate of the narrative tend? Emotions are shown as configurational situations, resonances of human behaviour, not polarized and with a nuanced nature. The poles from which the infinite emotional nuances spring up concern the perceived sensation (vital-nefarious) and the temporal connotation (present-expected) of emotions. Time and narrator parameters come from Genette's studies on narratology ("Gerard Genette", 2019). The emotion parameter is a union between Lisa Feldman Barrett's neuroscientific studies (Della Rocca, 2019) and Umberto Galimberti's philosophical analysis (Galimberti, 2019).

3. Adding the three parameters, every word of each micro-story is categorized and expanded semantically. Each word will have a wide range of connections with other words and at the same time a more specific connotation depending on the parameter. All the micro-stories, divided by topic and categorized by parameters, create the Beyondstories database.

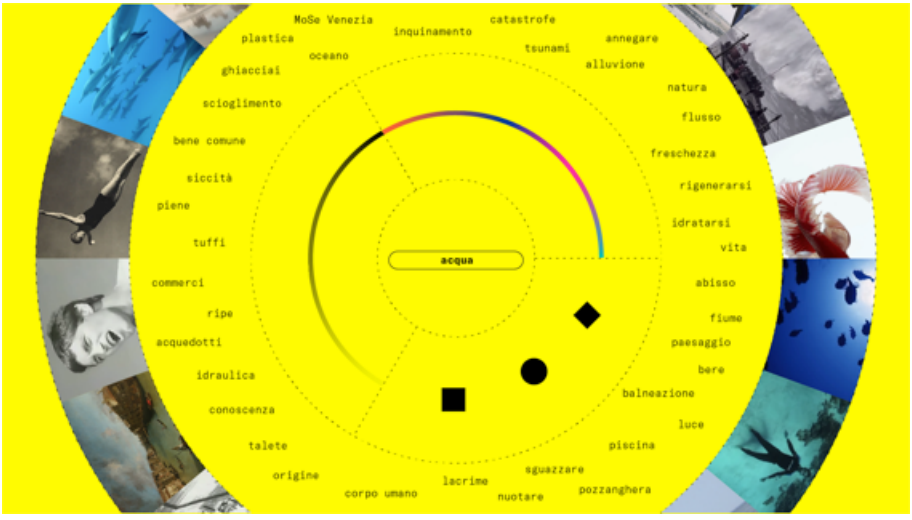

Figure 4. Beyondstories: Semantic widening. Each word will have a wide range of connections with other words and at the same time a more specific connotation depending on the parameter.

3.3 Visual code

To deal with the amount of information contained within a single audio file, it was necessary to develop a visual code that took into account all the acquisition parameters and easily concentrated them in a graphic display. A micro-story is represented as a cloud of words. The single word is represented by a long stroke and a short stroke. The amplitude of the long stroke is determined by the semantic connections of the word, while its transparency is dictated by the temporal parameter (the more a word is linked to a past tense, the more transparent it will be).

The morphology of the short stroke communicates the type of narrator: square if selfdiegetic, circle if homodiegetic, rhombus if heterodiegetic. The gradient of the short stroke transmits the emotion parameter: gradient from blue to green refers to the present-expected axis, the gradient from magenta to orange refers to the vital-nefarious axis.

To ensure a rectangular morphology and the slender shape of the module, the words are arranged on six vertical lines with a fixed horizontal line-spacing. The short stroke is located on the right of the long stroke. The distance between short and long strokes and between individual modules is constant. The final configuration of each micro-story is a pattern of lines and points that resembles a cloud, a slipstream.

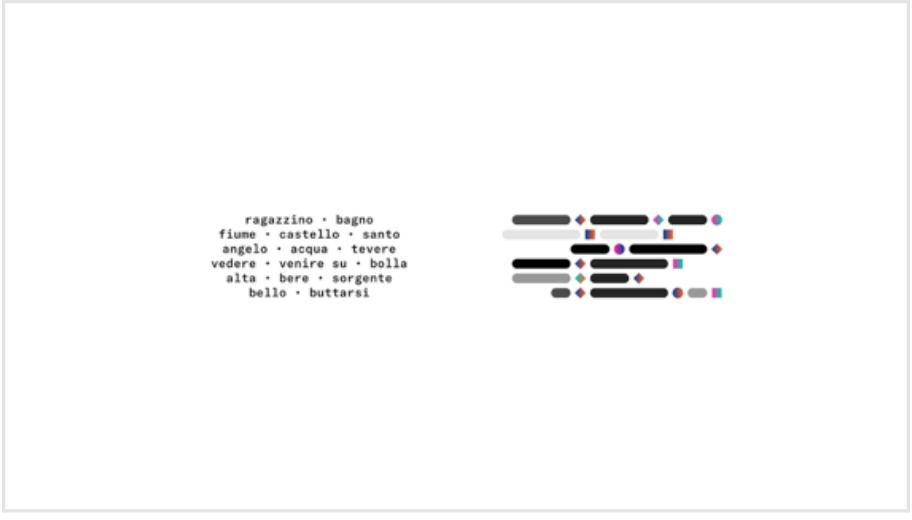

Figure 5. Beyondstories: Each micro-story is an agglomeration of the words that composed it. Through the visual code, the final configuration of each micro-story is a pattern of lines and points that resembles a cloud, a slipstream.

3.4 A narrative database

At the end of the acquisition phase, each micro-story will be composed of parameterized and semantically expanded words. Collecting an unlimited number of stories, a narrative database comes to light. “Database and narrative are natural enemies” (Manovich, 2002), but they are joined together by the language as an “archive of elements from which people assemble the linear utterances of speech” (Lupton, 2015). Micro-stories so become the elements of the new language of the territories.

From the elements, to the speech. By transitive property, the connections between words also become connections between micro-stories. Database starts being not only a way to gather parameterized fragments, but also a way to easily join a various number of them united by the same topic in a wider screenplay: the “beyond-story”. The continuous update of fragments makes the narrative combinations infinite.

Facing an indefinite number of contents coming from reality, Joyce and Woolf's a-synchronic narrative (Gorlier, 2019) and the combinatorial narrative studies of Calvino and OuLiPo (Martines, 2019) inspired us on how to translate a multiplicity into a composite narrative flow with meaning.

The next step is to move from an intangible database to a concrete experience. A beyond-story becomes a physical narrative path. The connections between micro-stories become connections between places. Urban aesthetics supported by a non-invasive technological intervention becomes the ideal medium for narrating stories of the context.

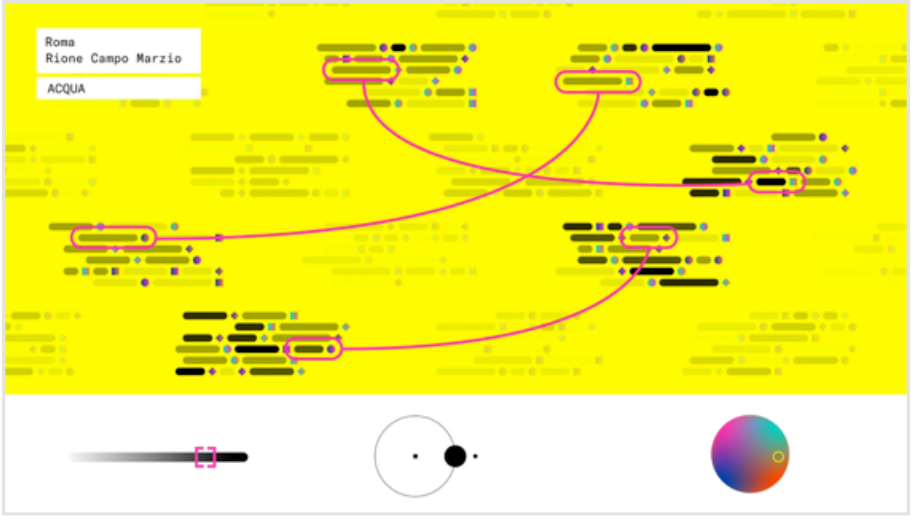

Figure 6. Beyondstories: In the database, connections between words also become connections between micro-stories.

4. Composition: Stories through Space

Considering territory as an open narrative entity, we faced how stories could remain and contribute to amplify memory context itself. Generally, memory has an organic and configurational nature (Yates, 1972): memories set up and fixed on places where they took origin (Yates, 1972). In the same way, composed narrations should return to the place from which originated.

Coming from different voices and times, various stories coexist in the same place. That place becomes a heterotopia, a “different place” (Foucault, 2011) where pairs of opposites - e.g. inside and outside, real and imaginary - coexist within a “habitable threshold” (Moca, 2019). The threshold takes on a dual and ambiguous nature, a conscious dream *reverìe* (Moca, 2019). Enhancing beauty and potentiality of urban thresholds as architectural discontinuity and patterns, cultural heritage pass through an augmented reality itinerary in stages.

In the composition phase we focused on space. Every beyond-story must be translated from audio to visual language and then laid down on reality. We built a grammar, an abacus to give a set of possible narrative configuration of the space, to let the architecture talk. Stories become markers, digital-physical checkpoint that can be experienced along the urban context through an audio-visual immersive path.



Figure 7. Beyondstories: Stories become markers, digital-physical checkpoint that can be experienced along the urban context through an audio-visual immersive path.

4.1 Urban Narrative Abacus

A composed narration needs a dynamic grammar, whose elements can be combined according to flexible rules of narrative composition. The Urban Narrative Abacus is a set of possible compilations of the space available to the digital artists who will have to design the augmented reality visual experience.

In designing this new grammar, we took into account the pre-existing urban and architectural scheme and we looked for analogies between physical space and narrative cases recurring in a narrative. Heterotopias have been the medium for imagining the kind of interaction between content, spectator and background. As an additional level of translation, we assigned rhetorical figures on the level of meaning to each element of the abacus.

The digital artists associate the contents of each micro-story with an element of the abacus and creates 360° visual compositions for every checkpoint of the entire beyond-story. The digital artist will be supported by a developer for the final implementation phase of the process. Depending on the main parameter of the narrative, digital artists can treat stories with different styles corresponding to different tones of voice. As in Queneau's Exercises de style (Queneau, 1983), each path can be narrated with a different narrative genre.



Figure 8. Beyondstories: The Urban Narrative Abacus is a set of possible compilations of the space available to the digital artists who will have to design the augmented reality visual experience.

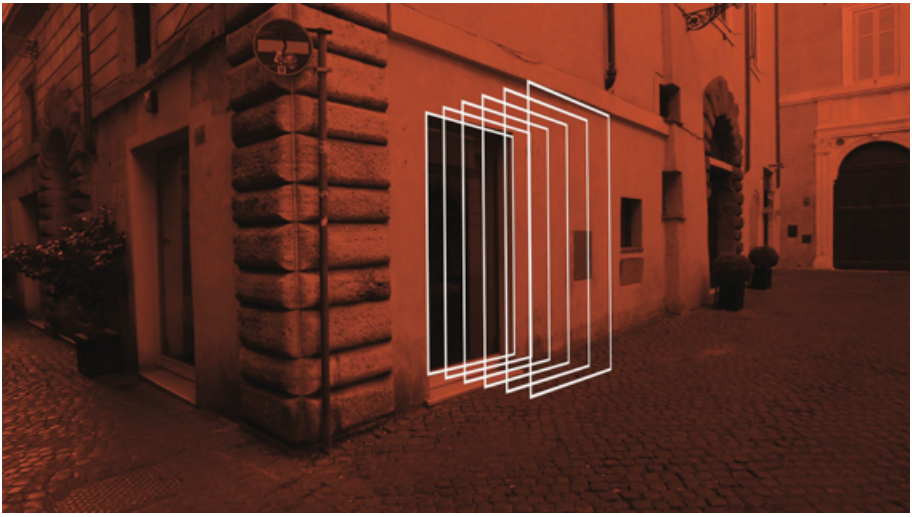

Figure 9. Beyondstories: Resonant Echo, one of the Urban Narrative Abacus elements.

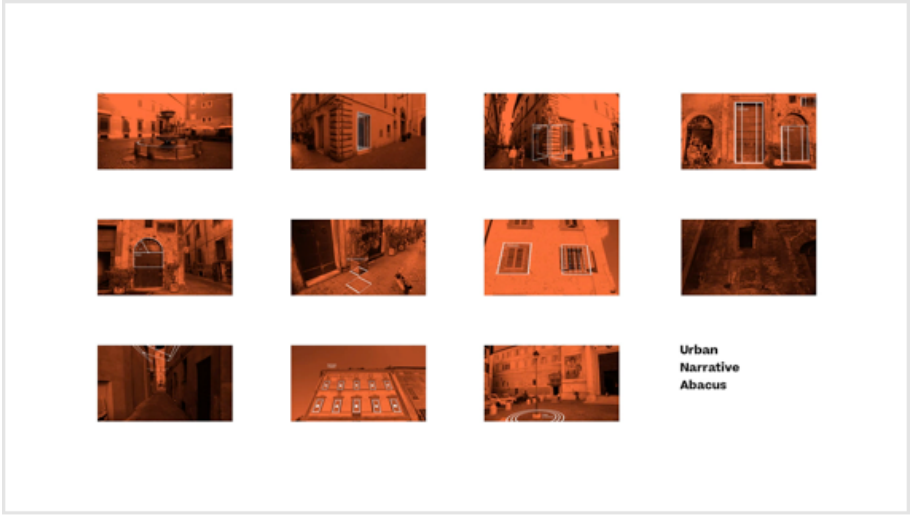

Figure 10. Beyondstories: The eleven elements of Urban Narrative Abacus.

4.2 Augmented reality experience

The first practical application of our system is an augmented reality experience proposed to the public through thematic itineraries in the urban area. The path winds through the physical checkpoints of the territory where the narrative development of the individual micro-stories will take place.

We faced nowadays not invasive technologies and chose augmented reality as the best one to make people aware of the stratified context where they live using themselves contributes.

Stories are composed and overlay to reality starting from the same motifs grabbed in the gathering of stories. Spectators discover a new context that evokes futures, echoes memories and encourages an imaginative approach to everyday life. Ordinary becomes extraordinary through sensorial assonance (Winkowski, 2019), showing how behind data there are real human stories (Lupi, 2017).

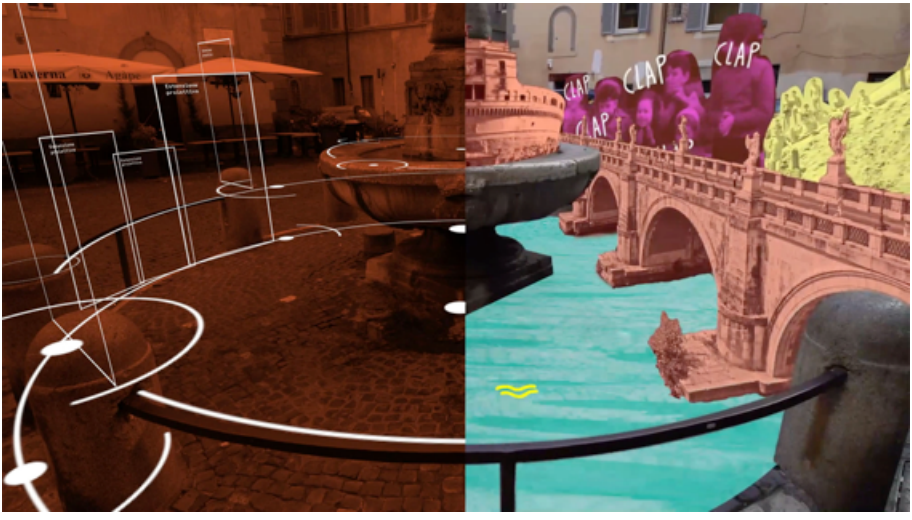

Figure 11. Beyondstories: Translation from abacus to augmented reality experience.

The street becomes a museum, a vibrant place of life and anecdotes, in line with the principles proposed by the theory of eco-museums ("Ecomuseo", 2019). As in an eco-museum, cultural experience is proposed in the same context where the stories are born.

Technology allows us to let the spectators live first-hand the experience in an audiovisual synaesthetic sphere. During the experience, visitors are attracted to multiple points of interest, free to evolve their own path freely.

Every micro-story is related to a visual slipstream. Slipstream move on the adjacent planar surfaces: flooring, walls, facades. The direction of the slipstreams is the micro-story checkpoint, so visitors can follow them during their walk. The closer the spectators get to the checkpoint, the more concentrated and denser the slipstream becomes.

Acoustically, the slipstreams drag pieces of the audio of the respective micro-story, disturbed by gradually less intense interference signals when spectators approach checkpoint. A plaque with information about micro-story appears once spectators arrive.



Figure 12. Beyondstories: A plaque with information about micro-story appears once spectators arrive on the checkpoint.

After enjoying the experience, visitors could be able to live again a context by listening to the beyond-stories as podcasts. The stories database can be used independently through an interactive sound composition platform. The platform allows to keep track of the configurations proposed by users and their feedback can give important advises for organizing the next acquisition session.

From context to context, through digital and physical channels, the main aim of the system is to promote the birth of a cyclic ecosystem.

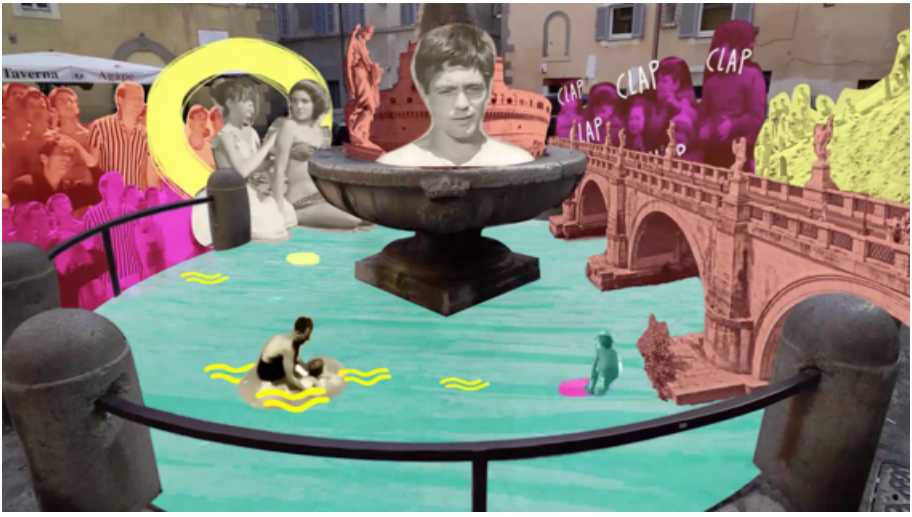

Figure 13. Beyondstories: A frame from the augmented reality experience.



Figure 14. Beyondstories: From the same story is possible to change tone of voice. Same topic and voices, different style

5. Scenarios

We believe that this approach to narrative could open to different scenarios.

We aim living as part of cultural heritage, in order to contrast massive tourism with quality cultural routes. Furthermore, we think that a territory should self-represents itself to trigger a renovated sense of belonging and civic participation and to give life to a support economy for local activities. Immersion in reality through stories provokes empathy for the context. Empathy stimulates people to make their own contribution, to explore other micro-territories within the macro-territory and to participate civically.

These could be the next steps to carry out research in terms of feasibility tests and interaction design prototypes:

- Design of physical devices and interfaces that translate the acquisition and composition logics in terms of user experience;
- Introduction of interactive logics during the augmented reality experience, providing objects capable of directing and modifying the stories path;
- Qualitative approach to the translation of stories in another language, in order to maintain dialect and the emotional charge that only an actor figure could faithfully reproduce.

The branches of the system open up to other possible longer-term scenarios, regarding tourism, civic engagement and circular economy.

5.1 Tourism

The new international trends are moving towards the search for emotional and experiential tourism. Despite the tourist is looking for authenticity, in Italian cities mass tourism is concentrated in a few places compared to the potential that our territory would offer. Self-representation according to the Beyondstories model can become a direct channel for presenting a territory, spreading the boundaries of cultural heritage.

Looking also at the representation of the territory and reiterating the concept of identity as a changing entity, the design of a coordinated image could be cyclically supported by a preliminary phase of coordinated investigation of the territory to be narrated. People's stories would become raw materials to express the real nature of a context to those who discover and explore it with an external eye.

5.2 Civic engagement

For some years, many cities (above all Bologna with the Urban Innovation Foundation and Barcelona with Decidim) have been equipping themselves offline and online platforms to mediate the relationship between citizens and the public administration. Cities are intended as a common good to take care together. Citizens are asked to be active and say their

thoughts participating to events or taking part to co-design workshops. Community managers are important figures in this process: they have the task of stimulating, collecting and preserving shared ideas.

The future of the territories is also at the core of universities' projects, particularly in the faculties of architecture and design. Universities have always carried out research on feasible ways of intervening in a context to improve their critical issues. Students start from a research about the context and then they are free to design with imagination.

Beyondstories can assume a role of narrative support to universities and coach managers, through representing projects and proposals hitherto fixed on paper or communicated through photorealistic rendering.

5.3 Circular economy

A territory is the result of exchanges and relationships that occur within it. The sustainability of a territory passes through its economic flows. Local actors produce goods, internal and especially external actors bring currency. Today a lot of historical commercial activities are closing due to the spread of standardized gadgets and the research for low quality souvenirs.

Marketing 4.0 theory said that the future economic scenario will shift the focus from value to relationships (Kotler, 2019). Any company should seize the addition of external factors as an opportunity to expand and grow its pre-existing vision and narrative.

Beyondstories could be an active part in the development of a support economy to protect the general economy of the context. While narrations are opened, it is possible to extrapolate characters, anecdotes, figures and situations from them: iconic material that lends itself to be attached to any product sector. The historic craft activities could find a quality circuit, promotion channel and source of collaboration in the development of representative memory objects of the territory.

6. Conclusion

The narration of a place has a threefold goal across the time: narrate the past in order to maintain, collect and create memory; narrate the present to inform and therefore take care; narrate the future to observe, imagine and then propose (or simply dream).

The construction of the narrative must be facilitated with a grammar that provides guidelines, constraints and ideas for the participation in the narration. We need to connect the languages of different actors and different cultures and to create a positive experience that encourages users to constantly and spontaneous sharing.

A new grammar should also enable people to "develop the ability to react creatively to the visible" (Rodari, 1972) to create an open narrative of the territory.

We want to trigger collaborative and participatory storytelling processes with the aim of developing the shared identity of an environment-territory.

Design is medium for maintaining heterogeneity and building new experiences to identify oneself as part of a community. The designers must take on the role of "architects of relationships" (Bottà, 2019) and arrange the exchange from “me” to “us” and from “us” to “others”. Beyondstories system spreads the practice of mixing, connecting and uniting, creating a common sense that starts from ambiguity, diversity and differences.

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Acknowledgements: Lorenzo Ceccotti, Professor of Video Animations at ISIAROMADESIGN. Federico Russotto, Directing Student at CSC - Centro Sperimentale di Cinematografia di Roma. Giovanni Abbatepaolo, Researcher and Coordinator for La Scuola Open Source in Bari. Daniele De Luca, Designer with BA in Industrial Design at ISIAROMADESIGN and Art History Student at La Sapienza Università di Roma. Andrea Di Mattia, Architect with MA in Architecture at La Sapienza Università di Roma.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Brand in Product. The language of the brand to govern complexity

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Abstract | Brand in Product is a project analysis and practice method aimed at brand-oriented typological innovation, useful to conceive new products and services integrated in the company's brand equity. It is a systemic methodology, new and experimental, developed a few years ago with rather original and positive results; its theoretical and operational foundations are inspired by the best brand experiences which were able to elevate different moments of their action, by synergically integrating roles and competences previously regarded as separate by the various brand's divisions.

KEYWORDS | BRAND, PRODUCT, COMMUNICATION, DESIGN

1. Introduction

In the fluid and ever-changing modernity, we are submerged in, products can relatively easily be reproduced by a competitor, yet the uniqueness of the brand continues to ensure quality to those who own it, update it, and feed it with consistence and foresight. And while products are quickly outdated, successful brands continue to come out on top against a backdrop of ever-increasing competition.

In a world where primary material needs are given as already met, brands continue to speak to the subconscious desire for identity and self-assertion which compels individuals to establish an intimate, empathic relationship with the products they interact with.

Brands work toward creating a mental space where tangible and concrete factors fuse with intangible and value-related elements, to establish a connection with consumers' deeper needs by speaking to the totality of their senses.

Competitors can imitate a brand's products, colours, shapes, or fonts, but no one can appropriate the culture behind a brand identity, which is the result of stories, relationships, visions, and aspirations. Content and attitudes before shapes and functions.

As Wolf Olins (1) reminds us, the intangible values of the brand are often much greater than the tangible assets of the companies that own them.

Only a strong and recognizable brand can express its own "language", keep its share of market, and expand its scope to new commodity sectors, all the while heightening its iconic, symbolic and value-related power.

The brand equity is "that set of distinctive and distinguishing values that allow the brand to enter the market and compete in it" (2), a mix of recognizability and mental associations, that is, the apparently intangible capital able to create fidelity and recognizability in its own public.

This value system is not born by chance but is the result of a complex layering of messages that a company conveys over the years through its products, communication campaigns, behaviour codes, and all the verbal and formal expressions that circulate via a wide range of different channels.

The brand must be regarded as a living organism, able to evolve with time and adapt to transformations. "The brand as a person" (2) states Jacques Séguéla, with its own face, posture, facial features, biography, age, culture, language and lifestyle.

However, what is at the centre of the emotional and value-fraught relationship between a brand and its public are the products themselves. It is through them that a brand defines itself and conveys its philosophy and its approach to the world of its clients.

Products are like mirrors, reflecting our images to the external world and projecting, more or less consciously, the set of identity values we relate to and identify with.

To govern contemporary complexity, companies must adopt a strategic and all-round vision to manage their brands. The chosen strategy must necessarily encompass all areas of design, in view of interconnecting and enhancing all the elements that make up the brand. Every project must therefore work toward a bigger, all-encompassing vision, like a jigsaw piece in a wider path that foreshadows the bigger picture.

Brand in Product is a project analysis and practice method aimed at brand-oriented typological innovation, useful to conceive new products and services integrated in the company's brand equity. It is a systemic methodology, new and experimental, developed a few years ago with rather original and positive results; its theoretical and operational foundations are inspired by the best brand experiences which were able to elevate different moments of their action, by synergically integrating roles and competences previously regarded as separate by the various brand's divisions.

As an example, we will analyse a number of case studies, in all of which the success factors of a company were determined by its strategic vision of connection between its products and its communication with the public. In all these cases, we can find strong, clear, inimitable and immediately recognisable insights from generations of consumers over the years. The brand defied the passing of time and social, cultural, technological and financial transformations. It came out undamaged and by contextualising new landscapes it was able to keep hold of its leadership in a sea of fierce competition.

2. Race to Infinity

The first case study to look at is the brand Nike, a company founded in 1972 by Phil Knight in a commodity sector at that time dominated by Adidas.

Around the mid-70s, an obsession with health and jogging started sweeping the Usa and Nike was able to embody those new societal values thanks to a thorough research into the development of running shoes designed for a new generation of running enthusiasts, both amateurs and professionals.

According to Nike's philosophy, a better technology would result in a better performance and by creating an innovative product, original also in appearance, Nike gained the respect of running devotees.

In its race to beat Adidas, Nike heavily employed celebrity endorsements, not only to gain credibility in the sports world, but also to convey emotive and self-expression messages. Indeed, harnessing the emotional side of sports has been key to the mystique of Nike since its early days. The kind of athletes chosen by the brand have always had a strong profile, far from model athletes, sharp-edged, aggressive and independent, people with strong characters who first and foremost wanted to be themselves. The great basketball player Michael Jordan, who perfectly symbolised the brand, was chosen as the face for the Air Jordan sneaker, designed with the air cushioning technology -air bubbles capsuled in the

sole-, and invented by a NASA engineer. To better show the technology, the sneaker's sole was designed with a see-through side, so that innovation could happily marry marketing strategy. The functional advantage of air cushioning was then reproduced by competitors, but the perceived value of the Air Max line has remained unchanged since 1987.

Nike's brand strategy was able to single out deep-seated desires in its target consumers, through strong, aggressive, almost provocative language and an imagery that featured everyday heroism, spirit of sacrifice and self-reflection.

The "Just Do It" campaign launched in 1988 has produced one of the most successful ad slogans of all time and emblematically reflects the brand's philosophy. Nike's marketing strategy has been renewed and updated over the years, adapted and adjusted but never distorted, increasing its communicative power, and its ultimate manifestation took place on the thirtieth anniversary of the brand with an ad that faced a lot of controversy. It featured National Football League quarterback Colin Kaepernick, who was marginalised from professional football for kneeling during the national anthem as a form of protest against racial injustice and systematic oppression of the Afro-American community.

The brand has continuously innovated its brand communication by creating new dynamics and marketing platforms, such as the use of big urban spaces, huge billboards and gigantic graffiti realised by street artists and depicting the sponsor celebrities, thus easing into the fabric of city life and creating icons of our times.

Nike's impact was also remarkable in the retail world, with the opening of Nike Towns in 1992, flagship stores whose size had never before been seen.

Far from simply selling Nike products, these huge spaces were tasked with communicating the brand's essence and transmitting the energy and philosophy of the "Just Do It" motto through an unforgettable buying experience, designed to be immersive and multi-sensorial and realised through the employment of all means available. Success was quick to follow and in 1996 Chicago's Nike Town became the main touristic attraction of the city, surpassing every other museum and exhibition with over a million visitors a year.



Figure 1. The "Just do it" commercial of 2018 that had as a main character Colin Kaepernick

3. Thinking differently

Apple is THE quintessential brand, a true cult that has made its mark on history through its revolutionary approach to information technology and marketing.

There lies a deep connection between all the material and immaterial elements, the tangible and intangible of the Apple experience. Behind every product of the Cupertino's brand, there is a unique, clear and coherent vision that makes it a part of other marketing moments and turns it into an effective vehicle through which everyone perceives the brand that gave it life. Products' shapes are intrinsically linked to packaging shapes, the atmosphere you breathe in an Apple store also comes through online marketing, the colours and icons of the interface can also be found in their ads, the behaviour of sales assistants welcoming visitors to the store is the same of its leading testimonial, Steve Jobs. Every little piece of the Apple world "can perfectly be traced back to a sole project, global and all-encompassing, held together by a strategic and design-oriented vision of the brand.

The unbreakable link between the development of Apple products and the marketing strategies that launch them is tangible in the success of their most famous ad campaigns.

In the 80s, Cupertino's company launched its first Macintosh with "1984", an advertising masterpiece which was to write the history of marketing. The spot clearly references

Orwell's literary masterpiece of the same name, a dystopia governed by the ever-present glare of the "Big Brother" talking to the masses through monitors. The crowd, sluggish and unresponsive, is only awoken when a brave heroine manages to go beyond security and break the screen with a hammer, saving everyone from the threat of conformity and the "status quo". Macintosh represents a break from a deep-rooted system of uncritical thinking and lack of creativity. The product is depicted as a change in paradigm, able to "democratise" the use of technology, in most part thanks to an easier and intuitive interface, accessible to anyone.

The phrase "Think Different" was coined in 1997 in the context of a revolutionary institutional marketing campaign that describes and sums up the "vision" of the bitten apple.

The spot features a line-up of important figures such as Martin Luther King, Mahatma Gandhi, Albert Einstein, John Lennon, Maria Callas, Pablo Picasso, Bob Dylan and many more, while an inspired and provocative narrator explains: "here's to the crazy ones, the misfits, the rebels, the troublemakers, the round pegs and the square holes, the ones who see things differently. […] Because the people who are crazy enough to think they can change the world, are the ones who do."

Between 2006 and 2009 the ad series "Mac vs PC" was broadcast, featuring 66 commercials and focusing on the comparison of two lifestyles exemplified by the technological products.

The two computers are personified in two opposing characters, where the Mac is embodied by a young man, who dresses casually and is always able to come up with innovative solutions, while the PC is personified by a clumsy man, awkward in the contemporary world, clinging to old-fashioned stereotypes and obsolete conventions.

The comparison was thus presented mainly in terms of social identity, suggesting a different attitude in accepting technological challenges designed to make Apple consumers stand out from those who were not part of the community.



Figure 2. 1984 Apple Adv Campaign

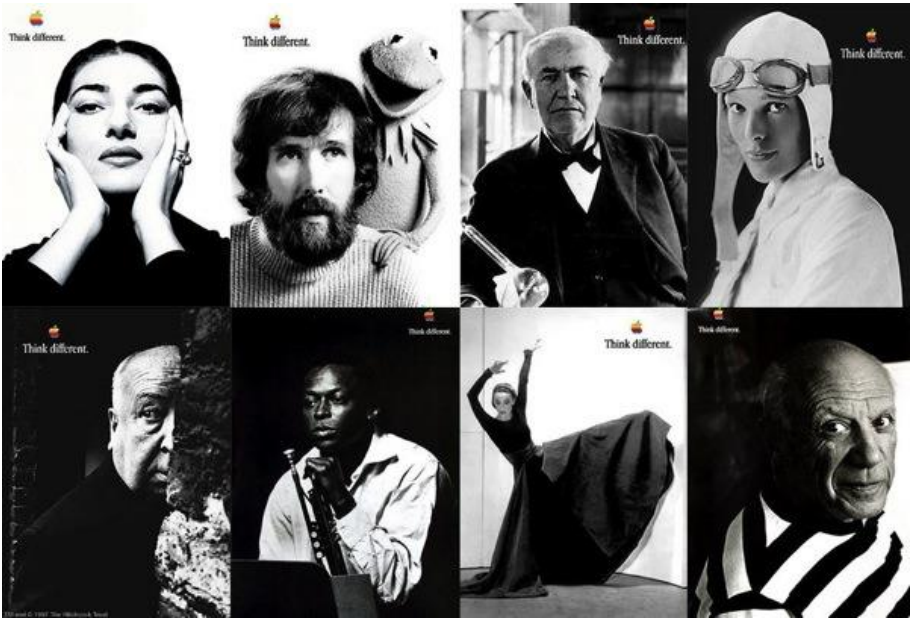

Figure 3. 1997 Apple Adv Campaign "Think different"

4. Extended family

If, as we have seen so far, on the one hand a brand can influence or outright determine specific behaviours or even lifestyles as an active presence in the lives of its consumers, on the other, it is true that a "reciprocity" criterium exists, which dictates that a brand will be led by its supporters to behave and express itself in a manner that is consistent with the collectively intended and shared values, so that the community it represents can safely identify with it.

Reciprocity is not a mere issue of marketing, therefore it does not end in the choice to buy a product or not. To better understand this principle, it is useful to examine quite a sensational incident, which took place in 2013 and involved the brand Barilla.

In a radio interview, the company's President, Guido Barilla, stated: "We will not feature homosexuals in our commercials as we are fond of the traditional family. If the gays disagree, they can always eat a different brand of pasta. Everyone is free to do what they want as long as they don't bother others."

This statement backfired on the company's business, even starting a boycott campaign of Barilla products around the world. The company immediately ran for cover, publicly apologised and adopted wide-reaching inclusive practices, both internal and external, culminating in the institution of a "Diversity & Inclusion Board" which had the goal of monitoring and defining the objectives to reach in order to protect staff's rights and fight inequality on grounds of sexual orientation, gender, ethnicity and disability.

It was a complete backtrack on the concept of family, consistent with modern times and current standards, which earned Barilla the top score on the "Corporate Equality Index", drawn by the "Human Rights Campaign", one of the most important associations for gay rights in the world.

This episode helps us appreciate the need for a systemic and integrated vision of the delicate relation between "brand/target", to be continually and organically updated in conjunction with societal changes. The concept of "family", historically a value at the foundation of Barilla, has radically changed in recent decades, evolving from a traditional structure to a plurality of models that do not necessarily include the traditional roles of "father, mother, children".

With the institution of divorce and all the societal, cultural and economic transformations that have occurred in developed countries, families have been subject to profound changes. This has altered family roles, composition and the very quality of interactions between family members.

Guido Barilla's statement in 2013 thus revealed not only a cultural delay but, most importantly, a misalignment between the values expressed by the brand and its actions, running the risk of creating an emergency and seriously compromising its perception in the target audience. The word "emergency" in systemic terms emphasises a "bump" in the

system that has the characteristics to modify the behaviour of the system itself, progressively impacting all other elements in a chain reaction.



Figure 4. Erberto Carboni - Barilla, "La pasta del buon appetito", 1952



Figure 5. Barilla Adv campaign, focusing on the women role.

5. Brand in Product

The case studies examined so far help us to understand that in the era of complexity brands play a key role in the evolution of society and of its language, although they should not be regarded as the only actors on this stage. The "show" that the brands put on through their products, but mainly through their marketing, always aimed at maximizing sales, is in turn affected by the buying audience that receives it, uses it, recognises its values, and interprets it, at times defining a new plot, like in the Barilla example.

That is why concerning ourselves exclusively with product design is to us nowadays meaningless, if not in the context of an integrated systemic vision. This open methodological approach has been aptly named by us "BIP – Brand in Product".

The name stands for that specific quality in a product, however material or immaterial it may be, that allows the product itself to fully express in all its aspects the primary values that make up the brand to which it belongs, and which make its very existence possible, more importantly.

Namely, we are talking about that mix of identity and identifying concepts of a brand, without which the brand would no longer be recognisable, credible and reliable.

Let us give some clear examples: Apple is identifiable through the concepts of smart, technology, reliability, excellence, made in Usa; Nike through the values of personality, challenge, victory, self-realisation, made in Usa; Barilla is identifiable with the words “pasta”, quality, “family”, and “made in Italy”.

For a company or any business that wants to sell products, interacting and communicating with its consumer base is key to keep these references in focus, to be competitive and long-lasting, regardless of the scale of business.

BIP was thus born to fill a void: the lack of an integrated methodological tool, brand-value oriented, able on one hand to allow for the creation of flexible and effective market strategies, and on the other to identify a targeted and sustainable product innovation. Given the importance of branding in our society and its ability to impact the market as well as societal behaviours, it is crucial to equip ourselves with tools of critical analysis and systemic checking, modelled around the brand of reference. What we aim to obtain is an “open mapping” of the system with which the system interacts, keeping at the centre the company’s *brand value*. The brand is thus imagined as a sort of dynamic organism submerged in a wider, ever-changing, ecosystem.

For several decades a new teaching methodology on Design has been developed. Drawing inspiration from the System Theory by Ludwig von Bertalanffy (5), this methodology bases any kind of design planning on the analysis of the interactions between systems and between single elements of every system, regarding them as dynamic and ever-changing.

This methodology is called System Design and was fundamental in structuring the methodology of Brand in Product, which is oriented to *brand value*, has been applied in hundreds of projects developed in the academic context over recent years, and was partly collected in the 2016 volume Brand in Product (6).

To synthetically describe the main phases of the work methodology, we start by identifying BIP Values, that is, by defining the actual set of core identity and identifying values of the brand, namely those who are widely recognized, and not necessarily coinciding with Brand Values (in the event of a “misalignment”).

We can regard BIP Values as a touchstone for Brand Values. To further test value reliability, we study the evolution of BIP Values, identified through the history of the brand, verify their stability over time and that of possible *Value Fluctuations*.

Secondly, we develop the *BIP Value Strategy*, which consists in reinforcing the values of the brand, realigning BIP Values and Brand Values in case of a misalignment and, most importantly, in updating value concepts according to the *Scenario Strategy*, illustrated below.

At this point, we analyse all communicative expressions of the brand through the critical analysis of Brand Identity (visual guidelines, brand colours, type&lettering, variations on the main supports, etc), advertising campaigns, social marketing activity, company printing,

packaging, space design (retail shops, exhibitions, fairs, etc). Verifying the alignment of brand identity elements with BIP Values offers content for the development of the *Brand Communication Strategy*.

Next, we analyse the *Brand History*, and research the historical events that made the brand what it is today. Products, services, technologies and know-how are considered in relation to the social, political, cultural systems that were taking shape at the time of their development. This research leads to identifying the *Brand Attitude*, that is, the brand's approach to seizing opportunity and bringing about innovation. Projecting the *Brand Attitude* onto emerging scenarios allows for the development of the *Brand History Strategy*.

With relation to the market, we carefully examine the brand's positioning and compare it with the Strategic Competitors, the direct or indirect players to monitor because they are significant core elements of the market system with which we deal. Developing positioning maps thus allows us to verify consistency between *BIP Values* and *Brand Positioning*, useful to put together the *Brand Positioning Strategy.*

The analysis of the *Emerging Scenarios* consists in identifying the interactions between cultural, social, political, and technological systems concerned or potentially interesting for the brand. By immersing the *Brand Vision* and *Mission* in these systems, we can develop *Systemic Scenario Maps*, useful to create the brand's *Scenario Strategy*.

The analysis of the *Contexts of Use* is an in-depth look into the systems where the brand's products and services are used, put into practice, distributed, maintained, transported. Through this mapping, we can photograph potential changes in variations of the elements of the *Context System*, to get to the development of the *Context Strategy.*

It is essential to operate a complete cataloguing of all the products and services of the brand through *Typological Systemic Maps*, corresponding to the state of the art and the relevant primary, secondary, accessory, technological, dimensional, ergonomic functions.

This allows us to identify all those typological voids that, through the cross-examination of *BIP Values Strategy, Brand Positioning Strategy, Context Strategy, Scenario Strategy,* lead us to the Typological Strategy and on to the development of the *BIP Overall Strategy.*

The merits of this methodology lie in its ability to provide wide and upgradeable strategic tools that can intercept and assess, in the fields of real interest, ongoing or foreseeable changes, in order to seize market opportunities. Once the scope of action is defined, emerging interactions between the elements of the involved systems are defined and selected, and energy and resources are targeted at those in order to generate *brand value-oriented* typological innovation. Integration between product and communication goes in-depth, as it does not stop at aesthetic factors, albeit necessary, but works simultaneously on more levels, harmonizing them and enhancing their pervasive effects.

To give a tangible example, we can mention the project developed by Barbara Muratori in 2019, about a particularly sensitive and original theme: sex toys for the American brand

JimmyJane. Muratori worked on the project in the context of non-profit research with teaching objectives.

Applying the BIP methodology, the brand identity and history were accurately analysed, defining the BIP Values actually perceived, and then letting them play in the socio-cultural context of reference. It was a far-reaching and multi-faceted task as the theme of sexuality is complex to deal with, oftentimes complicated because it is subject to different interpretations, especially depending on the assumed point of view. Furthermore, we identified all the systems illustrated above, to which to refer the brand JimmyJane, such as market, context of use, and technological systems.

In the context of this ecosystem, the company's products were positioned, through the use of infographics and typological maps, to further analyse them in detail.

This work led to identifying several design and market opportunities, some more simple, like the possibility of expanding the range or adopting new technological solutions, as well as more complex ones, like creating new typologies of products able to compel new behaviours and emerging social interactions.

This in turn led to the creation, consistent with the Brand Values, of two new typologies of smart sex-toys, one designed for men and one for women, usable by one or more partners at the same time, intercepting the emerging need for expression and sharing in the context of sexual interactions, especially in the more evolved and emancipated societies.

Apart from the just described products, a booklet titled "Svelati" (Unveiled) was conceived, written, illustrated and laid out. The booklet aims to be a vehicle for cultural dissemination by unveiling the different taboos surrounding sexuality. The theme is tackled objectively and delicately, far from the mystifications and misunderstandings that shroud the topic, through a narration that, starting from the antiquity, crosses cultures and peoples until it reaches the digital area, in which the Internet has globally changed the way we perceive relationships. The illustrations accompany the tale giving it a light irony and a pleasantness that helps even the youngest to dive into the theme and unveil the most arduous of taboos.

In conclusion, after a decade of development and application of this methodology, we can confidently claim that the innovation brought about by the BIP systemic approach in the brand context has proved to be extremely effective and productive, ready to be adopted in all those design and production industries that are looking to put in place flexible and trustworthy strategy planning in the medium and long term.



Figure 6. Cover of the book "Svelati" designed by Barbara Muratori



Figure 7. The book "Svelati" has a tear opening system



Figure 8. The inside pages of the book "Svelati" designed by Barbara Muratori.



Figure 9. The sex toy Edoné, charging on his base



Figure 10. The sex toy Imerò, charging on his base

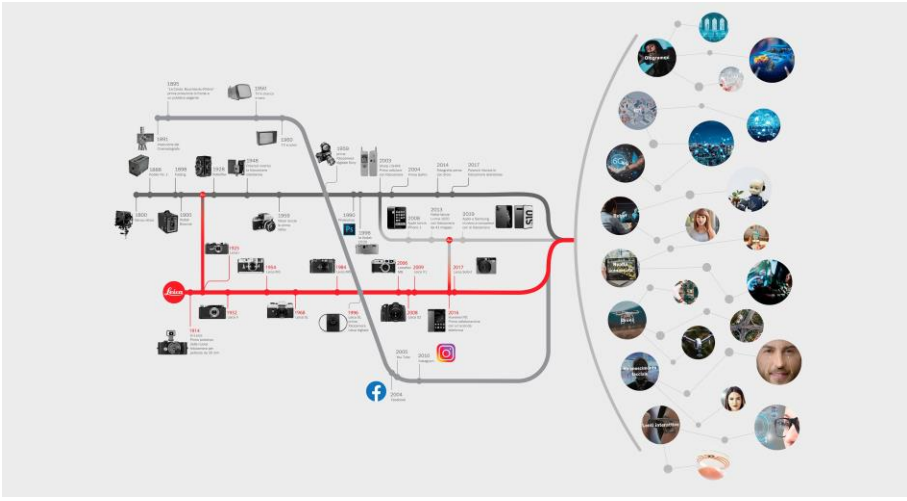

Figure 11. Research about Leica: Brand History Strategy

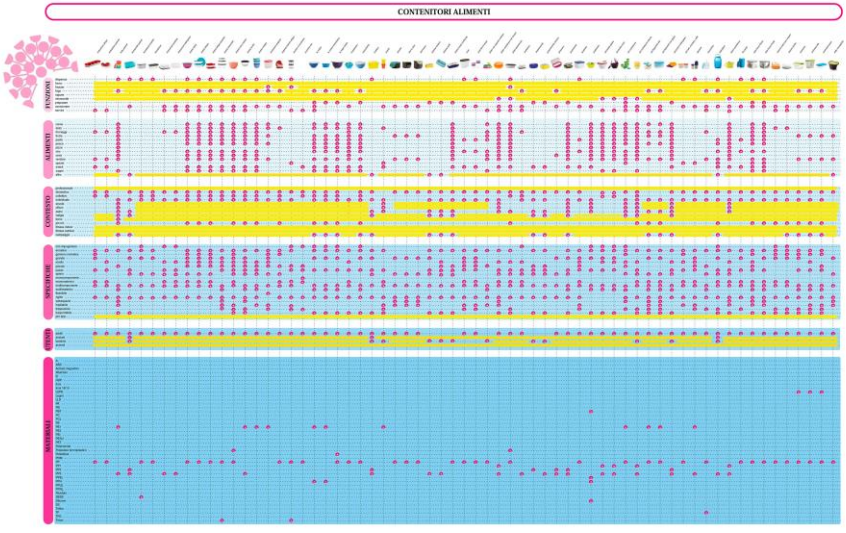

Figure 12. Research about Tupperware: Typological Systemic Maps

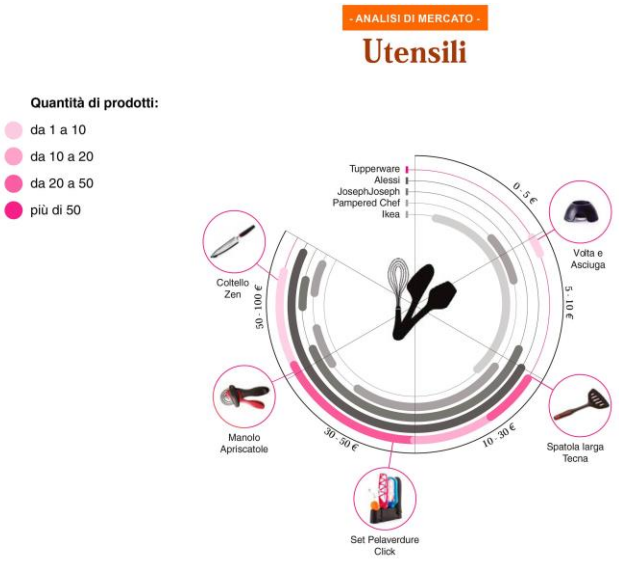

Figure 13. Research about Tupperware: market analysis

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Creating Visual Identity as Constellation: Methodological Project for a Design Workshop

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Abstract | At the crossroads facing design today the idea has emerged of conceptualising and defining a methodology with a holistic perspective, based on the arts and design, which can become installed at the intersection between the biographical and the contextual plane. In a later instance, a *fissure* or intersection is established between these two planes from which arises a graphic project through the coordination of mechanisms and operations which will stimulate creativity and observation in students. Different dimensions in the construction of a visual identity emerge, whose axes become coordinated through biography, culture, memory and migratory movements. The repercussion at the academic level will be to allow us to expound other teaching methodologies based on creativity, and to specify their implications for artistic learning in a *Workshop* environment. Finally, this work refers to the quality of university education and its commitment to a creative, intellectual training, incorporating constant questioning and critical reflection.

KEYWORDS | VISUAL CONSTELLATIONS; TEACHING METHODOLOGY IN DESIGN; INFOGRAPHIC OPERATIONS; VISUAL IDENTITY; LAYERS OF MEANING

1. Introduction

> "Briefly, what I am proposing is that the psychology of the mature human being is an unfolding, emergent, oscillating spiral process marked by progressive subordination of older, lower-order behaviour systems to newer, higher-order systems as man's existential problems change." (Graves, 2019)

Is it possible to establish a constellation of binding relations between the biographical dimension and those nexi of meaning present in the inter, intra and transcultural ambit, strengthening the construction of a new visual identity[1]? (Author, 2019)

The experience of teaching is a domain in permanent transformation and innovation, due, among other factors, to the growing democratization of the composition and diversity of students entering higher education. This implies the need for closer support in the learning processes, giving priority to the task of debating the projection of new teaching methodologies.

In the ambit of design, an important research context – characterized by a profound discursive and conceptual consistency – reflects on emerging theory and practice, as well as expounding contingent problems which form part of the collective imaginary linked to education. In this respect, the context is found to determine a space which strengthens the integral and autonomous development of people as subjects capable of managing their own experience of creative learning.

At the same time it is vital to address certain implicit problems, one of which is the debate over which competences are important in the context of the reformulation of learning when it comes to determining the map of the intersections between different cognitive resources, using reflection on the space of design to generate empathic responses to the varying requirements of the social and cultural environment.

Teaching approaches acquire deep meaning in relation to the exercise of professional praxis, and are decisive for understanding how teaching strategies are connected with artistic production. These perspectives constitute the specific manner of understanding, imparting and stimulating learning of the Visual Arts in their different techniques, traditions, forms of construction and specific fields of expression in art and design. It is important to understand that the way in which these models develop is closely linked to the teaching approaches assumed by the same methodological constructs.

For education in the arts, a field in which our reflection is based, the rhetoric of the models of thought has achieved greater density, making them a potential support for conceptual analysis and reflection on motivations, implications and project limits.

[1] Visual identity is understood as the unique characteristics that are defined in a design project. A distinctive quality that gives it both conceptual and visual meaning.

From a critical point of view, education in the arts involves a commitment by teachers to training and development:

> "Without a solid, sustained intellectual training which promotes reflection about the theory and practice of education in the arts and its various cognitive domains, there can be no improvement in quality" (Errázuriz, 2015).

Meanwhile, the success of knowledge is conditioned by the students' acquisition of self-regulation strategies, and by a profound focus on the organization of learning. This perspective generates in the student the bases of autonomy and freedom, in order to learn actively and reflectively throughout the development of the project. Linguist and cognitive scientist Noah Chomsky (Chomsky, 1977) says that learning should inspire students to discover from their own motivation, learning to read contents critically and opening themselves to a dynamic, fluid search for new and better creative solutions. Teaching should inspire students to discover for themselves, to ask questions when they disagree, to look for alternatives if they believe that better ones exist, to review the great achievements of the past and learn about them because they are interested.

The field of art allows us to determine critical reflection, through observation and interpretation, under the premise that "in order to know, we must imagine" (Didi-Huberman, 2013, p.11).

In terms of investigation, it is important to determine which competences are of key importance – in the context of the reformulation of learning – for establishing a geography of the intersections between different cognitive resources, in which experience and knowledge of design are decisive requirements for developing projects. Researcher Robin Edman says that it is reflection on experience that generates significant learning, and therefore it must be shared (Edman, 2004, pp.44-45). This enables us to dimension the complexity of the human being and generate, in reflection on the university space, the projection of empathic responses which will strengthen new, living relations of thought. As Albert Einstein said, "the formulation of a problem is often more essential than its solution" (Einstein & Infeld, 1938, p.29).

The practice of design as a discipline should not concentrate on the mere creation and production of objects, but on projecting and relating meaning and establishing a conscious encounter with the social environment. Consequently the transfer of knowledge of Design should coordinate experiences that, in the words of Juhani Pallasmaa, tend to "strengthen our sense of reality and of the ego and transcend the indiscriminate production of consumer goods" (Pallasmaa, 2016).

By enriching the space of dialogue and broadening knowledge in education in the arts, it is possible to determine the coordinates of a learning that can respond organically to the needs which arise in the formation of a society. Likewise, in the reformulation of the narrative present in education, it is vital to understand the artistic environment as a space that projects "*the arts as experience and open narrative*". (Aguirre, 2006).

Interdisciplinary reflection implies examining varied experiences as a whole, in the understanding that their connections enable us to project and enrich the scaffolding of a new methodological structure. These experiences generate a learning model that favors the interconnection of ideas and unlimited exploration from a variety of beginnings. It is a means to integral training which builds links between areas of knowledge and always teaches students to perceive more than two situations at a time.

This idea-generating process is influenced by various factors related with the dynamic of the *Workshop*, including the space where it occurs and the arrangement of the students within that space which together determine the flow and atmosphere of learning. Using the concept of *auratic*, defined by Walter Benjamin as "a strange tissue of space and time: the unique appearance of a distance, however near it may be" (Benjamin, 2008, p.23), we infer that the dynamic of knowledge transfer generates a unique moment when the *aura* refers to a fine tissue articulated by space and time which expresses the specificity of a unique moment, in which distance appears to come closer.

Likewise, through the web of interrelations between space and time, the classroom acquires a unique creative value in which the essential interdependences between everyday mental and physical aspects generate a particular way of understanding our surroundings, projecting a specific way of relating causalities and interdependences which are in themselves unquestionable.

From this we may infer that although we are only occasionally conscious of the fact, we all have the metaphysical ability to endow our everyday existence with experiential meaning, integrating it into a specific conceptual system from which are born infinite networks of associations.

In this ability to integrate, it is vital to ask how the predominance of sight and the suppression of the other senses have influenced ways of thinking and teaching, and the "importance of the senses in articulation, the storage and processing of sensorial responses and ideas" (Pallasmaa, 2014). Following the concept minted by Juhani Pallasmaa, all our senses "think" and structure our relationship with the world, although we are not normally aware of this activity.

The prevailing teaching methods and educational practices continue to separate the mental, intellectual and emotional capacities of the senses and of the multiple dimensions of the manifestation of the human, not recognizing the full depth of the fundamentally holistic essence which should exist in our self-awareness. Didi-Huberman says of this fusion: "…I refuse to separate the emotional from the intellectual dimension. I believe that images and words are related. Everything goes together…" (Didi-Huberman, 2014).

The act of educating seeks to establish adequate conditions for the transfer of knowledge. The experience of creative learning, meanwhile, implies an unfolding, emergent, oscillating spiral process towards the acquisition of new knowledge which becomes more complex as man's existential problems change and his relational structures with his surroundings are

transformed. For Mihaly Csikszentmihalyi, creativity is situated in the change or transformation of an existing field into a new one (Csikszentmihalyi, 1996).

In the system of visual codes present in the genesis of the *Workshop* project, as Albert Einstein said, "the psychical entities which seem to serve as elements in thought are certain signs and more or less clear images which can be *voluntarily* reproduced" (Shavinina, 2003, p.25). In this space of associations, we perceive a threshold in which the creative process guides the keys of access, defining and facilitating a fluid transfer of information.

This paradigm shift should open all those hegemonic educational practices to debate, promoting reflective discussion about recovering teaching experiences which make up new cartographies of the world through learning that awakes in students the capacity to establish multiple connections from their own experience of being. In the words of Jean-Paul Sartre: "Understanding is not a quality which reaches human reality from outside; it is a characteristic mode of existence" (Sartre, 1993, p.9). This, in the understanding that reflecting on our own activity opens up the possibility of transforming it, generating certain repercussions in both those who teach and those who learn.

But it must also be understood that when people have the possibility of correlating their educational processes with their own realities, the context and the social circumstances become decisive variables in the promotion of learning:

> "Undertaking any activity does not happen in a vacuum but is charged with memories, expectations, abilities, interests, attitudes and personal characteristics." (Monereo et al, 2013)

Finally, we establish a dynamic, vital relation in the transfer of certain contents from the historical context to a constellation articulated by a multitude of relations determined not only by intra-cultural aspects, but also by their implications in the influence of biographical references.

2. Linking methodology: creating visual identity as constellation

The whole learning system implies contextualizing and relating significant experiences with one's surroundings, not from the fragmentation of information but from an integrating globality which consequently generates identity in the creative process.

In contrast, removing the context of learning involves the projection of teaching methods and educational practices which move away from this holistic relation. Thus a critical look at methodologies which do not generate nexi of meaning becomes a priority in any diagnosis of design as a discipline.

The so-called Linking Methodology for Workshops was developed in the context of investigation into new paradigms of project-related learning in design studies at universities, in order to relate artistic praxis with the different cultural, social and political layers and thus re-signify their identity codes. Coordinating these three spheres requires us to constantly re-think and re-question the frameworks of thought, and on that basis design new learning models.

Structurally, this is defined as an associative teaching method, the areas of which are not dissociated but dynamically correlated towards determining new relations of thought. In projects, this associative teaching methodology aims to establish a critical reading of teachers' practices in a Workshop space, in the understanding that their implications have been little understood, and that the dynamic linking relation between theory and praxis constitutes a dialectic spiral. The aim is to use the creative genesis of projects to strengthen conscious observation and thus detect ideas, defining time as a dynamic axis by which meanings are articulated, in a process constructed in interaction with others.

Thus this space acquires direction as the body of the workshop takes shape through collective narratives and conversations which enrich the exchange of ideas. The methodology of this linking structure integrates and connects the different dimensions intersected in the construction of a visual identity, and whose axes are formed by biography, culture, tangible and intangible memory and migratory genealogical movements. Consequently, every new intersection of these dimensions generates a map of living relations visible through a system of conceptual infographics, in which the results give birth to new links. Infographics are defined as a visual navigation system in which the synthesis of formally decoded concepts is represented, hierarchized and correlated dynamically.

In terms of the conceptual dimension, we infer that the learning structure of the workshop seeks to develop the intellectual, emotional and existential or spiritual aspects of intelligence in the search for an essential unity.

> “I refuse to separate the emotional from the intellectual dimension. I believe that images and words are related. Everything goes together […]. For me there is no separation between the sensible and the intellectual. Having said that, the emotional aspect is central.” (Didi-Huberman, 2014).

Finally, the formal structure of this methodology comprises four phases making up a circular teaching process, the layered geography of which establishes a unique process of reflection; the stages have been called metaphorically the INTERIOR WORLD and the EXTERIOR WORLD, and the intersection between them, the FISSURE. These three stages make up a meta-narrative of relations which are projected like synaptic conductors of receptive sensitivity; these establish a navigation map coordinated by Phase 4, the CONSTELLATION phase.

2.1 Phase 1: Interior World

As the French art historian and essayist Georges Didi-Huberman (Huberman, 2014) says, to know one must define the space from which one speaks. This also implies indicating a position and taking a decision in time in relation to our unconscious desires. It is having a space in the present to aspire to a future. But all of this only exists against the background "of a temporality that precedes us, envelopes us, appeals to our memory even in our attempts to forget, to make a clean break, to pursue something absolutely new". Taking a position is not to be seen as an act of rebellion, but of taking a position *with respect to something,* determining the specificity of a point of view.

In essence, the *Interior World* phase seeks to navigate in the biographical ambit of the being in order to recover, by a primary impulse, the nexi which give meaning to the theme of the project.

As a path of investigation, it proposes to the student a profound, sensitive journey towards the appropriation of the memories and experiences of her own genealogy to endow them with meaning, thus generating a conceptual matrix which is precursor to the project. This is an uncertain space that the French investigator Guy Aznar describes as the space where "nobody feels alone with his illusions; he travels with them to imaginary countries" (Aznar, 2004).

It also projects investigation connected with our inheritance from our ancestors, in order to recognise certain variables on the political, social and cultural planes of our own history. Among these layers of transfer from each person's family inheritance, there is also room for an important intersection of data from the genealogical migratory legacy and its particular forms of settlement, to which is added the flow of hereditary trades.

The act of constellation is defined as an exercise of linking and resignification of the various happenings and referents which surround and condition the individual in the *auratic* moment. At the same time, the instance of constellation implies a space-time that is not linear, but capable of multiple relations.

In the *Interior World* we investigate the elements of history that have permeated the individual as a primary impulse from which to identify personal interest; and then, in the *Exterior World*, since we are aware of the previous milestones by which we are marked, we can become actors and articulators of a new tissue of identity. Thus, the biographical research is transmitted and received in the degree that it is communicated from personal interest and meaning.

The personal resonance consolidated in the *Interior World* interacts with a different space, which intervenes to transform our perception in a creative act of design. Nothing here is coincidence – all the answers coexist in the family biographical ambit. Knowledge of this information is not an isolated event; it is related with other dimensions of learning, which in turn intertwine with self-knowledge as the path of articulation between the interior and the

exterior. The student must know her own environment and herself, correlating these two dimensions to determine an unpredictable, multidirectional relation between a "whence" which is created and a "whither" towards which this creation is projected.

In the *Interior World*, navigation around significant artefacts in our own memory generates a primal link of profound symbolic value. Thus coming across letters, everyday objects and documents, or holding revealing conversations with family members, define an opportunity to recognise the inheritance of our ancestors and our relation with those no longer with us; this other space where “The dead are invisible, but not absent” as Saint Augustine said (Tessitore, 2002, p.6)

The development of this stage of investigating our memories acquires an intimate, personal character, which implies eliminating the influence of the teacher – whose only task is to facilitate the articulating process of receptive sensitivity, allowing it to flow naturally. Thus teaching is a performance, in which there is always a presential and auratic element.

This poetic imaginary of metaphors, present in our *Interior World*, establishes a series of interrelations and connections, which are interwoven in an infographics substrate.

2.2 Phase 2: Exterior World

In the *EXTERIOR WORLD,* the artistic and cultural imaginary acquires great importance, establishing a binding relation between man and his environment and projecting itself as a significant instance of permeability to different creative referents. The human being structures the *Exterior World* in the image and likeness of his *Interior World*; thus the connections and significates that he establishes will be determined from his own conception of himself and of his surroundings, defining a different space in which both dimensions will finally coexist.

On a methodological level, it is a central concept from which students analyse and research their social and cultural context and form links through different creative tasks set by the teacher, both two-dimensional and three-dimensional, with references in art, philosophy, ecology and politics as they impinge on their different expressions and ideologies. These referents may include exhibitions, books, essays, documentaries and films, which are translated into project assignments that allow students to reflect on and propose their own visual codes to develop the identity of their narratives. Thus each external referent determines the possibility of opening a dialogue and reflecting on the implications of the student's observations.

Finally, whatever our perception of the *Exterior World*, it is a reflection of the correlations of meaning that coexist in our *Interior World*; their results are unknown but essentially valuable in their capacity to reveal new images from a subtle breath of information. So this instance allows students to broaden their creative referents, determining processes of meaning and emotion. To take a position, we must submerge ourselves in both worlds in the certainty of

an encounter which will reveal a unique new project space of self-recognition called a *Fissure*.

2.3 Phase 3: Fissure

In this stage of the project, the INTERIOR and EXTERIOR worlds become connected and correlated in the geography of a residual space called a FISSURE.

This *fissure* or crack allows students to generate a space of own recognition in which to address a graphic structure which forms a constellation or coherent relation with all the navigation processes carried out during the project.

In a different context, this intersection unveils and reveals a unique opportunity for project development, specific at the level of relations and observations, born of the students' own biography. Gastón Bachelard says of this: “Nothing is evident. Nothing is given. Everything is constructed” (Bachelard, 1934).

In this stage of chance and fortuitous associations, solution-finding is established from a process which does not follow any structural logic, but permeates the finding of new relations.

The project proposal emerges, with its degree of urgency and relevance, in the space of the *fissure*; this implies self-questioning about the impact that its object will generate in the field of design, in order to identify who will be the recipients of its content.

Among the problems addressed are the destruction of the environment, social inequalities, memory and identity, migratory movement, the relation between geography, territory and landscape, etc. These proposals allow the design to be re-thought and re-defined, acting as a meta-language for questioning of contents. In this stage there is an imperative need for actions to educate the consciousness, modify beliefs, transform imaginaries, un-learn in order to reformulate and question and reconfigure conceptual frameworks about important aspects for man and society.

2.4 Phase 4: Constellation

The CONSTELLATION phase establishes coordinating axes of meaning, drawn on a linear or divergent narration, acquiring profound meaning in the person by whom they are determined. In this stage, the student designs, articulates, correlates and communicates her observations with a certain coherence, fluidity, flexibility and originality. The constellation of these axes of meaning defines a network of new associations of thought articulated in a conceptual matrix.

This creative instance is directed to a determined end, even if, in practical terms, the product is not immediately applicable or is still being processed, suffers imperfections or is incomplete in the terms of the project. In this way the process is validated as a creative structure.

In methodological terms, a log is kept with a cartographical record of the voyage of the project with the intersection of various significant factors and events. In this meeting of relations and courses, discovery will consist in "seeing what everyone has seen and thinking what no one has thought" (Szent-Györgyl, 2013)

The final graphic piece generates different creative supports, such as object books, new digital applications, performances, montage displays and data visualization. This methodological approach with four research phases allows us to generate a final project with a unique degree of fidelity, a recipient of meaning, clearly recognised as such by its target audience. Finally this process acquires a unique value, strengthening new paradigms in the field of design.

3. Infographies: projects

3.1 Sequence from one student: example

Felipe Pavez's project addresses the concealment and reconversion of the main detention and torture centers registered in Chile, in the context of the dictatorship that occurred between 1973 and 1990, and motivated by the experience lived by his own father (Figures 1-6).

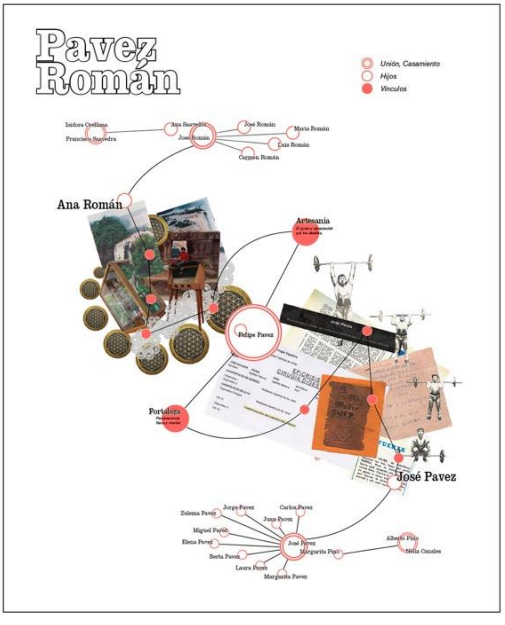


Figure 1. Interior World

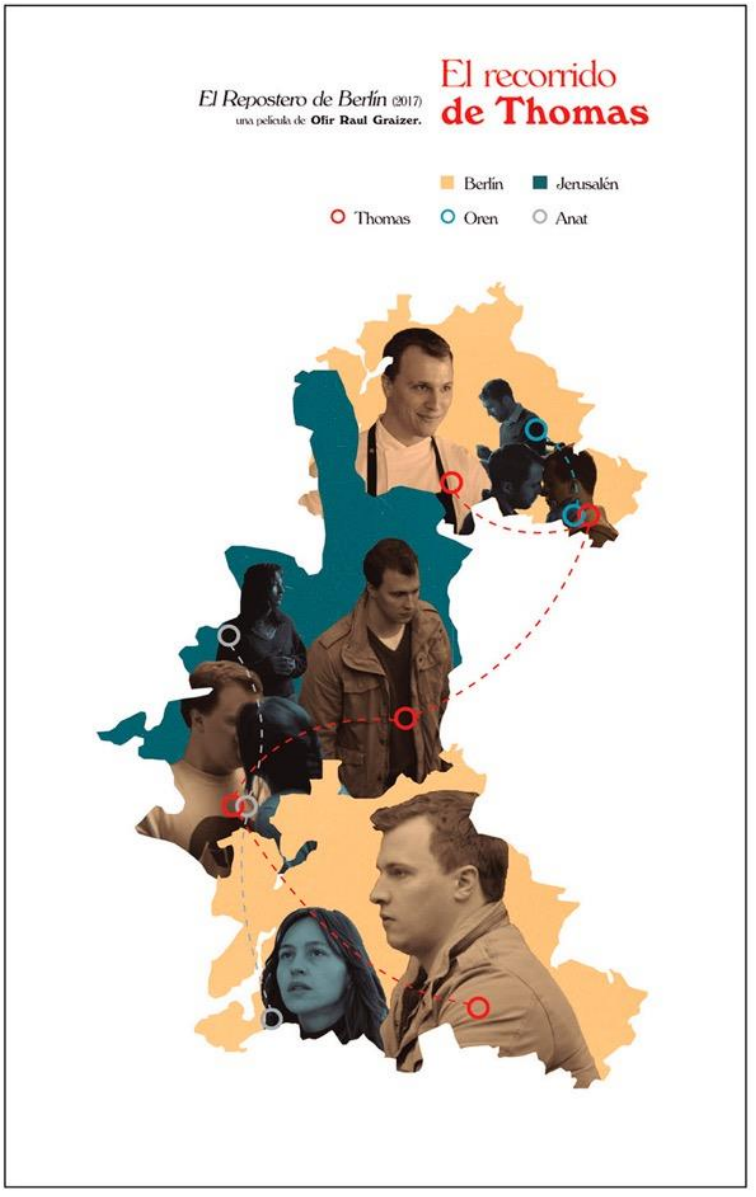
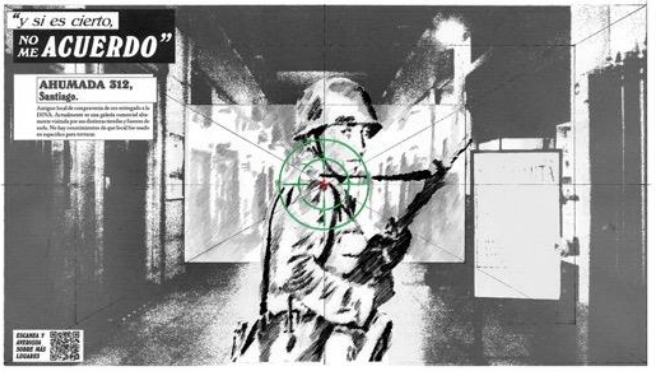


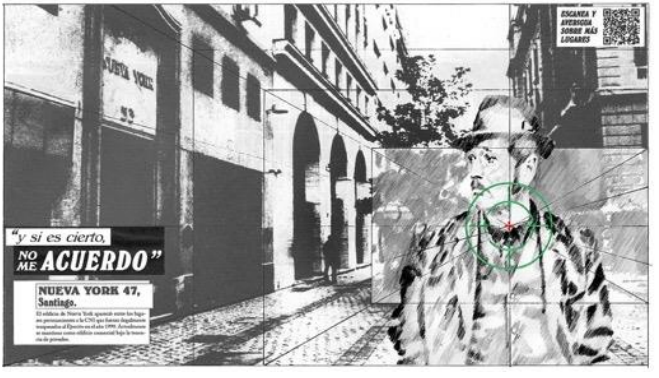
Figure 2. Exterior World



Figure 3. Fissure and Constellation







Figures 4-5-6. Project

3.2 Example of Interior World

The Interior World phase seeks to navigate in the students' biography (Figures 7-9).

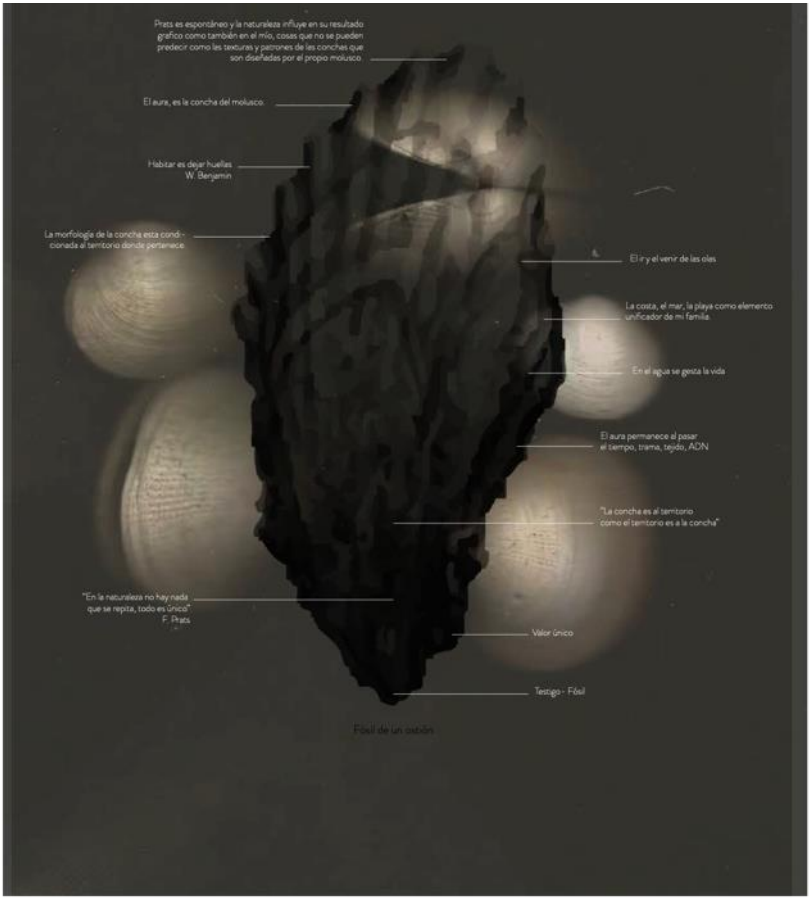


Figure 7. Infography by student Alexandra Pijas, 2016.

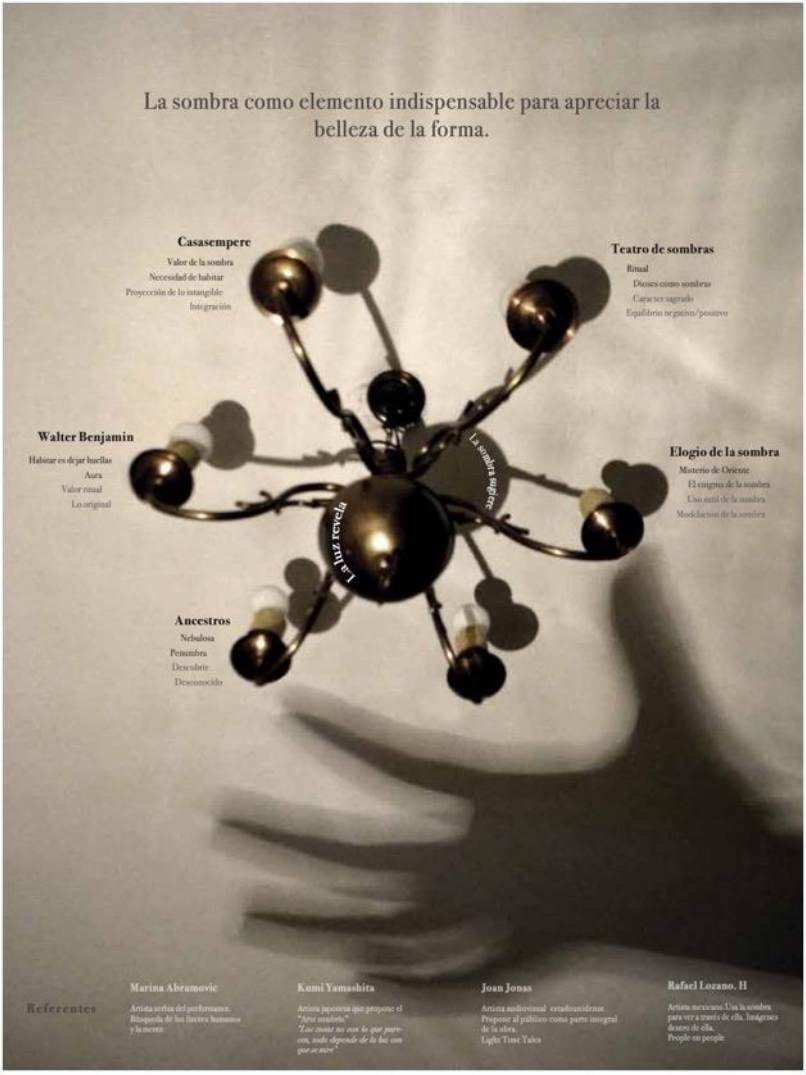


Figure 8. Infography by student Trinidad Borja, 2017.

3.3 Exterior World

Methodologically, a conceptual matrix from which students analyse and investigate their social and cultural context (Figures 9-12).

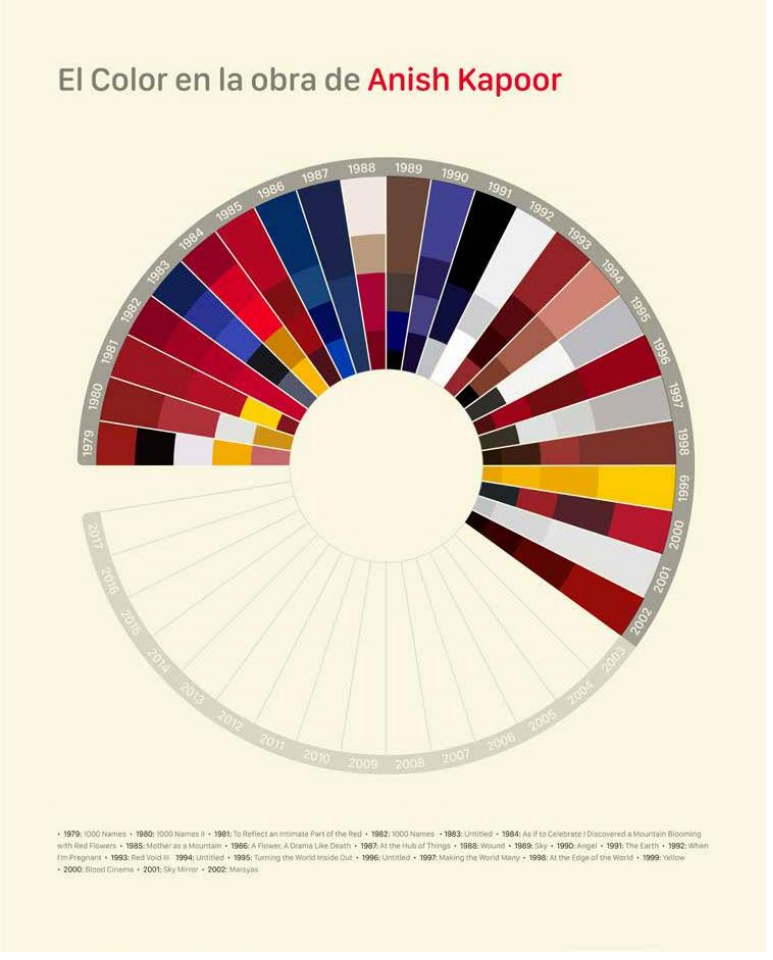


Figure 9. Infography by student Victor Narvaez, 2019.

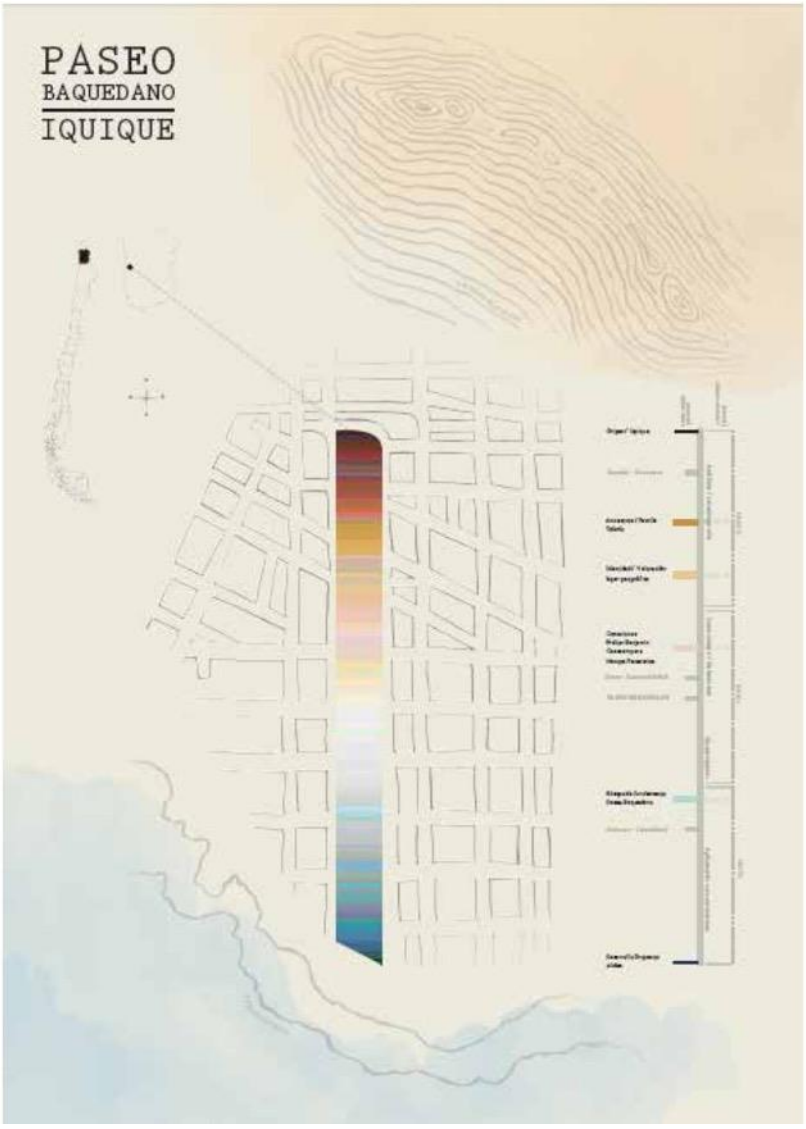


Figure 10. Infography by student Catalina Toleda, 2015.

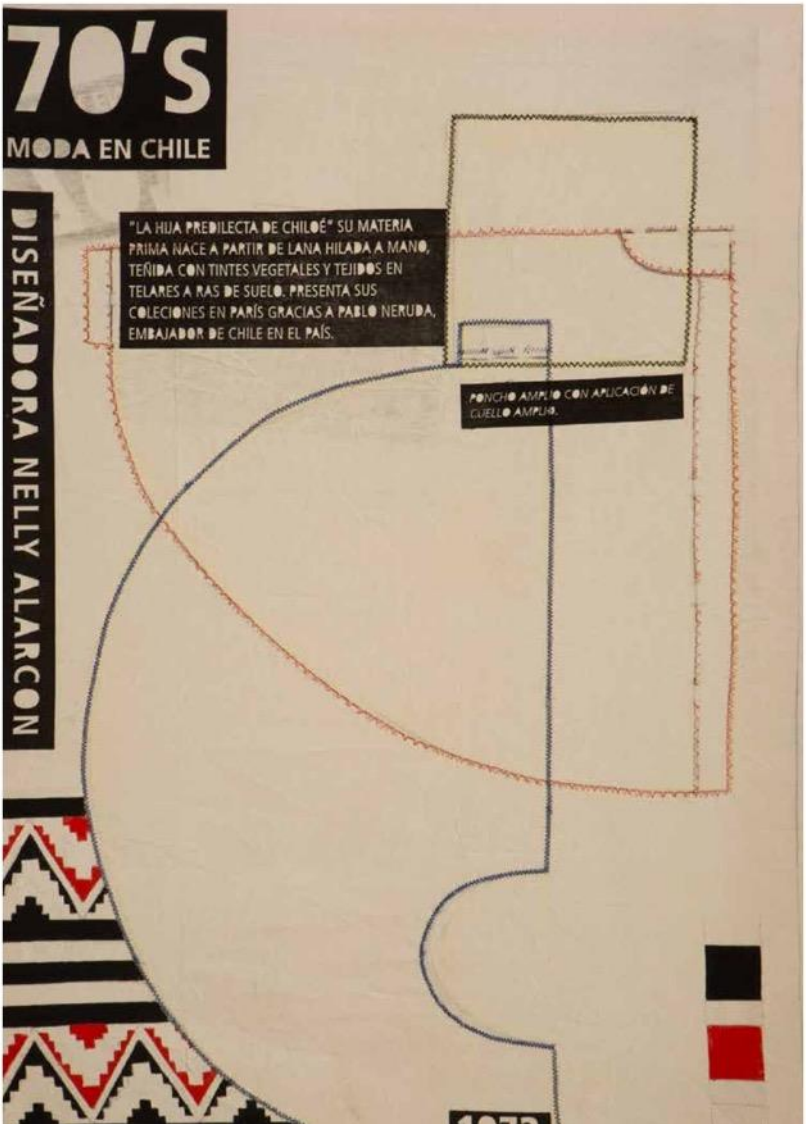


Figure 11. Infography by student Mariana Hernández, 2016.

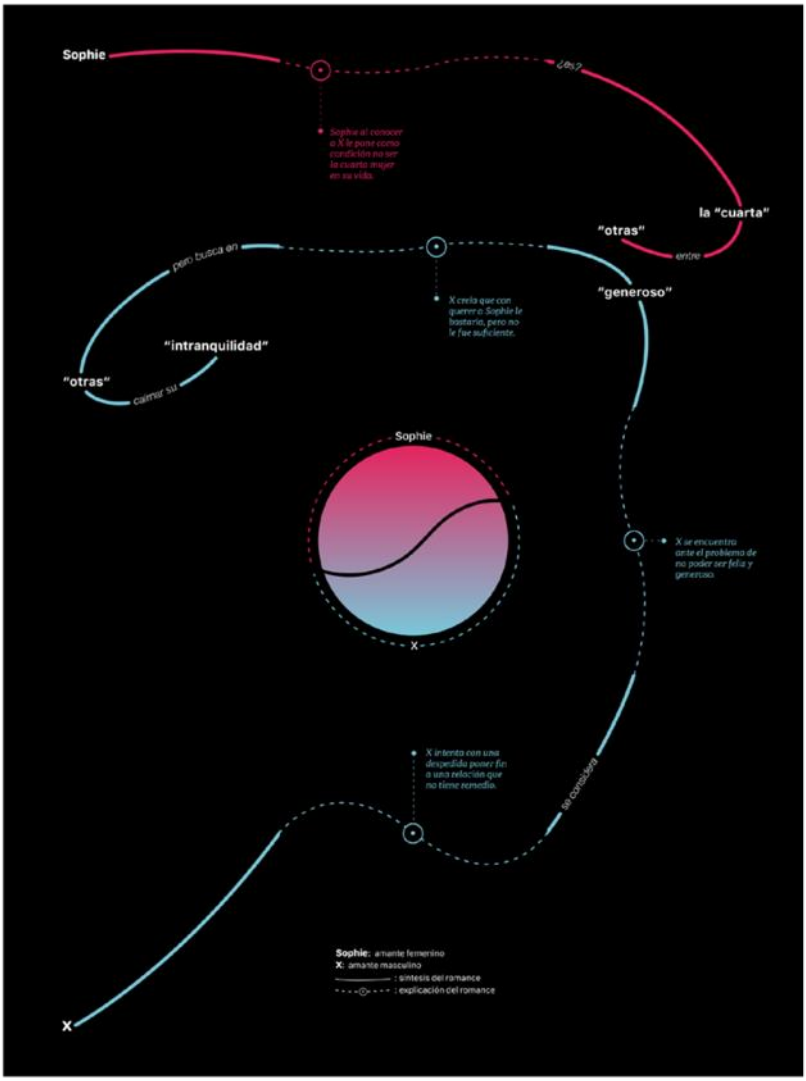


Figure 12. Infography by student Victor Narvaez, 2019.

3.4 Fissure

The INTERIOR and EXTERIOR worlds become connected and correlated in the geography of a residual space called a FISSURE (Figures 13-16).



Figure 13. Infography by student Agustina Leguizamón, 2017.



Figure 14. Infography by student Alexandra Pijas, 2016.

3.5 Constellation

This phase establishes coordinating axes of meaning, drawn on a linear or divergent narration (Figures 15-16).

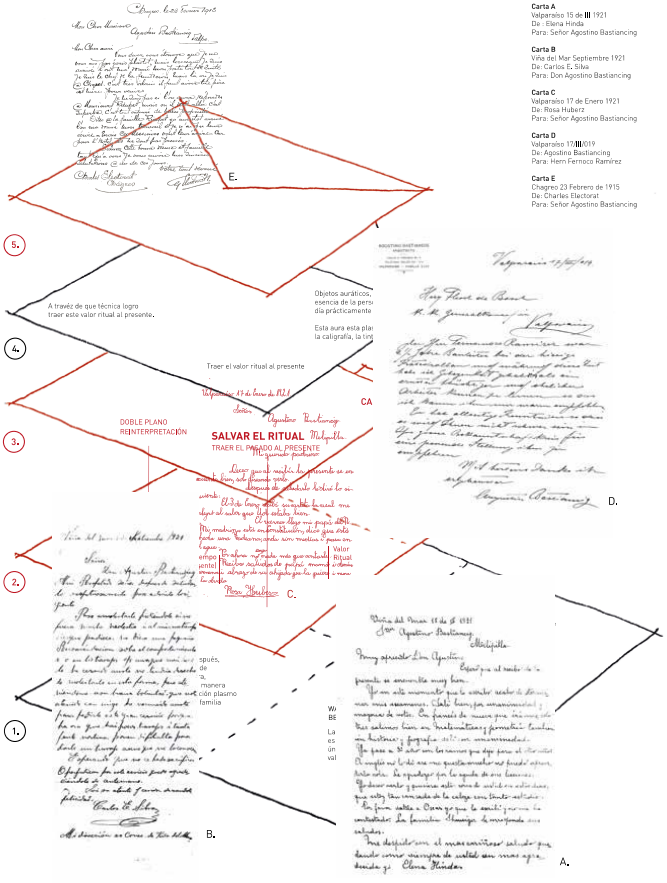


Figure 15. Infography by student Ignacia Navarrete, 2018.

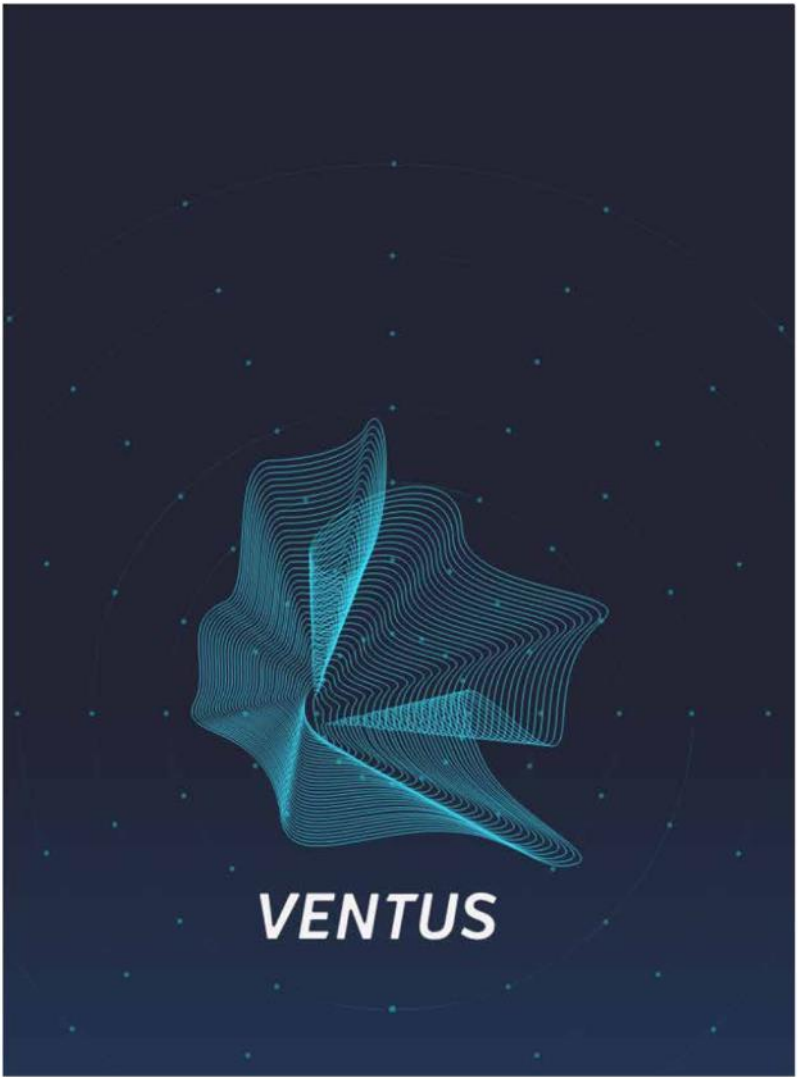


Figure 16. Infography by Antonia Salgado, 2019.

3.6 Final Project

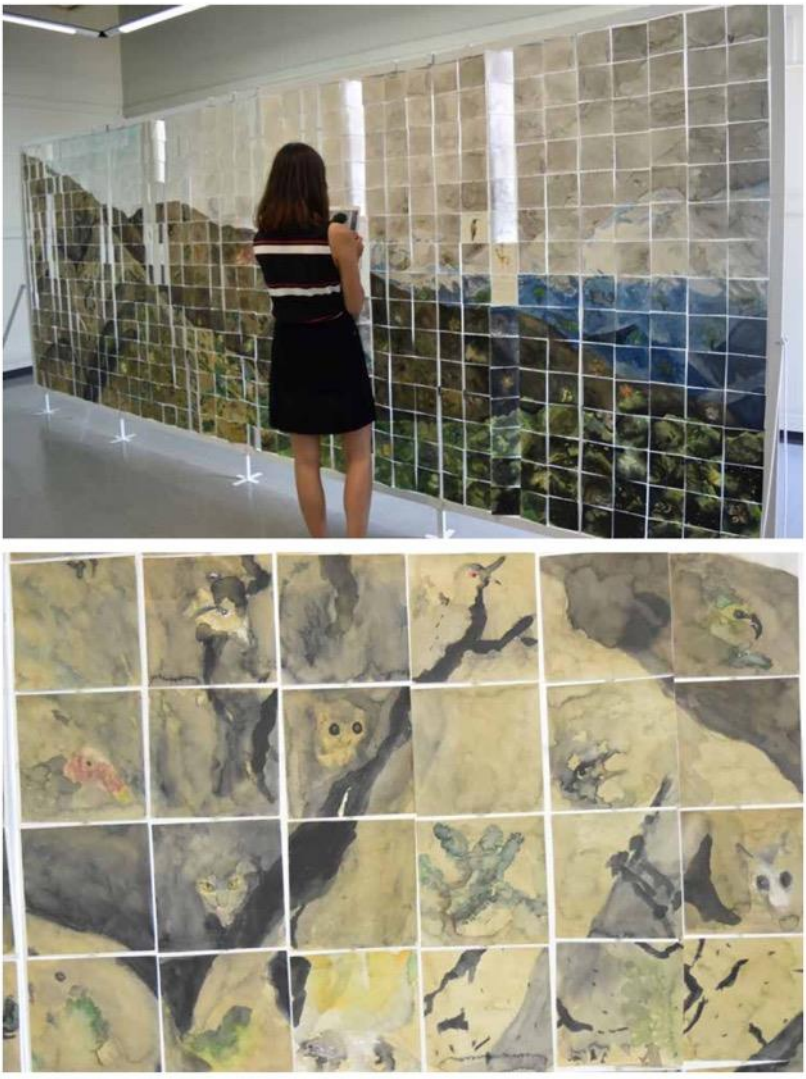


Figure 17. Project "Deterioration of the ecosystem in Santiago parks", by student Roberta Banda, 2016.



Figure 18. Project "Deterioration of the ecosystem in San Carlos Park", by student Roberta Banda, 2016.



Figure 19. Project "Deterioration of the ecosystem in Panul Park", by student Belén Acosta, 2016.



Figure 20. Project "Chile: land of immigrants", by student Belén Acosta, 2018.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Data visualization as a qualitative driver in knowledge communication: an interpretative framework

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Abstract | The growing cultural relevance of data literacy requires a deeper acknowledgement and assessment of the role that data visualization can play if interpreted as a mean to increase the quality of information besides reporting its quantitative features, being therefore actively integrated within the current ecosystem of knowledge communication. In fact, while data visualization is often considered as a merely quantitative tool for information analysis and reporting, the methodologies underpinning this particular branch of visual communication go far beyond the simple restitution of numbers and sizes, frequently approaching more qualitative stances. Highlighting an implicit correlation between data visualization and qualitative research, the present contribution proposes an interpretative framework based on a set of five comparative analogies, in relation to which a same number of emergent fields of application for data visualization are identified, described, and contextualized.

KEYWORDS | DATA VISUALIZATION, QUALITATIVE RESEARCH, KNOWLEDGE COMMUNICATION, INTERPRETATIVE FRAMEWORK, COMPARATIVE ANALOGY

1. Introduction

Since the early years of the new millennium, alongside the massive acceleration occurring in the technologic system, a growing interest in investigating the role of visualization in the production, transmission, and dissemination of knowledge started to spread transversally within the international research community (Burkhardt, 2008).

Definable as the realm of knowledge communication, this now well-established disciplinary current has frequently pointed out the strong potential of data visualization – broadly intended as the visual representation of data through both analogical and digital means – in dealing with the surplus of information generated by contemporary society. In fact, the observation of recent trends in this field seem to testify how, despite a remarkable aesthetic diversity, many experiences tend to accomplish common principles and procedures, which "result in a type of emergent taxonomy [...] and reveal the initial building blocks of a new visual language" (Lima, 2013, p. 159).

Nowadays, the flourishing iteration of efforts aimed at codifying the syntax of this language, and addressing its widespread dissemination, represent a major cultural issue in terms of data literacy, since "in the information age the ability to read and construct data visualizations becomes as important as the ability to read and write text" (Börner, Bueckle & Ginda, 2019, p. 1857). For this reason, is important to emphasize how, while data visualization is often considered as a merely quantitative tool for information analysis and reporting, the methodologies underpinning this branch of visual communication go far beyond the simple restitution of numbers and sizes, frequently approaching more qualitative stances (North, 2006).

This attitude recalls quite impressively the domain of qualitative research, definition standing for an array of strategies shared by many academic disciplines "for conducting inquiry [...] aimed at discovering how human beings understand, experience, interpret, and produce the social world" (Sandelowsky, 2004, p. 893). More than with exact counts or measures, qualitative data analysis is concerned with the detection of meanings, concepts, definitions, characteristics, attributes, metaphors, symbols, and descriptions of things, constructing research outputs suitable for being returned according to interpretative, discursive and thematic paradigms.

This analogy, highlighting an implicit correlation between data visualization and qualitative research, represents the common thread of the present contribution, aimed at defining an interpretative framework suitable for evaluating data visualization, and its potential qualitative impact, in relation to the broader field of knowledge communication.

2. The growing relevance of data literacy

Is important to premise that, within the bounds of this reasoning, the notion of knowledge communication will be primarily understood in its role of fundamental human prerogative, as "the (deliberate) activity of interactively conveying and co-constructing insights, assessments, experiences, or skills through verbal and non-verbal means" (Eppler, 2007, p. 291). This interpretation reverberates in the ultimate purpose of data visualization, which resides in the willingness of formalizing – through the design of infographic outputs such as tables, graphs, charts, diagrams, maps, or similar – a common language able to communicate information across cultural, translational, and disciplinary boundaries.

Such an attitude gains even more significance in view of a technological system which has led in few years to "the datafication of everything" (Mayer-Schönberger & Cukier, 2013, p. 194), and where the increasing proliferation of new digital devices, networks and infrastructures endorses the possibility of mapping the world in a mostly quantifiable, analyzable and computable way.

As we are all surrounded by information operating at varying degrees of immediacy to our lives, becoming at the same time both data producers and data consumers, it is important to identify and develop the "competencies that make up the all-round talents of a visualizer as well as those required to be an efficient viewer" (Kirk, 2016, p. 385).From this point of view, data visualization designers should start to operate according to a stance which is not simply data-driven, but also and especially data-informed and data-aware (Tan & Churchill, 2018), being able to encode new ways to turn information into value, and define the best ways to address them to a particular audience.

At the same time, also qualitative researchers began to advance the claim for redefining the traditional methodologies employed in gathering, analyzing and summarizing data, in order to understand more deeply how these activities affect the general process of investigation in the midst of the "information explosion" (Major & Savin-Baden, 2012).

The growing cultural relevance of data literacy requires a deeper acknowledgement and assessment of the role that data visualization can play if interpreted as a mean to increase the quality of information besides reporting its quantitative features, and actively integrated within the current ecosystem of knowledge communication. In this sense, it is of paramount importance to emphasize the qualitative features of data, from "the most personal information that is essential for our physical survival to the most abstract form of information that encompasses our personal myths, cultural development, and sociological perspective" (Wurman, 2001, p. 160).

Moving from these premises, the essay outlines a range of analogical – rather than strictly logical – arguments to support data visualization designers in gaining awareness about their role in turning quantitative information into qualitative experiences, fostering more consciousness in dealing with the increasing complexity of the world we live in.

3. The qualitative value of data visualization

Since the most ancient times, the visual display of information has been practiced across an extremely wide range of disciplines – ranging from mathematics to architecture, from economy to medicine, going up to sociology, psychology, music, art, and many others – as a vehicle to address sector-specific epistemology. It is also because of this transversality that data visualization has struggled for a long time to find its own disciplinary status, which started to effectively establish only around the mid-nineteenth century, meeting the need for managing a growing amount of statistical units becoming more and more significant to understand modern society.

However, while in the last decades data visualization has largely focused on quantitative processes of exploration and analysis, some of its earliest examples were created to show and explain that "the elements to be transformed [...] were no longer just quantities and numbers, but qualitative and semantic elements as well" (Burgio & Moretti, 2017, p. 893).

If we consider the achievement of a balanced ratio between evidence and rhetoric as an essential requirement for translating data into meaningful representations, experts in the field require to develop both statistic and design knowledge, since "without the former, visualization becomes an exercise only in aesthetics, and without the latter, one of only analyses" (Yau, 2013, p. xi). In this sense, data visualization community is growingly stressing the need for its practitioners to adopt explanatory, beyond simply exploratory, strategies in their design approaches, aimed at detecting relationships that may be hidden by summary statistics, and communicating interpretative insights inferred from scrutinized data (Barlow, 2014).

In turn, the potential of incorporating data visualization in qualitative research also started to be acknowledged, firstly as a way for generating hypotheses and developing theory, and secondly a mean to give readers the possibility of seeing the author's meaning represented in more ways than just verbally and textually (Verdinelli & Scagnoli, 2013).

In light of these considerations, could then data visualization be considered as a qualitative driver in knowledge communication? To validate this perspective, an interpretative framework bridging together data visualization with the domain of qualitative research is proposed and applied pointing out a group of comparative analogies.

On the one hand, five methodological categories are borrowed from the most prominent traditions detectable in qualitative research, as masterly synthetized by John W. Creswell (2006) as:

- narrative approach
- ethnographic approach
- grounded theory approach
- phenomenological approach
- case-study approach

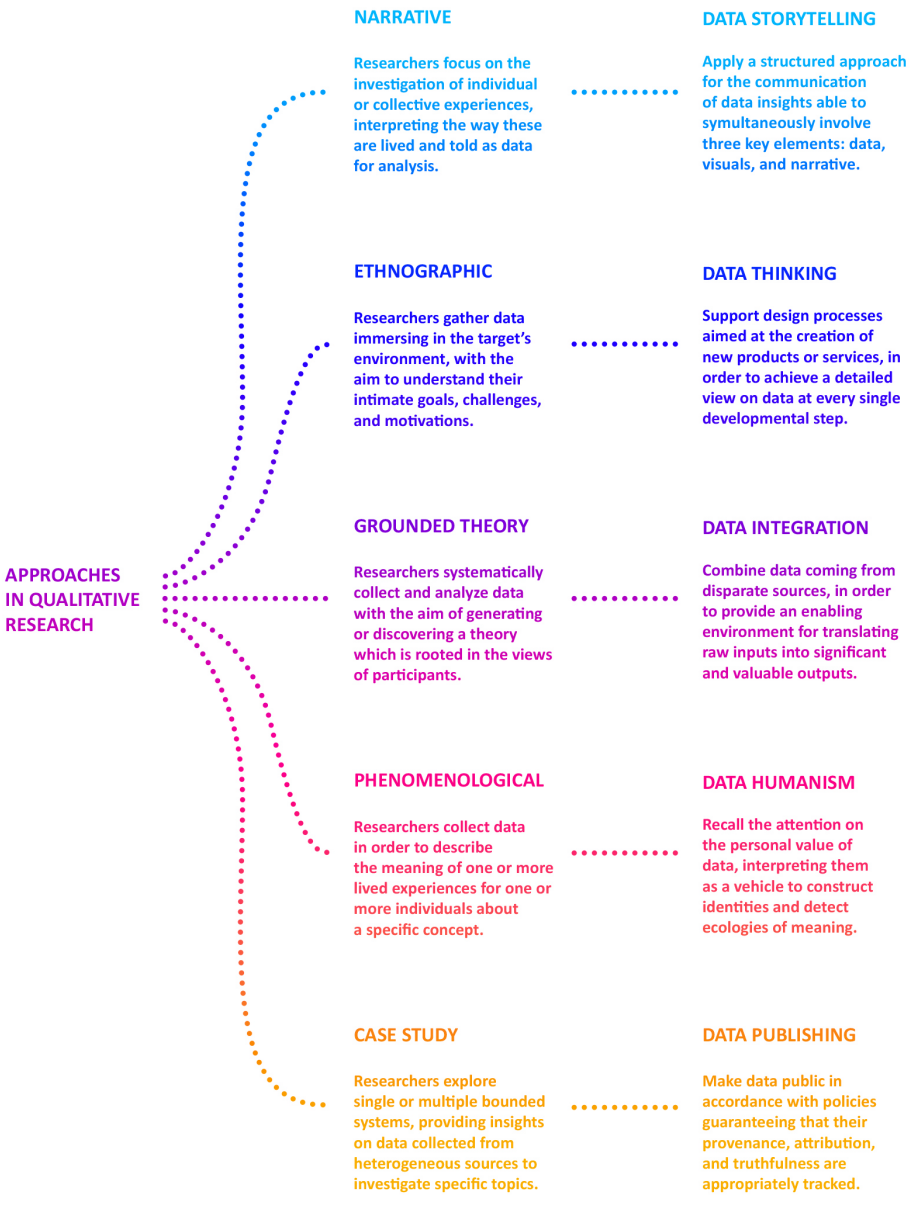

Figure 1. Schematic visualization of the framework proposed in the article.

On the other hand, the aforementioned categories are employed to identify, describe, and contextualize a same number of emergent fields of application for data visualization, emphasizing how these inherently promote a qualitative treatment of information:

- data storytelling
- data thinking
- data integration
- data humanism
- data publishing

3.1 Data storytelling

The first comparative analogy outlined in the proposed framework relates the discipline of data visualization to the qualitative mode of inquiry known as narrative approach, in which researchers focus on the investigation of individual or collective experiences, interpreting the way these are lived and told as data for analysis (Creswell, 2006). The procedures for implementing this methodology imply in the first place the collection, examination and interpretation of data in order to identify units and patterns of meaning, and afterwards the assemblage of those segments according to a clear narrative structure and a temporal – yet not necessarily linear – criterion.

This perspective, where a strong epistemological priority is assigned to the readability of research outputs, inherently points out the role of data visualization design in enhancing the sensorial and synesthetic features "that provide a narrative structure and guide the reader through the story" (Kosara & Mackinlay, 2013, p. 48).

In the last two decades, the narrative instance of data visualization has found an attainable and prolific field of application in the domain of data storytelling, a now diffused label identifying a structured approach for the communication of data insights involving a combination of three key elements: data, visuals, and narrative (Dykes, 2016).

Above all, data storytelling requests data visualization designers to deeply understand the distinguishing features of diagrammatic representation, being able to adopt the appropriate choice to convey specific information, and to translate them into both online and offline communication strategies (Lankow & Crooks, 2012). It is interesting to observe how strongly those competences would impact the treatment of data, since "whether genres are pure or mixed, words or graphics, ordered or not, every piece of discourse requires authors to select the information that is relevant, to express it felicitously, and to link the pieces into a whole" (Riche, 2018, p. 26).

Among the major expressions of data storytelling, one cannot omit the reference to the practice of data journalism, whose origins are traceable since the mid-twentieth century and which today represents one of the most important vehicles for the production of news stories, where visualization is structurally involved to highlight relevant topics.

A leading figure in this scenario is undoubtedly that of Alberto Cairo, Spanish information designer interested in the convergence between visual design and cognitive sciences, working in the field of data journalism since the early 2000s and currently director of the Visualization Program at the University of Miami's Center for Computational Science. In his PhD thesis, entitled *Nerd Journalism. How Data and Digital Technology Transformed News Graphics*, Cairo investigates "how news graphics has changed as a practice, as a professional endeavor, and as a set of products" (Cairo, 2018, p 17), redefining the search for a balance between the objectivity of representation and the aesthetics of communication.

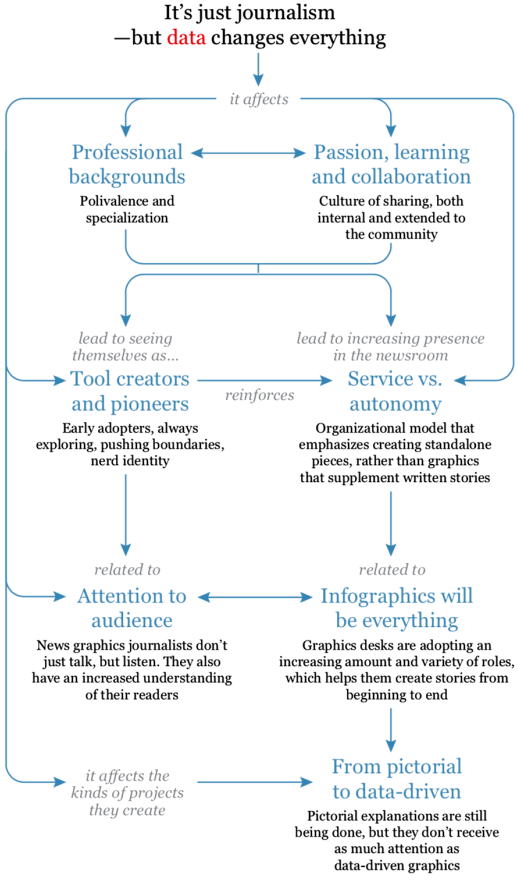

Figure 2. "Nerd Journalism. How Data and Digital Technology Transformed News Graphics", Alberto Cairo, 2017.

3.2 Data thinking

The second comparative analogy outlined in the proposed framework relates the discipline of data visualization to the qualitative mode of inquiry known as ethnographic approach, in which researchers gather data immersing in the target's environment, with the aim to understand their intimate goals, challenges, and motivations (Creswell, 2006). Drawing from a user-centered paradigm, this methodology interprets data as a vehicle of interaction and accessibility towards an entire group, domain, or society, in order to decrypt its shared patterns of behaviors, beliefs, and languages, and address contextualized experience within its cultural reality.

Such an attitude resonates in the principle according to which, to transform information into knowledge, data visualization "must share some context and meaning [...] to become encoded and connected to preexisting experience" (Vande Moere, 2012, p. 16), considering participants' social background, previous thoughts, distinctive abilities or disabilities.

In this sense, a promising field of application seems to be that of data thinking, a lately emerging concept identifying a range of strategies aimed at supporting design processes involved in the creation of new products or services**,** where the substantial purpose is to achieve a detailed view on data at every single developmental step (Kronsbein, 2019).

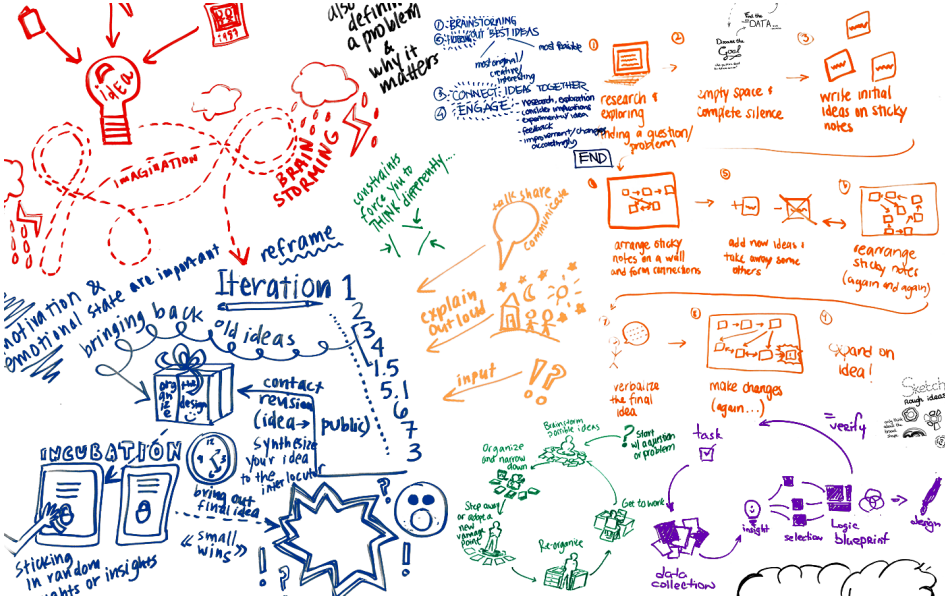

Figure 3. "Process Matters Workshop", Sense Information Design, 2016.

Understood as a symbiosis of design thinking and data science, the data thinking approach meets the instance for which, "designers need to address the impact of the increasing amounts of data available from a multiplicity of sources and […] inform how decisions are made" (Newman, 2017, p. 25). This acknowledgement assumes even greater significance if we consider how, in the face of an often-overlooked set of analytical skills, many data practitioners are too focused on accomplishing the usage of specific tools and techniques and not concerned enough with asking the right questions: put the why before the how (Shron, 2014).

Although the concept of data thinking is currently mostly affirmed in the business world, it offers insightful perspectives for addressing more widely the practice of data visualization to better understand people's mental models, and increase users' involvement while designing accessible interfaces, interactions, and experiences.

From this point of view, it is particularly significant the approach carried out by the designer and researcher Sheila Pontis, interested in mapping complex data through discerning "what type of information would be more helpful for the intended audience to be displayed in a visual explanation, and with what level of detail" (Pontis, 2018, p. 111). Together with Michael Babwahsingh, in 2013 Pontis founded Sense Information Design, a New York based design consultancy promoting a deeper understanding in all aspects of collaboration and communication, through people-centered experiences aimed at turning complex and unfamiliar messages into useful, meaningful information.

3.3 Data integration

The third comparative analogy outlined in the proposed framework relates the discipline of data visualization to the qualitative mode of inquiry known as grounded theory approach, in which researchers systematically collect and analyze data with the aim of generating or discovering a theory rooted in the views of participants (Creswell, 2006). Compared to the previously introduced ones, the intent of this particular approach is to move beyond the purpose of basic description, pushing towards the grouping of unstructured sources into concepts, categories, and codes, to obtain an analytical schema of a process that contributors have personally experienced.

Such perspective is particularly suitable for framing data visualization into the digital ecosystem, where the design process became deeply intertwined to an array of techniques – such as those of data acquiring, parsing, filtering, mining, representing, refining, interacting (Fry, 2008, p. 5) – which not necessarily involve direct manipulation of visible features.

This assumption paves the way for advancing a connection with the concept of data integration, designating the operations of combining data coming from disparate sources, in order to provide a unified view of them and an enabling environment for translating raw inputs into significant and valuable outputs (Roth, Wolfson, Kleewein & Nelin, 2002). Although drawing mainly from computer sciences and information technology, this concept

is indeed strictly related to data visualization, intended as “the process of making data intelligible, enabling human intuition and expert knowledge to be applied in areas where algorithmic interrogation is unrealistic” (Pettifer & Attwood, 2013, p. 519).

Since data integration establishes itself on a strong principle of collaborative community, where data and the tools for their processing should be mutually shared between users, data visualization can actively contribute to the release of participated theories that are both iterative and reflexive, both contextual and conceptual (Knigge & Cope, 2006).

Involving operational methodologies at the intersection of machine learning, database systems, and business intelligence, the field of data integration purposely requires data visualization designers to become acquainted with competences usually more concerned with profiles such as those of coders, statisticians, or engineers.

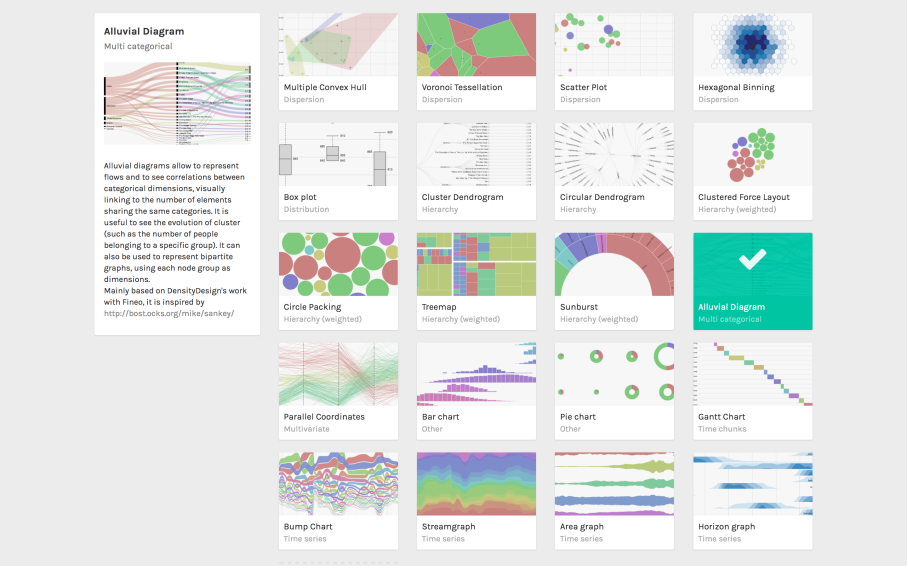

Figure 4. “RAWGraphs”, https://rawgraphs.io/

In this perspective, one of the most prominent examples is that of RAWGraphs, an open-source web application for the creation of static and dynamic infographics developed since 2017 by the DensityDesign Lab at the Polytechnic University of Milan, building upon previous work on visualization tools, libraries and platforms. Strongly relying on concepts such as open outputs, reusable charts, and community building, RAWGraphs defines a set of instructions for the creation of specific representations, giving users the ability to change the underlying data and customize their graphical variables (Azzi, Caviglia, Elli, Mauri, Uboldi, 2017).

3.4 Data humanism

The fourth comparative analogy outlined in the proposed framework relates the discipline of data visualization to the qualitative mode of inquiry known as the phenomenological approach, in which researchers aim to describe the meaning of one of more lived experiences for one or more individuals about a specific concept (Creswell, 2006). In comparison to the narrative approach, before than the translation of unstructured data into a story, the fundamental goal of this methodology resides in describing the essential nature of a particular phenomenon, deriving significant arguments and statements about its meaning from evidence provided by those who personally experienced it.



Figure 5. "Dear Data", Giorgia Lupi and Stefanie Posavec, 2016-2017.

If transposed to data visualization, a similar stance suggests the enactment of a methodology in which the design process draws from deeply understanding the causes, consequences, influences and projections referred to a given circumstance, in order to display its connection and significance in relation to everything else (McCandless, 2014).

Such consideration closely intercepts the theoretical dimension of data humanism, which is rooted in the recognition of the interpretative nature of visualization towards the phenomenal world, as "the display itself is conceived to embody qualitative expressions, and the information is understood as graphically constituted" (Drucker, 2014, p. 129).

Standard analysis procedures could lead data practitioners to give priority to numbers before people, losing sight of the most important characteristics which address human beings in gaining self-awareness and developing emotional intelligence: creativity, drive, persistence, motivation, rapport, and empathy (Goleman, 2011). The instances underlying the current of data humanism recall the attention on the personal value of data, interpreting them as a vehicle to construct identities and detect ecologies of meaning, privileging the investigation of small, consistent, and detailed matters rather than big, uneven and scattered ecosystems (Georgakopoulou, 2007).

These are, in short, the foundations and purposes that lay the groundwork for applying a humanistic approach to data visualization, aimed at contextually depicting the uniqueness of phenomenons pertaining single individuals' experiences through the graphical representation of their intimate, speculative, and even poetic relationships.

Exemplary, in this perspective, is the work of Giorgia Lupi, Italian information designer and partner at Pentagram Studio, according to which "we are ready to question the impersonality of a merely technical approach to data and to begin designing ways to connect numbers to what they really stand for: knowledge, behaviors, people" (2017). *Dear Data*, probably the most renowned work by Lupi, is a year-long drawing project carried out with Stefanie Posavec: each week, during a year, the two designers collected and measured a particular type of information about their lives, and used these to make a drawing on a postcard-sized sheet of paper, approaching data visualization in a slow, analog, and artisanal way.

3.4 Data publication

The fifth comparative analogy outlined in the proposed framework relates the discipline of data visualization to the qualitative mode of inquiry known as the case study approach, in which researchers explore single or multiple bounded systems, providing accurate, detailed, in-depth insights on data collected from heterogeneous sources (Creswell, 2006). Since the case study approach might loosely select to investigate specific topics drawing from several source, or multiple topics housed within a single source, some disagreement exists about whether this methodology should be considered as an effective type of qualitative research, or instead as an object of study, or even as a product of the analysis.

Dealing with sources is a prominent issue also for what concerns data visualization, since inadequacies in their scientific accountability could lead to misleading or disempowering aspects, such as lack of transparency, merely extractive collection, technological complexity, and deficiency in the control of impact (D'Ignazio & Bhargava, 2015).

In this sense, relevant instances have lately been pointed out by the emerging research field of data publishing, a practice through which data are made public in accordance with associated policies guaranteeing that their provenance, attribution, and truthfulness are appropriately tracked (Candela, Castelli, Manghi & Callaghan, 2017).

Although a general agreement is still to be reached, the academic community started to recognize the need to define specific standards aimed at documenting and referencing the processes underlying the publication of data (Austin, Bloom, Dallmeier-Tiessen, Khodiyar, Murphy, Nurnberger, Raymond, Stockhause, Tedds, Vardigan & Whyte, 2016) In parallel, many important companies, organization and institutions throughout the world have extended their corporate image systems to include guidelines specifically calibrated for the visual display of information, acknowledging "the growing importance of using data [...] and the value of branding them appropriately" (Cesal, 2019).

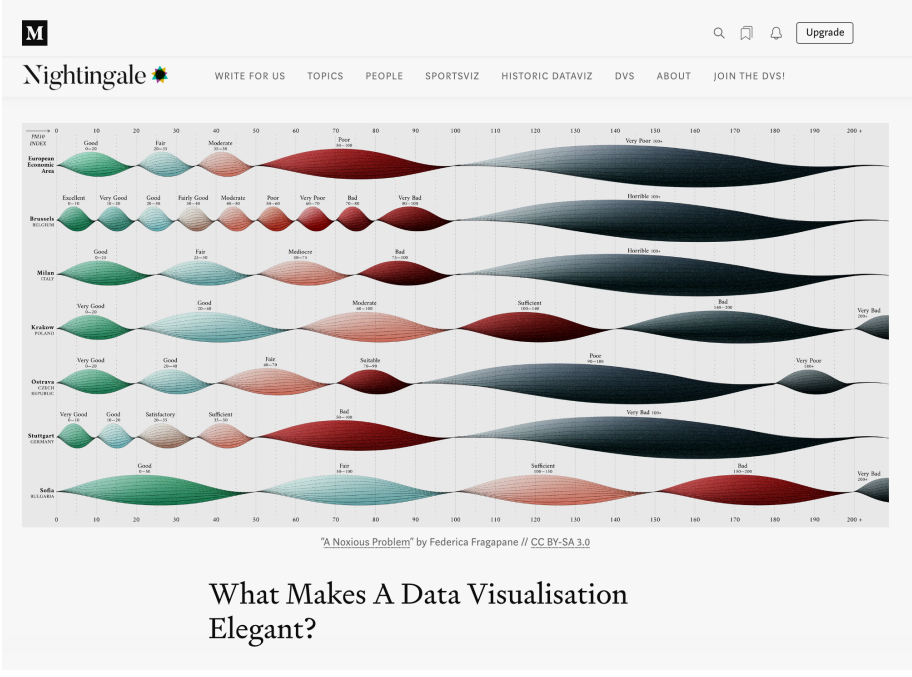

Figure 6. "Nightingale – Journal of the Data Visualization Society", https://medium.com/nightingale

Although their formalization into more codified principles is still in progress and mostly empirical, these signals warn us about how the massive spreading of data visualization across analog and digital media calls for an institutional environment able to supervise the circulation of information and establishing protocols for its usage on a case-by-case basis.

Remarkable, in this sense, is the work recently carried out by the Data Visualization Society, instituted in 2018 by Amy Cesal, Mollie Pettit and Elijah Meeks in order to "address that lack of professional development in the field, create a larger community, and [...] establish guidelines for professional development" (Meeks, 2019). The Data Visualization Society has also founded *Nightingale*, a digital journal based on the *Medium* publishing platform, with the aim to provide high-quality daily articles covering many aspects of data visualization, including education, entertainment, history, sports, best practices, new techniques, and many other.

4. Conclusions

In conclusion, the framework proposed in this dissertation seems to confirm the hypothesis of an inherent correlation existing between the practice of data visualization and the domain of qualitative research, reciprocally concerning both their underpinning theoretical assumptions and the methodologies applied for investigation purposes. The revealed analogies appear consistent and pertinent, as the corresponding fields of application put forward relevant issues about data – such as those related to their readability, accessibility, usability, personality, and accountability – opening insightful perspectives for practitioners involved in this disciplinary and professional field.

More generally, the involvement of visual semantics can act a powerful mean for leveraging the cultural value of information in order to enhance the spread of data literacy, and is mainly in this sense that data visualization could be intended as a qualitative driver in the processes of generating, organizing, and communicating knowledge.

At the same time, the outlined framework presents also several questionable criticalities, as in the first place the limited number of design examples presented in relation to the five identified categories, which amount could be enriched and implemented with additional references that may have not been here considered. Furthermore, as already mentioned in several passages of this contribution, the arguments upon which the framework itself is articulated rely on an overtly interpretative stance: an aspect, this, which would necessarily imply further inquiry to appropriately validate the effectiveness of the advanced classification.

In any case, this study has provided presumptive evidence to affirm that promoting and enhancing occasions of cooperation, contamination, and fertilization between the fields of data visualization and qualitative research could lead to account the shift from a paradigm founded on data accumulation to one oriented to data signification.

A greater involvement of qualitative research procedures in data visualization would encourage the latter in developing a deeper inclination towards incorporating principles of understanding, participation, cooperation, empathy, and openness, as well as a stronger proclivity in operating in contexts and conditions of uncertainty. Data visualization, in turn, could contribute to the realm of qualitative inquiry by offering a design-oriented perspective, aimed at providing ad-hoc formats and layouts to support researchers in organizing informational contents, as well as at arranging visual shortcuts for helping them in exploring their data more effectively.

More comparative research focused on this specific, intertwined analogy would definitely be welcomed and recommended, acknowledging how the quest for a broader theoretical systematization could contribute to address data visualization in fully unleashing all its communicative, cultural, and ultimately qualitative potential.

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Design and Cultural Sites: New signage methods and languages for fruition, accessibility and storytelling.

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Abstract | The enhancement of cultural heritage is a relevant field for design research and practice, involving important issues such as accessibility, storytelling and knowledge sharing. A good fruition of cultural sites can be promoted through different scales of action and targeted strategies, including wayfinding design. Among its role in facilitating orientation, a signage system can convey identity and historical, cultural and artistic value of the context where it is placed. This contribution aims to evaluate, through the analysis of certain cultural heritage case studies, interesting strategies and tools used to narrate places, defining different approaches regarding interaction with the visitors and relation with the context.

KEYWORDS | INFORMATION, IDENTITY, COMMUNICATION, INCLUSIVE, NARRATION

1. Introduction

Nowadays, the enhancement of cultural heritage is an important topic where the contributions of several interdisciplinary subjects play a key role in communication, sharing, and narration of stories and identities of cultural places. In recent years, the design discipline has seen the growth and strengthening of this research theme and the related debate. The outcomes of these considerations are documented in the form of scientific publications, conferences and events, creation of research groups and university degree courses that place the design of cultural heritage at the centre of their attention and action. That is because design has a natural vocation to communicate the identity and the potential of a place, becoming an important narrator in the context of fruition, sharing and construction of culture (Trocchianesi, 2014).

In this scenario, this contribution focuses on the design of signage systems for orientation and fruition within artistic and cultural sites. Through the analysis of certain case studies, it is possible to outline interesting strategies and tools used to narrate places, both from the point of view of their spatial articulation and in terms of their cultural meaning. A critical interpretation of the design approaches is proposed, considering both the tangible and the intangible dimension, the analogical/digital possibilities, the declination on physical and cultural accessibility, also through non-verbal sensory solutions, and the symbolic-narrative aspect integrated in a specific context.

2. Fruition and accessibility of cultural heritage

Museums, cultural institutions, archaeological sites and even art cities are promoted – or, in other words, enhance their cultural value – when the fruition by a community of regular and tourists reinforces the collective memory and consciousness towards history and identity (Montella, 2009). To encourage a good fruition – intended as the opportunity for an audience to access and enjoy various cultural and art manifestations – every cultural site needs a recognizable visual and conceptual identity, integrated in a communication strategy addressed to a heterogeneous, global and multicultural public.

In this context, the project disciplines and design became strategic after the transition from a merely conservative approach – intended as protection and safeguarding – to promotion activities which provide new meanings and new values for empathic institutions (Lupo, 2013). In fact, various fields – such as exhibition, product, service, graphic, digital, branding and multimedia design – are involved at different scales of action and targeted projects, dealing with important topics including accessibility, storytelling and knowledge sharing.

The concept of enhancement is closely linked to the notion of accessibility, ideally setting the task of unlimited access to culture, regardless of disabilities or sensory limitations.

> "The categories with disabilities involved are not only the classic ones but also people suffering from a temporary disability due to illness or accidents, the elderly, the parents accompanying small children who often have specific needs and whose capabilities are not yet fully developed, people suffering from allergies, and even those who, for example, do not know the local language." (de Paolis & Guerini, 2015, p.73)

In early years, the focus was mainly on the aspects of physical access, determined by natural or architectural barriers, especially for those with reduced mobility. With the diffusion of the "Design for all" approach, the term accessibility took on a new meaning, involving solutions that facilitate and improve the experience to everyone and not just the majority. At present, the definition of barriers has broadened, also including social and economic factors that may affect fruition, from sensorial accessibility to the concept of cultural accessibility. In an accessible and inclusive cultural site, a similar visit experience is guaranteed to everyone in terms of time, understanding and enjoyment.

An integrated communication strategy with a powerful storytelling of a cultural site is shaped by its architectural context, its exhibit structure and all internal and external communication artefacts, from the institutional signboard to information leaflets and social media contents (Lupo & Vitali, 2018), as well as signage and orientation systems. When these elements are recognizable and express a precise and authentic narrative, the institution's identity activates visitor involvement and establishes an emotional relationship with the latter.

> "Ultimately, the image creation process becomes critical to visitors' final impression. In many instances, this image creation is achieved through the direct manipulation of environmental stimuli both inside and outside of the heritage attraction itself." (Bonn, Joseph-Mathews, Dai, Hayes, & Cave, 2007, p.346)

Among the traditional visual design artefacts and environmental stimuli, the role of signage is usually underestimated, whereas it can be a useful tool to optimize the fruition of a space and, at the same time, communicate its identity. Signage is not only about wayfinding, but it can be the means to supply information, stories, regulations and various contents like a mediator between the user and the natural or built environment.

3. The signage role between fruition and communication

As known, a signage system is an informational structure consisting of physical and/or digital elements that help visitors in the fruition and understanding of a place. It defines a space, identifies functions and suggests paths depending on the nature of the site with a hierarchic categorization (Gibson, 2009, p.47):

- Orientation signals represent an overview of the place, visually described by a site map with volumetric or planar view, as well as a directory of activities and points of interest. Usually, they are located near the main entrance on freestanding structures and indicate the current position – with the "you are here" symbol – and the boundaries of the site.
- Directional signals regulate the visitor circulation system, especially in the key decision points such as intersections, hallways and elevators/stairs.
- Identification signals are visual markers that display the name and the function of a space, also indicating entrances and exits to primary or secondary destinations. They can express a place's personality, character and historic context, for example by presenting a logo or evoking an image.
- Regulatory signals make explicit permitted and forbidden actions, usually complying with legal codes. Nevertheless, they should be unobtrusive and clearly communicate instructions or warnings.

However, a signage project is not just about the placement of indication signals. It is closely related to the concept of wayfinding (Lynch, 1960), the answer to our innate orientation need in complex and foreign environments. Understanding the current position, favouring the construction of a mental map and being able to make decisions about the path to take to reach a particular destination (Arthur & Passini, 1992) are cognitive tasks that can be supported by an efficient signage system, especially when environmental clues are not enough. In recent years, the concept has further evolved proposing an interdisciplinary approach that involves not only design disciplines but also environmental psychology, semiotics and ethological science to better understand human spatial behaviour (Zingale, 2010).

The functional role of signage can be summarized in effectively communicating the "hidden logic" of a place, a pattern of movement or spatial organization that becomes the framework to the wayfinding system and helps visitors to navigate easily and quickly in that specific space. On the other hand, the perception of signage plays a crucial role not only in the fruition of a place, but mostly in the narration of its identity. As known, a specific environment is a combination of different elements and its perception can be affected, positively or negatively, by their interaction with the visitor.

In particular, the concept of "ambiance" (Baker, 1986) concerns attributes such as lighting, sounds, temperature, signage, graphic elements and colour scheme.

In the context of heritage and cultural tourism, Bonn et al. (2007) demonstrated the link between specific atmospheric elements and particular visitor behaviours that affect intention to revisit and to recommend the attraction to others.

> "The presence of friendly, knowledgeable, and superior-service-oriented staff members as well as the availability of proper signage and general information all assist in ensuring the return of current visitors and positive word-of-mouth evaluations to others about their experience." (Boon, et al., 2007, p.352)

As any other communication artefacts in cultural sites, signals should balance environmental integration – or the capacity of preventing physical and visual interference – and environmental differentiation – or the ability to avoid excessive mimicry with the surrounding (García, 2007). This means that

> "the qualitative nature of the orienting stimuli must have its own aesthetic relevance, capable of activating an attentive fruition, able to capture the attention of a subject and, consequently, having the ability to make itself identified and memorized." (Zingale, 2010, p.29)

To assure the correct level of environmental integration and differentiation, every project should define a reference point from the local context, adding elements of reinterpretation and innovation. Among the different types of cultural heritage, three "design themes" can be identified (Bozzola & De Giorgi, 2017) in which signage can play an important role:

- Museum systems and historical buildings are place/containers of culture where human talent and historical memory are displayed and divulged.
- Environmental and natural heritage includes historical parks, theme-based paths, nature reserves, archaeological sites and areas of land with historical or landscape value.
- Art towns are cities or towns recognized for their strong cultural and artistic identity with an important tourist flow.

All these contexts should offer suitable tools for their fruition and communication, enhancing their uniqueness and personality. The interpretation of the *genius loci*, the "spirit of the place", is an added value needed to build a language capable of enhancing or reinterpreting the place's identity. Consequently, the action of promoting a cultural site involves the design of functional tools for communication and information, endowed of aesthetic significance, which becomes an important interface between visitors and the environment, making it easily accessible (Piscitelli, Ferrara, & Guida, 2013).

Signage methods and languages derive from the design choices concerning three main components (Calori, 2015):

- The hardware system includes size, materials, mounting solutions and all the physical aspect of signals. It can be tangible – with traditional systems – or almost completely intangible – using digital solutions.
- The graphic system includes the configuration between shapes, colours, typeface, symbols, layouts and pictograms. It is the core of the visual communication and an important element for the transmission of information, identity and storytelling.
- The information system involves the message that should be communicated. It mainly concerns hierarchic orientation instructions but can also extend to various contents such as multisensory stimuli and interactive experiences.

As discussed below, original solutions for each of these components combined with a sensitive approach to accessibility and, in some cases, the use of new media allows plural and multicultural narratives.

Today, the “one-to-many" model (Spallazzo, Spagnoli, & Trocchianesi, 2009) - mainly used in audio guide and information panels – is outdated and was replaced by a multimedia approach which allows a more personal fruition with tools for interaction, edutainment and appropriation of an individual memory in a community context.

4. Case studies

Based on these considerations, a number of case studies were analysed. Certain recurring attitudes may be identified and, in particular, it is possible to summarize four different approaches, resulting from the combination of opposite attributes.

Regarding interaction with the visitors:

- A passive signage system communicates its information with a low level of interaction with the user. It is clearly visible and reachable with a self-explanatory message, usually in graphic form. The storytelling aspect is guaranteed by its coherence with the communication strategy of the cultural site.
- An active signage system communicates its information with a high level of interaction, mainly involving the visitor in a selection process of multimedia contents. These tools allow a custom-made experience in terms of time and topics. The storytelling aspect is supported by platforms of information at

different scales with the possibility of connecting different cultural sites as a network.

As regards the relationship with the context:

- An integrative approach is realized when the physical elements are perfectly fitted in the identity of the context which is well represented and recognizable. They follow architectural alignments, recurring shapes or symbols and use selected colours that blend with the environment. Also, another form of integration includes the technological systems that dematerialize their presence with the effect of a place that "speaks" for itself.
- A divergent approach is realized when the signage elements are easily detected as external artefacts that instate their presence through foreign aspects such as strong colours and non-contextual materials. However, they do not interfere, but use a non-mimetic language that accompanies the visitors as a silent guide.
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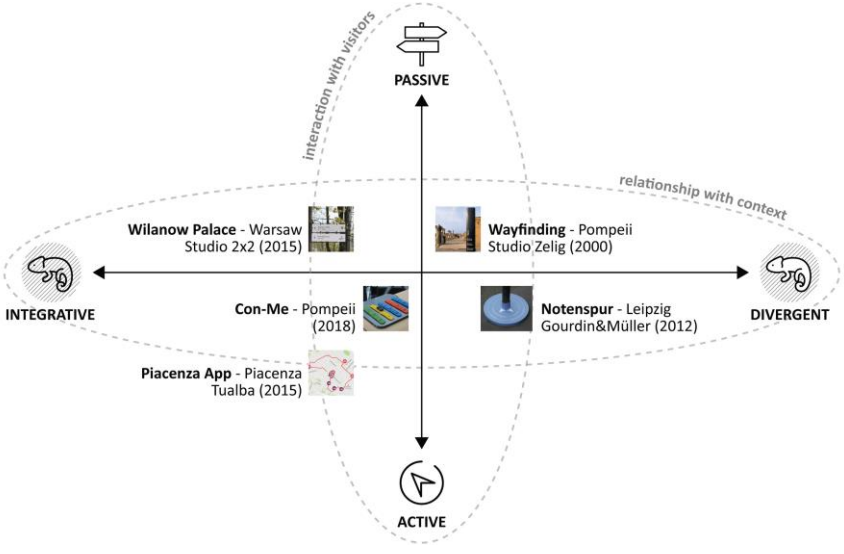

Figure 1. Four strategies to narrate places through a signage system. (Authors' diagram)

4.1 Same language, different versions of inclusion

The signage project for the Wilanow Palace Museum of Warsaw by Studio 2x2 (2015) is designed to make every visitor independent in the discovery of museum, park and surrounding areas. The system was introduced in order to organize the information space and to increase its visual coherence through the development of a range of indoor and outdoor panels and directional signs. The graphic operation overlaps with a multitude of forms, epochs, styles and hues existing in the context and minimizes its language in monochromatic signs and pictograms, designed based upon the structural elements of the chosen typeface. Visual coherence and integrated signals into existing elements – such as light poles and outdoor furniture – are the guidelines of a neat operation which effectively conveys the identity of the place without the involvement of other media.

In the perspective of inclusiveness, the studio created a specific guidebook for autistic people to help them have a more reassuring experience. Based on discussion with experts in the field, the information was translated into visual communication, considering the specific perception of the target users. This is an interesting example of a passive signage system with an integrative approach which enhances the value of the cultural site, leaving space for complementary accessibility-oriented actions.



Figure 2. Signage project for the Wilanow Palace Museum, designed by Studio 2x2, 2015. The simple visual language is recalled in all communication artefacts, including the guidebook for autistic people. © STUDIO 2×2, photo: Maciej Bączkowski.

4.2 Storytelling of musical heritage: a sensory narrative

The Notenspur (Music Trail) – followed by other paths like the Notenrad (Music Ride), Notenbogen (Music Walk) and Notenweg (Music Path) – is a 5.3 km city itinerary, articulated in 23 stations and accessible by foot which connects place of birth, lives and works of numerous prominent composers including Bach, Schumann and Wagner. The idea of a music trail for the city of Leipzig, proposed by Prof. Werner Schneider in 1998, was initially rejected by the city authorities as unnecessary and unrealizable. But in 2006, the Cultural Department prompted a feasibility study highlighting a potential interest on behalf of tourists and launched a design contest for a route and audio guidance system, eventually installed in 2012 (https://notenspur-leipzig.de/termine-verein-chronik/chronik/das-projekt-notenspur/design-wettbewerb-wegeleitsystem/).

The sensory narrative is the focus of the proposal by German design studio Gourdin&Müller. In a place deeply permeated by its musical heritage, urban exploration is combined with a music discovery tour by means of a traditional orientation system and relevant audio tracks for each location. Information panels, comprising a vertical information surface at eye level and an orientation point on the ground, are the tangible elements of the system which also create a strong and explicit visual identity, supported by the chromatic impact. In particular, the orientation disks are placed at every traffic junction, guiding the visitor from one station to another. Fruition of audio data is guaranteed in the form of download stations, free of charge, and with free-to-rent devices offered by the tourist service and cultural institutions. Additionally, sound oases are proposed in quiet, park-like locations. The audio reproduction is triggered by the visitors when they sit on a bench or cross a motion detector.

In this case study, the combination of tangible elements (signals) and intangible messages (music) creates a direct emotional and multisensory experience, making classical music a tangible presence in day-to-day living space. The Notenspur narrates the city heritage in a stimulating and accessible way for all age groups, regardless of their level of musical education, and encourages the interaction between present and past. The combination between divergent signage system and an active interaction reinforces the relationship between the musical heritage, the place and the curious visitor.

4.3 Augmented city for a custom-made cultural experience

The Italian city of Piacenza is the scenario for the “Sonorizzazione Urbana Aumentata” (Urban Augmented “Soundtracking”) project, developed by Tualba in 2015 and updated in 2019. It became the first city in Europe to be mapped with the use of Beacons. After the successful experimentation of the same technology within the wall of the art gallery Pinacoteca di Palazzo Farnese, the project has conceptually crossed the limits of the

single cultural site, transforming the entire city into an open-air museum. By using the Piacenza App, the visitor can choose between three urban itineraries: Sacred Art, Profane Art and “Luoghi Dotti” (Academic Locations). The audio tracks, wrote and performed by local talents, are triggered automatically by the proximity sensors, each associated to a point of interest. After the last update, the app also includes an events calendar with live notifications and information about commercial and food&wine activities.

The orientation system is fully digital: an interactive map shows 32 cultural and artistic attractions and live directions to reach them. Thanks to the Beacon technology, the informative level goes beyond the urban dimension, following the visitors inside museums, churches and art galleries, showing multimedia contents related to each location. Tourists and citizens can freely live the city and enjoy the beauty not through an invasive filter but with a personal guide. The map gives an overview of the points of interest and it is always accessible, so the itinerary of the visit can be planned in advance. As in the pilot project, the app is a practical tool to recover contents and information after the visit, with the search function or in a library of personal bookmarks (De Marchi, 2015). Apps and proximity detection systems are perfect examples of active signage systems with an integrative approach. They can change the cultural experience, giving a high degree of customization in terms of content, fruition time and categories of information. The cultural site becomes an open, flexible and multisensory space which proposes an immersive practice for habitual and new visitors. Nevertheless, from the visitor’s point of view, two accessibility-related issues could arise. Audio tracks must be available in two languages, at least, and a totally digital system could leave out certain categories of people not able to manage digital devices in autonomy. On the other hand, from the museum point of view, the Beacon technology allows collection of data on visitor behaviours (such as people flow and time of visit for every room/artefact) which are crucial to support future strategies and curatorial choices. In conclusion, the concept of augmented city as an active and integrated system is both part of a cultural marketing strategy for the promotion of the city and its territory and, at the same time, a means to enrich tourists and even residents with a custom-made experience, combining technology and creativity.



Figure 3. Piacenza App, developed by Tualba, 2015.
The information system based on proximity sensors is dematerialized, fully integrated in the context and works with a digital interface. Property: Piacenza Municipality

4.4 Complementary systems to narrate complexity

Traditional and digital orientation systems can coexist in a complex cultural site when its fruition involves several targets of visitors with different necessities and expectations. The Archaeological Park of Pompeii was the first Italian cultural site with a visual identity system, selected among competitors in a public contest and designed by Zelig studio in 2000 (http://www.alessandrococchia.com/2019/12/14/pompei-logo-brand-identity-signage/).

The project involves different archaeological sites – Pompeii, Ercolano, Boscoreale, Oplontis, Stabia – and the National Archaeological Museum of Naples, using a unified language for all the official communication artefacts. In particular, the wayfinding system changed the fruition of the location itself, compensating the lack of a single privileged path. Minimizing visual interference, signals were designed as narrow poles with an elliptical section, engraved information and colour combination of white, black and Pompeian red, perfectly contextualized in the excavations. Due to its durability and resistance to atmospheric agents, the studio decided to use the composite material Corian®.

The reduction of visual impact was a strategic choice that allowed a later integration with other support channels and accessibility initiatives such as “Pompeii for All” (Sicignano & Di Ruocco, 2019) and Smart@Pompei (Bruni & Papi, 2018). “Pompeii for All” allows all visitors to easily tour the site along an itinerary – realized within the

context of the Great Pompeii Project – that connects the most significant buildings and domus from the square called Piazza Anfiteatro to the Sanctuary of Venus. The 3.5 km-long itinerary has ramps, limited changes in height and allows a more comfortable visit experience, not only for mobility-impaired visitors. Also, the archaeological site proposes different experimental projects for other levels of accessibility, such as "silent visits", guided tours led by specialized mother-tongue LIS speakers for deaf people.

Moreover, Smart@Pompei is a pilot project – resulting from an agreement between MiBACT (Italian Ministry of cultural heritage, cultural activities, and tourism) and CNR (National Centre for Research) – that proposes an integrated technological model based on IoT technologies which allows management of the safety of people and monuments in both normal and emergency conditions. Starting in 2017, Pompeii is the first Smart Archaeological Park in Italy and in the world. In particular, the Con-Me system provides an electronic bracelet for blind and visually impaired visitors, designed to ensure an accessible and safe visit of the site. Each device is equipped with an SOS button, Wi-Fi and Bluetooth receivers, and a GPS module to check and detect the user position in case of emergency. A grid of sensors is positioned along the path and acquires visitor data, sending them to the central server via access points. Also, the visitor can request an audio aid describing his/her current location. The first twenty prototypes were tested in 2018 and received important feedback. Blind and visually impaired visitors suggested changes regarding the subject of the existing audio descriptive guide. Instead of historical information, they reported the need for an accurate description of the site. Currently, this project is being further developed, considering the results of the test.

The case study of the Archaeological Park of Pompeii is a successful example of complementary systems for the diversified fruition of the same cultural site. A passive signage system with a divergent approach represents the basic structure to which other active and multisensory projects are added, enhancing one another.

5. Conclusion

Cultural heritage is a particular context where design requires an especially attentive and sensitive approach based on the physical, symbolic and narrative characteristics of a location. In particular, its communicative capacity, expressed through wayfinding and signage systems, supports important activities for promotion and storytelling with the aim to engage different targets with different tools. The relationship with the context can determine alternative approaches, such as the integrative or divergent ones, while the interaction between signage and visitor can be either passive or active.

Following the case studies analysis, it can be stated that these four approaches are particularly effective, both for cultural institutions and visitors, when they are intended

as complementary and integrated strategies. The coexistence of various initiatives, even when implemented at different times, can meet the increasing need for accessibility and inclusiveness, highly promoted by cultural heritage sites.

An ideal project can be developed on the basis of a stratified system of information, from a basic level to a high degree of details, which is revealed to the visitor through different means. Fundamental data that are not subject to change – such as information about orientation, navigation and identification of landmarks – should be communicated immediately and using commonly known codes and languages, preferring a passive approach as provided by physical signage systems. On the contrary, in-depth data - such as historical/artistic information, descriptions, critical interpretations and related multimedia contents - can be delivered by digital systems that propose an active approach, offering simultaneously a high degree of updatability and customization. The identity and main characteristics of the location guide the designer's choice between an integrative approach or a divergent one, taking into account many factors including pre-existing initiatives. It is a virtuous circle where cultural identity becomes dynamics and participatory, encouraging revitalization of the sites and the combination of old and new solutions for an even more inclusive and engaging future fruition.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design and the 'Magical magic'. Disney and history, perceived heritage and shared memory

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Abstract | Disney as a love-brand and a hallmark has doubtless a huge social impact. The aim of the paper is to offer a perspective which considers how much of shared memory and continuous narrative are entrenched willingly, hiding or revealing brand reputation, since the creation of the brand and how much of this is finally conveyed in a Disney artefact, as for its expected quality and design. The essays wishes to reach this discourse through a historical positioning of the research method, as using existing information and observing how the people behave in relation to design, and it is then developed in its conclusion through an open conversation with a Disney designer. In the end, the statement is that as a widespread movement of taste, Disney involvement in design activities is yet to be understood enough and has to be wider taken into account as a social factor and indicator.

KEYWORDS | DISNEY, DESIGN RESEARCH, DESIGN HISTORY, NARRATIVE, SHARED MEMORY

1. Introduction: a material 'Magical magic'

Disney here meant as *The Walt Disney Company* is something that everyone knows: a brand connected with a variety of offered products, either intended as physical and visual, affirming through their diffusion and popularity that we are looking at a hallmark and a love brand.

Somehow and somewhere, grasped and uttered or not, there is a deep symbolism and a multiplicity of good values behind and besides the scenes. The products are connected with the characters of the movies and cartoons, their personalities and their style. All these objects come to be as part of our domestic and personal landscape, no matter which our age is. This happens with all the 'things': it is a natural process: no way we can avoid it (Norman, 2004; Csikszentmihalyi & Rochberg-Halton, 1981).

It is a fact that this huge company has precise rules that go over the discipline of design and instead are mirrored in all possible sides the activities in which the company is interested in. First of all in every marketing document and analysis, Disney is for those who are inside and outside synonym and symbol of safety. In this sense, the brand reputation is considered the best value to be defended with any possible measure. So far, even if being an enormous corporation Disney avoid conflicts, public embarrassments and dangerous situation. This because, recalling a *mantra*, Disney is a synonym of magic or better said 'the magical magic'.

Thus, it is unavoidable the necessity for this magical power to be sustained - clearly not only with the movies, the comics or the entertainment parks - with the whole production that goes along and around this huge world. And every single activity must be stainless, immaculate. This might appear far from reality to detractors, but let assume a position of doubt and give credit to the idea.

Our society needs certainty: in a time of uncertainty, spinning fast, always more and more influenced by violence and social problems, scholars have somehow pointed the society's degradation as a product of the excesses given by consumerism. Nevertheless, even if with an impellent green imperative nowadays under the attention of everyone, we live in a world made of objects and artefacts that are not only things. As said by Adrian Forty:

> "The same apparent paradox occurs in all manifestation of culture: any painting, film, book or building contains ideas about the nature of the world, ideas which exist in other minds apart from that of the artist, author or designer, but which are mediated through his or her ability to conceive a form or means of representation." (Forty, 2005, p.224)

Going back to Disney, we choose, parents choose, because Disney and all world around is the representation of something good: good feelings and positive attitudes such as love, friendship, independence, good self-assurance and open-mindedness. Who refuses to be represented this way?

> "Of all the ways in which design can influence the way we think, the only one to have been acknowledged widely has been its use to express the identity of organizations. Empires, armies, navies, religious orders and modern corporations have all used design to convey ideas about what they are like both to insiders and to the outside world." (Forty, 2005, p.222)

When we examine what could be behind, when we relate all these immaterial concepts with the design matter we reach inevitably the idea of the creator Walt Disney, fond of representing what is 'good' through a shared memory and historical heritage.

But, what, instead, about the constitution of this quantity of products, again largely intended even here encompassing events and side activities, that nevertheless are called to deliver the same magic and to follow the identical aforementioned rules (Vannicola, 2018) – these latter getting to be limitations in which the designers have to find a way of exploiting their creativity without jeopardize brand reputation and safety? We can since the beginning state that the magical attitude is not already embedded by inner nature, differently from it is perceived, and it needs indeed a long means to interweave stories, memories and all the Disney magic within the final outcome. In this process company constraints are not enemies, but facts with which to deal, the basis from which to depart. (Chimenz, 2019)

It would be naïve to think that only Disney pursues its own narrative through the complex world we have in mind, made of parks, cruises, events and newborn on-demand channel. Regarding this Falcinelli says:

> "Companies and entities even before producing goods and services, produce discourses; these form an imaginary about things which, with the English term, is called a brand." (Falcinelli, 2014, p.121)

Moreover, is appropriate to highlight Disney as an American brand: in fact, as for better understanding it in a design history perspective is proper to observe what Heskett says:

> "If Europe stimulated a profound body of design theory that stressed the role of art and craft, in the United States, a new scale of industrial technology and organization evolved by the 1920s and profoundly changed design practices. Through mass production based on huge capital investments, giant businesses generated a wave of innovation products that fundamentally changed every aspect of life and culture in America, with reverberations across the globe. To stimulate markets, products needed to be changed constantly, with mass advertising campaigns exhorting consumers to buy with abandon." (Heskett, 2002, p.20)



Figure 1. Princesses' Castle, for Notorious Cinemas in Milan 2019, design by DZ, courtesy of DZ, TWDCI. Delivering the magic is a continuous process to foster the storytelling and the character's own narrative, within movies and animations - of course - but also embedding it in products and letting the consumers' experience be extraordinarily unique always.

2. Methodology: positioning a historical research

2.1 The whys of writing a design research paper about Disney

The whys of writing a design research paper about Disney first of all arise from a chance. Disney products and animations are part of everyone's everyday life but coming in contact with a Disney designer is not something that happens every day. From this lucky and fortuitous encounter and from all the discourses that were born around his work and design history research - as my work - the paper took its moves. (Chimenz, 2019)

Far from being invented by Walt Disney, in design history, it is uncomplicated to find material assertion about the importance of merchandising and the care of a bond with customers: all is aimed to lead the users *feeling* the brand in their lives. It is an old strategy: letting people desiring new things is part of the play, as well as proposing new styles or re-styling, linkable with what has been but new. Heskett, in fact, reports:

> "[…] Changes are part of repetitive historical pattern. […] the evolution of a new stage in design does not entirely replace what has gone before, but, instead, is layered over the old. This has been a recurrent pattern throughout the history of design. It not only helps explain why there is such a diversity of concepts and practices about what constitute design in contemporary society, but also raises a

> question about the extent to which similar changes will confront us in the future." (Heskett, 2002, p.23)

So far, design becomes a discipline able to meet consumers' desires, in an inevitable bond with producers and marketing realm. As Forty expresses:

> "But although increasingly sophisticated market research may have made designers better able to understand people's wants, increasingly sophisticated techniques of persuasion […] were making manufacturers more adept at convincing their customers that the products being offered had been designed exactly to match their desires. It is therefore almost impossible to say to what extent the needs, that consumer-oriented design satisfied were felt independently, rather than being the products of persuasion." (Forty, 2005, p.220)

If it is true that Disney has been related to religion for the relationship that the brand tends to build in its meaning and attitude towards customers (Moore, 2001), it is true as well that this connection has to be sustained and alimented through times. For those who are critic through the possibility that generally brands truly exert their capability of creation and innovation and give shape and matter to consumers' emotional and practical needs Forty's world will appear as the truth, when saying:

> "Consumer oriented design was highly selective in what it chose to express to consumers' ideas and beliefs, with a strong tendency to relate only to those problems of consumers' lives that the product concerned stood a good chance of being able to banish. Naturally, it was very much easier to banish false or mythical problems than real ones." (Forty, 2005, p.221)

Affection, when related to something so material and so perishable as a product or a design, is definitely double meant. Clearly, everything depends on the end-users sight and disposition towards the 'object': this is a concept and a lesson that is now more than ever largely understood and exploited in the marketing realm. Nevertheless, assuming we all live a material world, by possessing 'things' we do not only state our *status* but also our feelings, dreams, credos.

This is why design is not marketing, and from time to time the ability of innovation and self-narration has to be as spotless as brand reputation, and as farthest as possible from profit. Bassi, correctly observes:

> "In short, goods are produced (destined to quickly become waste or rubbish) in relation to an ideology of the market and of the company (which has long been more and more of finance), which is now successful but dated and self-referring to the conditions of the present, in objective difficulty in the current fluid and unpredictable global context, with the changed behaviours and needs of society, consumers and users." (Bassi, 2017, p.100)

Hence, becoming substantial, designed ideas might lose a part of their initial magic and as well, simultaneously, they get enriched not only of physical matter and shape but of something as intangible and unsubstantial like the matter of dreams, of friendship and love.

The same good feelings featuring Disney characters are to be conveyed in their material substance, as Falcinelli says:

> "No object today is simply advertising or exclusively expressive: design is different things at different times. [...] An example of this reasoning is the Pixar movie Toy Story (1995), which has an impeccable narrative structure, a poignant staging and there is no doubt that it has radically changed the language of cinema; at the same time, however, it is also a perfect mechanism for selling toys. The one of Pixar is an art that generates and operates in a complex and conflict-filled society, an art that accounts for marketing and advertising, yet this does not subtract anything neither to the mastery of the story nor to its poetry." (Falcinelli, 2014, p.143)

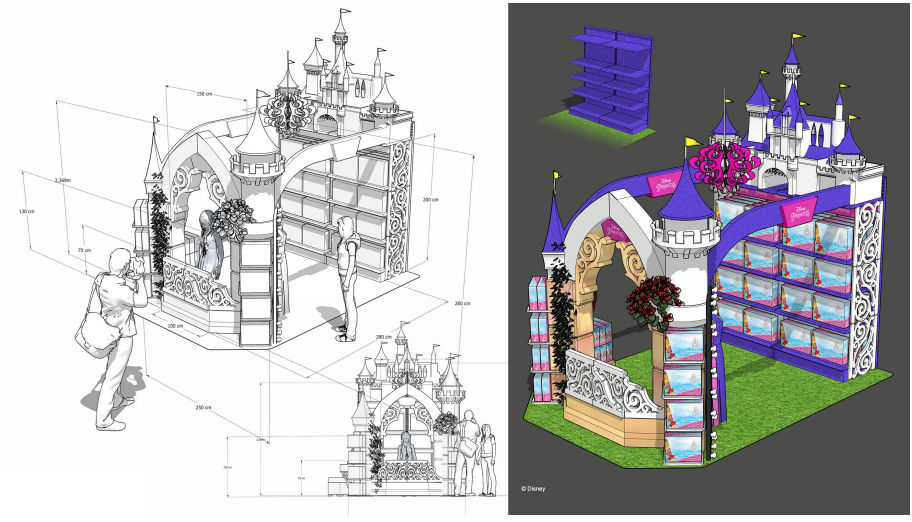

Figure 2. Design concept for a delimited Disney Area in a multi-brand store, Milan 2019, design by DZ, courtesy of DZ, TWDCI. How is it possible to distinguish original products from fakes? In stores, even multi-brand ones, the characterization and the brand positioning is given to designer's personal ability of delivering and reporting the 'magic' through an hyper-optimized project - according to the constraints, such as deadline and budget; thus, the result and its visual and overall quality is not-expected in a certain definite form and un-predictable.

2.2 How to treat a design research paper on Disney

It is a fact that The Walt Disney Company is such a widespread entity, e.g. indexed in Dow Jones, and a well-know and beloved brand to be within the first fifteen more known ones in the world. But, whilst it could be easily said which is Apple or Coca-Cola product, referring it to Disney is much more complicated and alongside it is intricate expressing, delivering and analysing a yet unfixed identity.

The reality is perfectly expressed by Bassi, saying:

> "For a long time the figure of the designer coincided - in particular in certain economic and local contexts (above all Anglo-Saxons or Northern Europeans) - with that of those who provided solutions to problems of different order and grade. In the beginning above all technical-formal and then progressively linked to corporate identity and strategy, up to the needs of the markets and sales. This has configured a specific operating space, but has sometimes weakened the specific contribution and innovation that the designer is the particular bearer of, within a collective, complete and shared process." (Bassi, 2017, p.101)

In the matter of design, research is yet to be understood in its importance outside the academic enclosure, but maybe it might be easier to explain it with the help of the concept of knowledge. Jonas says, indeed:

> " 'Design through research' assumes that the 'swapy lowlands' of uncertainty will be subsequently replaced by well-grounded knowledge. But exclusively scientific research is unable fully to recognize the implication of acting in a space of imagination and projection. The 'knowledge base position' needs to be complemented by the un-not science as a method, but science as a guiding paradigm for design, which is being called into question." (Jonas, 2007, p.202)

The major issues as perfectly expressed by many scholars, over the rest by Schneider is that:

> "Design has become a fashionable term that is applied to almost everything. It triggers associations with trendy products, beautiful forms, aesthetic life-styles, the comforts (and drugs) of civilization etc. Design, at one time a luxury and the prerogative of the upper classes, has been an article of consumption for the general public since the 1980s. It is now the mass markets' favourite word. Design exerts a powerful fascination on people and is seen by many as the art form of our time. Design object enjoy cult status. The old functionalist principle 'form follows function' […] has long since given way to the post-modernist slogan 'form follows fun and emotion'. […] Design is a mass-cultural phenomenon that shapes human perception and thus has a powerful influence on general judgement of taste. Products such as baseball caps, blue jeans, Coca-cola, Disney, Hollywood, as well as the various styled images […] have enduring impact on collective taste the world over." (Schneider, 2007, p.207)

Beauty and taste seem always to be depending exclusively on personal judgement or social reputation, but it is not so. As Sudjic underlines:

> "Fashion cycles are the natural means for one generation to be edged out of the way to make room for another, but they don't always make for the most reliable of critical judgements." (Sudjic, 2014, p.42).

In this sense, historians are reliably able to operate criticism thanks to a certain background of knowledge and evidence of recurrent occurrences.

Norman's idea, for instance, about emotion design, might be found close to the one expressed many years before, from Arts & Crafts Movement designer, William Morris, saying "Have nothing in your house that you do not know to be useful or believe to be beautiful." (Newson, et al., 2016, p.215)

So far, the issues of opening a novel line of research or developing an existing one faces the positioning of the topic. How to evaluate a multi-faced and complicated problem such as design criticism in the point of view of a historical positioning relating it to Disney? In this sense is valuable to observe what Walker, more generally, says:

> "How can design historians gather information about the process of reception? A numbers of methods can be employed. […] Clearly, research of this kind is also done by designers and market research agencies when they are planning new products or seeking to improve existing ones. It is also the kind of work undertaken by sociologists and anthropologists. However, design historians are more disinterested than market researches and more concerned with history than sociologists." (Walker, 1989, p.182-3)

Walker, in fact, present a series of research methods that perfectly fit design criticism with a willingness of historical point of view, and might be not so common in other branches of design. Within those he proposes, "using existing information" - as they are "crude indicators of popularity and consumer trends" - and "observing how the other people behave in relation to design" - being this latter observation "covert, casual or systematic" (Walker, 1989, p.182) - will be both used as the methodology for this paper, and at this stage for the research.

It is, solely Newson, Sugget, Sudjic stating the importance of the issue for design theory and history in their work, through their words here integrally reported for the unmissable preciseness, that anyhow at a point turns to architecture, not existing a study on design objects, artefact, or visual communication:

> "1992. High culture meets popular culture. While Walt Disney (1901-66) has had an enormous influence on popular culture, Disney's first theme park in California in 1955, where he built a 5/8 scale recreation of an idealized Main Street, was initially met with critical disdain, despite its success. Only more recently has there been a realization that Disney was in fact an expression of urban life that touched an emotional chord for many people. After Walt Disney's death, the corporation that he started spread around the world. When Euro Disney (later Disneyland Paris) opened in 1992, the distinction between 'entertainment' architecture designed by set builders and high culture architecture had vanished. Bob Stern, dean of architecture at Yale became a member of the Disney board, and the corporation worked with Aldo Rossi […], Frank Gehry […], Arata Isozaki […] and above all Michael Graves. By this time, the theme park had broken out of the park and into the world beyond." (Newson, et al., 2016, p.228)



Figure 3. Disney (and Marvel) corner in a multi-brand store, Toys con Te Scalo Milano - Milan 2019, design by DZ, courtesy of DZ, TWDCI. Part of the striving in visual communication and projects' valorisation is given by the heterogeneity of the products to be displayed, even if the final consumers are targeted in all the children and, largely, in families, because it has is to be delivered a complicated and multi-faced brand identity. How to let Princesses' world coexist with Spiderman, for instance?

3. Conclusion: an open discourse

Considering the enormous power that Disney might have on the material culture nowadays, this paper takes into account a novel point of view for being disruptive towards common places and prejudices. The matter is that whether we like them or not, whether we can recognize in them or not the expectably embedded quality - even as an aesthetic or immaterial value - the Disney products offered are everywhere.

What lacks in this perfect world and complicated multi-faced structure? Let go back to the concept expressed in the beginning about the precise will to avoid conflicts and any possible endorsement that could in immediate, short or long term provoke embarrassment to the company. Disney does not take part in any political issue, but inclusiveness has nothing to deal with this (as it is perfectly displayed by the social causes sustained).

Thus, the question is, does it exit a Disney style? The answer is basically no – *not yet,* would be more correct and proper - but the whys are yet to be satisfied by this simple answer. Would it be needed? The answer, again too simply and somehow naïve, is definitely yes.

In the end of all the observation, three appears on the whole as major issues, maybe sides of a one wider one. For explaining it, a line of thought has to be followed: firstly, it has to be considered what Falcinelli says:

> "The tools of visual design are within the reach of more and more people, its issues no longer concern only a limited number of professionals. Having the means, however, is not enough. Huge communicative powers unfold in a few centimetres of desk, but as Spiderman says, great responsibilities derive from great powers. Knowing how to use a software is a small thing, what is needed is, precisely, cultural awareness; because visual design is above all a social fact, where clients, users and designers have desires and intentions. For this reason understanding design is not recognizing shapes, but comprehending who is speaking." (Falcinelli, 2014, p.302)

Disney is rarely inserted in design history books, maybe being apparently more under the marketing realm, instead of being seen as a design matter but still, as for its impact on consumers' behaviours, The Walt Disney Company should be treated as a movement of taste, not less important than others, mirrors of the societies that in the past generated them, as for instance the Art Deco was.

As design is about in a variety of realities, as said by Newson, Sugget, Sudjic:

> "Design is charted by ideas and movements, by manifestos and chronologies. But it is also about things. Since the emergence of mass production, the world has been transformed by a sequence of remarkable objects. They mark the history of design and of particular type of design – from fashion to furniture –that are in themselves revealing of the tastes of evolving societies." (Newson, et al., 2016, p.194)

So far, we might observe through Disney's consumers' behaviours a number of design concerns, above all the matter of quality. Moreover, has to be considered as true what Schneider states:

> "Design involves a lot more than simply creating an attractive world of objects, and far greater attention ought to be given to this fact in the future. Design shapes communication and creates identity. It is a conscious act that aim to create meaningful order, and is thus essential part of our culture." (Schneider, 2007, p.207)

Thus, following same line of principle and observing what Newson, Sugget, Sudjic report about Noyes initiative to demonstrate how good design does not have to be expensive – some years before Dieter Rams's Ten Principle, and quoting his own words - "A good design should have nothing which is irrelevant, accidental, or unrelated to the main idea." (Newson, et al., 2016, p.73) – the matter is evidently not the budget neither the deadline as major issues in the occurring lack of a single identity or an overall perceived quality: the matter is a recognizable identity!

In fact, about Rams, elsewhere Sudjic says:

> "Rams made objects that hinted at some deeper meaning beyond their obvious purpose. Making toast, shaving or turning a radio the Rams way was much like

> transubstantiation for his true believers. An electric razor from Braun seemed to offer the prospect of turning shaving from a time-consuming chore into a religious daily ritual. A Rams juicer made squeezing an orange into painless version of the Japanese tea ceremony." (Sudjic, 2014, p.379)

What can be understood from this? As for its social impact and role, according to the development of this study, it would be needed or desirable for Disney products to have a definite and recognizable poetry of expression, a unique identity – in the past appointed as corporate identity - respecting the origins whilst improving them through the pursuing of the narratives, the old ones along the new ones. Is that possible in a multi-faced brand like Disney is?

Walt Disney's idea to reach everyone, was profoundly democratic even seen in contemporary perspective; so, activating something transversal, as the huge differentiation of products and services offered, the creation of diverse lines, from the affordable to the luxury one, perhaps causes a paradox perfectly understandable yet despicable, according to Papanek: "The word creativity has become trendy over the last two decades, opening the door to a strange collection of absurdities" (Papanek, 1985, p. 151-2)

In this way design loses its strength and capability to create a new better world. Could this coexist with profit and could the interest of brand uniqueness in multiplicity in all over the world, remain as said by Dieter Rams thorough down to the last details?

To be honest, the answer is greater than the question at least at the beginning, but anyhow a strive for quality and for a determinate sense of belonging, has to begin and then the way will be long but easily reachable. As for its power of being so spread, so well-known and so loved from followers it can be stated that this could be the time for a change in the company. A new beginning, where to bring the same stainless behaviours not only in shapes and visual communications but even in all the possible and multiple facets of design, to better deliver - truly - a sense of magical magic in this world.



Figure 4. Disney (and Marvel) internal façade and corner in a multi-brand store, Toys con Te Roma - Rome 2020, design by DZ, courtesy of DZ, TWDCI. The variety of products within the heterogeneity of characters held by Disney aim to follow doubtless the intents of the brand creator to reach everyone and every family, delivering to all ages a touch of magic, coming from dreams and childhood, but requires a huge design work to control details and developments.

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Luisa Chimenz, senior lecturer in Design, focuses her research interest on objects and production as expressions of social belonging and tools for communicating intangible and immaterial values. The realm connected to the product - largely intended – is investigated as a complex and overall expression of the society 'accepting' and endorsing it. Author of two monographic works, she published many peer-reviewed papers in international conferences proceedings and essays.

Acknowledgements: The author wishes to thank Davide Zannetti for letting the use and providing the images of the original design here published and pictured. On behalf of the designer, and along with him, the author wishes to thank The Walt Disney Company Italia, Notorious Cinemas and Toys con te for letting once again the Magic come true.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

DEsign
DEcide
The sign

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Abstract | The evolution of human needs gives design not only the opportunity, but also the difficult responsibility to solve the puzzle as good as possible. God is in the detail. That's why Design in architecture is the step towards perfection. The design industry presented by fashion, furniture, products is a next level in a design sense. Design in tech world is contemporary and evolving. But we must possess design thinking to create something new, valuable, useful. After years "Searching for The Self" and despite the technical evolution, we must not forget, that all of this is human made. Almost everything was invented so far. The individuality, that has been crowned, reaches to the identity, waiting to be revealed despite the globalization. Strange but true, we explore history to create future. That's why we must learn from the past and evolve, not just to swim downstream, but rather to create the stream.

KEYWORDS | HISTORY, INDIVIDUALITY, HUMAN NEEDS, IDENTITY, SOCIETY

1. DESIGN CULTURE OF LANGUAGES

A language gives us individual units and the possibility to combine them in various ways. As a result, we create different meaning, express different things, give different signs. The headline is inspired by the similar pronunciation of different words. Let us see the transcriptions:

Design [dɪˈzaɪn] **De**cide [dɪˈsaɪd] The **sign** [ðə] [saɪn]

In this example we are using just one language, but it is remarkable that similar connections could be seen also between languages. The meaning stays even written with different letters. This is the design truth – creations could be similar, but they affect everybody in a specific way. Yes, it's all about creation and humans are responsible for it.

Another word for creation is design.

Sometimes the simplest things are the hardest to explain. The different tracks presented in this conference are an indisputable proof. Design is not only thinking, it's a revolution, resilience, proximity, multiplicity, making, life, a language, it's artificial.

I'm researching design as an answer. An answer for different and important questions.

Why should we design?

How to design?

What's the goal?

Is design a rational product by our irrational desires?

What's the most important – function, technology, empathy, embodiment, inspiration?

Which **sign** are we going to **decide** to give to **Design**?

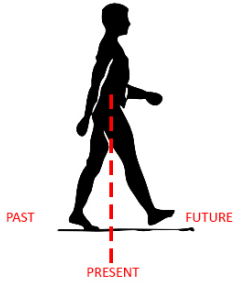


Figure 1. Life is not a dot ".", it's a line "___". Every step consists 2 foot positions – the first foot is going to the Future, the second is staying in the Past. The body is embodying the Present.



Figure 2. And then the dot becomes a line. With a direction.

So many years people are searching for the truth. And they have found only *their* truth. But the desire is half the battle. That's why science exists. That's why we're trying to do better design, to know more.

From design, as the core of architecture, we expect to combine the aspiration and inspiration of art with an utilitarian function. Design as a noun *(a product)* or a verb *(creating)* is an individual unit of interior design, which is the intimacy of architecture, living in the world of urban design. That's why the truth about design applies to the other "family members". But they all exist in the world of dynamic ever-changing societies.

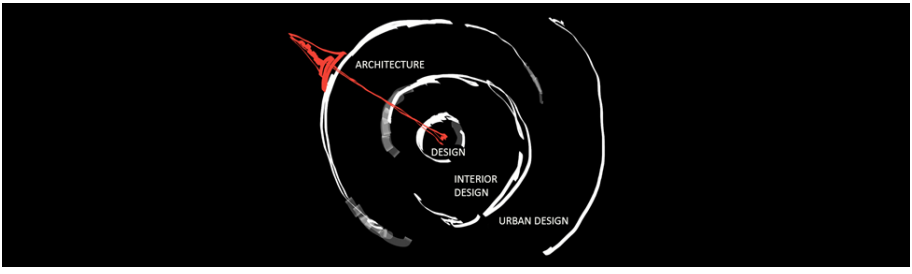


Figure 3. Design as a core.

The world needed all kinds of languages through time: alphabets, movements, symbols. To become understood. Design is an alphabet with increasing number of letters – it's not just about creating, let it be meaningful.



Figure 4. From left to the right: a compilation of The Glagolitic script, The Bauhaus logo, supremacist composition (Blue Rectangle Over The Red Beam) from Kazimir Malevich, The Shukhov Radio Tower (Russian Constructivism), Greek Mythology symbols.

The language is a way somehow to send and receive information, to express and to impress, to exist. An individual could be supremely understood if he's able to *find language with others*. And as was noticed and announced: "Individuality is the link; cooperation is the chain. You can strengthen the chain only as you strengthen the link." (Jordan, W.G., 1909, p.3)

The signs that we create through design will be key points of tomorrow. Their meaning will be different for distinct people. But we are part of a society and we could create directions for the future.

2. Society shapes design or design shapes society?

The birth of the idea of a consumer society is well explained by Paul Mazur, a leading Wall Street banker working for Lehman Brothers in 1927:

> "We must shift America from a needs- to a desires-culture. People must be trained to desire, to want new things, even before the old have been entirely consumed. [...] Man's desires must overshadow his needs." (Mazur, 1927, Harvard Business Review)

Of course the corporations welcomed the following mass production. The greatest contribution comes from Edward Bernays as a central adviser, known also as "the father of public relations" and Sigmund Freud's nephew, with his idea for the dome "Democracity" at the World's Fair in New York in 1939 – showing the link between Democracy and American business. The General Motor Corporation was responsible for the construction and the public admired it. After searching and exploring "The Secret Self", one of the leaders of the Human Potential Movement, the psychologist Abraham Maslow, was given a special task from SRI International (Curtis, 2002, Docu-series 1, 3). As a result he published the "Hierarchy of needs" – the well-known pyramid constructed on a base of physiological needs, and proceeding upwards through safety and security, love and belonging, and self-esteem, before topping out with self-actualization. In the next paragraph will be discussed the evolution of the pyramid towards modern people. The differentiation of the individual from the society leads to need of variety of products. The goal is to meet the specific needs of different people. We are still witnessing this today.

> "It was in a sense the triumph of the Self. It was a triumph of a certain Self Indulgence. A view that everything in the world and all moral judgment was appropriately viewed through the lens of personal satisfaction. Indeed the ultimate ending point of that logic is that there is no society. There's only a bunch of individual people making individual choices to promote their own individual well-being" (Robert Reich for Curtis, 2002, Docu-series 3)

History guides and restricts design. We're still part of this consumer society. But this historical trend started differently in other countries.

My PhD research is focused on the path of Bulgarian design. That's why after the historical facts about Design as driven force for satisfying and controlling the society in the United States, in a short retrospection I'm going to present what society needed and how design helped in the XX century in the specific historical context. Five hundred years (1396-1878) Bulgaria was under Turkish slavery. The religion with the architectural symbols – churches and monasteries conserved the Bulgarian culture and the faith for liberation. The crafts are empowered at most with woodcarving – iconostasis, iconography, interior elements and furniture. Nowadays only few monuments of woodcarving from the Second Bulgarian State (1185-1396) are preserved. Two of them are in Monastery of Saint Ivan of Rila (known also as The Rila monastery; on the World Heritage list of UNESCO) - an entrance door with exquisite wood-carving and wood-carving throne. Interesting to mention about the throne is that the design repeats the arches from the monastery building and shows impressive details for handwork. On the other hand, the interior of a Bulgarian house then was so minimalistic, that it won't be strange to compare it with the Japanese conciseness. Later The Bulgarian National Revival (sometimes called the Bulgarian Renaissance) is a scene for many crafts. Some of them and their present interpretations will be described later in the article.



Figure 5. From left to the right – the throne, the entrance door, view from the Rila monastery. Common characteristics in different design elements – chair, door, building complex.

The beginning of the XX century was like a new blank page – the birth of The Kingdom of Bulgaria. Major public buildings from famous Bulgarian and foreign architects were built – the Bulgarian National Bank by arch. Ivan Vasilyov and arch. Dimitar Tsolov, "Bulgaria" complex by arch. Stancho Belkovski and arch. Ivan Danchov, The Sofia Bath by arch. Petko Momchilov with façade ceramic elements, produced in one of the first factories "Izida" 1908-1913 (Author team, 2016).



Figure 6. From left to the right – interior of the Bulgarian National Bank (produced in Iordan Hristov - Iordaneto's workshop), interior of concert hall "Bulgaria" (cooperation Thonet), The Sofia Bath (ceramic elements by Haralampi Tachev and Stefan Dimitrov, produced in Izida).

As you see, design existed as an individual unit for interior architecture and as a product from the first workshops and factories - founded by Czechs, Hungarian, Armenian and Bulgarian people, who recognize Bulgaria as their place to live and develop (Parvanov, 2008).

After the change of the political system – the birth of The People's Republic of Bulgaria (1946-1990), the production capacity increased. The state founded new factories, the education was targeted to professional skills, new design centers were also founded (Author team, 2016, p.53-54):

- Central Institute of Industrial Aesthetics (1963)
- Center for new goods, packaging and information (1971) before named as Assortment cabinet (1964)
- Center for New Products and Fashion
- Institute of Furniture and Furnishing (1971) before named as Center for Research and Development (1966)
- Center for Research and Experimental Packaging (1967)

After the democratic changes in 1989 the Republic of Bulgaria again flips the page to start over. The contemporary environment for design development is characterized with private companies and their interests. The state structures step back, many of them no longer exist. In the last decade Bulgarian specialists are actively involved in the world market. As designers they want to answer questions of the modern society. That's why the impact is no longer local and the awareness has almost no boundaries in this technological world.

Thank to Ezio Manzini's definition (2015), influenced by Anthony Giddens ("The Consequences of Modernity", 1990) this timeline looks comprehensible:

> "…today, in many western (traditionally rich) countries, the present economic crisis has been compelling more and more people to learn how to live, and if possible to live well, while reducing their consumption and redefining their ideas about well-being (and work). At the same time, the majority of people in fast-growing

> economies are driven to shift quickly from their traditional socioeconomic contexts to new ones, which we will refer to as "modern": they have to radically redefine the way they live and their ideas of well-being." (Manzini, 2015, p.11)

Even though Bulgaria is not an example for a top fastest-growing economy, it is one of the 16 countries with emerging and developing economies (data from World Economic Outlook Database, 2020). Supported also from my research data – this quotation highlights why the current success search has so many diverse faces.

3. "Be part of…"

After searching and exploring different selves, in conclusion I'm heading the present design trend **"Be part of…"**.

This trend applies not only for Bulgarian designers, I'm sure you can find the signs in your national industries, too. Strange or not, the individuals want no longer to think only about themselves. They want to give their own individual contribution by solving a problem or filling the missing. This can be successfully correlated to the *social innovation as a main driver of change* (Manzini, 2015, p.26).

3.1 Human as a part of the Globe

The opportunity is just around the corner. I'm going to mention just three examples for Italian products, designed by Bulgarians. The first one is the chair *"Lastika" by Velichko Velikov for Lago*, as a result from a workshop in 2010. The second is the wall mounted washbasin *"Tatoo"* in Corian® with stainless steel towel rail *by Elia Nedkov for Rapsel*. The third is the slimline vertical radiator *"Flaps" by Victor Vasilev for Antrax*. Boundaries are blurred. Nationality is not a stamp, but what could it bring to a new product? This will be discussed later.

3.2 Human as a part of the Earth

We are existing not just for ourselves, but as a part from a bigger plan. The already Maslow's Hierarchy of Needs has been actualized to the modern thinking of human place on the Earth.

> "The most important takeaway from this quick pass through the collection of hierarchies is the fact that they are all related. Each level of biology requires a healthy and stable lower level to provide the ingredients for its existence. Each level also needs a healthy and stable level above it to provide a durable habitat for its existence. And the top-most level of evolutionary biology can only kick off (as far as we know from the history of Earth) after the formation of biochemistry in the lowest level. In other words, no matter how much you focus on one seemingly individual tree, it is actually part of an interwoven forest of life." (Gibney E., 2017)

The realized responsibility after the active discussions about the climate change, about all kind of pollution (air, water, light etc.) affects design. A description of “eco”. A great response to that, are the products of *Playground Energy*, awarded with Red Dot Design Award in 2017. The generating energy playground products are already installed in many countries. The leading designer *Ilian Milinov*, who won many design awards, is also recognizable by *Seattable* - comfortable seat and table in one piece of furniture. The last surprises with its simplicity and double function. And when we research materials, not products, the Bulgarian start-up company *BioMyc* offers a local produced alternative to Styrofoam for packaging. A great addition is *LAM’ON* - a 100% biodegradable laminating film for print. It is toxic free, optimised, competitive. It offers the same results, it is used on the same machines, and is offered at the same price range as the currently used laminating films. It is time to pre-order your sample.

3.3 Human as a part of the technological society

After destroying the real society, now we’re creating a false new – our web avatars can travel around the world, shop online worldwide, disrupt the distance. Our new homes are profiles with determined shared information. Everything is one button away. We could benefit the new ideas – through crowdfunding – an interesting distributed financial opportunity. For example, the Bulgarian product *Halfbike* was funded at Kickstarter. The promise to “Bridge the gap between man, machine and dance” suited well – this is their third successful Kickstarter campaign. Using new technologies is also a modern choice for the Bulgarian designers. The 3D printed origami bottle *Hyperfold* is already on the market. In 2015 was held a contest called “LampiON”, the collection *“Hex shade” by Voood* won the first place – parametric modified 3D printed pendant lamps. A great contribution to the methodological explanation of these modern examples, categorized as *distributed fabrication* could be found here:

> “The result is worldwide experimentation in small-scale, high-tech design and fabrication system capable of supporting new forms of open design and networked micro factories (such as the ones proposed by FabLabs and by maker movement). We can add that the distributed production idea is migrating from the area of high-tech fabrication to traditional craftsmanship and small and medium-scale enterprises, revitalizing them and giving them a new perspective.” (Manzini, 2015, p.19)

A wonderful prelude to the next category, which is closer to craft in the historical understanding.

3.4 Human as a part of History and Culture

> “The most fascinating product solutions are those which reveal a cultural reinterpretation of the Arts and Crafts movement, where digital production tools

> continue to focus on the way things are made and not the formal outcome as such." (Paris, 2016, p.75)

"Carpets Making - The tradition of Chiprovtsi" was listed as Intangible Cultural Heritage from UNESCO. This ancient Bulgarian handicraft of carpet making is searching for its Revival. In 2016 during One Design Week in Plovdiv was presented the project CHERGODEIKI- "as a part of the Baba Residence – an initiative against depopulation of villages and for sharing of traditional knowledge, which old people there still preserve. This is the knowledge about working with natural materials, and the knowledge of hands and their movements" (One Design Week, 2016). Three years later, again in Plovdiv, which was European Capital of Culture in 2019, and again in Kapana Creative District was performed "Open carpet atelier". This time the target group were children. These workshops don't give an opportunity for mass production, but they aim to attract attention to the historical and cultural features, which we are going to forget.



Figure 7. Examples for carpet making in Chiprovtsi, traditional forms and colors.

Interesting analogy is the tribute to Romanian shepherd stools by Romanian designer Dragoș Motica for the 5th edition of the Romanian Design Week (Domusweb, 2018). These stools were popular in Bulgaria too, but the society doesn't appreciate them as a typical design heritage.

A step forward is the "living minimalism" of Faina Design, the brand founded by Victoria Yakusha reinterprets techniques and symbologies of Ukrainian material culture (Domusweb, 2020).

4. What's next?

The coin always has two sides. "Be part of…" is a vision with certain proof of evolving. However, the present generation is a challenge for psychologists, too.

> "They are not only the biggest generation we've ever known but maybe the last large birth grouping that will be easy to generalize about. […] Those rising micro

> generations are all horrifying the ones right above them, who are their siblings. And the group after millennials is likely to be even more empowered." (Twenge, 2013)

Where is the mystery? This approaches aren't wrong. But we aren't completely able to predict the future of design. Because society is changing and what a product embodies is a personal experience.

Interesting example is given here:

> "For example, the meaning of a cup is not just some abstract concept specifying a defining set of features that constitute it as a cup. Rather, the meaning of a cup is all of the experiences, ences, both actual and simulated, it can afford us. […] However, the meaning of the cup is not just what it affords us by way of physical perception and motor interaction, because it also includes the social functions of cups, given our cultural values and practices surrounding the use and significance of various types of cup. Finally, in addition to this public and shared meaning, there will be each individual's own personal past experiences with cups, and perhaps with this very same cup which now sits before him or her." (Robinson et al, 2015, Kindle Locations 415-421)

A similar hypothesis towards designers is also valid - they include a special "truth" about the function or the form of the product. The individuality of thinking results in specific characteristics and point of view. The sympathy for style also meets this individual choice:

> "Some will prefer Mies van der Rohe, others Art Moderne lines, others Gaudi's organic ecologies, and still others Gehry's playful postmodernism, because of the way each of these markedly different qualitative unities affords us dramatically different imaginative experiences for how we can engage and interact with those structures." (Robinson et al, 2015, Kindle Locations 552-553)

Same is with the observing of a design product. Same truth. Different scale.

Only with the right answers we would be able to create something innovative and unique. Stop doing without asking questions, without solving problems, without design as thinking and of course creating than just producing as a result: "Will it pay? Is it popular? Is it successful? […] Is it right? Is it true? Is it helpful?" (Jordan, 1909, p.6).

The history has its powerful statements. One of them is made by Walter Landor "Products are made in the factory, but brands are created in the mind". But how to connect minds? Through the language of ideas and through design thinking.

The science is not so distant from design and architecture. The new goal is not only to innovate construction, but using the scientific methods of neuroscience and psychology to understand better the idea of creating. After we could visit every part of the world – in internet or in person, be whoever we want, possess almost everything, what could be the next step? It's already happening.

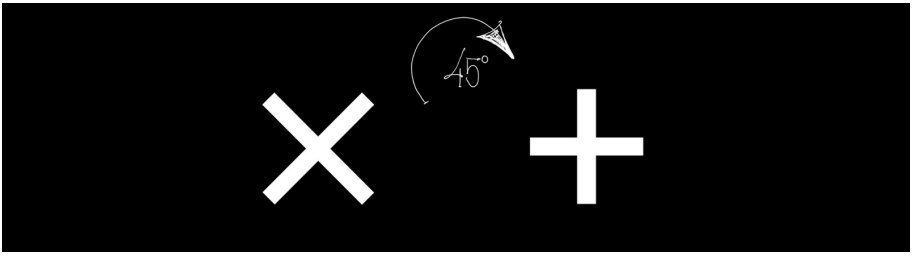
Go back to the roots and make the Utopia “Rebirth the crafts and cultures through design in a technological world” come true. The technology could help us, but in fact we’re a link between Nature and Technology. Our individualities, in the pure and specific sense that William George Jordan described in “The Crown of Individuality”, are the key point.

This is my truth.

> “Optimism is the sunshine of the soul radiated in action” (Jordan, 1909, p.46)

So, it couldn’t be so difficult to turn the flaws into strengths.

It’s just one 45 degree rotation.



In conclusion, Ezio Manzini inspires me to share with you this quote:

> “…since culture is bound to context, as it should be, we can say that it is an Italian contribution to an international conversation. That is, a contribution that starts in a well-defined cultural context.” (Manzini, 2015, p.5)

In this line of thinking, my shared thoughts and study work may be a Bulgarian contribution to this international design conversation. I hope it could be.

Today the language barrier is no more available. Why should a design barrier exist?

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing the Gross.
In search for social inclusion.

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Abstract | Numerous researches dedicated to the gross exist in psychology, focusing notably on the sense of otherness behind this reaction of disgust and fascination. Furthermore, many grotesque works of art have been achieved, in particular in the XX and XXI centuries, in attempts to challenge prevailing social and moral models.
Contemporary design practices, inheriting from a universalist desire of modernism, presuppose a single, unitary identity built according to dominant social constructs. They are nonetheless questioned by the recent emergence of speculative design projects employing materials traditionally deemed disgusting.
The present research examines from a material semiotics stand the gross at play in queer & feminist art and in recent speculative design works. As these works show exemplary potential in questioning moral *a priori*, this research sets them in discussion with a design research program conducted by NGO design studio thr34d5 on kombucha pellicles and their craft. The theoretical and experimental analysis presented in this research form an understanding of the role that material semiotics combined with the gross can endorse to leverage design in matters of social inclusion and impact.

KEYWORDS | GROSS, OTHERNESS, KOMBUCHA, DESIGN THEORY, MATERIAL SEMIOTICS

1. Introduction

Wet, slimy, sticky, mouldy, rotten, spoiled, decaying, smelly… Gross. The construction of taste as what is commonly acceptable is built throughout centuries of collective memories. In present times of peak in social inequalities and societal need to recognise and give agency to situated communities, it is this shared memory that is urgent to understand and seize methodologically. The modernist globalisation of consumption habits shapes most of our societies into clean and smooth realms, with a universalist goal of standardizing our ways of being, our habits, our instincts. This universalisation that pervades in the design of everyday objects and services keeps pushing further away identities that do not fit within the norms by instrumentalizing moral into aesthetic forms and technical functions. This resorts into accidental or strategic suffusing of new designs with a semiotics of dominant models – principally for dominant classes privileges continuation, whichever they are.

Gross phenomena nevertheless resist, but rendered marginalized as they illustrate behaviours that defy dominance. Gross as considered here is the combination of disgust and fascination, defined respectively as the "*experience of intense physical dislike for an object or a situation*" and the "*urge to explore, investigate, or to understand something*" (Fokkinga & Desmet, 2013). It is in itself the subject of many studies in the field of psychology and has become an activist symbol in art and emerging xenodesign[1] practices as a way to question the construction of identities. Beyond fetishism, mobilizing this emotion is a call for otherness. Accepting the other, be it a person that endorses a different culture or a non-human being, is to agree to confront ourselves to what is uncommon, to what is beyond frontiers and control. The semiotics behind the works resorting to the gross contribute to form a relational aesthetic opening a discussion on the role of collaboration in the design methodology, a defining quality at stake in this study.

The present paper introduces a design research program conducted by NGO design studio thr34d5 on kombucha pellicles. This microbial community was chosen as it is both alive and unsettling in its materiality, and presents the benefit of having a low cultural anchorage. From the perspective of material semiotics, this study discusses the holistic sensorial approach of grossness in the making of kombucha pellicles and presents the potential that lies in this emotion and semiotics focused method for envisioning a richer, more inclusive and impactful practice of design.

1 Xenodesign is a term constructed by using the xeno prefix, which sits in the context of speculative realism related theories. It aims at describing techniques of alienation as productive ways to think about the unknown (Shmeer, 2019).

2. Gross is not grotesque[2]

2.1 Transgressivity as a project

"*Disgust is an ideological response to something that is offensive to the self because of its nature or origin*" (Rozin *et al.*, 2008). While neurological studies aim at evaluating the innate part at play in our disgust reactions (Moll *et al.*, 2005, Toronchuk & Ellis, 2007), a wide literature investigates its mechanisms of acquisition. While often criticized for their static analysis that does not taking into account the evolutions of disgust in a given culture or individual across time, and the possible accustoming to initially revulsing things (Lupton, 1996), Mary Douglas and Pierre Bourdieu have demonstrated that the sense of disgust is a social construct (Bourdieu, 1979; Douglas, 1966). While Bourdieu offer an analysis of the relationship between class, habitus and taste, Douglas has shown that not only does the sense of disgust vary from a cultural context to another, but it is a tool for maintaining social systems and boundaries – a remembrance of biopolitics in Foucault (1972). "*Feelings of disgust function to dignify humanity by allowing humans to put themselves above the animals that are deemed as inferior*" (Goldenberg *et al.*, 2001). Disgust crystallises the will to distance oneself from creatureliness; and we witness how this quality is being instrumentalised with intent, for instance in attempts at controlling one's body shape (Angyal, 1941, Rozin *et al.*, 2008., Goldenberg *et al.*, 2001). If we are to extend the argument, this distanciation is not only from what is animal, but from what is other, made foreign. The mechanics of it justify a rejection of what is not deemed moral to the profit of what is, as seen in resources exploitation and in formation of castes. It ties back to a larger phenomenon of exclusion, discussed in Foucault as instrumentalized in the production of truth and subjects' control. A central matter since his early works, Foucault analysed one of the apparatuses at play as the partaking of mental disorders in the process of legitimising discourses, proceeding to the exclusion of subjects deemed mentally ill to moral margins.

The elaborated body of work provided by Foucault set in perspective with our present object of inquiry, the gross, highlights the process of construction of our social identities through alterity. In an ever-expanding world of multi-cultural encounters, the project of a universal western moral meets raising defences for the recognition of situated identities beyond fringes or spectacles. Design at large, as the discipline of the construction of the synthetic world – not to say cosmos – can and need to seize the opportunity of recognizing its importance in the mediation of everyday interactions, thus becoming instrumental in building a togetherness around this alterity.

[2] "Grotesque" is a French word that designates both the baroque mobilization of the gross in art, and a ludicrous act.

2.2 Mobilizing the gross

The disgust is presented in psychology as a form of construction of our societies; how do these unmanageable phenomena perform in the construction of the self of the social life? A major part of the construction of our identities is mediated through our senses (Friedman, 2016). There are many forms of solicitation through the senses, of models that we have tested, inherited or accepted as part of our individual cosmos. Challenging those models helps us to better contour ourselves by sharing experiences of the construction of reality. Grossness represents then a negative space - it is part of this photographic impression of our social constructs for what is other, what we have been taught to fear and question, what does not *belong*. In times of uncertainty and divide among cultures, confronting fears is a movement against the grain, against borders to identify liminal spaces. To question those borders is to accept for one to change themselves, to challenge their identities. The fascination at play towards disgust is a call to embrace and adopt the fear of the unknown to try evolving our understanding or reality construction. We are other to others; everyone is a stranger in a quest to become object of others' fascination - to be adopted as part of a social group. Designing with the gross is one way to open up a shared platform, a public space for collective identities to advent.

Throughout history, arts heavily relied on triggering this mixed emotion for the viewer to put dominant models into question and enquire on the definition of identity. Tackling unravelling emotions calls for a discussion about censorship. As a globalising universalist moral censorship, violent and radically unifying in the form of modernism, some artists engaged in pushing the barriers of what is deemed acceptable. Questioning axioms of dominant cosmogonies, Duchamp's *Paysage Fautif* (1946), Serrano's *Piss Christ* (1987), Quinn's *Self* (1991) or Delvoye's *Cloaca* (2000), form an ensemble of provocations stirred by using "abject media" (Kristeva, 1980): semen, urine, blood, faeces. The mechanism of these works of art relies on the fascination from these various contexts - sometimes religious, always linked to our collective identities - and questions the conventional material semiotics by a raw transgression (Law, 2008).

Challenging the legitimacy of dominant models with the help of disgust and fascination is an antimodernist stand. The hierarchical, controlling relationship to nature is predominantly questioned by resorting to the gross; among most famous contemporary artists, Damien Hirst or Pierre Huyghe regularly mobilize living entities, including some usually perceived as unsettling. Picture venomous snails, flies, bacteria, and even cancerous cells. Huyghe articulates gross, life and otherness together in his pieces - notably in *After ALife Ahead* (2017), *Colony Collapse* (2012) or *Untilled* (2013). While he advocates for his installations to be self-organized systems growing on their own, "indifferent to the public", the fragile equilibrium reached between artificial and natural components in his works acts as a call for reassessment of our place in the world for the viewer (Russeth, 2017). It is with rotting flesh and food installations such as *A Thousand Years* (1990), *Mother and Child* (1993) *or Let's Eat Outdoor Today* (1991) that Hirst develops a reflection on "*human attempts at isolating and*

retrieving horror from our lives" (Ghenasia, 2017). His *memento mori* recall the association demonstrated between death awareness and the feeling of disgust (Goldenberg, 2001), as he underlines the violence of our relationship to flesh, the severance of our relationship to nature and our inability to relinquish control.

Since the 1960s corporeal fluids and normatively gross body details have been reappropriated by queer and feminists' movements to protest universalist injunctions by political oppression and physical standards of domination. Feminist art, with works such as the *Read My Lips* campaign (Zoe Leonard and the collective Gang, 1992) or the especially extreme *Rhythm 0* by Marina Abramovic (1974), exposes the control of women bodies and question the role they are conferred in patriarchal societies through aesthetics of shock (Martinique, 2016). Such works helped perceive body norms as particularly strong mandates in contemporary societies, thanks to radical meanings they suggest by instrumentalising materiality. Contemporarily to feminist art, since the 1920s a queer art has been emerging and recognized for its artistic value, but also for the collective conditions of its emergence - challenging our perception of the artist as a masculine isolated genius for art as a social activity (Alfonsi, 2019). Queer art is characterized by its visceral challenging of rules aiming at normalizing identities. This current in art is activist, but beyond a political banner, it engages in making visible public claims for a revised humanism. Questioning one's own being through themes such as hybridity, mutations of the body, and the self, queer artists are illustrative of a liquid modernity (Bauman, 2000) and of a societal need to leave space for a variety of identities and cultures. Mobilizing disgust in art thus shifts from a grotesque staging of flesh & fluids to more subtle issues of identity recognition and discourses acknowledgement in the tradition of humanism critique.

2.3 Liquifying design

Grotesque in design has been more scarcely used and examined, with the exception of (Fokkinga & Desmet, 2013) and of children toys (Livingston, 2019). Speculative design increasingly relies on provoking a mild feeling of disgust, in a similar fashion to the works of art previously cited, in order to trigger a long term reflection on the contemporary hybridization of identities; some illustrative works are: Sinae Kim's *Urine Ware* bowl designs shaped as urinary bladder and using urine as a glazing material, Studio Basse Stittgen's *blood related* series of objects made entirely out of human blood - some pieces of the series even being made out of HIV positive persons' blood -, Studio Nienke Hoogvliet's *Waterschatten* lighting, table and bowls made of used toilet paper. In these three cases, the sense of disgust coming from the materials is a reminiscence of abject media as used by artists. As an answer to the analytical culture infused in modernist design, we find again in those illustrative works a mobilization of materials that are morally unacceptable. Even though the productions are delicate and aesthetic, they embrace disgust and make it fascinating.

In designs are encoded contemporary beliefs, contemporary cosmogonies; Slavoj Žižek illustrates this concerns through the phenomenology of toilets: "*We have such a multitude of*

the toilet types because there is a traumatic excess which each of them tries to accommodate - according to Lacan, one of the features which distinguishes man from animals is precisely that, with humans, the disposal of shit becomes a problem." (Žižek, 1997). Design – as craftsmanship and in its lineage – has become a principal vector for the mediation of phenomena through technics, and its practice has recently evolved as a new form of crafts of affordances, an engineering of virtual and/or material interfaces to phenomena. Design is never neutral but an artefact of an ideology, of a sociotechnical system it belongs to. As design was born with fashion-led planned obsolescence, we understand that the conception of objects and services can be driven from semiotic concerns that go further than optimizing their supply chain and interfaces for financial purposes and competitive risk mitigation (by green washing, for instance) but need be appropriated to build a rich and inclusive practice. Thinking design practices as neither enslaved to financial purposes nor elitist in their speculative qualities, but meant to positively impact situated communities and empowering to users, it represents a massive negative space around current practices.

Xenodesign is an emerging critical practice inheriting from speculative realism schools of thought. Explorations in this field focuses on decomposing the genetics of design systems so to identify their principal qualities and hack them, by replacing marble by coagulated blood for instance. Xenodesign artefacts situate in the context of hyperobjects, challenging socio-cultural events such as sustainability, AIDS, or gender inequalities (Morton, 2013). If design is an act of negotiation (Rigobello & Gaudillière, 2019), then xenodesign is an activist act towards social inclusion. It is an answer to aforementioned liquid modernity, which characterises by an increase in the rate of change of contemporary institutions and beliefs, which is to say that are subjected to an ever-decreasing lifespan. They therefore cannot "solidify", leaving individuals to have to constantly reassess their environments, decide and act in a fragmented way. This indeterminacy and unpredictability reflect on our ways to live and act upon the world, and ultimately on our ways of being. The western universalist project that is conveyed by capitalist led designs is thus being questioned by xenodesign practices, hence highlighting the need for a recognition of multi-cultural coexistence through what mediates our social life: objects and services.

Similarly to the critic that Alfonsi (2019) builds on art history analytical traditions biased by the masculine idea of the isolated genius artist, xenodesign practices often find an antimodern alternative is its modes of production. Collaboration in craft is found in queer theories, and in inherited artistic practices as with Enzo Mari and Sol Lewitt, or in Tom Sachs and Thomas Hirschhorn, to name a few. This change in modes of production is also nested within Donna Haraway idea of companionship, which drives xenodesigners into a struggle to build pathways to a co-dependence with non-human beings, reminding of the search for extended collaboration. Such a methodology we recognize as radically inclusive: one that is offering space for an expression of the identities, emergent, community centric (Rigobello & Gaudillière, 2019). Becoming less and less viscous, a xenodesign is emerging under collaborative and vindictive forms. In fact, the millennial or centennial traditions we

previously relied upon for a social belonging, such as sharing a family recipe that is passed on over generations, tend to fade away as they are being partially replaced by faster changing values systems embedded in everyday designs. Novel craft practices as Do-It-Yourself and Do-It-With-Others in the domains of electronics, biohacking, mechanics and woodworking as seen in fabrication third places demonstrate means of production that valorise the social life of designs through open practices. On the contrary, examples of instrumentalization of these social ways of being are found in major social media businesses, or open research platforms relying on a needed belonging to contribute to a collective constructive project.

Design represents a tremendous yet dormant potential of methodological improvements that can foster a sense of togetherness in alterity, that is by promoting a "repository-forking" strategy allowing for the co-existence of multiple yet situated genetic and memetic evolutions for objects and services. On another level, and as is manifested in open-source platforms, efforts need to be put towards favouring a holistic approach to design supporting social inclusion and an increase in knowledge transmission affordability; in haptics belongs a relay to enrich the wideness of points of entry to a shared idea, as illustrated by the gross.

3. A craft of all senses

3.1 Kombucha as a canvas

Determined to advance the comprehension of the social inclusion potential lying in design disciplines, NGO design studio thr34d5 decided to test out hypotheses about the gross in the presence of a complex of micro-organisms and/or material system that have a low cultural baggage: kombucha.

Symbiotic Cultures Of Bacteria and Yeast (SCOBY) are co-existing communities composed of microorganisms – kombucha is part of this group. Kombucha is composed of a zoogleal mat grown aerobically by *Komagataeibacter xylinum* bacteria from a sweet tea solution (designated as "the pellicle" here), which protects from contamination *Zygosaccharomyces* yeasts feasting in the sweet tea solution, while using ethanol produced by the latter to produce the mat. The fermented solution eventually turns into a sought-after probiotic beverage for humans. The fibres of the pellicle are composed of bacterial cellulose, which is about a hundred folds thinner than the fibres found in plant cellulose (Schurz, 1980), making it a competitive material to synthetic polymers. Kombucha has a mythical origin. It traces back in Central Asia (eventually from Manchuria, China), and has apparently spread from this region over a period of approximately two thousand years.

The kombucha pellicle can be dried out, obtaining thus a material similar to leather, textured, that can be used in a comparable fashion to craft objects. Several designers or engineers have worked with this material, making garments (Suzanne Lee, Scobytec), packaging (Elena Amato, MakeGrowLab) or small leather goods (Echocella). In continuity

with peer-to-peer sharing practices sustained for many years around the preparation of the kombucha beverage, designers such as Suzanne Lee have developed their work under Creative Commons licences and shared their expertise in open-source organizations such as biolabs. The information shared on kombucha pellicle and its production focuses nonetheless on the growth recipes rather than on other aspects of the process for instance, drying and post-treatment methods. Furthermore, many companies have recently formed selling the kombucha beverage, and product designers are launching commercial initiatives based on kombucha leather goods. A difficulty subsists to industrialize the production of kombucha pellicle: while designers have conducted research on the material, its production process, possible textures and colours, and crafted objects, there are little replicable initiatives due to *K. xylinum* phenotypic expression and variations from strains' origins in yeasts and bacteria ecologies. Internal research exists in the kombucha drink industry, with a specific focus on drinks quality and users experience rather than pellicle production. In general, little academic research exists on the culture of the pellicle, but for the cultivation of bacterial cellulose in the life science industry (Rajwade *et al*., 2015), food applications (Lin *et al*., 2020), marginally in paper production (Zhang *et al*., 2019), bio-based sensors (Wei *et al*., 2010) or functional aerogels production (Zhen-Yu *et al*., 2014).

Our interest lies in the low cultural anchorage of kombucha pellicle; as there is only a developing set of craft practices developed around the SCOBY, and especially towards drinks production, we are in the presence of an alien material. As no cultural practices are tied to the pellicle yet, it favours its appropriation by anyone, turning it into a peculiar means of experimenting otherness in design.

3.2. Crafting for otherness

thr34d5, a design research NGO, has been developing an inclusive design practice since 2018 through its kombucha Applied Research Program (kARP). Initially focusing on the alteration of the kombucha cultivation process to build an understanding of the pellicle growth, researchers involved in the kARP tested various compositions of the cultivation mix in an attempt to make the process even more sustainable by replacing the sugars provided as nutrients to the SCOBY (glucose and fructose sources). Tea polyphenols are also key to kombucha production, especially as they provide nitrogen to the bacteria. But as tea has an important environmental impact because it is only produced in central and south Asia, our researches also look into replacing it with vernacular organic food wastes as a mean to lower it. Among other areas, research has been conducted on colours, growth containers, scale of production, and waterproofing of the dried pellicle. Experiments are documented on various social media[3] and a git website[4]. The adventurous DIY approach, led by a collaborative will to

[3] Applied research traces can be found on https://instagram.com/thr34d5, https://facebook.com/groups/kombuchafr, and https://facebook.com/thr34d5.
[4] https://wikifactory.com/+thr34d5/karp (consulted November 2019).

build an emergent craft practice of this alien companion, led to the discovery of a variety of material languages, textures and behaviours. While welcoming new researchers in thr34d5' workshop and at workshops animated by thr34d5, the sense of fascination and disgust - to say grossness - that fresh kombucha pellicles trigger is particularly worth noticing. The candid approach to the material in previously mentioned experiments uncovered a wide variety of fascinating textures.

One thing that is learnt from experimenting with biological companions in a spirit of inclusiveness is the respect of its agenda. There is a necessary discussion with the material. Kombucha does not do what we want, it rather agrees to collaborate with us. Kombucha is ours as long as we are theirs. Hence, there is a necessary indeterminacy in the craft practice that is developed. As opposed to a modernist way of "French gardening" the material, liquid design practice aims at leaving space for both the micro-organisms in presence and the social context to express themselves, "English gardening" style. If a slick and eye pleasing design is being curated in galleries for privileged clients, a gross design is activist and its craft aims at giving a voice to the unprivileged, to the marginalized or unheard. Until it is acknowledged that there are no merges, but only situated cultures.

Designing with the oddest, grossest materials, is a political stand in favour of including others, favouring otherness and openness for the sake of not only reconnecting to the territory but doing it collectively.

To sustain and spread the values it promotes, thr34d5 has structured a knowledge transmission sequence throughout workshops on kombucha crafts - growing a pellicle, treating it, making from it. The process itself is particularly simple, with few steps and tolerant of variation - as an example the bacteria need sugar but are quite lenient on the type of sugars provided, which has a surprising influence on colour, texture and thickness of the pellicle. The kARP has been the birthplace for a series of objects made out of kombucha pellicle, from garments to art pieces, all of which contributed to develop novel craft practices. More recently, thr34d5 has started investigating the possibility of harvesting both the pellicle and the kombucha drink to reduce waste from each of the processes. The kARP is an open-source program for participants around the world willing to contribute, and thr34d5 documents the knowledge gathered, making it available online, including the data on kombucha culture and crafting.

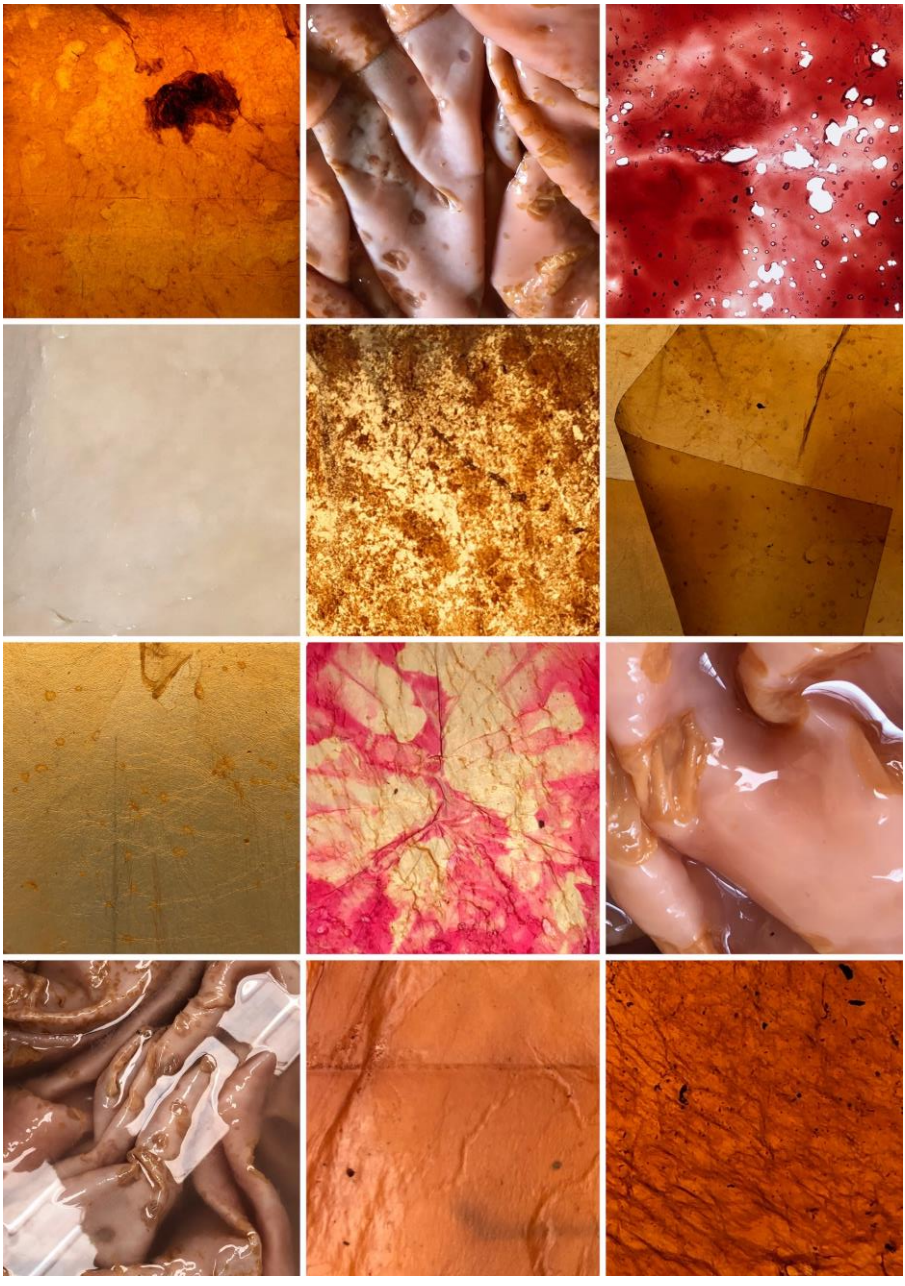

Figure 1. Textures of kombucha as experimented by thr34d5.

4. What is gross is liquid

4.1. Disgust in kombucha

The kombucha pellicle is appalling as much as it is appealing to the five senses, contributing to trigger core disgust (Rozin *et al.*, 2008) (Figures 1 and 2). While the privileged senses of taste and touch are identified as provoking disgust, smell and sight also participate, and the confrontation with the pellicle therefore is a memorable experience. As a pellicle grows in a liquid usually considered a beverage, taste immediately comes into play. A superposition is created with the liveliness of the culture of bacteria when being involved in the process of production; this aspect is deemed particularly gross in Europe where the kombucha drink is mainly sold pasteurized, while much easier to accept in South America for instance where the drink is sold with cultures still active - a reminder that disgust is as much a social construct as is edibility. Whether it is possible to eat the pellicle is also an extremely frequent question, and is in fact possible, with some people even making candy out of it. Thus, the idea of ingestion is constantly present when interacting with the kombucha pellicle. Furthermore, a sweet acidic smell is developed during the long fermentation that is necessary to grow a kombucha pellicle. This characteristic smell is quite familiar to fermented food inclined people as it relates to umami – a flavour found in preparations such as soy sauces, cheeses, wines, pickles, to name a few. The sense of hearing is involved too: while not particularly significant on its own, the squish of the pellicle participates in the general characteristics of an encounter with kombucha cultures.

The pellicle goes from squishy and wet, saturated in water, when retrieved from the mix, to sticky while drying to smooth and soft once treated. The confrontation is constant as the pellicle needs to be manipulated at all stages of the process. Most designs with the pellicle would be garments due to its mechanical behaviour (bacterial cellulose can be up to fifteen times stronger in tensile strength than leather), which involves a skin contact while worn. Skin contact has been shown to be a major component of the gross related emotions. The appearance of the pellicle, reminding skin through its colours and textures, the marks and moulds sometimes appearing during the growth process, the bulges forming when manipulating it wet, are all classic elements of the Grotesque aesthetics.

4.2. From fascination to animism

“When bodies spill out of their boundaries, or when parts are severed from the whole, they become unsettlingly other” (Thackara, 2019). As is shown in the photograph below (Figure 3), a raw kombucha pellicle has a distinct appearance reminiscent of skin and organs. This visual analogy to human guts and body parts leads to a renewed reaction of disgust related to anthropopathism. This proximity to human anatomy can even lead to one not hesitating to confer life to the pellicle. This mechanism reminds of animism and ways to confer a sacred status to non-humans, or life. The friction stemming from the awareness of the possibilities of eating and drinking the resulting liquid and pellicle and of this organic aspect

results in the notion of ingesting the other, a feeling of a major transgression of moral boundaries. A path exists on which we could embody the SCOBY, transgress the moral rules to become one.



Figure 2. Endeavor on the aesthetics of fresh kombucha by thr34d5.

The kombucha pellicles, because of their usage as vectors of transmission of SCOBY colonies from peer-to-peer, are also referred to by the terms *mother* and *daughter*. A mother is the strain used to inoculate a kombucha mix and a daughter is the pellicle produced by this mix overtime. Keeping track of the strains and their ties is done in the form of a family tree by thr34d5 as well as by other kombucha researchers, with each mother and daughter baptized with a name and family name. Participants to kARP workshops and to the applied research program are often found to spontaneously baptize their batches of kombucha and refer to the SCOBY as beings. Furthermore, the care for conditions of culture and the growth over time act as a constant reminder that the SCOBY are living organisms. The precautions to keep it from being contaminated during the cultivation setup evoke the fragile aspect of life. Feeding the SCOBY with sugars and witnessing their reactions to changes in the conditions recall that it is not handleable, it is other, and one builds a respect towards it.

4.3. Towards inclusive cosmogonies

While the characteristics of the kombucha production naturally render it gross, thr34d5 has been documenting the kARP activities by further staging the grossness of the process and of the raw material. The lab-like installations where the pellicle is grown, the glass jars in which some are cultivated, also feature a Grant Museum, curiosity cabinet-like style known to be a marker of the Grotesque. Enhancing the flesh and wet aspects of the pellicle stirs fascination, grasps the gaze. The frequent overlap with human bodies seeks to remind that the gross craftsmanship is inclusive by essence, as there is a trans-species collaboration at play. The establishment of a collaborative craft with a non-human is in fact not really new territory, for there are countless works acknowledging the non-continuity of the concept of nature in pastoral ways of living and pre-modern societies (Descola, 2005).

The culture of kombucha pellicle is the place of a lasting clash between disgust and familiarity, generating a sense of fascination and grossness. The personification of the kombucha contrasts with the unsettling solicitation of the five senses during the process. When harvesting and treating the pellicle, it changes from a strange, raw, wet, lively, organic matter to a leatherlike, much more familiar textile. The steps of the process relating to the growth of cellulose, although presenting similarities with producing food and cooking, can be exotic to many given that it involves bacterial culture. The steps relating to the pellicle treatment, however, are commonplace and mobilize everyday tools and activities such as sewing. Kombucha culture therefore goes back and forth from disgusting to usual, in a continuous disparity between liveliness and object-like familiarity. These clashes enhance curiosity towards kombucha, strengthen the impulse to adopt and personify and are an encouragement towards interspecies collaboration. Conversely, kombucha crafts oddly resemble the aesthetics of gut clothing traditionally found in Arctic regions (Schmidt, 2019), which brings an interesting perspective onto our discussion onto aesthetics, taste, craft, transmission and situatedness.

5. Conclusion

The kombucha practices introduced by thr34d5' kARP illustrate a xenodesign practice in that it acknowledges a collaborative dimension of conception in regard to both humans and non-humans by its material semiotics. The program and the introduced design practice focus on care, maintenance, and inclusiveness by adopting an aesthetic of grossness and methodologies fostering indeterminacy and holisticness of senses. Mobilizing the gross in design works is an opportunity for the continuation of the challenging of dominant models, of which the normalized representation of the body (Figure 3). Liquid practices in everyday designs have the potential to carry out activist and affordance aware practices, or rather build impact for designs endorsing intentions. If a user-centric practice is by definition anthropocentric, modernist and replicating dominant models by conforming to what is expected of it, a community-centric practice challenges the establishment, opens the dictionary of semiotics in design (Rigobello & Gaudillière, 2019) and leaves space for identities to become familiar within the relational space that is generated.

Beyond the materiality of kombucha, the present paper explores the potential of a design methodology in becoming building on queer art investigations of identity and otherness, of difference and individuality, and on gross as a reaction, towards the articulation of a design practice for social inclusion, referred to as xenodesign. We understand from the experience of this research that the transmission of knowledge in design and craft practices embedding a such qualities shows much potential for developments, for there is an intuitive and leverageable act of animism happening over the variety of situations encountered that illustrates at individuals' level the striking power lying in material semiotics. This foreseeable aspect of craft practices development should be further investigated with a variety of

materials in an effort to build an understanding of knowledge transmission, belonging and intuition for social inclusion.

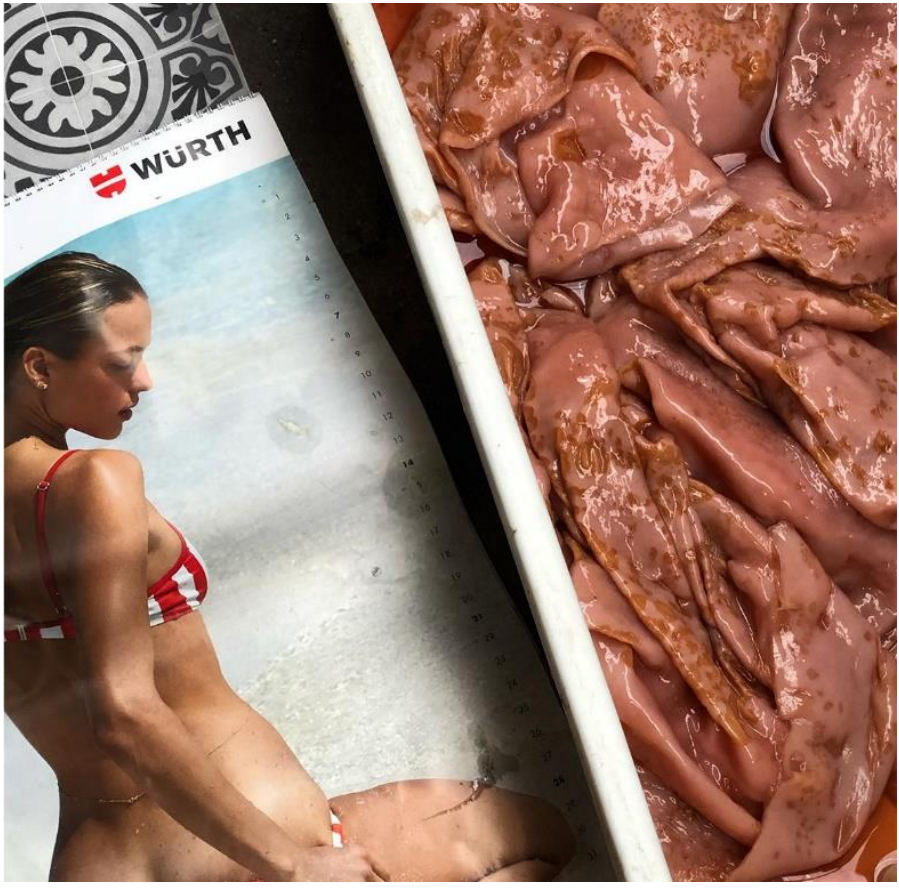

Figure 3. Confrontation of aesthetics by thr34d5.

This research aims at supporting a larger movement in maturing everyday design methodologies to build upon ones that satisfy only a few senses by an “eye-candy” effect or mind pleasing by normalization and identification, that is by encouraging a richer and yet affordable understanding of the material semiotics at hand for contemporary designers.

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Acknowledgements: authors are thankful to members of thr34d5 for the many discussions that foster this continuing research, especially to Vivien Roussel that generously shared his knowledge on conceptual art.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Finding New Representations of Old Knowledge: a design study of visualizing I-Ching

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Abstract | This is a design study that explores the potential of using modern technologies and visual design strategies to represent and find new meaningful insights into the ancient Chinese text *I-Ching*. The goal of the project is to overcome cultural and language barriers and investigate innovative visual solutions to objectively analyse and interpret *I-Ching* than language translations. The text visualization project follows a mixed-methods approach that involves document analysis and design research process to identify analysis tasks with matching visual models. The interactive visual outcome intends to reveal new patterning insights of the Hexagram symbols and the commentary texts from *I-Ching.* The visualization approach and research process explore new opportunities for viewing and understanding abstract text information that is polysemic and sometimes uncertain. The assessment results suggest that a modern visual design approach can be an effective strategy for encouraging people to learn in unfamiliar territory.

KEYWORDS | INTERACTIVE DATA VISUALIZATION, TEXT VISUALIZATION, TEXT AND SYMBOLS, DESIGN METHODS, DESIGN RESEARCH, ANCIENT CHINESE PHILOSOPHY

1. Introduction

The adoption of computational techniques within the humanities allows scholars and experts to build tools or employ digital technologies to assist research and communication. Among various digital and computational methods, the growing prevalence of information visualization techniques has been tied to the analysis of humanities subjects. The main role of information visualization is described as to help users to perceive patterns that could be used for building an appropriate model (Purchase & Andrienko, 2008). It provides a convenient means to summarize dense information in visual forms that allow users to understand and identify data insights. Thus far, text mining and visualization resources and applications have been mainly focused on English language or Latin-based scripts. This study directs its focus towards visualization design of ancient Chinese text - a significant and rather unique book – I-Ching. Published in the late 9th century BC, I-Ching (also called Yi Ching, Yijing, or Zhou Yi) is one of the most important books in Chinese history. *Yi* means *Change*. Therefore, it is also known as the *Book of Change*s. Although the most popular understanding of the book lies in its value as a divination manual, it is a book based on the psychology of individualization process in its essence. I-Ching has a direct influence on much of Chinese culture and philosophy including Confucianism and Taoism. It has also inspired thinkers of almost every intellectual persuasion: from the realms of philosophy, religion, art, politics, social sciences, to mathematics, physics, astronomy, and technology (Smith, 2012).

Ancient Chinese language is very concise and often obscure. There is no tense, gender, plural, article, preposition, or punctuation, and sometimes there is not even a subject or object. Therefore, the contents and their interpretations of I-Ching have revered and attained mythic status with the passage of time. The original I-Ching is a very “visual” book that is composed of symbols and their meanings. The sixty-four unique hexagrams with six changing lines all apply to a particular reading. Many studies of I-Ching in present days try to use verbal language to interpret these visual symbols and their meanings. Thus, the relationship between different elements is not easily identified from these text descriptions and the meaning of the readings is often ambiguous. In a world where people communicate increasingly with images, we are asking: can we use modern data visualization and visual communication design strategies to reinterpret the hexagrams of I-Ching so that the patterning insights are more clearly represented, and the themes of the readings are more evident? Furthermore, can an innovative visual approach reveal new connections among the elements in I-Ching that were hidden before?

The study here presented is, therefore, the first to examine how modern visual design approaches may reinterpret I-Ching in a clear, appealing, and digestible manner, and to make the ancient text more accessible and likely to attract more interests by new generations of readers and scholars. We hope to overcome cultural and language barriers and seek more innovative methods to objectively analyze and interpret I-Ching than language translations.

With this in mind, the first objective of this study is to dissect the contents of I-Ching and understand its historical background. The second objective is to develop a visual system, taking into account principles and theories of visual perception and graphic representations, as well as considering the role of motion and interactions, to highlight the patterns of interconnections within I-Ching. The third objective of this study is to investigate whether this modern design approach to view I-Ching can communicate clearly and effectively to audiences with different knowledge backgrounds, as well as stimulate their interests in learning more about I-Ching and ancient Chinese philosophy.

2. Background

I-Ching is a system to explain the nature of the world and how it acts in harmony with its patterns and processes. This project is based on the version formulated in the Zhou dynasty (ca. 1045-256 BCE). The contents contain 64 six-line (a combination of solid and broken lines corresponding to Yang Yao and Yin Yao) symbols known as Hexagrams. The Hexagram originated from The Yin and Yang represent the "Two Modes" (两仪), and they can be divided into "Four Phases" (四象). Then dividing the "Four Phases" yields the "Eight Trigrams" (八卦). Each Hexagram is composed of upper and lower Trigrams. The combinations of the Trigrams result in 64 total Hexagrams (Figure 1).

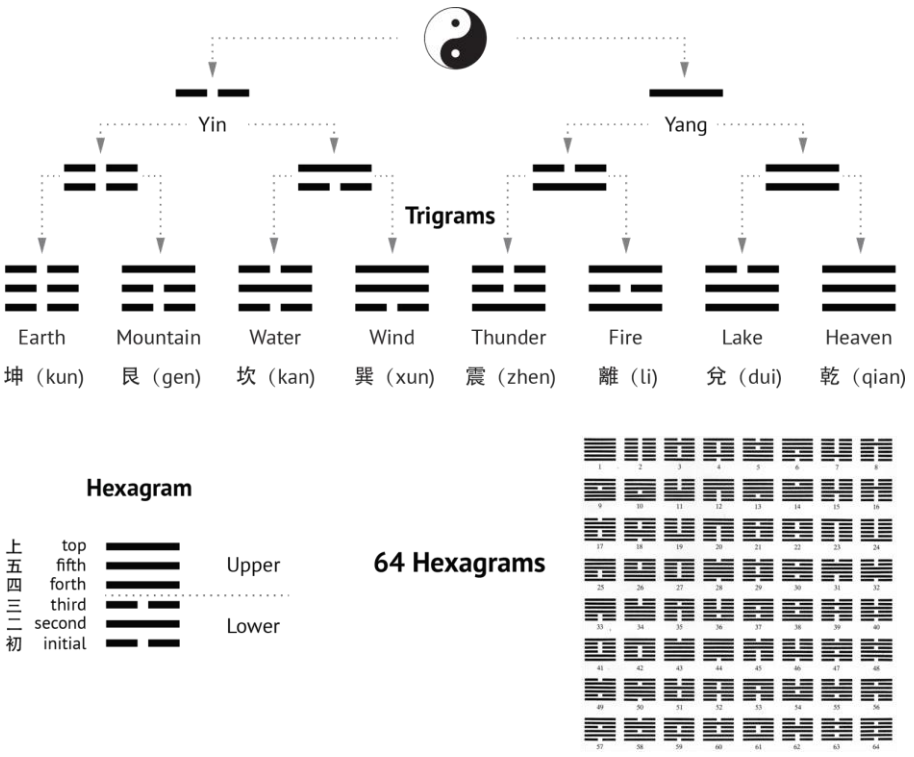

Figure 1. The foundation and structure of the Hexagrams.

Each Hexagram has a name, a brief statement known as the Decision or Judgement, and commentary texts to explain each of its six lines called Yao Text (Figure 2). Ancient Chinese language is known to be extremely concise with many possible interpretations. Therefore, the statements and comments provide a vast set of possible interpretations for I-Ching. Although there have been many versions of translations, from modern Chinese to western languages, it can be a lifetime endeavour to reveal the linkage among all elements and the sequences of structures within the contents (Huang, 1998).



Figure 2. Elements included in each Hexagram with the example of Third Hexagram "Zhun".

Ideas and concepts constantly evolve. Since Shao Yong (1011–1077, Song Dynasty)'s "image-number" approach to studying I-Ching (Birdwhistell, 1989), there have been more than one thousand image interpretations in China from the Tang dynasty (618-907 CE) to the Qing dynasty (1644-1912) collected in *Zhou Yi Diagram Collections* (Shi Wei, 1995). Besides divination, many of the visual reinterpretations relate to cosmology, alchemy, Yin Yang, and Fengshui study. In the western world, the visual structure of I-Ching has been re-constructed mainly based on mathematical principles. For example, a spherical structure to reflect the image of the world called Yi Globe (Drasny, 2007 and 2011) and a nine-stack mountain cube with reflective symmetry (Martyn-Smith, 2016).

How to bring out elements and their correlations in the original I-Ching through unbiased objective visual interpretation is what we focus on. The target audiences for this project are primarily non-specialists. It is intended for people who are interested in I-Ching and to provide them an intuitive model to objectively explore the rhythm and flow of the symbols and their relationships to the commentary texts. We want to help readers deconstruct the ideas encompassed in I Ching to build an understanding of it piece by piece.

3. Methods

This study follows a mixed-methods approach involving document analysis and design research. Document analysis includes literature reviews of the structure, the symbols, and versions of commentary texts in I-Ching as well as the relations among them. Qualitative and quantitative methods of data collection, text mining, and text data analysis are applied. Design research involves the iterative process of analysing, ideating, prototyping, user testing, and implementing a web-based interactive application.

As a design project for a specific humanitarian subject, matching the analysis tasks with appropriate tools and design models is essential. Therefore, the two approaches of document analysis and design research are consistently intertwined in the process. Text analysis and visualization aim for the purpose of comprehension, categorization, comparison, and correlation of the visualization tasks. The visualization tasks are:

- Reconfigure the symbol representations and categorize them in such a way that the patterning structures and connections between the Yin/Yang positions of the 64 Hexagrams can be better presented and comprehended;
- Allow viewers to browse and locate frequently occurred keywords that relate to disparate stages of divination from the commentaries. The distributions and the transitions reveal a glimpse of the "correlative thinking" mode of Chinese philosophy;
- Identify common subjects from the commentary texts and query these subjects at the scopes of identify, compare, and summarize.

4. Design Process

Edward Tufte's concept of micro/macro readings of information display (Tufte, 1990), and Ben Schneiderman's visual information-seeking mantra (Shneiderman, 1996) both advocate for representing information of various scopes from the overview to details. The interactive functions (programmed with D3.js) of this visualization project enable this approach. With the interactive model, the details of the design components are there to expand and support the larger system as it grows in richness and complexity. In order to create design solutions that reveal the trends, patterns, clustering, and outliers of I-Ching from multiple scopes of reading, the design process considers:

- The symbols: visual representations of the Hexagram symbols and the geometrical patterns among all Hexagrams;
- The semantics: the individual divinatory terms and subject categories, and the cyclical movements among different stages of situations and subject coverage among all commentary texts.

4.1 Redesign of the Hexagram

In I-Ching, Hexagrams are arranged in numerical order from one to sixty-four and are organized into pairs based on the principles of inversion and the opposition of Yin and Yang. *Inversion* means that the lower and upper trigrams flip positions, which results in a mirroring effect; and *opposition* is demonstrated as each line of the Hexagram turning into its opposite (Figure 3). However, for people who are unfamiliar with the arrangement of the Hexagrams, these organizing principles are not easily perceived. According to visualization perception theories, spatial region and hue contrast are the top two most effective identity channels to recognize categorical data (Cleveland & Mcgill, 1985; Mackinlay, n.d.; Munzner, 2014). Therefore, we apply contrasting hues to the symbol to separate the Yin/Yang states and add an additional spatial dimension (from lines to forms) to better reveal the sequence structures and the inverse and opposite patterns of the neighbouring Hexagrams (Figure 4).



Figure 3. The arrangement of 64 Hexagrams is based on principles of inversion and opposition.

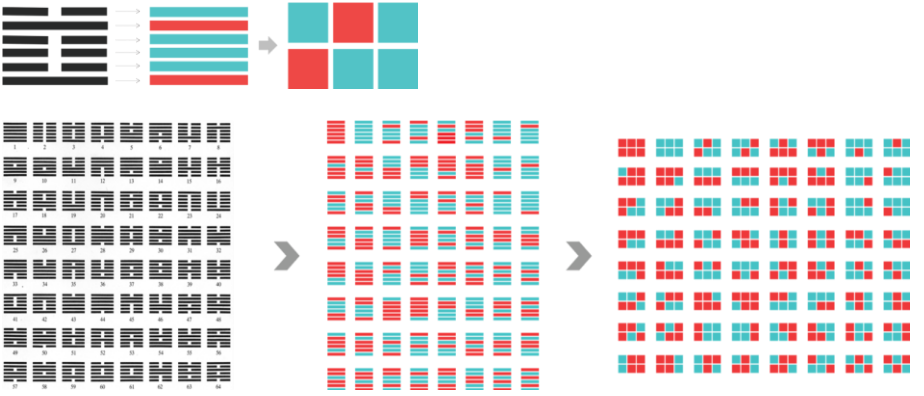

Figure 4. New symbols of the Hexagrams are designed to make the sequence structures more noticeable.

4.2 Geometrical Patterns of the Hexagrams

The redesigned symbols of the Hexagrams intend to make the patterning structure more pronounced and maybe better respond with user interactions. Each Hexagram consists of six lines (or squares in this version). They are called *Yao*. When the positions of the Yin or Yang Yaos are highlighted, users may examine the correlations among the Hexagrams with the

same Yin/Yang Yao position. Trigrams – when each Hexagram splits into the upper and lower three – are another critical element in the signs of I-Ching. The eight Trigrams, invented by the legendary hero Fu Xi (Deng, 2013), represent the fundamental order of the universe (see Figure 1). Besides the commonalities in the patterning structure among Hexagrams that share similar attributes, how the positions and patterns relate to other data points is another query that guides the visual design direction. We seek answers to questions relating to the hidden connections among the elements of I-Ching with the redesigned visual representations. For example, do all Yang Yao in the second-order reflect negative divinatory meanings in the commentary texts? Or do these Yao consider the same subject category? Do their appearances in all Hexagrams share any correlations or causality connections?

With such complex information display, we use visual design principles such as creating visual contrast and controlling the visual movements to guide users' attention to particular elements. The users' experience of searching, acquiring, and receiving information is also intended to be enhanced with motion as visual active feedback responses (Stone & Wahlin, 2018).

4.3 Word Frequency in Commentary Texts

The meanings of the Hexagrams are mainly explained through the commentary texts in I-Ching. The commentary texts include two parts: The Decisions (卦辞) and the Yao texts (爻辞). The Decisions and Yao Texts were originally composed by the Duke of Zhou in the 11th Century BC (Huang, 1998). The Decisions are one-line statements to describe each Hexagram. The Yao Texts are commentaries to explain the individual lines within the Hexagram. The analysis of each individual line (or square with the redesigned symbol) corresponds to each of the six stages of a particular situation of divination (See Figure 2).

I-Ching scholars believe that one of the most important messages from I-Ching is that everything is in a process of continuous change, rising and falling in a progressive evolutionary advancement (Deng, 2013). This process of continuous change is conceived in terms of the Ying-Yang metaphysics (Cheng, 1976), which is an essential form of the Chinese "correlative thinking" philosophy. *Correlative thinking* suggests that different types of things are classified and coordinated into correlative systems, and thus considers explanations of individual happenings as relating to these systems (Needham, 1991; Graham, 2016). Such a principle also applies to the Chinese mode of divination. I-Ching is traditionally used as a divinatory system, so fortune-related keywords constantly appear in the commentary texts. With the text analysis algorithm, we are able to identify the three most frequently occurring characters in all Yao texts are 无咎 (no misfortune), 吉 (auspicious), and 凶 (ominous), and they happen to represent the three stages from the favorable to the unfavorable time and situation. The change dynamism, in particular, appears when disparate keywords occur next to each other within the Yao Texts of one Hexagram. The most frequently occurring keywords in the Decisions have been sorted into three categories: positive, neutral, and negative in regard to their divinatory meanings. At the moments when the transition from

one extreme to another occurs, the paths of these transitions are highlighted with user interactions. These highlights that reveal the distributions and the transitions of the divinatory words convey a glimpse of the "correlative thinking" idea of Chinese philosophy.

4.4 Subjects of the Comments

Although the Decisions and the Yao Texts are written forms to help explain the abstract significations of the Hexagrams, the concise texts are still cryptic and obscure in many ways. In order to sort through the wide range of contents from the comments, we use the three subject categories generalized by Richard Smith in his book "The I Ching: A biography": images of things, images of affairs, and images of ideas (Table 1) (Smith, 2012) to gain a better understanding of the implications of the Hexagrams.

Table 1. Subject categories based on Smith's classifications

Images of Things	Elements of Nature	heaven, mountains, rivers, wind, fire, animals, dragons, the natural or supernatural elements or phenomena
	Elements of Artifacts	clothing, food, drinks, barrels, vessels, wells, and other mundane objects
Images of Affairs	Social Relationships	friends, neighbors, other social interactions
	Political Relationships	mainly with the aristocratic superiors
	Family Relationships	marriage, parents/children
	Warfare	Chinese character "师"
Images of Ideas	Mindset	situations or advice relate to psychological attitudes and faith
	Emotion	happy, sad, fear, contempt…
	Senses	sensory or extrasensory experiences

The subject codes are generated from the commentary texts is based on the semantics of the sentences and keywords. As a result of the coding and sorting, we find that most Hexagrams contain more than one subject. For the visual presentation, we want to reveal the connections and distributions of each subject and its corresponding Hexagrams.

4.5 User Interface

I-Ching Hexagrams traditionally have been arranged in both a circular and grid-based structure. In Chinese culture, the Yin Yang symbols make a perfect circle, and the circle shape is a symbol of harmony, unity, and infinite cyclic movement (Eberhard, 1986). Therefore, the redesigned Hexagrams are organized clockwise along a circular form starting from the right end of the meridian. Outlined rectangles extended out from the Hexagrams represent the character count of the Decisions. The filled-in rectangles are the ones that

correspond with the divinatory keywords. Shades of grey separate the positive, neutral, and negative meanings of these keywords. Lines of dots that represent characters of the Yao texts are arranged toward the center of the circle. The color patterns of the dots are to reflect the corresponding Yin/Yang stage of the Hexagram. Navigation tabs on the right side of the screen provide interactive opportunities for viewers to explore the system (Figure 5). The navigation structure is organized by the visual analysis tasks: word frequency in Yao texts; commentary subjects; divinatory keywords positions; geometrical patterns of the Hexagrams.

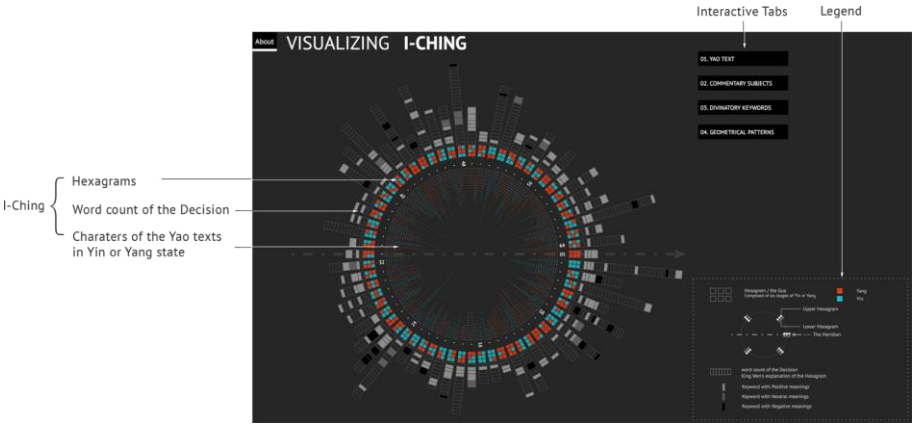

Figure 5. Web-based user interface design of I-Ching

The hover effects triggered by user interactions intend to convey a sense of movements flowing in the visual display of the Hexagram system. The movement of changes, *i.e.*, twinkling highlights and connections among different graphic symbols, gives rise to multifaceted meanings of this revamped visual interpretation of I-Ching.

5. User Evaluation

User testing is conducted twice during the design process. One with a digital sketch-based prototype in the early design stage, and the other with a functional interactive screen on desktop computers toward the end of the design stage. There are a total of 6 participants involved in both testing sessions that include 2 scholars whose research expertise relate to I-Ching and Chinese philosophy, and 4 non-scholars who have little or some knowledge of I-Ching. During the first testing session, participants were asked to openly evaluate the visual design, and scholars were asked to provide feedback on information accuracy. The second testing was a combination of task-based usability assessment of the interaction experience and design evaluation regarding visual aesthetics and communication effectiveness.

5.1 Evaluation Process

The first user testing session provides valuable feedback from the I-Ching scholars regarding literature references and existing I-Ching studies. The commentary subject category is one of the examples that is revised after scholars' reviews. One scholar found it had been challenging for her to see the Hexagrams in completely different visual forms from the original six-line symbols. Such a transition was not a problem for the non-scholars. But all participants agree that the patterning structures and the organizing principles are more noticeable with the updated Hexagram symbols. Therefore, we decided to keep the design concepts of redesigning the Hexagrams.

The second testing session aimed for evaluation of usability, communication quality of the content, aesthetics, information quality, and user engagement. Several techniques and instruments were used to gather evidence on these dimensions (Table 2). Usability was mainly assessed by a task-based questionnaire. The required tasks include: identifying the Hexagrams that share both the inverse and opposite relationships; picking out the most common divinatory tone(s) of the explanatory comments; considering the correlation between Yin/Yang position or Trigrams and the commentary subjects. Communication quality of content was assessed by objective measures (self-report of comprehension problems) and subjective measures (task-based performance evaluation). Aesthetics was assessed by identification of user perceptions of visual expression and creativity. Users were asked to use 5-point scales to rate in categories such as "pleasant", "clean", "creative", "original", and "sophisticated". Information quality addressed the educational impact of the visualization project. The measure builds upon the Bernier Instructional Design Scale (BIDS), a method of evaluating the instructional design quality of printed educational materials (Bernier, 1996). We used four categories related to learning objectives, quality of content, reusing potentials and chances of recommendation, and learning potentials. User engagement was measured by three related items with a 5-point scale.

Table 2. Assessment considerations

Usability	Tasks relate to the speed of reading, understanding, and navigating Self-report of usability problems Color accessibility testing through online colorblind web page simulator (https://www.toptal.com/designers/colorfilter)
Communication quality of content	Self-report of comprehension problems and clarity of delivery Tasks relate to the identification of information hierarchy, navigation structure, and icons
Aesthetics	5-point scales: visual attractiveness and creativity
Information quality	5-point scales: learning objectives and quality of content Dichotomous choice: reusing potentials and chances of recommendation
Engagement	5-point scales: engaging, educating, stimulating

5.2 Results

The assessment results show that all users are able to complete the given usability tasks and successfully interpret the visualization. However, all users agree that a thorough grasp of the context (mainly from reading the "about" section on the web page) is necessary for them to understand the model and enable them to reason about the visualization. With the online color-blind simulator tool, we learned that the red/green and blue/yellow color blindness both return favourable results that the colors representing Yin and Yang are able to display distinguishable contrast for users with color-vision impairments. Problems addressed by the participants are associated with the abstractions of visual symbols and the overwhelming feelings of the information density.

As shown in Table 3, almost all participants agreed that the visual creation is pleasant and original. Information presented through the visualization is engaging and stimulating. The non-scholar participants all agreed that it is helpful for them to understand I-Ching and stimulate their interest in learning more about I-Ching and ancient Chinese philosophy.

Table 3. Testing participant's opinions regarding aesthetic, information quality, engagement, and educational effects.

	Opinion				
	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
Opinon1: Visual Attractiveness	0	0	0	1	5
				100%	
Opinon2: Creativity	0	0	0	2	4
				100%	
Opinon3: Content is engaging and meaningful	0	0	0	2	4
				100%	
Opinon4: Acquiring new knowledge	0	0	1	1	4
			17%	83%	
Opinon5: Increase of Learning Interests	0	0	2	0	4
			33%	67%	

6. Conclusion and Discussion

This is a design study that aims to create a compelling visual expression of an ancient text that may overcome cultural and language barriers and reach a new generation of audiences and scholars of Asian philosophy and history. The design approach and research process

explore new opportunities for viewing and understanding abstract text information that is polysemic and sometimes uncertain.

The visualization outcome achieves the following tasks: It uses alternative visual symbols to represent the Hexagrams that better disclose the geometrical patterns and their organizational structures; It highlights the key divinatory terms and the transitions among them to visually convey the "chance-driven correlative thinking" Chinese philosophy; It connects the 64 Hexagrams with the subject categories to bring more clarity to the meanings of the comments. The graphical expression shows clear and immediate results in that most explanatory comments indicate positive or non-judgmental (neutral) divination; "nature" and "mindset" are the two most covered subjects among all commentary texts; most Hexagrams share the "inverse" relationships and four pairs of the Hexagrams share both the "inverse" and "opposite" relationships. More connections and studies can be explored using this modernized graphic depiction of I-Ching.

If the history of knowledge is the history of forms of expression of knowledge (Drucker, 2011), then this project intends to undertake the challenge of finding a proper new representation of old knowledge. The concise language and the unique symbols make I-Ching seem like a suitable piece of work for graphical rendition. However, because of its obscurity and complexity, any interpretation runs the risk of being treated with skepticism. One of the ground rules in the early stage of design is to ensure that the visualization is based only on objective information without any interpretative construction. Then it comes to the realization that "subjectivity" is unavoidable during the design process. For example, many obsolete characters of Ancient Chinese have been interpreted or translated in different or even opposite meanings. The translation chosen would affect the information reading significantly. Then the decision of information display – as for the registration of point of view, correlations of parameters, and visual expressions are all subjective to some extent. A nineteenth-century Chinese commentary on I-Ching states: "The *Changes* is the mirror of men's minds" (Smith, 2009), which means that everyone can and will have his own interpretation of I-Ching. This characteristic of having infinite possibilities is a part of I-Ching's identity.

The complexity of I-Ching also requires some background knowledge, to begin with. It is confirmed with user assessment in the design cycle that all users, scholars or non-scholars, need to receive relevant context to help them understand the layers of information visualization. More experiments can be conducted on how much background information is necessary and how it shall be obtained by users. Evaluation results also confirm that this new visual approach to access ancient knowledge helps people to gain a better understanding of complex concepts and increase their interest in learning more about it. The testing results support the conclusion that a modern visual design approach can be an effective strategy for encouraging people to learn in unfamiliar territory.

The divinatory practice is another important part of I-Ching that has not been covered in this study. By casting the coins or yarrow stalks multiple times, a Hexagram would be obtained

for I-Ching consultation. In 1951, John Cage created “Music of Change” using the divinatory method of I-Ching. The process of composition was based on a system of tables that contain sounds, durations, dynamics, tempi, and superpositions. Then selections from the charts were made through coin tosses according to the procedures in the I-Ching (Clarkson, 2001). How this “indeterminacy” composing approach in music (Childs, 1974) may be applied to delve deeper into the changing dynamism and the chance-driven uncertainty of visual expressions could be the next step of creating modern design interpretations of I-Ching.

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Acknowledgements: I am immensely grateful to Dr. Han-wei Shen (Professor, Ohio State University, Computer Science and Engineering) who provided insight and expertise that greatly assisted this project, and Peiyuan Tang for assistance with D3 programming and his extensive knowledge in I-Ching and Chinese history.
My gratitude also goes to Dr. Ying Zhang (Associate Professor, Ohio State University, History), Dr. Mark Bender (Professor, Ohio State University, East Asian Languages and Literatures), and Dr. Richard Smith (George and Nancy Rupp Professor of Humanities emeritus, Rice University) for their support, comments, suggestions, and encouragement for this project.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Form is function. Ethics and aesthetics of digital technologies in inclusive interface design.

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Abstract | The discourse on the relationship between form and function in the world of design has its roots in the industrial and Tayloristic model that contrasts and differs from the artistic and artisanal process since the disciplinary foundation. At the origin of the debate there are visions about the role of design in society, but also about the specificity of its own language. The digital revolution and the introduction of Human-computer interaction and the wider concept of Human-centered design have profoundly transformed this relationship, strongly shifting it in favor of people, their expectations and their needs. In particular, when design then focuses on inclusive and universal approaches – i.e. addressing needs that go beyond standards – form is often sacrificed on the altar of accessibility transforming the experience of both audiences – "normal" as well as impaired subjects – into a poor and a "low-resolution" one. On the other hand, for people with disabilities, form itself is the essence of experience. Whether it is the sound channel or VUI in the case of visual deficiencies, the figurative language, for acoustic disabilities, or the tactile-sensory component, considering the cognitive and perceptual aspects, the form becomes both the medium and the message as well. The paper aims to identify the stages of a possible cultural and social journey, within the broader scenario of Universal design/Design for all and the culture of accessibility, which includes the aesthetic-emotional dimension as a shared design value and driver of innovation in the sector. Besides, it illustrates through the discussion of case studies, in the field of personal and public communication, possible approaches to ethics and aesthetics of inclusive design.

KEYWORDS | ETHIC AND AESTHETIC IN DESIGN, EMOTIONAL DESIGN, UNIVERSAL DESIGN, DESIGN FOR ALL, SOCIAL DESIGN

1. Form is function?

The serial production of mass-objects begun by the Industrial Revolution breaks the generative relationship between the object and its shape. The mass product, in fact, has, as its purpose, the satisfaction of basic and common needs, which inevitably implies standardization, in the process of serialization, and conformity in the formal language. The object, which is symbolic by its very social nature, becomes a-symbolic or hyper-symbolic, since massification breaks the link of semiotic meaning produced by the individual and the cultural context.

Historically, the Modernist movement and its functionalist drifts also redefine the relationship between form and function from a design point of view. From the lapidary aphorism of Sullivan (1896) "form ever follows function. This is the law", extrapolated however from its original context and repeated like a mantra, to the exasperated search for functionality, the imbalance in favor of *utilitas* has long crystallized the debate.

As underlined by Cloninger in *'Form Follows Function' Revisited* (2009) presenting the second edition of his *Fresher Styles for Web Designers: More Eye Candy from the Underground* (2008), a book aimed to bring back the discussion about *style* in web design:

> "One problem with 'form follows function' is that it is tautological—it presupposes that every form in the natural world exists as it does because of functional requirements. We start with the end result (the form), look backward toward its origins, and assume that the results were inevitable. But there are any number of reasons why something might have a particular form (chance, malevolence, whim, purposeful design, play, folly, and numerous combinations thereof).

The digital revolution and the mass medium par excellence, i.e. Internet, have brought back the dimension of *pleasantness* among the design variables, even if with extreme delay and strong resistance. The theoretical, cultural and methodological path started with Human Computer Interaction, then declined in cognitive ergonomics and usability and, now, as user experience design has overwhelmingly brought the human factor – needs, fears and expectations – and research with users at the center (Desmet & Hekkert, 2007; Hall, 2013). Yet even these areas, focused on people and their demands, have long shown strong resistance to the contribution of aesthetics and its value.

The main prominent figures in the field, who shaped the cultural frame since the late 90s, have been represented by Donald Norman and Jacob Nielsen and the less known partner Bruce (Tog) Tognazzini at NN/g.

On the one hand, Donald Norman, as he points out in his book *The psychology of everyday things* (1988), represents the rational and "scientific" approach to interaction and experience design. Norman is a complex and hybrid figure: an electronic engineer with a PhD in Mathematical Psychology. During his professional and academic life, he has given a strongly rational and cognitive science/ergonomics related imprint to his research and dissemination work in the field of usability and experience design. Coming from these

research backgrounds that he himself defines as engineering, science and experimental approach that looks at "data" as a source of certainty, Norman completes the gap between the need to affirm the primacy of usability and component of *pleasantness* only in recent years with the book *Emotional design* (2003).

On the other hand, Nielsen, considered *the* usability guru, has shaped almost 25 years of web design culture with his *do's, don'ts* lists. His primordial *battles* against with space in homepage – a counterintuitive approach compared to the visual design and Gestalpsychologie principles – or his radical assumption on user behaviors such as *users don't scroll,* or link must be *underlined and blue* to be recognizable (2000), almost limited the richness of the online experience to a data-retrieval activity. If information access is the driver both of the project as well as the fruition, then, everything can be measured and statically evaluated, certified, in a way. If the debate about industrialization and modernity has relegated *form* as a consequence of function/ality, in the digital era, it is a consequence of data and rational measurability of the user performance:

> "There is an unarticulated war currently raging among those who make web sites. […] this conflict is one that only its participants recognize. The war is not between commercial sites and experimental sites. […] This war is between usability experts and graphic designers. […] For better or worse, the divide between these two camps existed long before 'new media,' and will continue to exist long after the web has become as commonplace as indoor plumbing. 'New media' merely brings this dichotomy into renewed focus because, well, it's new. We're still developing the web's vocabulary. Consequently, we're still trying to get a handle on this 'usability/design' conundrum, largely unaware of its primordial origins." (Cloninger, 2000)

Taking in to account the ISO 9241 standard (1992) definition of "Ergonomics of Human System Interaction" (revised and renamed in 2006), nevertheless, the parameters to be considered are three: efficacy, efficiency, *and* satisfaction.

> "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use."

But, main of the formulas developed to measure the first two component, miss or are not feasible for the third one:

> "Most usability tests are impotent to evaluate the success of a site in terms of conveyed emotion, because emotion is something that most users (and most humans) have difficulty articulating, particularly in response to multiple choice questions. But just because a positive interactive experience can't be charted doesn't mean it hasn't occurred. […] Such inarticulability is inherent to a vocabulary of the aesthetic. Graphic design on the web is no exception. Still, just because a truth can't be reduced to a sound bite, it nevertheless remains a truth." (Cloninger, 2000)

At the same time, studies by Kurosu and Kashimura (1995), however, opened a new scenario, showing that even such an elusive parameter as the aesthetics of a digital object and its impact on human behavior could be measured empirically. The experimental – and therefore scientific – contribution reopened the discussion also within the HCI world. In *Emotional design* (2005) Norman, in a sort of revision of previous studies reconsiders "visceral design" among the design components and the elements that influence the way we make decisions. The completely rational and *sequential* person – outlined in cognitive psychology studies, which is often synonymous with logic/rationality – finds his emotional, visceral and sensorial part again.

Tractinsky, with Lavie and Ikar (2000), reproducing the Kuroshi and Kashimura experiments usefully express the parameter of beauty as a structural element of perception and function. In their research, in fact, they abandon the ambiguous and mimetic wording of "apparent usability" to embrace that of "beauty" (Bollini, 2017). Form, then, is not another element, but an intrinsic component of function, and aesthetics is not superfetation, but an intimate quality of the relationship that the digital object (and not) will entertain with people.

From access to accessibility and back

However, from its own very first foundation the web has been considered an accessible environment, it hasn't been in the proper way. If people's perception is played out in contact with the surface, as defined by Bonsiepe (1993) or on the highest level of the experiential system designed by Garrett (2000), what happens if in the vocabulary of possible interpretations, a sense is missing?

Precisely because the forms of digital communication, starting from the paradigm introduced in the 80s by the GUI (Graphical User Interfaces), are still deeply rooted in the visual dimension of interaction, the question of how information is *presented* is crucial. However, the scenario has become increasingly complex. On one hand, the widening of the media and instrumental spectrum – Voice User Interfaces (Schumacher, 2009), chatbots, mixed, cross and blended realities, tactile and tangible interfaces and so on – on the other hand, the opening of the definition and spectrum of phenomena that go under the idea of disability/accessibility. The design of the communicative-visual dimension of these artifacts has its roots in the long tradition of graphics, its theory and its practices. A tradition, cultural and professional, field with a strong ethical-social connotation. But having become the interface system the intermediary – or at least the collector/connector – between people and many services and information, the ethical dimension becomes even more crucial (Bollini & Branzaglia, 2003; Bollini, 2006).

In the vision of Tim Berners-Lee, the "father of the web", access is conceived primarily as a factor of inclusiveness and participation:

> "The power of the Web is in its universality. Access by everyone regardless of disability is an essential aspect." (1997)

Almost at the same time of the transformation of the web into a mass media – as far as its commercial beginnings in 1994/95 – the W3C starts a project dedicated to online accessibility: the so-called "WAI standards". The *Web Accessibility Initiative* was born in October 1997, also thanks to the activity already carried out by ICADD, the International Committee for Accessible Document Design – in particular by Mike Paciello, George Kerscher and Yuri Rubinsky – which met for the first time in March 1992 on the occasion of the *Conference Technologies and Disabled People* (Bertini, 2002).

The sensitivity to access to digital resources of disabled people offers a broad vision ranging from physical disabilities – visual, auditory, motor (Boscarol, 2003) – to cognitive disabilities including dyslexia, but also low digital literacy or the use of a language other than one's own. The World Health Organization definition further broadens the spectrum. It is estimated that about 15% of people have disabilities worldwide, but if we consider disability, in a broader sense, as a *mismatch* (Holmes, 2018) or a gap between the characteristics of the individual and the environment in which he or she lives and interacts – according to WHO – there are at least 1 billion people who identify themselves with at least one form of disability, twice as many in the broad sense, and in a holistic sense the entire world population. Moreover, when we talk about disabilities, we have permanent disabilities in mind, while temporary or situational conditions also exist. It is, that is, a dynamic and evolving state.

The paradox of universality

There are, in fact, two critical nodes on which accessibility plays its statutory dimension. On the one hand, the definition itself is explicitly addressed to people with disabilities. On the other hand, the idea of a design that, also for reasons of economic cost and timing, tries to give a universalistic answer to the problem according to the motto *one-size-fits-all* (Bollini, 2020).

On the contrary, in his last speech Ronald Mace (1998) – inspirer of the Universal Design "movement" and founder of the Center for Accessible Housing – is very explicit:

> "Its focus is not specifically on people with disabilities, but all *people*. It actually assumes the idea, that everybody has a disability and I feel strongly that that's the case. We all become disabled as we age and lose ability, whether we want to admit it or not. It is negative in our society to say 'I am disabled' or 'I am old'. We tend to discount people who are less than what we popularly consider to be 'normal'. To be 'normal' is to be perfect, capable, competent, and independent. Unfortunately, designers in our society also mistakenly assume that everyone fits this definition of 'normal.'"

If we redefine the very notion of *normality*, as in fact both WHO and Mace propose, the spectrum and the variability of the conditions for which it should be designed, are irreconcilable, especially if the reference is normative. The laws and guidelines – from the WAI to the Stanca law in Italy or section 508 of the Federal Rehabilitation Act in the United States – mainly give a minimum or practical-quantitative requirement response as an operational tool. From a social point of view, on the other hand, design offers answers of an experiential type, of understanding and interpretation of the problem, beyond the respect of the technical aspect and, above all, of an inclusive type.

According to this approach, the different immeasurable needs must be able to coexist and dialogue within the common ground of plurality in a sort of realistic utopia like the *veil of ignorance* proposed by the American philosopher John Rawls in *A Theory of Justice* and recently taken up by Monteiro. The latter suggests adopting it as a criterion for evaluating the designer's work:

> "It's very simple: when designing something, imagine that your relationship to that system gets determines after you've made it". (Monteiro, 2019: 48)

The invitation is to have a people-oriented or empathic approach, thinking of a project that is not universalistic, but differential: not equal, but fair.

Inclusion: design driven accessibility

When design, then, focuses on inclusive and universal approaches (Mace, 1998; Accolla, 2015) – i.e. addressing needs that go beyond standards – form is often sacrificed on the altar of accessibility, transforming the experience of both audiences – "normal" as well as impaired subjects – into a poor and a "low-resolution" one (Mantellini, 2017). A different response is therefore possible, especially if the ethical and social vocation of the project is taken into account. An approach that uses design as a driver of inclusion, in fact, exploits the elements that people have in common, despite their diversities.

The interface – the contact surface between the instrument and the subject (Bonsiepe, 1993) – needs all its intrinsic beauty which is an essential part of its functionality and it is essential for the experience to be positive and satisfying. This necessity emerges dramatically when the neurotypical/able-bodied people find themselves to overturn the daily life of those who, instead, have *different* needs.

An emblematic case is the site that at the same time of the first editions of *Dialogues in the dark* – a guided experience into the *dark* – proposed by the Istituto dei Ciechi di Milano, unfortunately not present in this version in the Internet archive. An apparently *empty* page offered an ordinary user what a disabled person – in this case a blind person – feels when navigating in a digital world that ignores his or her needs. The apparent incommunicability turned, instead, into an accessible communication for those who used a voice browser or for those who discovered that, simply the text was the same colour as the background: present,

but not visible. The site intentionally exploited two patterns from the first generation of the web to design this dystopia. On the one hand, it used the deprecated practice – often adopted by porn sites (!) or to fraudulently force the ranking of pages in Google and other search engines – to insert words and texts that were not visible because of the same color as the background. On the other hand, when you select text with the cursor, in browsers or in many writing software, the text is highlighted with a colored string. A similar experience is often proposed by Scano (2014) when presenting at conferences and talking about the accessibility in the Italian Public Administration field.

A much more mature, systemic and holistic project is *Quietude* developed by the University of Siena, Santa Chiara Fab Lab (Project Coordinator), Glitch Factory, T4all in collaboration with the University of Southern Denmark, Siena Art Institute (for a more in-depth description of the project: https://vimeo.com/225549829). A jewel, before it's even a smart object or an assistive device (Marti & Recupero, 2019) that works on the aesthetic value of the device, before its very functionality. Or, perhaps, precisely because it is beautiful it makes a prosthesis acceptable, both for the people who use it as well on a social level and normalizes the difference.



Figure 1. Quietude (Courtesy of Prof. Patrizia Marti ©, University of Siena)

Conclusions

In a blended world – where real and digital overlap in the different modes of interaction and where people's experience becomes the focus and the reason for the project and production

– the relationship between form and function seems to be reversed. The aesthetic dimension becomes a functional and usability factor in our perception and a crucial aspect of the project. The beauty, the pleasantness, the intangible, the immeasurable become elements of inclusion and equity in a design-driven accessibility approach that gives qualitative, not just quantitative, answers to people's needs.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

'Graphic*mance*'. New Visual Languages between Design and Performance

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Abstract | Today's communication scenario is increasingly characterised by composite images combining 2D and 3D techniques, frames in motion, short clips and videos in loop, *boomerang* and an endless list of new filters that define today's communication scenario. Static and dynamic, volumes and flat models merge, but above all stories and lives that only a short time ago were miles apart. Such production in the fields of art, graphics and advertising is reflected on the behavioural models of today's generations, who live through the production of images spread through social media, thus making the means and products of communication the actual stage of our time.
In this scenario, the present paper introduces the concept of Graphic*mance*, a neologism that combines the terms 'graphic' and 'performance' to describe an increasingly complex visual production capable of responding to the manifold cultural and technological stimuli we receive in real time. Languages and images that produce a fleeting, mobile aesthetics, constantly on the move and in progress, which can change and take on new shapes constantly, by producing increasingly short-lived, everyday life stories and narratives.

KEYWORDS | GRAPHICMANCE, AESTHETICS, INSTAGRAMMABLE, SPREADABILITY, EXTEMPORARY SOCIETY

1. Introduction

A long, long time ago, according to the canon of Polykleitos, if a statue did not respect certain proportions, then it "was-not", meaning that there was something wrong with the outline and form of that model which could not, therefore, be described as a work of art. The ideal of beauty was based on objective assessment models, mainly reflecting an idea of harmony between shapes and colours, subject and background, going as far as calculating to the smallest level of detail all the parts of the images that would then generate one complete work. However, with the "loss of rural tradition and urbanization, (…) the collective taste achieved irreversible changes" (Vettese, 2007) that go well beyond perfection, also accepting clashing forms and increasingly unnatural combinations among the canons of harmony. According to Remo Bodei (2015), we are

> "used to thinking that aesthetics is only concerned with beauty, while theory – since the 1800s– and practice have never distinguished between beauty in the classical sense, i.e. as a model, and the beauty that contains the ingredients of ugliness".

More and more composite aesthetics are appearing, which reassert the value of "simulacrum-works, ex-voto, totemic sculptures, trash objects, vintage accessories, lace, buttons, chains, toys and other plastic waste assembled in a stupefying way" (Ceresoli, 2017) Composite images that re-establish the canons of a new visual culture as put forward by Gillo Dorfles in the "Kitsch Oggi" exhibition (was held at Milan Triennale in 2012), in which he dignifies Kitsch as an artist's choice - a new model of taste through which to glorify desecrating, even playful expressive skills.

The idea of bringing together images that belong to contrasting universes influences Matteo Benassi's graphic works. The artist, known as Riffblass, mixes religious icons with elements of pop culture using collage, one of the most widespread practices to actually combine contrasting realities, with the aim of distorting the image of reality by creating imaginary scenarios that are particularly appealing to the world of fashion. In its never-ending search for phenomena to dignify, fashion itself does not so much ask itself what the future will be like, as photograph the state of the art and the main artistic energies driving the everyday aesthetic culture. Such an interpretative ability is present, among others, in the New York-based artist Dough Abraham (art name: Bessnyc4), who, in a mix of sexuality, good taste, porn, horror and technology, has cut, stretched and shaped the logos and visual identity of big companies, showing that beyond the canons of pure graphics – untouchable, precise and uniform, communication has in fact many new ways to communicate, going beyond the uniqueness of a brand's image.

From art to fashion, from illustration to graphics, there is a multitude of cultural and composition phenomena that stretch the boundaries of design, leading to new aesthetic parameters which, while undermining the border between "art and utilitarian object" (Benjamin, 2003), constitute a new culture of the image whose present is made up of a series of signs creating what Jean Baudrillard describes as hyper reality. A condition of life

affected by communication, which, shifting from the material to the virtual plane, fills our society with a number of simulacra born out of the mixture of real and unreal.

Such dilation and distortion of reality that affect graphic design methods "justify a multitude of sins (…) there are processes that are not driven by history, but by instinct and ugliness and that may, at times, bring to light extraordinary, flashing discoveries" (Heller, 1993). By way of example, fonts might be created apparently by accident, like a revelation that can be perceived through a fervid decorative form showing plenty of lines, dots, planes, shapes and colours. In this case we are witnessing a turnabout of typical graphic design processes. It's like designing backwards, starting from an emotion, sometimes from an instinct, to unveil the communicative product only at a later stage. Think, for example, of the Restraint font designed by Marian Bantjes with the collaboration of the printer Ross Mills: it is a font designed from the outside, so to say, following ornamental signs imagined with "simply a decorative purpose in mind" (Figure 1).

Minor aesthetic elements that unexpectedly reveal letters of the alphabet. A font that produces images first and then texts. First, it nourishes the sight, generating emotions and a sense of wonder; and only a few moments later it can send a clear message. The aim is to anticipate emotional scenarios rather than focus on one single communicative purpose as established by the principles of Less is More. In other words, paraphrasing Bob Gill (2013), one should say "More is also more", hence it is possible to use multiplied, repeated signs to send a message. The aim is more complex, or – we could say – expanded. Today images do not mean to show a linear, fluid thought only, but by having recourse to a multiple, increasingly complex grammar, they wish to draft the multi-layer scenario we are living in.

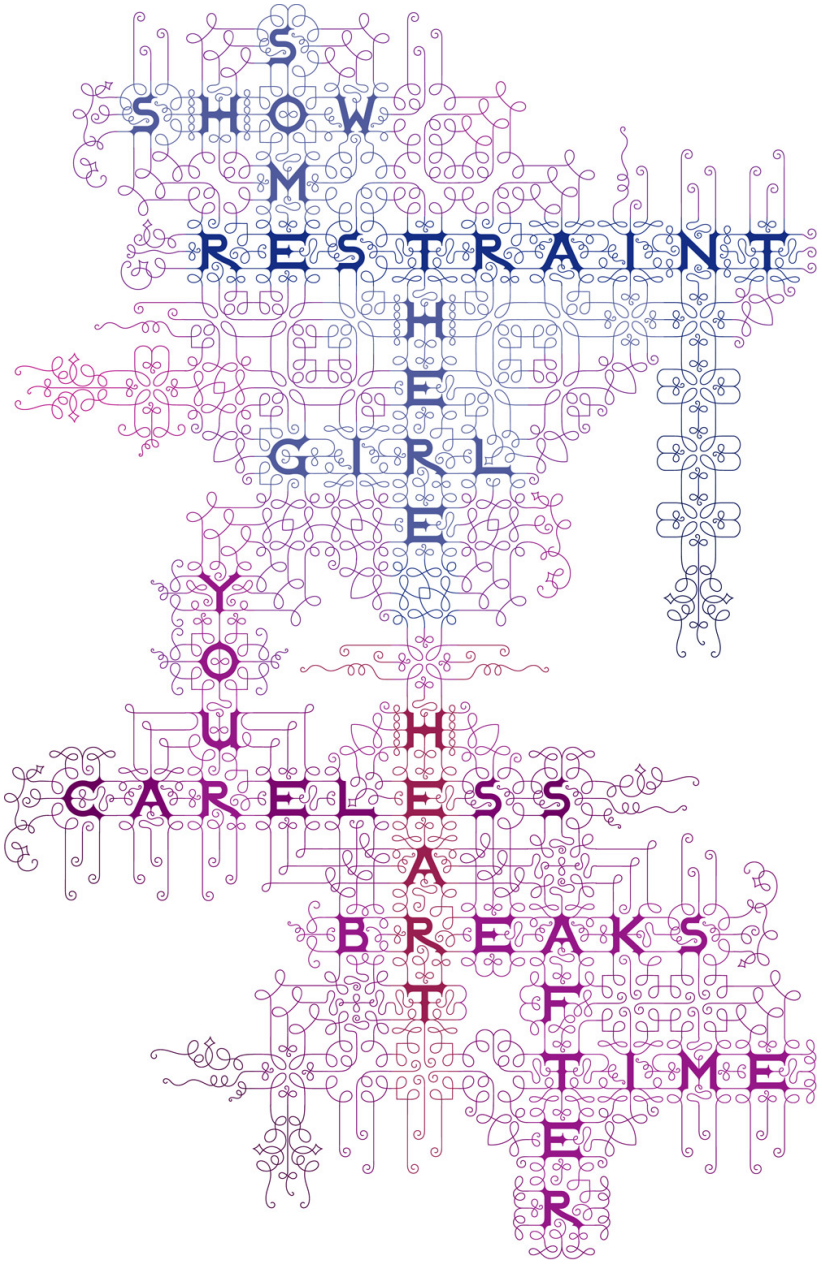

Figure 1. "Restait", typeface by Marian Bantjes and Ross Mills.

2. Images as a common language

Not only does the cultural and artistic setting described above affect graphic and advertising design, it is also reflected on the behavioural models of contemporary generations who live through the production of images conveyed on social networks, turning the products and means of communication into the actual stage of our time. It is an emerging society which, as stated by Vilém Flusser (2009), "is not to be found in any place or time, but rather in surfaces made of images; surfaces in which geography and history merge", recounting everyday occurrences as they happen. Several research projects show the constant increase in the production of images and videos by ordinary people: just think that Snapchat only records a remarkable 2.4 million data posted in one minute (Porro, 2019). Such production somehow reflects the present human condition. Now, according to T. Maldonado (2015),

> "the ability to imagine, portray and produce illusionary worlds is one of the most distinctive features of our species. We humans are, above anything else, advocates of symbolic worlds, worlds acting as mediators between us and the real world. And it is precisely in this sphere of symbolic mediation that the various creative practices of representation develop, following millenary traditions, and providing our own version of the real world".

Such representative capacity was developed by the Z generation in particular, followed by the Y generation, who are able to draw and communicate themselves and their surroundings: in this, they seem to confirm the views of the Canadian philosopher Ian Hacking, who does not talk of a *homo faber*, but rather of a *homo descriptor*, capable of producing images and of processing contents which, in the society of contemporary media "enjoy a new social life thanks to the digital networks along which they travel" (Wellman, 2012). As a matter of fact, the boom of social networks has been accompanied by the development of software, websites and free apps thanks to which anyone can create 'momentary manifestos' of the self, videos and short animations to express opinions and send visual messages in total autonomy. In addition to altering the relationship between works of art and the mass, "mechanical reproduction" (Benjamin, 2003). has given the masses the opportunity to produce images in few, simple steps. Images today are an integral part of everyday language: moods, reactions and emotions are expressed through emoticons, animated gifs and cinemagraphs – a particular technique that combines photography and video by increasing the number of communicative artefacts that a designer needs to know to tackle design in the extemporary scenario (Scalera, 2015). People's very existence, as stated by Peter Sokolowski (director at Merriam Webster) has become a "sort of performance" translated into the production of communicative stories that can only be winning if they are 'instagrammable'.

Suspended between pop culture and the new digital tools, new visual design stories are created, made of kaleidoscopic images that mix 2D and 3D techniques, combine frames in motion, small clips and videos in loop. Static and dynamic, volumes and flat models merge, but most importantly stories and lives that until a minute before were miles apart. Amateur,

mundane visuals that, while causing clashes and friction with professional productions, still affect contemporary visual languages in a major way. It is therefore necessary to de-absolutize and de-universalize the boundaries of visual design, as well as to blur the boundaries between what is right and what is wrong, because “those that used to be the only means of visual communication, today are most often inadequate, static and slow” (Munari, 1993).

3. The Graphic*mance* landscape

3.1 Graphic design between form and performance

When observing the evolution of digital languages and the proliferation of new communication channels, we are led to reconsider the theoretical and practical boundaries of graphic design, which are becoming increasingly fragmented and liquid. Among the parameters of design it becomes essential to define the “brand’s cultural landscape” (Schroeder, J., and Morling, M.S. 2006) that will no longer be recognisable through a monogram or an institutional colour: its identity will be a multiple one, enriched by several interpretations produced by the users themselves thanks to the new media and to their now mature visual skills. Openness, community, activism, dynamism, and responses to everyday occurrences become requirements to be included among new forms of design. The value of interaction is now an element that visual communication design can no longer ignore to the extent to which brands have changed their status and no longer communicate themselves as unquestionable truths, but rather as realities willing to listen to the new generations, who “do not only want to be convinced, but to be involved” (Schawbel, 2015). Today brands must propose, not impose, a vision, a product or a service; they must be able to establish an open dialogue with the public, who are more and more welcome into the creative and emotional processes. The idea is to involve, in order to enter the very mind of the consumer, like a travel mate along a unique path experienced in a special way, making every single person a protagonist.

Upstream, it is paramount to define the “narration” that the brand wishes to convey to the people even before their product or service is mentioned. A story that does not only tell the peculiarities of the marketed object, but one that “drafts behaviours, steers emotional flows, and synchronizes their circulation” (Salomon, 2014).

In the extemporary context, graphic design has become more complex: in addition to ‘signs’, it is required to design the lives of the signs themselves, their evolution and their relational abilities, drawing inspiration from new aesthetic forms, and opening up to the interpretation and re-elaboration of the sign itself by the public. This form of design appears as a performance, a form of

> "art with a strong experience-based content, aiming at aestheticizing the everyday, an art of the unpredictable: yet, at the same time, it is an expression of the technological age, siding with the modern tools of reproduction like photography, film- and audio-visual recording" (www.treccani.it/enciclopedia/performance/).

In this perspective, if they want to establish a new visual aesthetics, designs must not only contemplate the influences deriving from art and social networks, but must also include uniqueness, technology and responsiveness among their design parameters.

The concept of performance takes on different meanings depending on the discipline that explores it from time to time: in this paper, in addition to its artistic sense, we are also looking at its anthropological meaning: in anthropology, a performance is a re-visited representation of recognised cultural genres, a critical tool to reflect on the society, as well as a possible area in which to express a view of the world alternative to the mainstream one.

The hybridization of the artistic and anthropological meanings of performance gives birth to the concept of Graphic*mance*, which brings together the field of graphic design and performances with the aim of talking about visual and emotional projects, customisation and new technologies, as well as the social and interactivity aspects of the graphic artefact. Communication projects that never stay the same, but grow, expand, open up, become fluid in the ideal of Bauman's liquidity.

The term Graphic*mance*, therefore, refers to the design, over time, of a verbal and visual narration inspired by cultural, topical subjects which may involve the public and react, by means of the new technologies, to external stimuli – just like any living organism.

In addition to enhancing the aesthetic, functional and emotional aspects of a brand, the graphic*mance* project responds and changes, taking on different shapes in relation to the external environment. Like a performance, graphic design embodies mobility in its very essence, showing itself through complex, dynamic images that are open to change, to alter their own image in real time. An aesthetics in motion, suitable for representing the fleeting moments of a society that is becoming increasingly fast, mobile and unseizable.

3.2 Some possible applications through society, entertainment and "faith".

In this framework, designs must be able to illustrate stories that evolve and can have a different ending every time. A tale meant, as a long book that describes the brand's everyday nature, through which to reinforce the values on which brands base their statutes. Let's try, for example, to imagine the visual identity of a university Department designed according to the Graphic*mance* vision. The visual would react to academic life and could, on an everyday basis, change colour and shape in relation to the events occurring in the departments or the classrooms. A graphic design that narrates by moulding its shape - a visual alphabet connected to sensors and to the internet of things technology which stages permanent performances inspired to the life of a brand. Graphic designs that dialogue with

architecture, for example, and change shape in relation to the flows of people who move across them, reproducing the dynamism of the population that gives life to them in real time. Graphic*mance*, therefore, means an active, living communicative product, which responds to stimuli. One example of images sensitive to external events are Google's doodles, (Figure 2) which change their shape every day, drawing inspiration from a plethora of important historical events in a variety of fields. A re-design that, in spite of changing shapes and colours every day, still remains recognisable thanks to the narrative approach of the visual experimentation.

The above example tells us about the extent to which visual communication today can interpret and reflect lives, events and emotions conveyed through images in motion capable of shaping even a brand's icon. Similarly, for the brand image created for the cities of Bologna and Turin, open logos have been created, that change all the time in relation to the story that is to be told not only by the institutions, but also – and above all – by the people who come into contact with a place and have their personal experience to share, by creating a personal, customised city's brand.

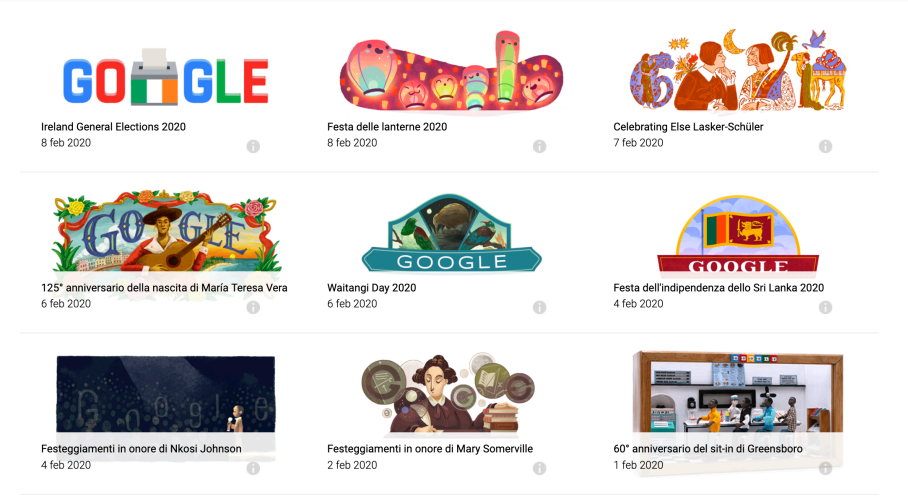

Figure 2. The image represents the last updating of Google's doodle.

The wish to combine the concept of performance with the world of graphic design originates from the observation of the main communicative trends and from the will to merge the communicative skills of the new generations with the evolution of means of communication and new media. Today, every individual makes their lives a show, and does so by sharing stories on social media – the dynamic, moving and film-like images that Marc Augé (2015) analyses in "The power of image" and which create a link between society, performance and faith. According to the anthropologist, dramatization can establish intimate relationships with every single person, increasing one's faith at the individual level. This reading integrates

the ideal of the community, showing how, through a performance, it is possible to dialogue with everyone and each individual at the same time, bringing the concept of customisation into the field of visual communication. Of all communication tools, "the filmic representation of reality is incomparably more significant to modern man" (Benjamin, 2003), and in the overcrowding of images, only visual narrations and dynamics can keep the public involved for a longer time, in addition to achieving a much deeper emotional engagement. Thanks to graphicmances, meant as visual stories in motion, brands can put forward a constantly evolving identity through veritable 'stories', to be followed very much like a TV series. Certain fashion houses, including Louis Vuitton and Yves Saint Laurent, are doing that already, involving new generations by activating customized filters on Instagram. The filters, which are mainly used for the promotion of cosmetics, allow everyone to take a selfie next to the company's logo – an action that brings customers closer to the world put forward by the fashion brand and makes them feel part of it. On top of that, YSL has expanded its communicative language through the self section on its website, which aims at exploring the manifold possible personalities of the maison as they are interpreted through the eyes of artists, photographers and filmmakers. According to Antony Vaccarello, creative director of the French maison, this project

> "represents the freedom of self-expression without censorship and conveys many different facets of the Saint Laurent attitude. Creative discipline across art and fashion reinforces and fuels the concepts of diversity, individuality, and self-confidence through a lens free from pretense and hypocrisy. This project is an artistic commentary on society, while emphasizing the Saint Laurent core values. **Self** is formed by a heady mixture of attraction, ambivalence and mystery generated by photographers, artists, and filmmakers who have come together to make a confrontational statement" www.ysl.com/it-it/introduction-saint-laurent-self.

This is proof that today personalities and events give a brand a multiple identity – unique, but at the same time representable in many different forms.

3.3 Tools supporting design

Alongside the projects that are created with their own concept based on the principles of dynamism, new platforms and software are appearing with the same inspiration, aiming at providing designers with variable models for the creation of unique, mobile visual languages. There are programmes which make it possible to customise fonts, such as "Variable Font https://v-fonts.com/, a simple resource for finding and trying variable fonts". In its beta version, this website offers a wide range of mobile fonts featuring up to 1000 variables per type. Several parameters can be customised – width, height, thickness, crenation, spacing, and many other forms that are generated in relation to the single character. For example, for the OC Format Shards font it is possible to vary the intensity of the fragmentation; for Marble, in addition to width and height, it's possible to adjust the optical size; or, for GT Alpina, to decide which version guarantees the best visibility on displays. Multiple

possibilities are being designed, at increasing levels of complexity, like the Gimlet X-Ray font (Figure 3), an experimental version released on 01/01/2020, which is based on the geometry supporting the font and the endless variables by which it can be modified. It is thus possible to design a customised font acting on its anchor points and change it altogether through the following parameters: Oncurve Point Size; Offcurve Point Size; Glyph Outline Weight; Point Outline Weight.

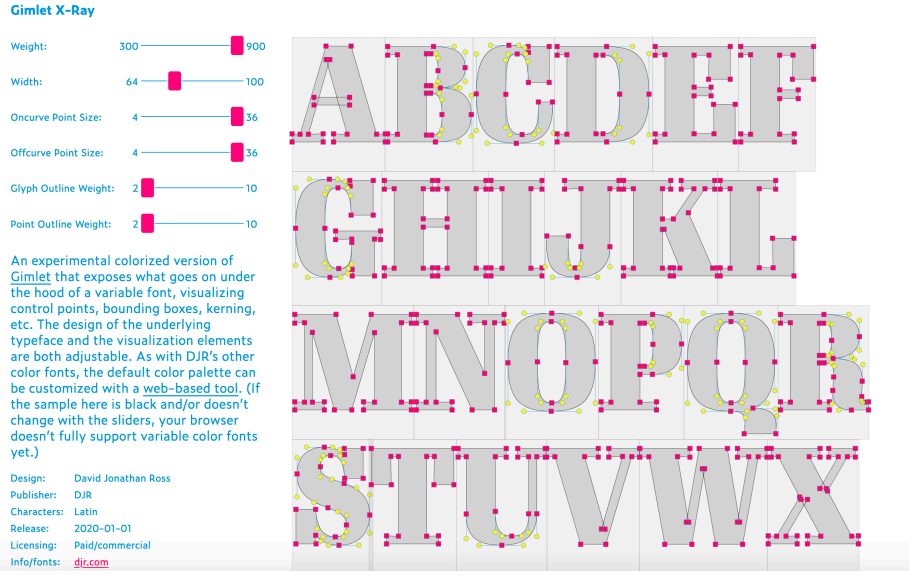

Figure 3. The screenshot represents the interface of the Variable Font platform that includes the font Gimlet X-Ray. Available to: https://v-fonts.com/

In 2016, Hansje Van Halem, together with the printer and programmer Just van Rossum, created the visual identity for the Lowlands, the Netherlands' biggest music festival, and designed the Wind font (Figure 4, 5), a mobile character that takes on multiple shapes. The typography is imagined as a script, capable of generating ever-changing posters and animations. Wind was later engineered to be made available to designers, giving them the opportunity to experiment with the endless forms of the same font: in addition to the four static styles, it also includes characters that can rotate 360°, clockwise and counterclockwise. Similarly to Wind, new fonts based on the logic of opening and mobility are appearing, a design horizon that is not widespread yet, so much so that not all operating systems can support the new font modellers. Major software development multinationals are working on this: since 2018 Adobe Creative Cloud, for example, have been providing increased interactive possibilities by including the plugin for variable fonts in Photoshop and Illustrator. These examples tell us of the birth of a new category of fonts: "digital movable types" which, unlike "leaden movable types" whose main aim was to compose a text, aim at expanding the

possibilities of design, customising projects to an increasing degree, and above all reacting to external stimuli in real time. Another tool for the customisation and creation of open visual languages is Spark AR Italia. The programme makes it possible to customise Instagram filters and spread one's project through social media. The filters are clearly 'incomplete projects' that only take shape with the interaction of the public, who are the activators and disseminators of the project.

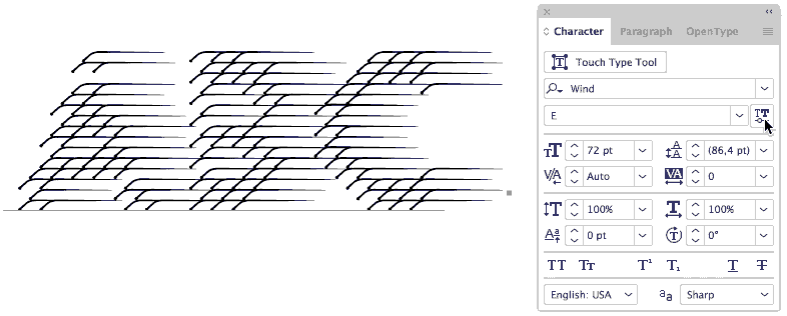

Figure 4. The program system is able to change the direction of all the segment of the WIND FONT.



Figure 5. An application of the Wind font by Hansje Van Halem

5. Conclusions

By telling stories through images and by promoting attitudes and values, the concept of graphic*mance* is above all an invitation to take part in a collective narration that could potentially have a positive impact on the definition of human identity. The visual design project gives an aesthetic shape to the time we live in; "the interfaces of cities, of places and non-places" are shaped, enterprises create their identity, driving the economies of countries and continents. Not only this: visual design can trigger good practices, and give voice to positive experiences, since a good project has the power to influence populations positively, by enhancing the values of culture, respect and environmental sustainability.

In a nutshell, here is what design culture is all about: taking the chance to create designs that make human life better. In this perspective, the project must be critical and reflexive above all, and young designers must be aware of their human and social responsibility.

To say it in Henry Jenkins's words

> "the public of the media is also made up of individuals who get passionate about cultural products, who want to dialogue with them, want to own them, remix them, and use them to create new social bonds and negotiate their identity".

It is necessary to shift the politics of the communication viruses generated with "memes and automatic bots" towards culture, because if these phenomena paved the way to the unstoppable sharing of contents, today they also identify those users who want to share cultural, quality media contents.

Producing graphic*mances* means, fundamentally, producing 'spreadable' interactive contents which spread because they are healthy, cultivated, reactive, and immersive and which may inspire good practices through the various forms of arts.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Inner Geographies as poetic-aesthetic knowing: the inspiration and manifestation of creative doings through an emotively-orientated sensory methodology

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Abstract | To explore and describe knowledge of the self and worlds as an expression of contemporary culture in our zeitgeist, this paper draws on my interdisciplinary qualitative research on the psycho-spatial phenomenon of the *inner geographies*. Via an (inter)subjective ontology and interpretivist epistemology, an emotively-orientated sensory methodology was employed to engage a sample group of global interlocutors in Barcelona, Spain through fieldwork. Creative doings therein prompted revelations and captured articulations of engrained, evolving, and entwined personal and geographic complexities – making the 'intangible' tangible. It was found that personal undertakings of creative doings aid individuals' navigation and comprehension of everyday life within the socio-spatial temporal condition and contribute to positive subjective wellbeing. Hence, this paper advocates the inner geographies' ontological and epistemological potential and value as poetic-aesthetic knowledge – which both inspires and manifests as creative doings – that emerges from lived experiences through the self's journeys in worlds without and within.

KEYWORDS | DOINGS, FEELING, KNOWING, PERCEPTION, WELLBEING

1. Introduction

Intertwined with lived encounters, *creative doings* (Hawkins, 2015) are less concerned with a finished product and more focused on learning through self-expression during the process of creation. "It is the act of doing itself" (Grüne, cited Rambhoros, 2019) wherein lies the value of such means 'to know' or 'to come to know' the self in the world and the worlds within the self. Drawing on my doctoral research on the psycho-spatial phenomenon of the *inner geographies*, this paper describes *what* individuals experience in worlds without and within the self in our contemporary socio-spatial temporal condition and *how* those experiences (typical and less typical) are interpreted and expressed as creative doings.

To do so, the paper presents an introduction to the research context of the *inner geographies* in relation to *poetic-aesthetic* knowledge as well as *creative doings*; an overview of the *emotively-orientated sensory methodology* for the theoretical and empirical research; a description of creative doings in the fieldwork process as well as those of interlocutors' different inner geographies uncovered as findings; and a conclusive discussion that reiterates the potential of the inner geographies in order to advocate its value as poetic-aesthetic knowledge.

2. Context and background

Focused on global citizens' everyday experiences within the contemporary condition, this paper conveys ways of living that reflect the spirit and tendencies of our time (Radhakrishnan, 1966; van Dam, 2014; and Jung, cited Chalquist, 2017). Based on the inner geographies, it affords insight into creative doings, which are:

> "The creative acts of human beings…[through] which life grants humanity the constitutive agency to bring about new organizations of life….[V]ital to the creative evolution of humanity,…they promote the existential fulfilment of the vital depths of the human soul" (Backhaus and Murungi, 2009, p.220).

The paper forwards that this is poetic-aesthetic knowledge, which is synonymous with the inner geographies, that both inspires and manifests as creative doings.

2.1 Inner geographies

The somewhat abstract, (in)tangible, and elusive nature of the inner geographies prompted my need to understand and substantially define it. The point of departure was the premise of human geographer Inger Birkeland (2005), who argues that the inner geographies is "similar to the idea of the self, which in Jungian terms refers to the totality or ordering principle of a human being's personality" (2005, p.7). And, according to psychoanalyst Robert Moore's (2009) neo-Jungian version via his 'map of the inner geography', it involves

deep structures of the archetypal self, entailing discoveries about holistic development and spiritual growth.

Building upon and interpreting these views via the lens of inner-sensory perceptive experience, my research suggests that the inner geographies is an innate yet omnipotent phenomenon actively and intimately involved in everyday life. In addition to the development of a theoretical framework and formulation of a methodological strategy, the research contributed to knowledge by proposing a definition of the inner geographies:

> "The coalescence of a 'way of feeling and knowing' and 'significant encounters' conveyed by our psycho-spatial biographies; a phenomenon that is shaped by and shapes the myriad lives comprising our lifetime." (Rambhoros, 2019)

2.2 Poetic-aesthetic

Emerging from lived experiences in worlds without and within the self, the inner geographies uncovers and engages with the qualitative nature of everyday life in our contemporary context, the *poetic-aesthetic*.

As "sensitive and intelligent contact with the world" (Scottish Centre for Geopoetics, 2017, n.p.), 'poetics' connotes a metaphysical quality that transcends material and rational essence, and evades reading, explanation, and translation (Bachelard, cited Pallasmaa, 2011). It infers "an exploration of the human powers to make (*poiesis*) a world in which we may poetically dwell" (Kearney, 1991, p.9). The Greek *poiesis* is an evocation via sensuous experience, denoting an evocation of awareness, reflection, contemplation, interpretation, discovery, revelation, and creativity (Paetzold, 1997; Casey, 2002; Ghosh, cited Bhushan and Garfield, 2011; Pallasmaa, 2011; and Moslund, 2015). Relatedly, the ancient Greek *aisthetikos* originally means "pertaining to the senses" (Maquet, 1986:31). Aesthetics is, therefore, sense-perception that involves the pre-conceptual apprehension of something by embodied consciousness that engages *all* the senses (Paetzold, 1997; Augoyard, 2013; Howes, 2013; and Pérez-Gómez, 2016). Conceptualised as a framework of knowledge by philosopher Alexander Gottlieb Baumgarten, aesthetics is about feeling and sensation (Augoyard, 2013; Franzini, 2013; and Pérez-Gómez, 2016). It is the 'theory of sensitivity' as "the study of the *sensibilia* and of the acts of perception" (Franzini, 2013, p.116).

Thus, rooted in *poeisis-aesthesis* – as "a sensory-based unconcealment of the otherness [and/or] sensuous hetereogeneity of phenomena" (Moslund, 2015, p.12) – a *poetic aesthetic* is a manifestation of "embodied resonances, a feel that corroborates the sensibilities" (Muller, cited Backhaus and Murungi, 2009, p.185, my emphasis). Challenging our conceptions of reality, it is "a language drawn from a way of being which attempts to express reality in different ways" (Scottish Centre for Geopoetics, 2017, n.p.). Unifying domains of knowledge and sensory entanglements, the poetic-aesthetic acknowledges and engages the integrated coexistence of familiar and unfamiliar, psychical and physical, intimate and universal, individual and environment, which inform one another to create and

re-create our ways of being through emergent knowledge (Bachelard, 1958; Kearney, 1991; Casey, 2002; Zumthor, 2006; Mason and Davies, 2009; Pallasmaa, 2011; and Springer, 2017). Hence, the philosophical paradigms of phenomenology and metaphysics aid in inquiries into the nuances of poetic-aesthetic knowledge through perceptual experiences. They mediate outer and inner realms of the self, navigate the discernible and the enigmatic, and engage with worlds that exist by being present, known, or described via characteristic properties, as well as those that are partially unknown due to ineffable qualities and multiplicity of possibilities (Tuan, 1974; Maquet, 1986; Storr, 1988; Birkeland, 2005; Jones and Garde Hansen, 2012; Smith, Davidson, and Henderson, 2012; and Pérez-Gómez, 2016) – encapsulated by the inner geographies.

2.3 Creative doings

Offering insight into the lived condition, the value of creative expression lies "in the doing" (Hawkins, 2015, p.263), which arises from situated and existential experience as poetic-aesthetic knowledge. Through 'creative doings' (Hawkins, 2015), idiosyncratic facts of everyday life and the felt pulse of inner realms are merged in personal and multi-textured creative expressions (Tarkovsky, cited Bachmann, 1984; Johnson and Petrie, 1994; and Pallasmaa, 2009).

Whilst satisfying individuals' needs for self-expression and/or yearnings for understanding, creative doings are spontaneous as well as considered explorations that emphasise process, through which affective reactions are prompted, personal situations are comprehended, inner truths are revealed, and life is meaningfully grasped (Pallasmaa, 2009; Hawkins, 2015; and Hunter-Blair, 2016). As an intuitive and intellectual process, it pulls feelings and thoughts into awareness to stimulate contact with the existential condition by assimilating past, present, and future in reflections, appreciation, and/or idealisation of life (Cooper Marcus, 2006; Merleau-Ponty, cited Pallasmaa, 2009; Tagore and Ghosh, cited Bhushan and Garfield, 2011; Pérez-Gómez, 2016; and Chrysikou, 2017).

Resulting in autonomous and authentic personal expressions, creative doings elicit feelings of being "more alive and fulfilled" (Ghosh, cited Bhushan and Garfield, 2011, p.62). The process awakens and unravels innermost stirrings located deep within or even hidden from the self – the "soul-idea" (Ghosh, cited Bhushan and Garfield, 2011, p.134) – revealed in the emotive character of the creative doings. But articulating this poetic in "a more vivid aesthetic sense" (ibid., p.133) requires operative, technical, practical, and instrumental knowledge and skills; thereby merging psychical intimacy and physical commitment (Sennet, 2008; Pallasmaa 2009; and Hawkins, 2015). Hence, creative doings embody the "specific relationships between thought and making, idea and execution, action and matter, learning and performance, self-identity and work, pride and humility" (Pallasmaa, 2009, p.53).

3. Approach and methods

Via an (inter)subjective ontology and interpretivist epistemology, my interdisciplinary qualitative research followed a GeoHumanities approach by drawing on inferences of architecture and the arts and humanities. Positioned within philosophical assumptions of phenomenology and metaphysics (philosophy of mind), it integrated experiential realms of spatiality and existentialism for a poetic-aesthetic investigation into the essential nature of experience of everyday life in the contemporary milieu.

3.1 Emotively-orientated sensory methodology

The poetic-aesthetic engagement with interlocutors necessitated a methodology that acknowledged other ways of sensing worlds via exploration and description of essences as well as interpretation and understanding of interlocutors' presences (Kvale and Brinkman, 2009; Mason and Davies, 2009; Pietkiewicz and Smith, 2014; Tally Jnr, cited Moslund, 2015; and Springer, 2017). To do so, existing research methods were drawn upon, adapted, and combined as an ontological and epistemological framework, for which those of Bondi (2005), Mason and Davies (2009), Brickell (2012), and Mendoza and Morén-Alegret (2012) were particularly influential. Hence, an *emotively-orientated sensory methodology*, which incorporated psychological, geographical, and biographical facets in a fieldwork system, was formulated and employed to investigate and make tangible 'intangible' phenomena. It tapped into deeper sensibilities of the emotive and intuitive being to reveal explicit and implicit worlds and uncover hidden presences of inner spaces via 'ways of feeling and knowing'.

Framed conceptually by emotional geographies (linking lived encounters with affective involvements) and practically by global mobilities (pertinent to the current socio-spatial temporal condition), the research was theoretically underpinned by inner-sensory perception with particular focus on essences of awareness, atmospheres, and imagination. The interconnected essences – extracted from literary and painterly arts (specifically those of Sir V.S. Naipaul, 1987, and Giorgio de Chirico, 1912, respectively) – were investigated theoretically through literature review and formed basis of empirical research in fieldwork. To obtain 'tangible' results on existential experiences of living as global citizens within the contemporary context, the notion of 'journeying' "geographically and psychologically" (2006, p.279) was borrowed from architect and educator Clare Cooper Marcus, who considers that different lived experiences compose life stories through deeply associated emotions. Using the triadic essences, the 'metanarrative' of journeys (which includes voyages outward to a physical location and inward within the self) engaged various forms of experiencing through interlocutors' biographies.

3.2 Setting and sample

Exemplifying the contemporary context, characterized by a high level of mobility, the empirical research was conducted within the naturalistic setting of Barcelona with a 'purposively sampled' (Smith and Osborn, 2007, p.56) group of global researchers (comprising local and foreign creatives, students, and academics) for rich in-depth inquiry. The diverse geo-biographical, personal, and interdisciplinary backgrounds of the exceptionally mobile societal group offered a range of perspectives and emotive complexities of the global condition. Simultaneously a point of transfer, in-between-ness, connection, and centeredness that is lived in and passed through, Barcelona was the common variable shared by interlocutors, which grounded the fieldwork as a point of orientation and center of affect, both geographically and existentially.

3.3 Data collection and analysis

Fieldwork focused on interlocutors' journeys in and near Barcelona, beyond the city and around the globe, as well as within themselves, by moving back and forth, and zooming in and out at different scales and intensities of experience. To do so, data collection employed narrative and creative methods, substantiated by the hermeneutic phenomenological method (HPM) (Lindseth and Norberg, 2004; Van Manen, cited Thomé, et al., 2004; and Dowling, 2007) for biographical life-stories and non-representational theory (NRT) (Thrift, 2008; Cadman, 2009; Anderson and Harrison, 2010; Patchett, 2010; Simpson, 2011; Jones, 2011; and Jones, 2012) for practice-based enquiry. Conducted mostly in focus groups in semi-structured workshops, fieldwork activities engaged the triadic essences of awareness, atmospheres, and imagination using techniques of dialogue, writing (especially 'free-writing'), illustration (pictograms, graphing, and mapping), reflection, and mind-wandering. Empirical data generated by fieldwork was analyzed in relation to the theoretical data of the literature using interpretative phenomenological analysis (IPA) (Smith and Osborn, 2007; Smith, Flowers, and Larkin, 2009; Hefferon and Gil-Rodriguez, 2011; Pietkiewicz and Smith, 2014; and Interpretative phenomenological analysis, n.d.) as well as narrative analysis (Lapan, Quartaroli, and Reimer, 2012) and thematic analysis (Mayring, 2000; Braun and Clarke, 2006; and Earthly and Cronin, 2008).

4. Results and findings

Outcomes of the emotively-orientated sensory methodology and the fieldwork process of creative doings depicted the epistemological potential of the inner geographies to probe existing life situations, raise questions, prompt alternative thinking, heighten felt emotive responses, and, significantly, make the 'intangible' tangible. Moreover, it offered 'something' to the interlocutors by enabling them to consider the deeper feelings and meanings of worlds experienced without and within. The sustained impact thereof was reported beyond the fieldwork setting, as some individuals continued to attune to,

acknowledge, and contemplate the relation of self and worlds through the notion of the inner geographies via awareness, atmospheres, and imagination as they went about everyday life. Significantly, the research revealed that engaging with creative doings prompted *uplifting* experiences – which pertained to both thought and felt qualities of oneness, integrity, enchantment, serenity, and attunement – that had a positive effect on individuals' subjective wellbeing. The fieldwork samples of ten interlocutors – namely Azul, Blau, Blu, Candela, Gris, Grüne, Oranž, Pers, Rojo, and Taronja (all of whom had been given pseudonyms to maintain their anonymity) (Rambhoros, 2019) – will be presented in this section.

An overview of the fieldwork observations of interlocutors' engagements with the techniques of free-writing (Castle, 2017 and Wickham and Breir, 2018) and illustration (Tarkovsky, cited Bachmann, 1984; Pallasmaa, 2009; Lynch, cited Gold, 2011; Hawkins, 2015; Pérez-Gómez, 2016; and Thompson-Schill, cited Chrysikou, 2017) is briefly discussed here. In workshops, 'free-writing' (Fig. 1) is the creative *process* of 'writing-to-know' that involves reflexivity and "embodied discovery" (Hawkins, 2015, p.254), just as illustration (Fig. 2) does. Relinquishing 'control', interlocutors employed "tacit and experiential knowledge,…critical (self) awareness and critical reflection on [these] different *ways of being and doing*" (Castle, 2017, p.124, my emphasis). Encouraging fewer restrictions on feelings and less filtering of intuition, the techniques heightened interlocutors' sensitive and affective exploration of their experiences; also raising conscious awareness to their felt states and emotive captivation during the expressive process. In so doing, they connected with, were immersed in, and merged with creative doings, which inspired ideas and triggered recollections.

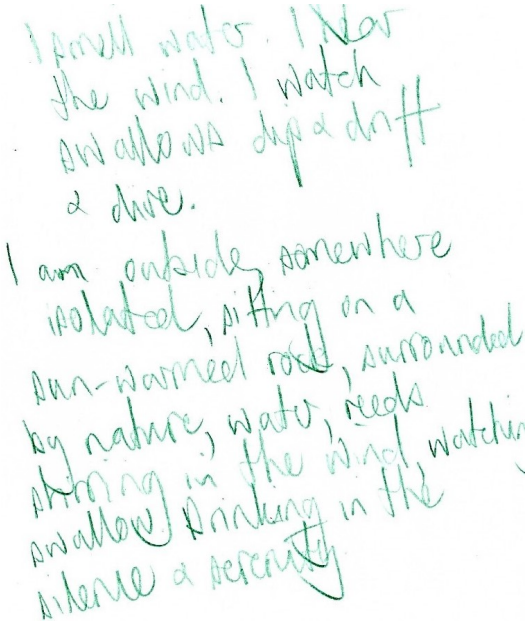

Figure 1. Example of free-writing in fieldwork activity, by Pers (Rambhoros, 2019).

Hence, rather than means to purely record data, both free-writing and illustration prompted alternative and liberated ways of thinking and feeling to generate knowledge as revelations, discoveries, and realizations. However, whilst free-writing stimulated interlocutors' internal dialogue and agency to release silent voices onto the page, those forceful undercurrents, subtle essences, and dormant or neglected aspects that could not be expressed as words were captured and given form by illustration.

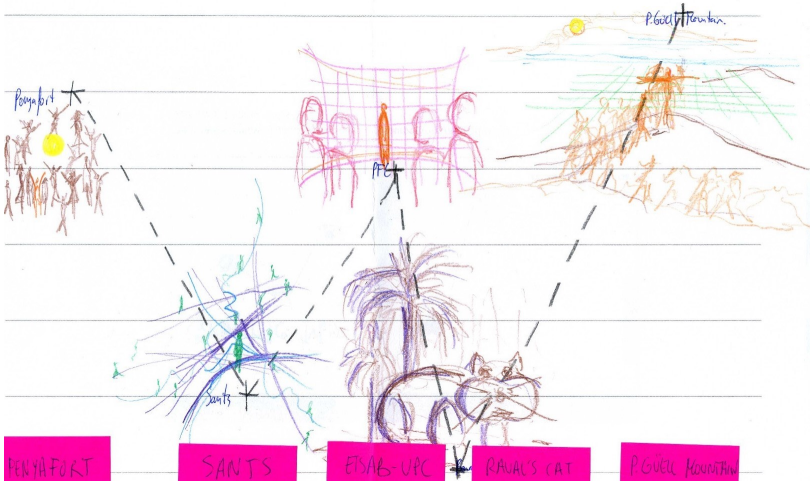

Figure 2. Example of illustration in focus group activity, by Taronja (Rambhoros, 2019).

Moreover, synthesized theoretical and empirical results showed interlocutors' emotive and intimate inner movements. It foregrounded hidden dimensions and complex realms of emotionality, which interlocutors may not have been conscious of, those that may have been lost, or those that are concealed yet continue to resonate within them. Via interlocutors' inherent and/or cultivated interests in ways of living, complexities of lifestyle and livelihood that open minds and broaden perspectives, and meaningful grappling with everyday life in worldly interactions, this highlighted the ontological potential of the inner geographies for engaging with existential experience in the socio-spatial temporal condition.

Significantly, these findings uncovered individuals' personal engagement with creative doings, which facilitate their comprehension, transitions, and adjustments in contemporary life. It was found that, in seeking to understand and/or make sense of self and worlds, interlocutors afforded themselves freedom to 'let go', be driven by personal will and emotion, and be immersed in a spirit and flow of interpretations and expressions of life – through their own creative doings. Drawing on personal backgrounds (such as origins, arts and culture heritage, family lineage, and childhood associations) as well as intimate and observational interactions, which were translated into 'tangible' forms, their creative doings included performance (dance, music, and singing), photography, illustration (tattoos, mappings, and drawings) and crafted books (written and graphic).

4.1 Performance

Dancing, playing and composing music, and singing are embodied and existential enactments that fully engage a greater self-awareness and attunement to the dynamic experience of performing (Pallasmaa, 2009; Gurdjieff, cited Goodrick-Clarke, 2008; Kaplan, 2010; and Zarrilli, 2015). The process entails a "transmutation of the soul through the self-conscious…system of thought and all-encompassing knowledge" (Gurdjieff, Goodrick-Clarke, 2008, p.233). Possessing "a kind of emotional aura" (Tarkovsky, cited Johnson and Petrie, 1994, p.200), dancing, music, and singing involve a "whole-body feeling" (Hawkins, 2015, p.255) through which to convey accounts of lived experiences and grasp expressions thereof as a "feeling of existence" (Pérez-Goméz, 2016, p.142), which is shown by Azul, Candela, Grüne, and Oranž (Rambhoros, 2019).

Azul and Oranž connect with people by singing in relaxed social settings and performing with their bands. Helping her cope with anxiety, Azul feels enthusiasm, happiness, joy, and excitement when singing. She also documents her observations and interactions of travels and the everyday as sound recordings and melodies. For Oranž, singing similarly affords feelings of fulfilment and tranquillity; it liberates her emotionally and stimulates introspection. However, due to a multilingualism 'dilemma', lyrics frustrate her since meaning is lost in translation. But Grüne believes "sound is something everyone can understand through its link with emotions, or music and feelings" (cited Rambhoros, 2019). Rather than express momentary feelings, playing piano activates her senses to access enduring memories of loved ones. By contrast, fleeting emotions are freely communicated

by Candela in dancing her native style of flamenco. Whilst connecting to her heritage, she deems it "a necessity to connect with yourself and express what you feel" (Candela, cited Rambhoros, 2019).

4.2 Photography

Photography possesses a "trace-like character [that] can serve as a point of entry into the 'having-been-there'" (Frers, 2013, p.438). So whilst photography is not a direct intervention or embodied enactment in the present, it is not intended to merely capture the visual record of a situation but contributes to the making of individuals through associating narratives of self to processes of discovery (Birkeland, 2005 and Taussig, cited Hawkins, 2015). It is "created and experienced in a temporal and spatial way, linking the exterior world, past and present, to the interior world of the person" (Birkeland, 2005, p.106). This relation of particular images to personal stories is demonstrated by Blu, Gris, and Rojo (Rambhoros, 2019) – who have different meanings behind their photographic practices yet are all expressive of experiences and reflections of worlds without and within the self.

On all his travels, Rojo takes photographs of his doll, Frida, which are posted on social media platforms. His photo-project 'Frida Worldwide' (Fig. 3) raises awareness of his heritage by reaching across borders via Frida's identifiable image, globally conveying the arts and culture of Rojo's native homeland. Gris' photo-narrative project, 'the return to nowhere' (cited Rambhoros, 2019), expresses a resonant sense of moving in adulthood inherited from her constant relocation in childhood. As manifestations of an "inner landscape and any concrete feeling" (Gris, cited Rambhoros, 2019), her photographs capture flashback associations, dreams, and thoughts in order to grapple with and better comprehend her experiences of moving and disparateness. Yet, Blu 'celebrates' dispersed family and friends by photographing a 'love ritual' (cited Rambhoros, 2019) – which entails the patterned arrangement of stones symbolizing their connection – when they reunite. Shared with loved ones to aid in recollection and reflection, Blu dates and records the images in a photo-diary to express their "emotional journey" (Pers, cited Rambhoros, 2019).

4.3 Illustration

Mediating past, present, and future as well as unifying time and space, illustration awakens ideas, enables embodied experience, and prompts intimate exploration of the way things are seen and felt through the process and/or result of/as drawing (Pallasmaa, 2009; Ghosh, cited Bhushan and Garfield, 2011; Deacon, cited Hawkins, 2015; and Hawkins, 2015).

> "The work becomes a Journey that may take one to places and continents which one has never visited before, or whose existence has been unknown prior to having been guided there by the work of one's own hand…." (Pallasmaa, 2009, p.111-112)

Whilst the process leads to discovery of possibilities, thinking and feeling, reflection and analysis are also involved in 'completed' illustrations, which capture aspects of self and

worlds as a record (Tarkovsky, cited Johnson and Petrie, 1994; Pallasmaa, 2009; and Hawkins, 2015). Contemplative spirit and internalized visions become outward expressions, as exemplified by illustrations of Pers, Blu, and Taronja (Rambhoros, 2019).

A subtle line drawing of abstract simplicity, a tattoo (Fig. 4) connects Pers to her origins and identity, expressing the solitude and quiet of both. Symbolizing the swoop of birds' wings, it prompts personal reflection of isolation and silence in the desolate and untouched landscape of her homeland. Relatedly, Blu's 'sentimental map' (cited Rambhoros, 2019) connects loved ones to special places around the world (Fig. 5). As a shared reflection, they place dots to "map those feelings which they are unable to translate into words…[and] show where their heart is for whatever reason" (Blu, cited Rambhoros, 2019). Meanwhile, connections to lineage and individuality are remembered, acknowledged, and respected by Taronja when drawing with a specific pencil that resembles an heirloom. Drawing daily in his sketchbook, he thinks analytically about his spatial interactions through free-hand sketches.

4.4 Crafted books

Crafted books are vehicles that communicate and conserve particular experiences and information. As modes of making, they are alive "experimental spaces" (Hawkins, 2015, p.257) and "living creation[s]" (Ghosh, cited Bhushan and Garfield, 2011, p.147). Whilst recording the lived world, "wherein the conceptual 'message' is 'the sum of all materiality's, content and formal, compositional elements" (Berstein, cited Hawkins, 2015, p.257), in addition, their "metaphysical essence…creates a world" (Pallasmaa, 2009, p.85). Crafted books are both interpretative and interpreted artefacts, which capture and are captured as an "outward seeing [that] serves to excite the inner vision" (Ghosh, cited Bhushan and Garfield, 2011, p.147). This inner transmutation of what is seen ranges from the professional to personal as well as mediations of both, which is characterized by the crafted books of Taronja, Blau, Blu, Gris, Grüne, and Oranž (Rambhoros, 2019).

Taronja's sketchbooks (Fig. 6) are useful for his recollection of particular information required in his architectural work and/or studies. They visually record observations, understandings, analyses, and interpretations of his interactions with places. Similarly, Blau's fieldwork diaries document observations and discoveries on archaeological surveys and "adventure[s] in the field" (cited Rambhoros, 2019) as written accounts. Also carried on holiday travels, he notes different languages and unexpected encounters, explaining, "I like to go there some years later to connect my lost visual memory with my written words and then I connect with the things of the experience" (Blau, cited Rambhoros, 2019).

Also for reflection, Grüne's travel scrapbook – which began as a keepsake of family photographs on her first trip abroad – is a 'memory capsule' of experiences, feelings, and personal thoughts. Her new Barcelona scrapbook contains everything she has "a connection with and want[s] to remember" (Grüne, cited Rambhoros, 2019). Similarly capturing personal thoughts, Gris lets her "feelings go and express themselves" (cited Rambhoros, 2019) in a written diary. Aiding the contemplation and understanding of her aloneness in

childhood and placelessness in adulthood, she explains the need and motivation for starting the diary:

> "That sense of moving, belonging and having something inherent to me, in the bind between dreams and concrete landscapes, was becoming stronger since I move so much through dreams and memories" (Gris, cited Rambhoros, 2019).

Recording feelings and lyrical narratives related to places and people on her travels, Oranž "invent[s her] own plot of how things work" (cited Rambhoros, 2019) in her notebook. She captures music, work, and academic notes to contemplate the unusual, unknown, and unfamiliar, understand her experiences, and later reflect and share them with others. Blu also expresses her travel experiences in notebooks by drawing in color "to represent everyday things" as pictorial expressions of her "inner feelings" (cited Rambhoros, 2019) – which she finds emotively therapeutic and reflective. Black notebooks include written records and documentations of information for her profession and research, whilst color notebooks comprise graphic expressions of personal interactions with emotion and beauty.

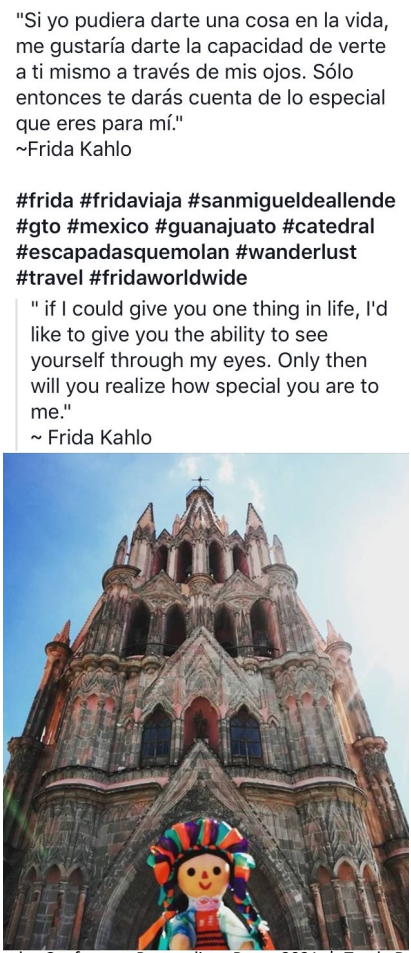



Figure 4. Pers' tattoo symbolising the silence of her homeland and within her (Rambhoros, 2019).



Figure 5. Blu's dotted 'sentimental map' mounted behind the front door of her home (Image by Blu, cited Rambhoros, 2019).



Figure 3. Rojo's 'Frida Worldwide' photo-project. (Image and social media post by Rojo, cited Rambhoros, 2019).

Figure 6. One of Taronja's many sketchbooks (Rambhoros, 2019).

5. Implications

The aforementioned contributions suggest possible effects in the field of artefact design by considering a variety of project types, the interdisciplinarity of fields, and persons across a range of backgrounds in a collaborative process that entails consultation with individuals, researchers, academics, and practitioners. This is particularly pertinent to assist individuals in developing personal projects that they may otherwise have difficulty realizing – as exemplified by Rojo's quandary, "I have several ideas but I don't know how to do it" (cited Rambhoros, 2019).

For example, an extension of this doctoral research may entail working further with selected interlocutors to extend the current data and translating it into design artefacts. These may include: transforming Pers's 'visualization of silence', Gris's 'hearing the landscape', Grüne's 'musical transmission of emotion', and Blu's ritual of 'connectivity' and graphic 'heart map' into soundscapes; producing Rojo's 'Frieda Worldwide' stamps (or perhaps postcards); documenting Gris's 'Return to Nowhere' photo-narrative; and recording Oranž's 'story-songs'.

Engaging on these joint-projects in a collaborative process would in turn contribute to further developing poetic-aesthetic knowledge on both the processes and products as well as positive effects of creative doings.

6. Conclusion

As we navigate life together in the current milieu, the inner geographies offer the opportunity to explore and describe lives lived from within, aiding in making the 'intangible' tangible. It depicts the intersubjective interaction of psychical and physical forces evident in individuals' geobiographical involvements, voyages abroad and inward, and streams of experiences that flow through space and time. Emphasizing personal agency and individuality whilst extending to the broader collective in a shared sense of society, the inner geographies speaks to universal and emotive complexities that connect our lives to each other.

This research on the inner geographies contributes to society and scholarship by offering a shift in perspective that mobilizes and generates knowledge on inner-sensory perceptive experience in an interdisciplinary manner and highlights individuals' understanding and engagement with felt encounters in everyday life. As a collective yet individually nuanced

characterization of profound and innate knowledge, it enlightens ways of both living and researching in our contemporary milieu, making it means to better comprehend and shape life in our zeitgeist.

Using the potential of insights of the GeoHumanities, this paper has offered an in-depth description of the fieldwork processes of the *emotively-orientated sensory methodology* and specific samples of interlocutors. It has demonstrated the ontological and epistemological potential of the *inner geographies* in developing contemporary society's need to acknowledge the value of creative doings. Significantly, it has shown the value of how *poetic-aesthetic knowledge* inspires and manifests as *creative doings* and contributes to subjective wellbeing.

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Acknowledgements: This research was funded by an Erasmus Mundus AESOP Doctoral mobility scholarship, hosted by the Department of Humanities at Universitat Pompeu Fabra, Barcelona, Spain. Thanks to all the participants for offering their time and interest to share their experiences and contribute invaluable insights to this study.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Italian Pavillion at XXII Triennale di Milano.

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Abstract | On the occasion of the XXII Triennale di Milano, dedicated to the environmental and social issues concerning our planet, Politecnico di Milano was asked to represent Italy at the national pavilion. A general concept emerged: the enhancement of technical innovation to heal and fight contemporary concerns, the goal of taking care of the planet as well as of the health and safety of mankind and of the built environment, all belonging to nature and landscape and part of the same wider ecological system. An interactive library shows a multidisciplinary Design approach, facing critical contemporary issues and caring solutions, organized around the four natural elements and different dimensional scales of impacts.
The paper analyses the role of Design in this particular context, both (1) as healer and leader within the most of researches (content/message) and (2) as a visualizer (exhibit/language) making the scientific research more accessible. This paper addresses the second topic in more depth.
(1) On the one hand Design, explained Antonelli, has the tools to become the catalyst for different skills and to describe alternative ways of solving the world's great problems. Design balances human impact and tries to take care of the nature and the environment, moving in between Art and Science (Oxman, 2018). As emerging from the featured projects, Design is conceived as methodological approach to envisage and select among potential future scenarios through feasibility criteria and to manage and reinterpret the limited resources of existing contexts to respond to issues and demands, also in innovative/creative way.
(2) On the other, the Design challenge becomes the task to encourage a multidimensional discourse (Klamer, 2016) with a wide audience, overcoming the high specialisation of the topics portrayed and expanding the visitor's vision into the future. Thanks to the use of technologies and multimedia set-up, all the exhibited projects result in an alternation of suggestive installations able both to fascinate the visitor at first glance and respect the research sophistication. Visitors are brought closer to global issues, thanks to their emotional involvement during the journey.

KEYWORDS | EXHIBITION, VISUALIZER, DESIGN RESEARCH, DESIGN CULTURE, BROKEN NATURE

1. Introduction

The XXII Triennale di Milano reaffirmed its decision to continue the tradition of the International Exhibition, the twenty-first edition of which was held in 2016 after a twenty-year hiatus. Titled “Broken Nature: Design Takes on Human Survival”, it consisted of a thematic exhibition and several installations from international participants and has run from March 1 to September 1, 2019. Curated by Paola Antonelli, the XXII edition was dedicated to the environmental and social issues concerning our planet. Through exhibitions and events, it prompted “a shift in our thinking about the environment, treated interjectionally to include human and animal life at all scales, and economic, social, and political systems in addition to natural ecosystems”. It highlighted the concept of restorative design and studies the state of the threads that connect humans to their natural environments. The idea that in the Anthropocene "humans are not an outside force perturbing an otherwise natural system but rather an integral and interacting part of the Earth system itself" (Steffen et al., 2007) clarifies why the object of the “taking care” has included humans as well as all landscapes, whether natural, artificially transformed or built, which all belong to a single environment where there is no distinction between nature and culture.

On the occasion, Politecnico di Milano has been asked to represent Italy at the national pavilion. The invitation offered the opportunity to draft an evaluation of the outcomes of its most authoritative current and historical research projects, devoted to the care of the surrounding environment as well as concerned the interpretation of respect for the "wonders of nature" and the possibility of "restoring" them. This has meant the tentative both to investigate the indelible human footprint on the Earth and to rethink the role and the civil engagement of Politecnico itself towards society. The Italian Pavilion, titled 4ELEMENTS / TAKING CARE, has selected, displayed and collected 41selected designs, embracing the different types of know-how in the fields of architecture, design and engineering and ensuring the deep respect of the natural elements (water, air, fire, earth), the different forms of life, and the adoption of sustainable intervention methods tailored to the specific contexts.

Once entered, the centre of the pavilion has been metaphorically dedicated to a **dynamic installation** on the four elements engaged in a dialogue with the surrounding interactive exhibition on projects that have been completed, are in development or yet to be realized, by students, researchers and professors from all twelve Politecnico departments. All the projects have been grouped in eight oversize books exhibited on the perimeter. They, arranged in a geometrical metal grid on which data and poems can be read, have created a multimedia library. Finally, in the background, there is a Wunderkammer, the tribute to the tradition of studies at Politecnico, which for over 150 years has offered countless testimonies of work devoted to the care of the natural elements.

Inside the library, each displayed research has been strung together the others in a narration that moves from the vast scale of the cosmos down to micro- and nano-units of

measurement. Each project, presented by a colour over-size book page, has tackled various contemporary concerns and such topics as: space pollution, climatic change, natural disasters, problems relating to specific Italian landscapes (such as glaciers, rivers, cultivated fields, urban realities), the reconversion of artefacts, the recovery and enhancement of Italian cultural assets, all the way to the artefacts and materials that accompany our daily life within domestic spaces, envelop our bodies, and, in some cases, penetrate and become part of them. Each research has shown a multidisciplinary Design approach, facing critical contemporary issues and caring solutions, organized around the four natural elements and different dimensional scales of impacts. Each one has represented an individual story with its own visual identity and its own language.

The intention was to enhance the multiplicity of interests, approaches and fields of application of each individual experience, avoiding processes of standardisation and resultant impoverishment, engaging the audience at large. The challenge was, without ever losing sight of the objective of a pleasant visitor experience, to make people aware and sensible to global issues.

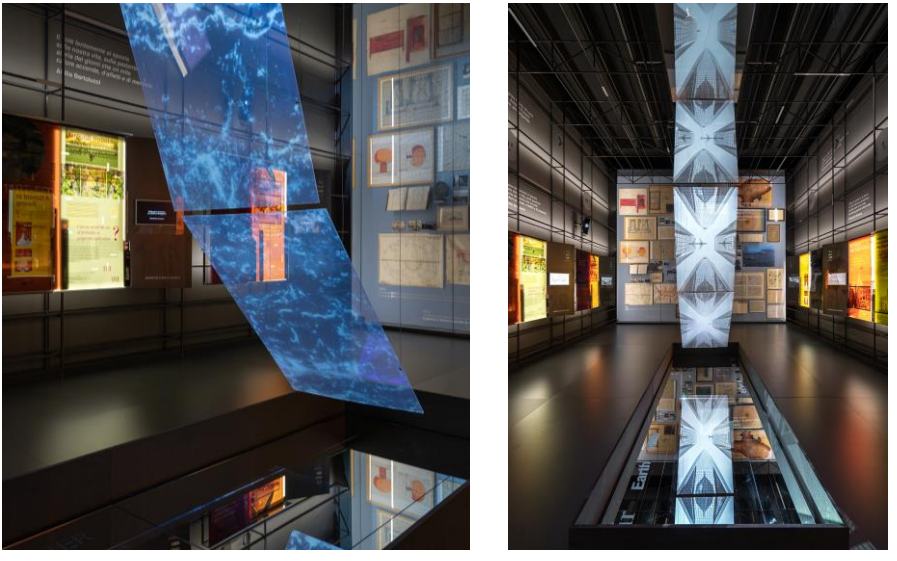

Figure 1,2. Dynamic and multimedia installation on the four elements, in the center of the Italian Pavillion.

2. A matter of communication.

Museum and libraries have undergone profound transformation processes in the last decades. From heralds of monophonic narratives, they have been turned into supporters of new pluralistic reality and society, capable of answering to the hunger for *“multiplicity”* of today’s transnational culture (Parati et al., 2012). During the visit, the construction of meaning inside a museum, and therefore inside the pavilion, can be compared to the process of conversation, as Emerita Eilean Hooper-Greenhill (2004; 2007) explains and Arjo Klamer (2016) reminds us. A **conversation** where both those who know and those who learn play an equally active part in the experience of visiting. The Italian Pavilion has sought that dialogue with its visitors. It has faced an enormous challenge: it has created hooks of attraction and ease of comprehension. It has offered a non-objectionable view of topics that could be complex and difficult by nature. Since the initial concept, the experience inside the Pavilion has been based on the existence of a **cognitive exchange between the university and the visitor**. It focuses on a non-univocal or unidirectional passage of information between them. On one side there are strong and diverse contents to convey, and on the other a group of visitors who decides to approach or allow themselves to be approached.

Any kind of conversation establishes some relationships, physical and actual exchanges among different identities, in which no single element should impose itself on the other, but in which each different element livens and enriches its identity. Nicolas Bourriaud is the first to suggest the concept of *“encounters”* in the art consumption: encounters — between visitors and museums; between visitors and curator; between visitors and visitors; among visitors, contents and exhibit protocols — should become the *"quintessence of the artistic practice".* Therefore, on one hand, the Italian Pavilion aspires *"to invent possible encounters"*; with awareness that encounters can only reach their actual manifestation when activated by human interaction. On the other, the purpose of the visitor is to engage with the exhibition and its contents, and thereby *"create the conditions for an exchange, as you would return a service in a game of tennis"* (Bourriaud, 2002, p.23). Moreover, the pavilion offers an articulated message that wants to address a heterogeneous audience; an interpretative community of different people and points of view. Seeing the audience as flesh and blood, and taking them into account, not as numbers of statistics and widespread dimensional analysis on museum consumption (Trimarchi, 2014), but as people, with their own individual faces, their own souls, with the right to create an experience or to refuse to do so, to make a gesture, to sculpt their own narratives (Balzola & Rosa, 2003).

Thus, the challenges that Italian Pavilion has been substantially related to three themes: Narrative (what is said), Voice (who says it) and the Tone of Voice (how says it). Politecnico di Milano and Triennale di Milano conveys the message, while Visitors are the listeners involved in a 'cultural model' two-way communication, participating individually and actively in the construction and representation of meanings. Deriving from these are the issues of the listening, of interpretation, of understanding, and of personal meaning construction.

3. What is the message? Design as healer and leader.

The Politecnico message conveyed through the Italian Pavilion is thoroughly consistent with the role of Design portrayed in the Broken Nature exhibition. Through Design, humankind can repair the former separation with nature to establish the concept of a wider “Earth system”, a new notion of eco-system as a set of diverse elements and innumerable intertwined relationships. Applying a systemic approach to comprehend and take action towards the complexity of the world’s great problems, design is in fact the connecting element amongst disciplines, the creator of eco-systems. The multidisciplinary approach employed for the construction of the research methodology and of the involved teams, deploys a multi-sectorial broad vision to overcome points of view that are too specialized and narrow. With its integrated approach Design has the potential of overcoming the nineteenth-century distinction and dissociation between humanistic and technical and scientific cultures, the “two cultures” (Snow, 1959).

Moreover, it is thanks to the application of a clear example of co-design process, a collective and collaborative research development, that it is possible to approach complexity (Morin, 1977); to develop a common knowledge as both individuals and part of a community (De Kerckhove, 1997; 2000); to trigger unexpected perspectives, and to develop paths of knowledge effectively able to affect societal change (Sennet, 2012).

Design balances human impact and tries to take care of the nature and the environment, moving in between Art and Science (Oxam, 2018). A further message depicted by the exhibition is the unexpected beauty perceivable even in the most specialised techniques and analyses. It is a change of perspective to look at phenomena or landscapes between natural and artificial but also from a scientific point of view. The visual representation of scientific or natural phenomena is also perhaps related to the aesthetic criterion that can be found, in science, in the correspondence between a sense of beauty and natural laws.

Design is also the common methodological approach able to envisage and select among potential future scenarios through feasibility criteria and to manage and reinterpret the limited resources of existing contexts to respond to issues and demands, in an innovative/creative way. It in fact embeds the idea of foreshadowing and anticipating future visions, which are not just plain modelling and simulations through mathematical algorithms but also entail the ability to define the appropriate path in order to achieve the scenarios or to discard unwanted alternatives and negative shifts. As a consequence, the potential of the strategic dimension (Brown, 2008) of design thinking, which includes the concept of "antifragility" (Taleb, 2012) to broaden the perspective and horizons of action, has the strength not only to provide an answer to a given demand in a specific context, but to re-think existing gaps and shortcomings as possible resources through the development of a new value, a new meaning, a new balance and evaluate potential opportunities for long-standing problems through radical but non-increasing innovation.

4. Who speaks? And who does it speak to?

We focus now on voice and subjects of the conversation inside the exhibition: visitors and researchers. Let's start from visitors, going beyond the usual reductive distinction between experts and non-experts. Besides not being homogeneous, the cultural audience varies both in space and time; those who attend Broken Nature, and exhibitions in general, are hopefully by nature open to change and therefore pretty unpredictable in their tastes and choices about tomorrow (Trimarchi, 2014). We can intend every **cultural experience as a cognitive process** in constant evolution.

Every time we visit an exhibition, our cultural experience is subjective and reveals an emotional feedback of past experience and personal knowledges. It is practically impossible to focus precisely on the subjective and kaleidoscopic sequence of readings, listening, observations, explorations and discussions, which encourage people to become curious and decide to visit the exhibition. Each visitor is the bearer both of more or less in-depth pre-existing knowledge on the exhibition topic and of expectations, historical and cultural backgrounds, learning skills, interpretative strategies and subjective emotions. In this sense, **a visitor is never a generic and passive listener** who simply absorbs information but an interlocutor who takes part in a bilateral communicative exchange, participating individually and actively. Exhibiting is therefore equivalent to creating a new cultural discourse and new meanings. **The visitor is an active subject of the conversation, just like the student or the scientist**: he observes, selects, compares and interprets during his/her visit path. He connects what he observes with many other things he has observed in other occasions. Inside the exhibition, “he participates in the performance if he is able to tell his own story about the story that is in front of him” (Rancière, 2011, p.7). The visitor cannot be threated as individuals until we actually know what is unique about him or her (Simon, 2010).

According to the dialogue dimension, Politecnico di Milano, thanks to the exhibition '4Elements /Taking Care', faces a twofold challenge. It has to identify new moments of cognitive permeability**. It has to satisfy not only the visitor's need to understand but also the researcher's need to tell the story behind the content.** The relationship’s ambivalence of message transmission is underlined. Emphasis is placed on the social reliability and ability to inform of academic and research work. The latter, often not accustomed to the explanatory narrative, and not being technical, has to make a certain communicative effort. Visiting a Museum (and experiencing its collection) is no longer just for specialists; it is no longer reserved for selected and elected people. As a form of knowledge, it is founded on an interrogative vocation. Overall, we wanted to stage a **collective tale**, written by a scientific community that operates in the service of the common good, rich in attempts and experiments aimed at healing or mending the dangerous rift between humans and the environment.

5. A tone of voice. Design as a visualizer and multimedia language.

As museums in the Netherlands have demonstrated, everyone has a preferred learning style, or more than one (Gibbs et al., 2007). Therefore, the design of exhibit set-up should include a range of ingredients that offer a connection to each style of content comprehension. **What matters is not simply the knowledge learners acquire as a consequence of their visit, but also the ways in which they experience and learn during their visit.** David Kolb explains that process has two-dimensions: perception/understanding and extension/intention. The former defines how a person grasps a cultural experience; the latter defines how the same person internalizes it. Storytelling is, as Bruner points out, the first interpretative and cognitive device used by man – understood as a culturally situated social subject – in his life experience. Seen as a process of knowledge facilitation, the narration is what allows to re-elaborate experiences, producing a functional knowledge, capable of giving value to the latter. Furthermore, John Falk believes that "there is no single right way to learn things and there is no single place or even moment in which learning occurs," (Falk, 2004, p.89) and, together with Lynn Dierking adds that "universally, people mentally organize information effectively if it is recounted to them in a story or narrative form" (Falk & Dierking, 2000, p. 51). Through narration, man gives sense and meaning to his own experience, outlining interpretations and foreshadowing coordinates of happened events, actions, and situations. In this sense, the place of narrative in the exhibition is central as well as the chosen design language and exhibit protocols are vital in defining the visitor's cultural experience.

We should reflect on what is the narration. Narrative thought allows the visitor to relate experiences, collection items, and present, past, and future situations in the form of a 'story'. How can we build a story where action and contemplation are combined in a balanced way? The attractiveness of the story is always made of two inseparable elements: the story itself and the world in which the story takes place. **The Design language challenge has become the task to encourage a multidimensional discourse and a balance story to transmit**, creating a space for knowledge and reflection without diminishing the emotional engagement and the pleasure of visit.

The Italian Pavilion narration has started with emotion. As soon as the threshold is crossed, a series of exploded surfaces of video, light and graphics rise from the floor to the ceiling. They represent the natural elements, which turn into environmental problems; playing on the emotional component of the visitor, they raise questions in an endless game of reflections. **The multimedia central installation tackles the most empathetic aspects.** It addresses the sensitivity of each individual, visitor and researchers. Its transparencies play with the background Wunderkammer, generating time bridges with the university's history. For Peter Jarvis, "all human learning begins with disjuncture—with either an overt question or with a sense of unknowing". Emotion, sensation or disjunction are the motor that enables learning; so, the potential triggers to start the visit.



Figure 3. General view of the Italian Pavillion. Eight oversize books exhibited on the perimeter and the Wuderkammer in the background.

Having lowered any cognitive reticence or experiential prejudice, the visitor **is invited to move freely** among the 8 over-sized books. A stylised and **library** around the perimeter attracts and encourages him to enjoy relaxed and informal interaction. Coloured and transparent pages overlap and flow, and, when selected, they activate the relative video contents. They rely on the title or image being questioned, to know what they are talking about; they turn into an essential meta-level of comparison, between researcher and visitor. The one's possible view on the other's world. **They invite the visitor to the choice of the topic.** From the initial dimension of contemplation, they lead to one of action, from 'being there' to 'acting'. If a first flow of contents has been moving in our direction and it has crashed into us, without the need to strive, instead, the gesture, the symbolic leafing through, decrees a choice and builds depth of meaning.

Gradually, **page after page, project after project, everyone is able to create a personal key of interpretation,** which is strengthened and expanded by the passage of time of the visit. Thanks to the use of technological devices, people are called to aggregate different and inconsequential narrative fragments; to choose what to deepen, having been intrigued by the cover, as happens in any library. Each page, like every book, is connected, sometimes without the reader's knowledge, to many others. It is a system of communicating vessels, the entrance door, free and revolving, leading towards the inspection. Whenever we enter the bookshop, there are books we choose by being attracted by the title or captured by the

cover's aesthetic or by the power of the image. We do it in a completely spontaneous and subjective way. All one has to do is select the 'right' topic, and then slide it into the fixed, white backlit page. By doing so, never-before seen multimedia content is activated. The narration begins. Films and images come to life on the adjacent monitor. Changing the subject, the video changes. A few seconds of viewing and then on to choose a different research.

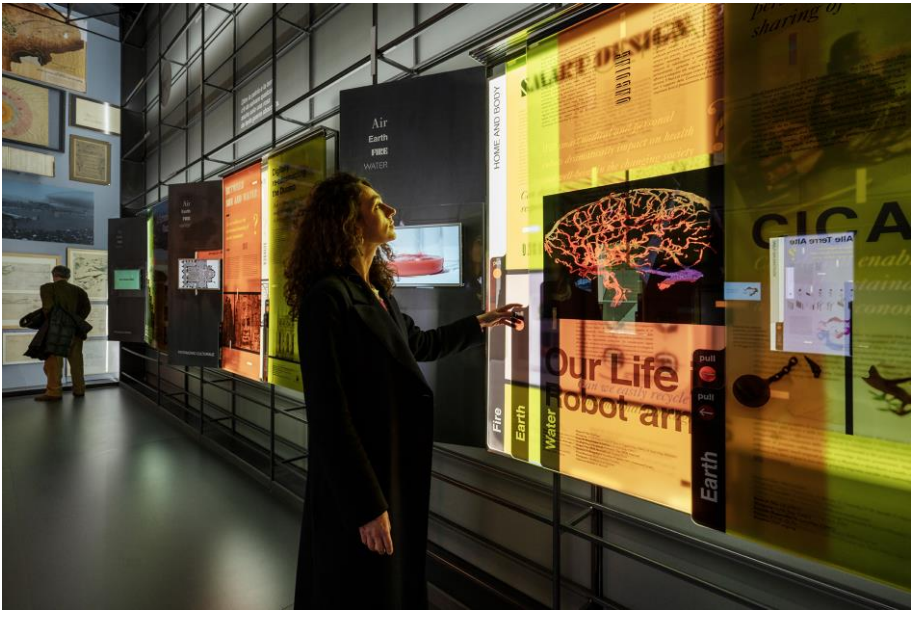

Figure 4. Closer view of the interactive and stylized library. The visitor is invited to slide freely the coloured projects pages.

Various levels of detail contribute to the autonomy of the various media that concur in a **polyphonic creation of languages** that live together, without neglecting their differences. Andrea Witcomb describes these kinds of designs as a "**polysemic exhibition practice**" where multiple voices are curated together into a narrative. Moving among the coloured panels and observing, someone is more attracted by the colour of the panel, the title, the research question, the visual power of the main picture. Some covers are able to immediately activate a sense of familiarity and make visitors feel at ease picking them up first and leafing through them; others can make visitor closer just making them curious.

6. Conclusion

The end result is a pavilion that can be browsed through, listened to and evaluated. The scientific and analytical approach has invited to escape from its safe ivory towers, in order to spread and open up to the outside world. The exhibition aims to reach a broader audience outside the academic environments. The narrative devices and design exhibit protocols had made the difference. The voice tones chosen for this occasion was synthetic and empathic, mixing both the immersive and didactive, contemplative and active dimensions of the visit experience.

This was made possible also thanks to the design approach able to select and re-interpret the contents of the researches and innovations beyond the simple disciplinary scientific and therefore specialized contributions but in their disruptive potentials and impacts on society and culture; it is a way of seeing through different eyes also opening up to different perspectives and applications, healing contrasts and narrow-minded positions.

Design, as visualizer, has the power to represent the complexity and to organize an exhibition as a space of becoming (Carr, 2010). Italian Pavilion, thanks to the chosen multimedia design language, has been presented as a **discursive exhibition** spaces able to foster negotiation and debate, polarize space, and invite discussion fraught with contradictory views (Macalik et al., 2015). In this perspective, no interpretation is ever a definitively finished and closed one: there is always something to add, and what is said can always be refuted and modified. The Italian Pavilion meaning is never static. Knowledge is something plural and fluid. Along the visit path, any process of interpretation is necessarily subjective.

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Acknowledgements:
4ELEMENTS / TAKING CARE credits

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Ferruccio Resta, Rettore - Politecnico di Milano

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Federico Bucci, Luisa Collina with/con Marco Bocciolone, Donatella Sciuto - Politecnico di Milano
and Ico Migliore - Migliore+Servetto Architects

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Exhibition and graphic design
Ico Migliore and/e Mara Servetto with/con Daniela Grimaldi, Daniele Pellizzoni, Giorgia Borroni, Rossella Forioli, Francesco Russo - Migliore+Servetto Architects

Graphic contribution and Catalogue Design
Italo Lupi with/con Rosa Casamento

Photo and Movie Design / Design Video e Foto
Lab Immagine, Design Department / Dipartimento di Design - Politecnico di Milano

Communication / Comunicazione
Communication and External Relations Area / Area Comunicazioni e Relazioni Esterne - Politecnico di Milano

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Language and identity in new Italian design.

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Abstract | The overcoming of the industrial dogma has in fact expanded the fields of the profession promoting the concept of a designer that can operate without distinction in the industrial sector or in that of the craftsmanship. The large differences in goals and process between the two productive spheres imply however a different approach: industry sets simplification as a priority while craftsmanship finds in the complexity of making its magnification. But where industrial design has established consolidated methodologies, "design for craft" is still developing methods and strategies. The paper analyses some processes and design languages that are the basis of a renewed design dialogue with the artisan sphere.

KEYWORDS | DESIGNER/CRAFTSMAN, LOCAL IDENTITY, DESIGN STRATEGIES, CULTURAL DIVERSITY, DESIGN LANGUAGES

1. Introduction

Modernity as wipe and restart, has interrupted many of the systems of evolution of knowledge that have always characterized the identity of the places. Even the aesthetic systems that underlie the construction of manufactures, whose definition was always proceeded with incremental processes, have modified their constitutive paradigms in function of a renewal of processes and practices.

Ornament and Crime by Loos has sanctioned the birth of a new aesthetic for the industrial product by initiating a progressive cancellation of the decorative aspects in favor of a strengthening of the formal aspects consequent to the functions carried out by the objects. The making of new languages, first outlined by the Bauhaus school and then by the Ulm school, has decreed a separation in the aesthetic canons between what is produced by the machine and what is produced by the man; between the geometric purity of the industrial product and the decorative accuracy of the handicraft product.

In this double track of doing, craft cultures, suffocated by the exponential logic of industrial processes, have not been able to build a distinctive identity or elaborate a renewed aesthetic, reproducing too many times consolidated formulas repeated in an uncritical manner.

This inability to innovate has led to the progressive erasure of the development of new decorative elements, whether related to signs, materials or colors developed over time by the productive cultures or to the personalization of the craftsman's manual know-how. Functional areas have progressively prevailed over expressive ones and that has implied a consequent renunciation of those symbolic, ritual or poetic aspects that underlie the aesthetic definition of objects. Aspects that have always been conveyed by the forms and functions but also by the sign apparatus that accompanied them. The traces, the decorations, the chromatism present in the material cultures contained iconographic and symbolic matrices at the base of the identity of each culture. In contrast, Design has developed its own universal aesthetic shared and replicable and consequently aesthetic "forgetful" indifferent to the relationship with geographical territories and cultural territories.

The need for simplification implicit in the industrial process has married a formal and aesthetic purity that has dominated all areas of design application. And this aesthetic corrective procedure has been further strengthened by the modification of the project instruments. The start of digital graphics with the supremacy of the three-dimensional on the two-dimensional has moved even more attention towards the shape (the three-dimensional modeling involves an imbalance towards the creation of shapes and makes difficult the application of decorations on the surfaces) pushing the ornament to be "added element" and not "constitutive element".

The tendency to simplification is a trend towards homologation; Design as an industrial culture has always been a conception of unity seen as uniformity, motivated by the unlimited reproducibility of its products, which has progressively cancelled the elements of diversity between the places.



Figure 1. Il lavoro dell'artigiano - Alfredo Quaranta, insegnante di materie plastiche Foto ItacaFreeLance

But Design is also a changing discipline, pervasive and in continuous transformation that, in the evolutions of the end of the last millennium has begun its mutation becoming no longer at the exclusive service of the industry (design as the project of the industrial product) but of the entire production chain, to the point of progressively contaminating in our country the territories of the craft [1] used first as a field of formal experimentation (see the role of craftsmen in the construction of models before the advent of 3D printers) , and later, called to the rescue of craft for its baggage of competences and planning, proposing specific strategies of innovation aimed at considering the product as a cultural expression of a territory.
In a systemic approach design becomes an instrument of connection between all the actors of the territory, "Design… is the common thread of a story that winds between experiences of valorization of traditions (languages adapted to local materials), skills (product quality) and actions in the sector" [2]. It is as a result of the renewed scenarios, and in coherence with the specificities of our production culture, that Italian Design looks today at the territory as a cultural humus that can fuel innovation. But all this involves a rethinking of the generative practices of the project.

2. New practices

The productive culture today pursues a new strategic vision in the balance between local and global; a practice that can oppose the hegemonic vocation of globalism and nourish diversity again by placing it at the basis of a new cultural season.
A renewed approach of design to craft systems implies a reconsideration of design methodologies. On the one hand it is necessary to replace the thought/action synthesis that has always characterized the traditional craftsmanship, with a split between the design act and the build act aimed at fostering the contribution of the designer, on the other hand, it is essential to deal on the design processes that lead the project.
The design for craftsmanship, in fact, never starts from a white sheet of paper but from a complex network of signs, materials, techniques, uses, which constitutes the cultural fabric of every productive territory; at the base of the design solution there is a process of appropriation that consists in detecting, deciphering and interpreting the characteristics of

[1] The widening of the visual of the design towards the territories of the craftsmanship in our country starts at the end of the sixties, on the margins of a radical season that had questioned many of the constitutive dogmas of the discipline, highlighting the need to develop new design languages
[2] Germak C., *Perché artigianato e design* in Tosi F., Lotti G., Follesa S., Rinaldi A. (a cura di), *Artigianato, Design e Innovazione - Le nuove prospettive del saper fare*, DidaPress, Firenze, 2014.

the material culture and then conceiving the idea of intervention. The project finds support in the cultural identity to move in the space of ideas driven by technical-graphic skills.



Figure 2. Roberta Morittu per la Biennale dell'Artigianato Sardo "Domo", Fotografia di Daniela Zedda

A renewed design approach therefore raises the issue of the transfer of knowledge relating to cultural heritage. The filing of tangible and intangible cultural assets is a process that for most European countries has started since the end of the 1970s in parallel with the theoretical formulation of cultural heritage within the Unesco.
The *National Archives of the countries of the European Union* collaborate within a working group called the *European Archives Group* (EAG), established in 2006. Currently the main archive site at European level is the *Europeana* website, a European digital library that brings

together contributions already digitized by several institutions between the 28 EU Member States. Europeana in turn takes inspiration from the *Gallica Project* (initiative of the *Bibliothèque Nationale de France*).
In Italy, the reference web archive for the immense cultural heritage is the *National Archives* SAN, a point of unified access to national archival resources made available on the web by information systems, digital databases and research tools developed at national, regional and local level by the State, Regions and other public and private entities. Many regions have begun to digitalize their tangible and intangible heritage and make it accessible in the form of web archives. Among these the SRBeC - Information System of the Cultural Heritage of the Lombardy Region the SIRPAC - Regional Information System for the Cultural Heritage of the Marche Region and the SIRPAC of the Friuli Venezia Giulia region, one of the most advanced in the organization of knowledge.
Most of the cataloguing systems in use have an exclusively archival character aimed at protecting the knowledge of the good but not to highlight its technical or formal characteristics which are then those necessary for a use within the design process.
This is the direction of the *Mediterranean Crafts Archive* promoted by the Sardinia Region as part of a field research conducted in Sardinia, Morocco and Egypt, which, in addition to its interest in highlighting contamination in a geographical area as wide as the Mediterranean basin, shows a system of functional filing both to safeguard the knowledge and to their use within the design process and therefore at the service of the work of designers, craftsmen, cultural operators.
The creation and dissemination of virtual archives and more in general of all ITC systems, in connection with new design models (from *Design Community* to *Neo Local Design* to *Design* 4.0), is characterizing the design processes of the New Design feeding a new season in terms of the processing of innovations and recovery of the elements of diversity.
Starting from these theoretical matrices, a cultural movement has progressively been generated, working with different approaches, on an updated identity reproposing.
Is this what is happening in many areas, a research direction "all Italian, which makes the recovery of its local material culture the opportunity to investigate popular visual languages and, through them, rediscover - sometimes claim - identity values"[3]. A new design approach that once again feeds diversity by putting it at the basis of a new cultural season. A new figure of "ethnographic designer, experimenter is being born alchemist; capable of becoming artisan" (Sironi 2018).
At the same time a return to manual work and consequently to the recovery of many decorative, symbolic and identity aspects is progressively infecting the new generations of designers who identify in the union between the culture of the project and the culture of making a workable path. This union in our country can become strategic if linked to a transmissibility of knowledge that can give continuity to territorial identities. It is an ever more widespread cultural movement, with close connections with the DIY movement and

[3] Piscitelli D. *Lo sguardo "strabico" della grafica popolare* in MD Journal n.7

with the phenomenon of Makers, but with some prerogatives linked to the specificity of our cultural and productive heritage.

3. New languages

A conception of the project that starts from connotative elements belonging to the cultural heritage of a territory, implies at the same time a reconsideration on the reformulation of the aesthetic codes. The renovation and adaptation of the decorative apparatus today represents a complex challenge for a new vision of design. The theme of languages is the main theme of the connections between craftsmanship and design, but more in general the main theme of the debate on the role of design in the defense and development of cultural diversity, equally declinable in the object system, in communication systems and in the use of new technologies.

The task is on the one hand to re-read the forms, the decorations and the symbols that come from the phase of acquisition of knowledge, on the other hand the elaboration of new signs that can graft a "innovation aware" without falling back into formal folklore.

A return to the complexity that characterized the differences between cultures and motivates a renewed interest in the decorative graphic sign, expressed for example by the rereading of patterns and textures belonging to different cultural territories.

"Today designers and architects feel freer in designing objects and environments in which the decorative aspect can be developed and expressed through a new sensibility, given by the use of materials and textures that are manifested in their physicality without constraints of subordination to what may be the formal aspects, so dear to the Modern Movement, overcoming the limits of the concept of form-function belonging to a period that seems by now distant"[4].

In the history of civilization the decoration of artifacts through the repetition of ornaments such as patterns and textures has represented among the most precious and refined skills aimed at increasing their value and ornamental tradition and makes manifest the artistic culture of a people (Gombrich E.H. 1979). The manufacturing cultures, and in particular those related to some specific materials (textiles, ceramics, stones and wood in the first place) have developed and reworked over time a heritage of iconic signs and figures that have consequently built the identity of the territories.

So, it was for almost all peoples; at the different scales of the project the patterns have become a characterizing element that has connotated the architectures, defined the interior environments, characterized the system of objects. The reinterpretation of patterns in an identity key characterizes the recent work of some architects in the international context,

"Despite the modernist emphasis on minimal forms, the advent of international style and the substitution of crafts with the rise of mass production have led to a systematic

[4] Pagni C. (2018) *L'ornamento non è più un delitto: Spunti di riflessione sulla decorazione contemporanea*, Franco Angeli, Milano.

elimination of ornament, we are experiencing its awakening in contemporary architecture through experimentation with new digital technologies"[5].
It's the case, for example, of the architect Kengo Kuma that works on the interrelation between patterns and layering within the architectural project. In Japanese textile art and printing, the use of patterns has a long tradition in Japanese architecture, layering is an established technique that has already inspired artists such as Frank Lloyd Wright and Mies Van der Rohe. In his research laboratory at the University of Tokyo, Kuma has developed a technically sophisticated methodology that combines patterns and layering into a single structural concept.
Contemporary design has also often used textures to characterize the surfaces of objects. So it was in Italy in Gio Ponti's projects: in the vases made of hand-painted majolica, such as the *Vaso Prospettico* (Richard Ginori 1925), in the polychrome coatings of the D.153.1 armchair designed in 1934 or in the textures made and exhibited in the 2014 exhibition, *"Trame: le forme del rame tra arte contemporanea, design, tecnologia e architettura",* entirely given by the game of intertwining with copper, or still in the plots proposed in the collection of carpets inspired by the patterns that characterize the paintings, decorations, flooring and ceramics.
But this has also happened during the avant-garde season of "80s.
The genesis of *Memphis* sank its roots in the experimental approach to industrial design that Sottsass and De lucchi had carried out during their experience within the *Studio Alchimia* and the contemporary proximity to the concepts of radical design. In the mind of Sottsass, the group Memphis gives the objects a symbolic, emotional and ritual thickness. The principle behind strange and monumental furniture is the "emotion before the function". The Alchimia group projects and designs objects in which the texture is the protagonist, they do not care if it is an object, or sculpture, architecture, scenography, art or other, but acts to cover the world of decorations, outside the project, in a state of disciplinary, dimensional and conceptual neutrality. For Alchimia the methods of conception and production can coexist and mix, within a basic concept, that of "variation". Given the insufficiency of the project to face the world, it is replaced by drawing, which becomes a work without principle, without end and without justification, a formalistic network of styling and visual references. Language games are intertwined, combined and repeated in the decorations of drawings, paintings, sculptures and objects. The same works of Ugo La Pietra, of 1966/1968, "*the tissue structures*", are drawings to communicate an idea matured through different experiences, which have their roots in informal painting.
In contemporary design there are many examples of a renewed use of textures as elements of design definition. Think of the work of Patricia Urquiola and Elena Gerotto for Paola Lenti's Crochet collection where the flowers and leaves that make up the rug are crocheted and sewn by hand on a synthetic support network.

[5] Strehlke, Kai and Loveridge, Russell, "The Redefinition of Ornament" in Martens Bob, et al., CAAD Futures, Springer, Dordrecht, 2005, pp. 373–382

But the use that the new Design makes of patterns and textures combines aesthetic renewal with identity characterization. The texture is a means, a medium, whose communicative potential can be grasped when the reference value to local cultures and territories is relevant. The decorative aspect of the surfaces of artisanal productions makes accessible (Calabi e Scuri 2015) the memories of material culture. Through the chromatic complexities and the chosen signs, the texture design reveals to the expert artistic influences, geographical and sociocultural origins as would a text, it offers to the reinterpretation of those who know the written language.



Figure 3. Patrizia Cara Anfora Anulare Cotto Orbace

"Surfaces are therefore medium and textures like *writings* which narrate memories and traditions. Signs that translate signs"[6]

[6] Ciarrocchi M., Calabi D. ,Texture Design and Environment, in AA.VV a cura di Mario Bisson, Environmental Design - 2nd International Conference on Environmental Design

It is in the new craftsmanship that the most interesting experiments on new aesthetic languages are being developed. The decoration reopens a collective identity, which declines and innovates tradition.
Among the most interesting experiments in this direction is the work of the Tuscan Giulia Cioli whose woolen patterns reproduce the lines of the Tuscan landscape in an original reading of the relationship between sign and identity, the surfaces of objects by Francesco Pace Sicilian designer for which the pattern is evocation of matter.
In the same direction Sardinia has been, in recent years, a virtuous territory of experimentation for the existence of an iconographic heritage still alive (and well protected by a strategic vision of regional policy) and a cultural humus that has allowed its re-reading and evolution. A direction that starting from the intuitions of the "magical world" of Eugenio Tavolara in the fifties, lands in the most recent experimentations like *Domo* (Sassari 2009), *Sardiska* (Cagliari 2018), *Punti di Frontiera* (Cagliari 2018) and in the work of designers such as Roberta Morittu, Annalisa Cocco, Angelo Figus, Eugenia Pinna, Ivano Atzori and Kyre Chenven, Paulina Herrera Letelier and Carolina Melis.



Figure 4. Giulia Ciuoli Traccia 2 Tie inspired by the textures of the cathedral of Siena

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Metaphors as Knowledge Activators in Data Visualizations: the case of the Archipelago of Calvino's literary works.

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Abstract In this paper we present the outcomes of a collaboration between scholars and designers aimed at exploring the potentials of data visualization in support to the creation of literary critique. By exploiting action research, we envisioned a methodological integration between data visualization, design and literary critique aimed at the representation of humanistic data and knowledge. In our work we made an extensive use of the visual metaphors (the natural landscape), with the aim of activating domain experts' knowledge and externalizing inconsistent and ill-defined information. In conclusion we argue that similar methodological integrations are important contributions that communication designers can bring to the field of Digital Humanities.

KEYWORDS | DIGITAL HUMANITIES, DATA VISUALIZATION, VISUAL METAPHORS, KNOWLEDGE ACTIVATION, ITALO CALVINO

1. Introduction

The work presented in this contribution lies in the field of Digital Humanities (DH): a multidisciplinary area of study, research and teaching where humanistic disciplines and computing come together (Caviglia, 2013). This context is multidisciplinary by definition and can see the collaboration of researchers coming from very different backgrounds.

In this contribution we present the case of literary scholars and information designers using data visualization to comprehensively represent the narrative production of the Italian writer Italo Calvino. The specific challenges related to this case study are addressed in section 3 (and in particular in 3.1 Goals and Challenges). Hereafter authors will introduce their approach to data visualization for Digital Humanities and the aim of this research.

Data visualization and its practices have been used in several fields during the last decade (D'Ignazio, 2018). This is due to their capability to give shape to complex phenomena and to make them accessible both to general public and domain experts. Humanities are no exception and have been experimenting similar practices, at times leading to interesting and meaningful results (Moretti, 2016), at other times pointing to challenges or mismatches (Marche, 2012. Posner, 2015, Uboldi & Caviglia, 2015). In fact, as Druker states, practices of data visualization had sprung from disciplines such as statistics, empirical sciences, business and have been shaped by them according to their needs. Being those disciplines so different from Humanities, data visualizations need to assess a process of critique and adaptation in order to support humanistic inquiry, a process that gives priority to interpretation, ambiguity, inference, and qualitative judgment over quantitative (Drucker, 2014).

Such 'loose' and 'ill-defined' humanistic approach to inquiry can be partly explained by looking at materials of study of scholars: they usually do not work with quantifiable information but with much more complex matters, that they want to put in relation with culture or human history.

In this context it is very difficult to perform measurements or categorizations (Posner, 2016) and then build data visualizations. Part of the reason is due to the fact that scholars are very much interested in singularities and details (Caviglia, 2013) and not just in the "big picture". Furthermore, their materials of study are most of the times incomplete, because damaged or just because impossible to be collected in their completeness (Marche, 2012).

The aforementioned considerations are very general and present a nuanced significance depending on the specific object of inquiry. However, it is of paramount importance to acknowledge them, because they put in the foreground the fact that human ability to understand and interpret cannot be directly combined with computers' ability to analyze massive datasets (Hall, 2013). Computation would come at the cost of reduction and many scholars are reluctant to this loss because it affects their possibilities of contemplation and of identification of connections. Additionally, not every scholar is interested in leveraging the power of technologies to cope with big data and emerging patterns. Instead, they prefer to work with a delimited corpus of documents, that is operable with their traditional tools and

methods. Even if not interested in big data, those scholars still manifest an interest in better understanding data visualization and adopting it within their workflow.

"*Is data visualization supposed to help such scholars in their work? How?"* This is the question behind the presented contribution, in which designers inquire the production process of data visualization for DH through the iterative process of action research (Swan, 2012; Muratovski, 2016; McCurdy, 2016).

2. Related works

From the perspective of data visualization, it is possible to identify projects that individually focus on some of Calvino's most famous works: *If on a winter night a traveller* (Piotrowska, 2019) and *The invisible cities* (Gianordoli, 2017). Given the combinatory structure of its index, this last book has also been used as case study to design an interactive tool aimed at performing multi-level readings (Van den Heuvel, 2016).

More generally, visualization has been previously used to represent individual written works of any genre. Very well-known is the work of Ben Fry (Fry, 2009) *On the Origin of species* and the same applies to Moretti's analysis of Shakespeare (Moretti, 2011), or Grayson (Grayson, 2016) analysis of Arthur Conan Doyle, Jane Austen and Charles Dickens.

When we consider the visual representation of corpora of written documents, it is possible to identify many examples that represent documents as elements in a virtual space (Wise, 1996. Chalmers, 1993. Hall, 2013). Even if documents do not inherently have spatial attributes, they are assigned coordinates via computational means so to create a visualization that metaphorically represents a natural landscape. As a consequence, information about individual documents or groups of them can be learnt from their distances and proximities in the landscape, thanks to everyone's intuitive understanding of it (Figure 1 and Figure 2) (Fabrikant, 2009).

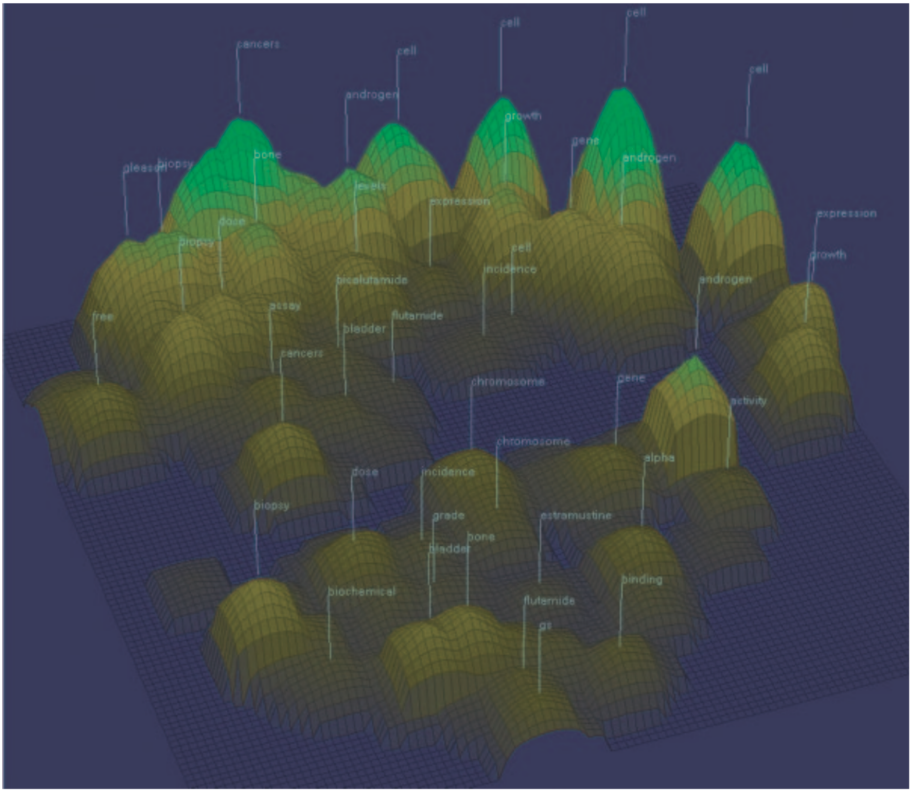

Figure 1. ThemeScape represents documents as part of a landscape and "utilizes innate human abilities for pattern recognition and spatial reasoning. The complexity of the terrain is perceived and analyzed with parallel and preattentive processing which do not tax serial, attentional resources" (Wise, 1995)

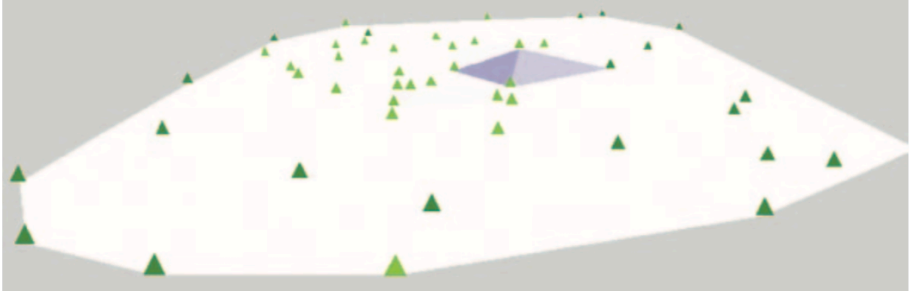

Figure 2. Bead information landscape system: scientific articles are represented as elements in a virtual space.

Using a landscape metaphor, or simple cartesian spaces, it is a common strategy used to visually make sense of documents collections. Yet, the ways in which we can calculate elements coordinates are not flawless. In fact, it is occasionally enhanced with human interventions (or human in the loop or touch-ups) in cases in which domain experts notice problems with the overall image produced through the computational means (El-Aassady, 2019). In such cases visualizations manifests their capability to elicit experts' knowledge by contrast between what they know about the considered topic and what they see in the visualization itself (McCurdy, 2019).

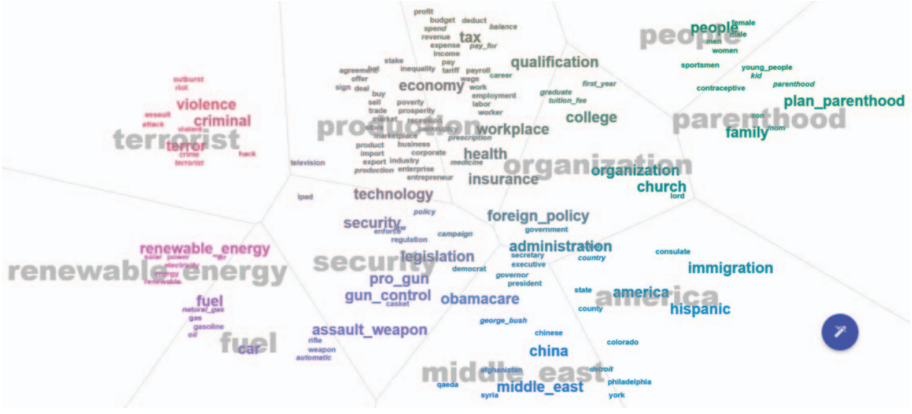

Figure 3. Results of Topic Modelling are manually refined with experts' interventions aimed at repositioning elements in the space. In this way, users' knowledge is incorporated into the visualization.

Despite the described examples, it is rare to find cases focused on a comprehensive representation of the production of an individual writer. In regard to Italo Calvino, it is possible to find cases that attempted to represent the author's most important volumes on a timeline [1] or the combination and re-combination of author's short stories into collections[2].

The publishing house Arnoldo Mondadori released during the 90s the most comprehensive collection of the written works of Italo Calvino. This collection consists in six volumes part of the series "I Meridiani" and gathers: narrative texts (novels and short stories), essays, letters and other forms of writing. At the time of writing there is no trace of a project that attempts to visually represent the author's narrative production as a whole. The presented case study is a step towards the fulfillment of this specific gap.

1 Visualization *Il tempo e le opere* in «La Lettura», n. 368, 16 dicembre 2018, pp. 16-17
2 Visualization *Il flusso dei racconti* in «La Lettura», n. 358, 7 ottobre 2018, p. 16

3. Case study

3.1 Goal and challenges

The presented design artifact is realized in the context of a research project where literary scholars and information designers work together to experiment on new ways to use data visualization in support to the creation of literary critique and to the representation of humanistic knowledge. The production of the Italian writer Italo Calvino serves as use case.

Our main goal was to produce a visual representation of all Calvino's narrative writings, a corpus of 229 titles which includes records for novels, short stories, and collections of short stories. Essays, reviews, letters and rewritings of the author were deliberately kept out by scholars' decision. The resulting visualization was supposed to be a tool for literary scholars, and it is designed to help them in the process of producing literary critique.

In a first place, the representation of the corpus is a challenging task because data in itself is very heterogeneous. A novel is very different from short stories: the former is a book while the latter could be only a few pages long. Collections appear very similar to novels, in the sense that they are volumes, but in fact they are different in their essence and are nothing more than the grouping of many short stories. Short stories that are part of collections were selected upon author's artistic taste and his tastes about themes, styles of writing, experimentations, political and cultural influences and many other aspects.

Moreover, short stories can be released on magazines or newspapers and then be published into one or more collections. As a consequence, they can present multiple publication dates and the earliest is not necessarily the most important from scholars' point of view. To represent in a single visual artifact all those heterogeneous and ambiguous elements and properties is certainly the first challenge to cope with.

Secondarily, the visualization ought to take into account author's different periods (political, cultural and artistic), that are very relevant aspects, but are very difficult, if not impossible, to be quantified. In fact, commonly used analysis strategies such as NLP (Natural Language Processing) are not able to grasp such information. They are able to quantify features of the text or even to provide summarizations, but to do so they break up the text in individual entities. Literary choices made by the author reside in details like the pairing of particular words, images, rhetorical figures and other literary instruments that get destroyed in this computational process, also named 'bag of words model' (Zellig, 1954). For this reason, the second challenge lies in the identification of a method to make such aspects emerge and become visible.

The researchers involved into the project identified a solution based on a methodological integration (Kelle, 2007) between quantitative and computational approaches proper of data visualization and qualitative and speculative ones proper of design (DiSalvo, 2012).

3.3 Design process

The design process of the presented visualisation followed a strongly iterative process. Several intermediate results where produced and evaluated in order to understand how to proceed. This process resembles the one of action research (Swan, 2012. Muratovski, 2016. McCurdy, 2016).

To quickly bootstrap the project and test hypotheses, we started using known solutions and tools. Specifically, we started from a *contour plot* visual model made in RAWGraphs (Figure 4) and we then modified it in Adobe Illustrator (Figure 5 and 6).

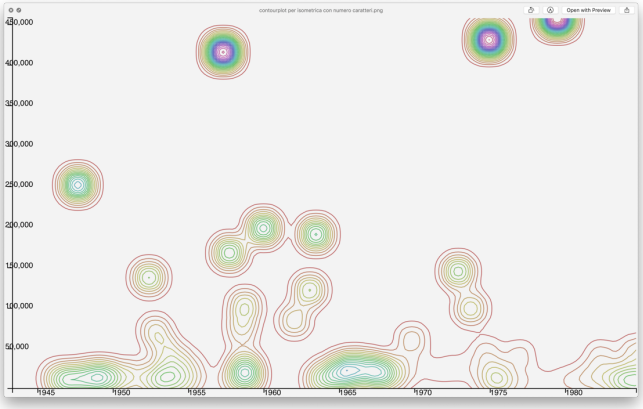

Figure 4. The contour plot was generated within RAWGraphs, using the first publication date on the horizontal axis and texts length in characters on the vertical one.

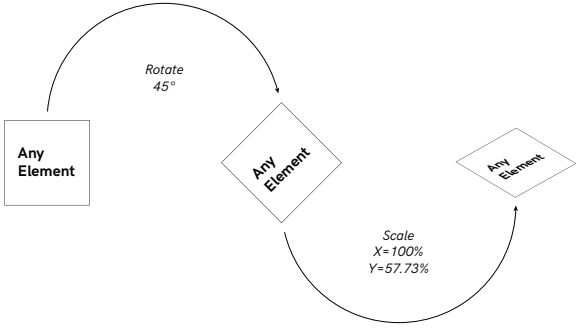

Figure 5. The isometric transformation performed on the contour plot.

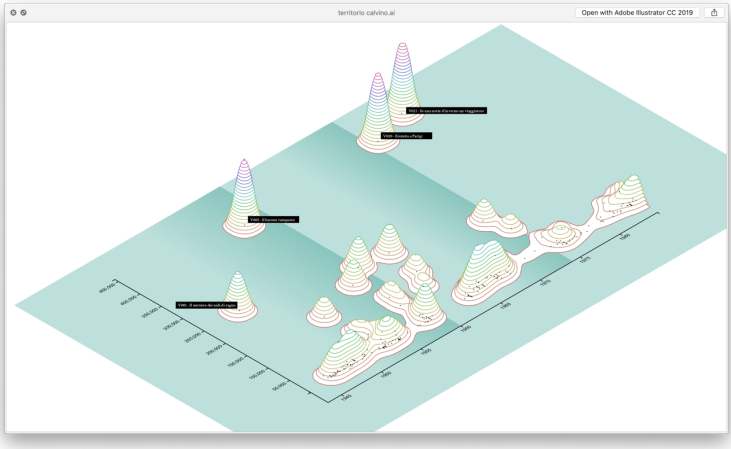

Figure 6. The first attempt to produce a visualization capable of resembling a territory.

In this attempt, the visual resemblance with a hilly territory was visible and the metaphor of a natural landscape was operative already. However, the visualization wasn't effective yet. In fact, precisely because of the metaphor, scholars perceived as inappropriate the position of many elements that happened to be closely positioned in the space. Those texts didn't share anything if not a similar length in characters and first publication date. Moreover, this resulting visualization didn't display all texts as singular graphical elements because some of them result merged in the same morphological agglomerate (Figure 7).

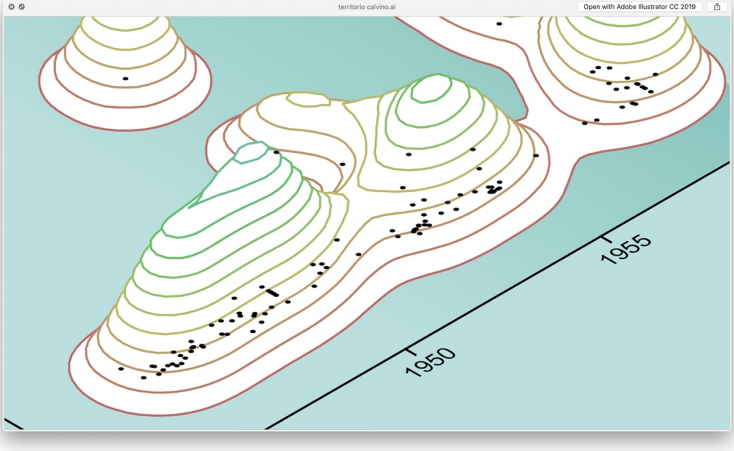

Figure 7. The first visualization of the territory was not effective since it grouped the texts according to their length in characters and date of first publication, often merging texts that overlapped into morphological agglomerates. This relationship did not allow all the texts to be seen and was not meaningful for representing the entire corpus of Calvino's literary work overtime.

The metrics we used to produce the contour plot brought many works to be close in the space without paying consideration to important aspects such as texts stylistics or their importance to the author. Even if such features cannot be directly quantified and visualized, other information could be used to indirectly display them: by looking at this first visual attempt researchers decided to experiment with a displacement of elements based on collections.

If compared to dates and other metrics, this information is less quantitative and less comparable but, at the same time, is more informative and more authorial. Indeed, the fact that a text is part of one or more particular collections, tells much about its framing into the writer's career, its importance, its stylistics and other aspects that are particularly relevant to a domain expert.

Collections can be seen as partially overlapping groups of texts, kept together by the relationships among themselves. In other words, we can imagine drawing a link between every pair of texts that appear in the same collection. This operation results in a network structure. Since network graphs are visual tools suitable for representing such kind of information, data was visualized into Gephi (Bastian, 2009) as an un-directional force layout graph, with nodes spatialized with a Fruchterman-Reingold (Fruchterman and Reingold, 1991) algorithm and sized according to their length. Nodes coordinates were subsequently extracted and used to produce the contour-plot model of RAWGraphs and the resulting SVG was reworked with a vector editing software to "reboot" the metaphor of the landscape.

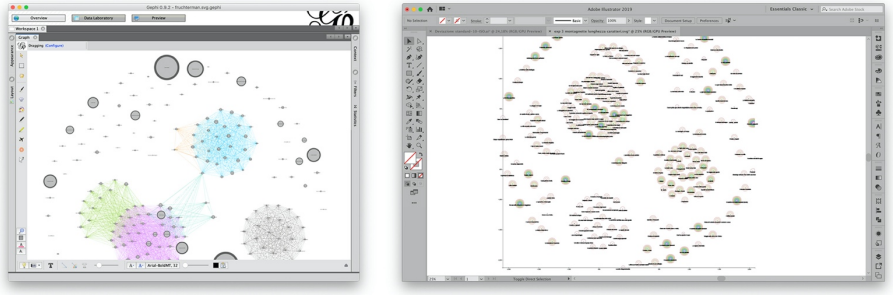

Figure 8. Gephi was used to position the texts in a space where the relationship between them and their chronology were significant (image on the left). Then, the coordinates of the nodes were used to produce the contour-tracing model and recreate the landscape metaphor (image on the right).

From this second result it is clearly visible the fact that writings could present very different behaviours and not all of them were published into collections. According to the visualised data, novels were all the time published independently and many stories were released only on magazines. Fruchterman-Reingold algorithm worked well for depicting that part of the territory occupied by connected elements: the closer they are in the space, the higher the number of connections they shared. However, the chronological dimension was almost completely unreadable, and the position of unconnected nodes is assigned randomly.

Again, reading the placement of texts through the metaphor of the natural landscape suggested the idea that some of their positions were meaningful, while others were inappropriate and needed to be fixed. A proper territory in fact, needs to present a morphology that could be read in a consistent way across all of its elements (Figure 9).

The metaphor, in fact, is capable of activating brain abilities of pattern recognition and spatial reasoning that are innate in humans; therefore, the reading of the visualization takes advantages of pre-attentive processing and ease the burden on attentional resources (Wise, 1995).

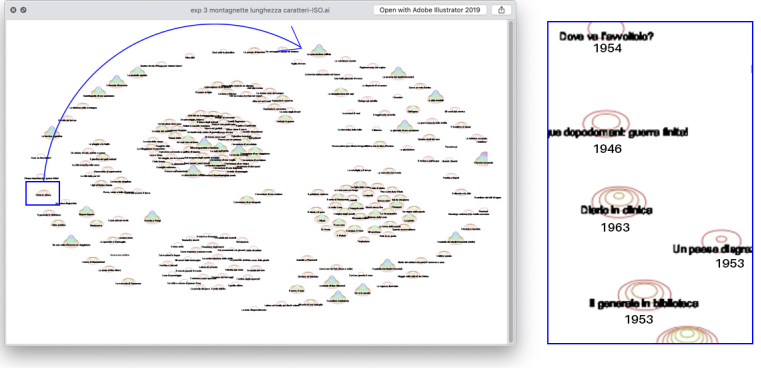

Figure 9. The computational position did not correctly represent all the nodes. In some cases, as shown in the image, the algorithm privileged the relation variable over the temporal variable or vice versa. The text "Diario in clinica" published in 1963 should be placed next to the other texts of the decade.

The position of those misplaced nodes needed to be modified, but it was not possible to identify any rigorous –or computational– method for doing so. For this reason, the team decided to adopt a solution based on a qualitative intervention on the visualisation: to touch-up the positions assigned by the spatialization algorithm, manually suggesting where elements should appear in the space (Figure 10).

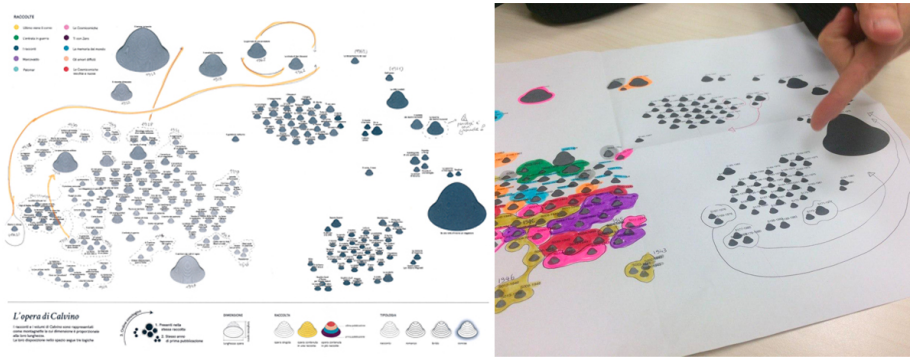

Figure 10. Many drafts were printed and manually annotated to decide how to fix anomalies in elements positions.

In an iterative sequence of transformations and evaluations, isolated nodes were grouped by years of first publication and successively scattered around the main islands of Calvino's collections, following a circular shape. Also, some nodes of the collections were at times repositioned, assigning a better position according to scholars' reflections on chronology and their reading of the territory. Position of nodes became relevant, allowing to read and understand the logic of this territory as a whole.

Nodes coordinates were once more retrieved from Gephi, but instead of using the contour-plot model of RAWGraphs, a custom interactive representation was produced using D3js (Bostock, 2011).

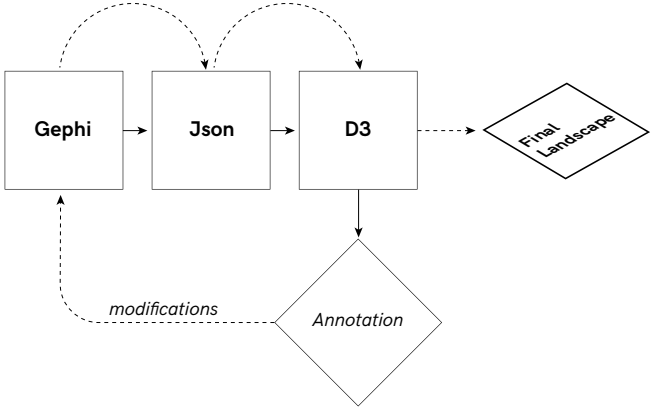

Figure 11. The iterative work of design, evaluation and adjustment of the nodes started with the use of network modelling tools (Gephi) to obtain the coordinates of the nodes (Json) and their visualization using the D3.js library. This computational process was evaluated by humanists, who modified the calculated positions of elements drawing from their knowledge.

After the review and annotation process, the process was repeated, altering the result according to the manual intervention.

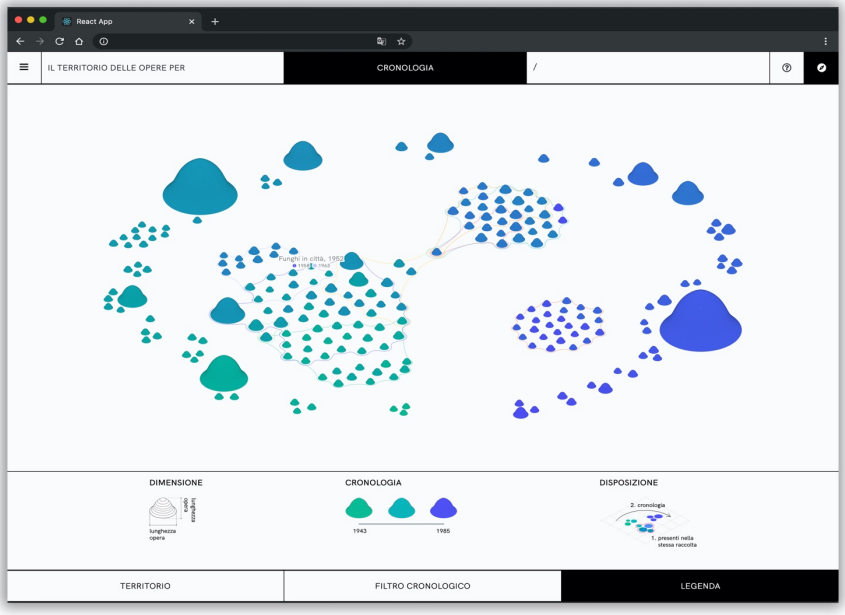

Figure 12. The final landscape is inserted in an interface that allows the exploration of the texts. In the image, the colouring of the "mountains" in the landscape represents the chronology from green (1943) to blue (1985).

3.4 Outcomes

The Archipelago of Calvino's Literary Works has been made available mainly in the form of an interactive webpage, with the possibility to search, filter, zoom and pan as if the visualization were a real interactive map of a territory[3].

Visualisation presents three islands surrounded by a big ring of smaller ones (Figure 12). Islands represent elements that are kept together by collections, whereas external ring is composed by the remaining written works, those that were not part of any collection. External elements have been manually scattered around according to first publication dates

[3] Find the visualization at: http://atlantecalvino.unige.ch/

and by following a clockwise direction that starts from the south of the Landscape (its central-bottom part).

For the elements part of the first island (the biggest, on the central-left portion of Figure 12), chronology had been partly sacrificed in favour of the grouping in collections. Still a general sense of time emerges from the artwork, because dates had been fuzzily taken into account in the manual orientation of collections and elements (Figure 13).

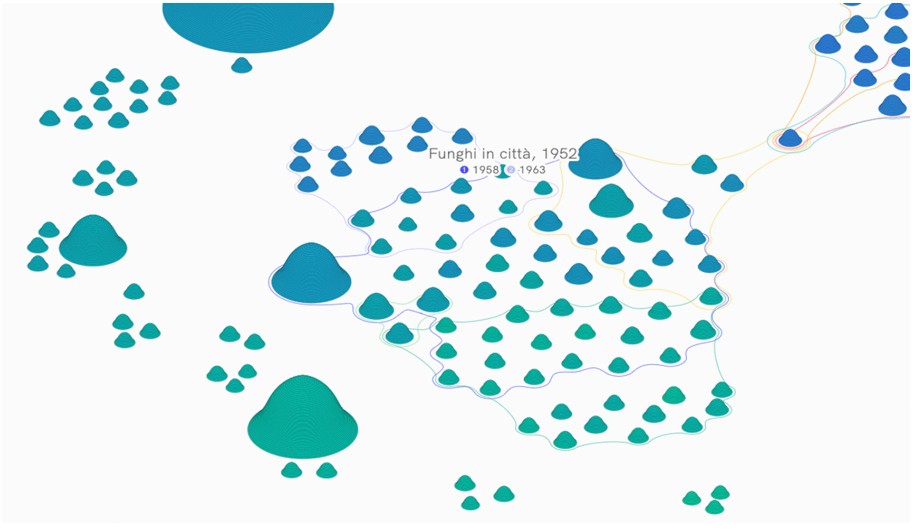

Figure 13. Detail of the first island: elements at the bottom are mainly green (older) than elements at the top, which are mainly blue (newer). Elements in the center are positioned according to a compromise between date and membership to collections. The position is the result of scholars' intervention.

The visualisation provides an immediate overview of all of Calvino's written works creating a nearly physical sensation of typologies and quantities. The diameters of collections oppose the elevation of novels, suggesting the idea that short stories are an important area covered by the author's production over his forty years long career.

The visualization also shows the multiple acts of re-mixing that the author performed on his own stories, together with the fact that earlier collections were less compact and more chaotic than the later ones. This is clue of the writer experience and awareness developed during the years.

4. Discussion

The process of creating literary critique is based on memory efforts and on scholar's capabilities of creating connections with culture and human history. The process of creating data visualization is usually based on quantifications and generative representations. This contribution reports on a viable way to integrate the two methodologies in order to design visual representations that are partly based on quantitative data and partly based on experts' elicited knowledge.

It is not unknown that that the realization of data visualization is a biased process (Kirk, 2016) which includes many choices that influence final outcomes. When creating the visualization discussed above, a key aspect had been to decide consciously on what to visualize among the many different data available and, once done that, to decide not to completely trust the result provided by the machine.

As described earlier, quantitative and comparable metrics were dropped in favour of the inconsistent and ill-defined information about collections. Although not an immediate decision, it is interesting to notice that this information is a direct result of Calvino's decision and presents an evident curatorial nature. Moreover, being so loose, it was the data dimension that less prevented scholars' tacit knowledge to emerge. The monographic setting in which this work had been carried out calls in fact for a deep understanding of the author's corpus through his personal history, his periods of break, his personal milestones, his professional achievements and the influence of external factors (like World War II and Partisan Resistance).

Some parts of that information could be derived, some others could be potentially embedded, but many others appeared as too complex to be fit into data. This explains the fact that metrics were too superficial to address needs of scholars, even if they perfectly fit the available tools for data visualization that are currently available.

This case study proves that visualization designers have to learn how to deal with ill-defined and incomplete information, even if it is hard to be exploited properly within data visualization tools. Precisely because of this fact, communication designers find themselves into an advantageous position if compared to other practitioners involved in data visualization, thanks to their expertise of manipulating graphics and images.

In the reported case, the use of a visual metaphor proved to be a particularly useful strategy, not only because it helped in the intuitive understanding of the visual outcomes, but mostly because it nurtured acts of speculation, pushing experts to ask the question: "where should this element be positioned to make sense within the context of this landscape?" For this reason, we can say that it represented an element of paramount importance in guiding the process of overcoming the limitations of tools for data visualization and for bringing the scholar within the loop of visualization.

The resulting visual artifacts are supposed to be a support for scholar's inquiry once completed. However, during their creation scholars actively engage with them, fostering the emergence of reflections, questions and eliciting their knowledge to emerge. For this reason, it is possible to say that visualization actively supported their process of critique, stimulating their work of memory and connection.

Nevertheless, they also show criticalities. This kind of visualizations require readers a lot of time to be digested, being so strongly customized and distant from ordinary visual models (e.g. bar charts or scatterplots). Some researchers pointed out that speed and efficiency better resonate with other fields of studies and that a visualization capable of slowing perception down is actually a *desiderata* in DH (Hinricks, 2018. Bradley, 2016).
To compensate, it is important to pay even more attention to the formal aspects of visualization, namely titles, legends, scales, etc. In addition, such visualizations may then require to be combined with a narration, in order to better explain the richness of the embedded information and to convey authors' aims and remarks.

5. Conclusion

Within this contribution we presented the outcome of an interdisciplinary work that brought together information visualization and literary studies for the making of an interactive data visualization designed in support to literary inquiry.

Creating this visualization has been of paramount importance to align habits and fashions of the two backgrounds involved, to develop shared sensibilities and eventually to start to understand how and at which extent it is possible to combine the work of critique with the work of creation of data visualizations.

The design process of this visualization pointed towards the overcoming of limitations of tools for data visualization. Such tools rarely allow for a complete exploitation of ill-defined and inconsistent information, which is however very common in the field of DH. The design process we presented, saw a methodological integration between methods of data visualization and design, with a particular use of the visual metaphor of the natural landscape deployed in order to elicit scholars' knowledge and bring them in the loop of visualization.

Similar methodological integrations, oriented towards the exploitation of inconsistent and ill-defined information, emerge as important contributions that designers can provide to those scholars that aim to create literary critique with the support of data visualization.

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Acknowledgements: this research is conducted in the context of the project *Atlante Calvino: literature and visualization*. The project is funded by the Swiss National Science Foundation (SNSF) and it is led by Francesca Serra, Professor at University of Geneva.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Patient Autonomy Indicators: a knowledge visualization tool for patient autonomy support

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Abstract | Patient autonomy indicators (PAI) template is a knowledge visualization tool for caregivers, aiming at supporting patient autonomy at the end of life by collecting and analysing patient data. We design PAI based on the Problem-Solving Cycle and the Event System Theory and iterate it through focus interviews. The writing of PAI is about a patient's story and shall be designed by three dimensions: narrative, numbers, and visualization. It involves collectivizing patient knowledge and provides a service-oriented process. In such a story, knowledge is the ability of terminal care services to impact patient autonomy. We conducted a PAI experiment with the support of four medical institutions in China. We concluded that PAI can help caregivers calculate and characterize patient knowledge, inspire their imagination and empathy, and perform suitable intervention activities for patients.

KEYWORDS | PATIENT AUTONOMY, PATIENT KNOWLEDGE, KNOWLEDGE VISUALIZATION, PATIENT SUPPORT

1. Introduction

Services in the modern world must receive and place thought and action in the center of their design (Secomandi, et al., 2011). Patient-centered services are essential to the doctor-patient interaction. In practice, people often adopt uniform service standards and ignore the assessment of patients' individual needs. The universally accepted ethical principle in the Western world is the promotion of patient autonomy. The concept of control related to autonomy affects a person's sense of dignity, helps reduce suffering, and improves the quality of life (Lavoie, et al., 2011). Therefore, the patient's beliefs and values serve as the basis for determining their needs and assessing the appropriateness of alternative interventions. However, autonomy is a multidimensional, plural, and multidisciplinary concept. It is important to analyze the characteristics of patient autonomy to guide the services. Patient autonomy analyses are currently supported with some scales, such as the Patient Autonomy Questionnaire (PAQ) and concise 4-item version (PAQs) (Vernooij-Dassen, et al., 2005). These tools require patients to have a clear awareness and relatively functional physical fitness to provide benefits. Many end-of-life patients are not in this condition. Some tools also assist in reflecting the autonomy of patients, such as France's national AGGIR, SMAF (Hébert, et al., 1988), and the ADL scale (Katz, et al., 1976) for supervising elderly customers. The Palliative Performance Scale version 2 (PPSv2) is most commonly used to predict the prognosis of patients and can estimate the workload. These tools are useful for fair medical resource allocation. However, changes in the disease lead to changes in the patient's ability to reason and move freely, i.e., fluctuations in their autonomic performance. How to evaluate and promote a patient's autonomy, especially for end-life patients, is still a challenging question.

We hypothesize that a close connection between patient autonomy and specific care practices will better guide autonomy support. This paper proposes an analysis framework, namely, the patient autonomy indicators (PAI) template, which is a tool for the caregiver (such as the doctors, nurses, social workers, service providers, etc.). It describes information in three dimensions event space-time, event strength, and patient condition, to analyse patient autonomy and design support strategies. PAI is a means to 'decentralize' knowledge resources and make patient knowledge easy to intervene by the caregiver. This template restricts the transformation of personal tacit knowledge into practically measurable and unambiguous operational understanding.

The PAI template has been tested in four medical institutions by six medical staff with more than ten years of medical experience. The results showed that the template can help improve autonomy support services more accurately, giving caregivers more confidence when facing end-of-life patients. The PAI template is flexible enough to handle different patient autonomy when used by care providers with different experiences. It can be used iteratively for better evaluations and strategies.

2. Beneficence and patient autonomy

The balancing of beneficence and patient autonomy is a critical issue in patient support because autonomous decisions are made intentionally and with a substantial understanding of and freedom from controlling influences. On the one hand, the highly technological nature of modern medicine and the patient's fear of erroneous decisions have strengthened the traditional paternalistic style of healthcare (Collopy, 1986). Illness deprives patients of their autonomy, and doctors define the patient's interests (Veatch, 1981). Therefore, it is hard to empower patients, and it is essential to emphasize the patient's agenda for patient empowerment, especially for dying patients.

On the other hand, calls for patient empowerment and autonomy in the sensitive context of palliative care may lead to an underestimation of the vulnerability of patients and increase conflicts surrounding care (Wilson, et al., 2014). The concept of autonomy support is sometimes misunderstood as to suggest that patients should be free to make their own medical decisions with little or no advice from providers. Van Eys (1991) states: "To be a patient is to be out of control. To be a patient is to be dependent. It is not the medical system that does that. It is the disease." Many patients, especially terminal patients, cannot cope with relatively complete independence and must rely on others (Ende, et al., 1989).

Solving this problem requires reasonable preparation or education of the caregiver. The caregiver is required to explain how to choose a service strategy based on the patient's wishes, knowledge, and understanding. Therefore, when and how to present and interpret a patient's knowledge is a significant challenge (Richards, et al., 2013). Caregivers should actively approach patients, understand their perspectives and feelings, and provide treatment and service options and relevant information when appropriate. Doctors in emergency care settings can quickly identify patient needs and reliably assess risks and benefits (Mc Cullough, et al., 1985). Palliative care faces more daily ethical issues and events (Christie, et al., 1986) that involve the patient's characteristics, such as personality, family, culture, and education. Patients in Asia have lower autonomy than patients in Europe and the United States (Mo, et al., 2012). Physicians traditionally discuss patient issues with the family rather than the patient because of the Confucian culture (Mo, et al., 2012). Palliative care is a new area in China, we need to pay more attention to the problem of patient autonomy. Although medical personnel can gain insight into the patient's world via instant imaginative identification behaviour, including the patient's unconscious motivation and attitude towards disease (Balint, 1955), the uncertainty of imagination (Scott, 1995) by caregivers can hardly lead to good results. Eppler & Burkhard (2004) defined

> "knowledge visualization aims to transfer insights, experiences, attitudes, values, expectations, perspectives, opinions and predictions, and this in a way that enables someone else to re-construct, remember and apply these insights correctly".

Therefore, we designed the PAI—a knowledge visualization tool to directly connect the vision of the caregiver with the problems or phenomena of patient care services. We use

narrative, visual, and number to present patient knowledge and promote the caregiver's reasonable moral imagination (Scott, 1997).

3. Design and experiment

3.1 Developing PAI

This section first describes the three stages of the design and implementation and then expands on the details of each stage.

Stage 1. Based on literature review and field surveys, we developed a prototype of the patient autonomy indicators using a problem-solving cycle (Sternberg, et al., 1986) and event system theory (Morgeson, et al., 2015).

Stage 2. We organized a group discussion to iterate the prototype for improvements.

Stage 3. We designed and conducted experiments that required participants to use the PAI for one month in a real context. The participants were interviewed for their feedback.

The design of PAI started with our two-month field surveys in the Affiliated Hospital of Jiangsu University. We want to investigate how doctors and nurses can help end-of-life patients improve their quality of life. And we found two problems: First, the patients at the end of life are weak and have difficulty withstanding the routine consultation survey, but we still need to get information about patient needs. Second, some tools or scales completed by the caregivers measured patient autonomy, but they were less relevant to clinical practice. Patient autonomy fluctuates with the disease, and we must analyse specific issues. Therefore, our hypothesis is that patient autonomy is closely related to a particular reality, which may reasonably solve the problem of supporting patient autonomy. Therefore, we performed an exploratory study. Theory-based exploratory research helps ensure content validity in the scales (Hinkin, 1998). We considered that the differences between the patient's personality and the subjective evaluation of the caregiver may require iteration of the solution. We constructed the framework of the prototype with the theory of the problem-solving cycle (Sternberg, et al, 1986) that includes the steps below:

- Recognize or identify the problem;
- Define and represent the problem mentally;
- Develop a solution strategy;
- Organize knowledge about the problem;
- Allocate mental and physical resources for solving the problem;
- Monitor his or her progress towards the goal;
- Evaluate the solution for accuracy.

"The cycle is descriptive and does not imply that all problem-solving proceeds sequentially through all stages in this order" (Pretz, et al., 2003). We can use the steps of problem-solving cycle flexibly and we designed PAI usage steps based on the steps above as below:

- Identify and represent the problem or phenomenon (Problems encountered during patient care);
- Solution strategy (Ways of solving the problem);
- Organize knowledge (Organize patient knowledge from three dimensions: time and space, event intensity and patient condition);
- Measure (Six operational definitions for the above three dimensions);
- Score (Statistics on the allocate section);
- Patient autonomy support strategy (Designing action strategies that support autonomy based on 'solution strategies');
- Feedback (Caregiver describes patient's response after experiencing supportive autonomy strategies);
- Evaluation (Caregiver's evaluation of patient autonomy support strategy based on feedback).

We used the event system theory (Morgeson, et al., 2015) to divide the section of organizing knowledge, which helps provide a meaningful description of the development process of events. "The event system is a complex of three interacting event components, including event strength, event space, and event time" (Morgeson, et al., 2015). We divided knowledge sources according to the three components and added patient condition items to organize patient knowledge more comprehensively. We set specific secondary indicators for the measure section (Figure 1) and use a 5-level Likert scale to measure the details of problems or phenomena. The design prototype (Figure 1) shows that the first row is primarily the necessary information of the patient and the caregiver. The steps are in order from left to right in Figure 1.

<table>
<tr><td>Name:</td><td>Gender:</td><td>Age:</td><td>NO.</td><td colspan="4">Doctor & Nurse:</td><td>Score</td><td colspan="2">Evaluator:</td><td>Date:</td></tr>
<tr><td>Identify and represent the problem or phenomenon</td><td>Organize knowledge</td><td>Measure</td><td colspan="5">Weak (1)←---- ->Strong (5)</td><td></td><td colspan="3">Patient autonomy support strategy</td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Space & Time</td><td>Space</td><td></td><td></td><td></td><td></td><td></td><td rowspan="2"></td><td colspan="3" rowspan="2"></td></tr>
<tr><td>Time</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Event strength</td><td>Degree</td><td></td><td></td><td></td><td></td><td></td><td rowspan="2"></td><td colspan="3" rowspan="2"></td></tr>
<tr><td rowspan="2">Solution strategy</td><td>Scope</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td rowspan="2"></td><td rowspan="2">Patient condition</td><td>Expression</td><td></td><td></td><td></td><td></td><td></td><td rowspan="2"></td><td colspan="2">Feedback</td><td>Evaluation</td></tr>
<tr><td>Disability</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Figure 1. Patient autonomy indicators (PAI) prototype.

3.2 Iterating the PAI prototype

To improve the PAI, we cooperated with the training group from QELCA (Quality End-of-Life Care for All), Jiangsu China. Eight palliative medical staff were invited in a 2-hour focus interview on this prototype (Figure 2). They are two doctors, four nurses, and two social workers.



Figure 2. Palliative medical staff participate in the interview of PAI prototype iterations.

The views and opinions collected included three aspects. The first step was to make the concepts and category relationships clearer in the PAI, such as, “Many concepts in the table, and it is a little hard to distinguish the relationships.” And “I need time to understand these categories and their meanings.” The second step was to simplify the quantitative calculation part of the PAI to make it easier to operate, for example, “I think I have no time to calculate the ‘score’ section by myself because I am busy” and “What is the familiar standard code that can be used as a reference in the ‘measure’ section?” The third step was related to patient privacy: “We write some details of patient life that they may mind being seen by others.” From then on, we iterated the scale (Figure 3) to optimize the visualization using a gradient ramp to guide the fill level from left to right, from objective observation to subjective evaluation.

Name:	Gender:	Age:	NO.	Doctor&Nurse:			Score	Evaluator:	Date:
Identify and represent the problem or phenomenon	Organize knowledge	Measure	Weak←--------Autonomy--------→Strong (1----------2----------3)					Patient autonomy support strategy	
	Space & Time	Space	Indoor		Area		Bed/Chair		
		Time	Min		Hour		Day		
	Event strength	Degree	Weak		Moderate		Strong		
Solution strategy		Scope	Point		Part		Body	Feedback	Evaluation
	Patient condition	Expression	Invalid		Fuzzy		Clear		
		Disability	Severe		Moderate		Mild		

Figure 3. Patient autonomy indicators (PAI) template.

The quantization part was simplified into three increasing levels with the vocabulary familiar (such as indoor, area, bed/chair, min, hour, etc.) to the caregivers, which made it easier to judge. We emphasize that people who use PAI should keep it properly. We also deepened the color saturation of the design of the patient information portion, which increased the difficulty of reading the information (Figure 3) to reduce the possibility of patient information leakage. In the 'score' section, it is a simple measure to make statistics on the degree of indicators and create an overall impression of patient autonomy. According to the focus interview, we also map out the scoring indicators for 'score' section (Table 1)

Table 1. Patient autonomy scoring indicators. (A score below 6 is invalid)

Score	Autonomy level	Support strategy
6—10	Weak	The caregivers should establish a smooth communication channel with the patients' agents, such as family members.
11—14	Moderate	The caregivers should make supportive behaviours and cooperate with patients' agents to support patient autonomy.
15—18	Strong	The caregivers should develop patient autonomy individually or in collaboration with stakeholders.

Caregivers can use it to determine the extent and frequency of supportive behaviors, such as attention to needs, empathy, care, recognition of individuality, information provision and dignity (Dickert, et al., 2009) to respect the patient's autonomy. The use of these indicators is elastic, and we cite similar cases in the experimental section according to the principles of indicators to provide a reference for the participants. Overall, the higher the patient's autonomy, the more comprehensive and supportive behavior is required. Caregivers received patient's feedback after service and evaluated the effects of describing and supporting the patient's autonomy.

The PAI is a complex form of reporting that combines narrative, numbers, and visualization. It uses the three dimensions to organize the patient impression. First, PAI has some form of knowledge 'narrative'—a scenario, a storyline of patient knowledge, and a storyline of how problems arise. Knowledge narrative focuses on how patient knowledge resources interact and enable caregivers to intervene. Second, PAI identifies a set of challenges for patient knowledge analysis and caregivers' efforts to support patient autonomy. A patient's story includes a knowledge narrative (the section to 'Identify and represent the problem or phenomenon') and a statement that supports autonomy (the section to 'Patient autonomy support strategy'). It aims to enhance attention to the details of care services.

The PAI also suggests that ‘numbers’ can be attached to challenge analysis to show how they are implemented, that numbers correspond to different concepts and hierarchies and that they show the authenticity of the proposed problem analysis challenges to allow the knowledge narrative to flourish. With the ‘organize knowledge’ and ‘measure’ sections the numbers can be used to explain part of the story. The caregivers can fill in the blanks numbers to support narrative or only tick the blanks to determine the degree of autonomy as shown in Figure 4, which makes the analysis and evaluation possible.

Name: XXX	Gender: Man	Age: 68	NO. X	Doctor&Nurse: XXX XXX					Score	Evaluator: XX	Date:13.11
Identify and represent the problem or phenomenon	Organize knowledge	Measure	Weak←--------Autonomy--------→Strong (1----------2----------3)						13	Patient autonomy support strategy	
The patient with reduced mobility went to the toilet at night and did not call a family member to help. There is a risk of falling. (The bathroom is 3 meters from the bed. It takes 15 minutes to complete the toilet process. The patient is frail with NRS Grade 3 pain, especially when moving .)	Space & Time	Space	Indoor		Area	3m	Bed/chair		3	Moderate autonomy: 1. Listen to the patient's reasons for not wanting to wake up the family; 2. Explain the risk of falling; 3. Family members express their support; 4. Moving beds; 5. Ask the patient his feeling after bed moved and encourage him and his family members.	
		Time	Min	15	Hour		Day				
	Event strength	Degree	Weak		Moderate	3grad pain (NRS)	Strong		5		
Solution strategy		Scope	Point		Part		Body	√		Feedback	Evaluation
We are going to lean the bed against the wall and the other side against the family's bed to prevent the patient from getting up at night without anyone knowing.	Patient condition	Expression	Invalid		Fuzzy		Clear	√	5	Patients' families accept this arrangement to avoid the risk of falling patients.	Good support for patient autonomy. The patient can safely rely on his family.
		Disability	Severe		Moderate	√	Mild				

Figure 4. An anonymous patient case. Caregivers can fill in PAI with reference to other scale data. Such as pain measurement—Numerical Rating Scale (NRS) in this case.

The PAI allows visualization to function in place of a written story (Segel, et al., 2010), and it’s not only an information analysis tool but also, above all, a data collection tool first. It implies a combination of evidence-based medicine and narrative medicine. The overall visualization of patient autonomy, including narrative and numbers, forms a network – the final report. These figures show that caregivers are serious about their patients and can be held accountable for their actions and desire to support them. Visualization constructs a certain “wholeness” in the organization of numbers, while the narrative suggests how the legitimacy of the patient autonomy strategy is formed. The PAI focuses on descriptive data and knowledge generation interventions, not knowledge application interventions. It aims to address clinical issues in medical and nonmedical settings and to support patient autonomy in the context of daily care.

3.3 Experiment

We performed an experiment in China. It was an exploratory study with small samples, and qualitative research methods were used. We recruited 6 participants from the palliative

caregivers, aged 32-46 years and were from four medical institutions (Affiliated Hospital of Jiangsu University, Zhenjiang First people's Hospital, Dongwu Hospital and the third people's Hospital of Zhenjiang) in Zhenjiang, China.

We first showed a 30-minute video to the participants, explaining the content of the PAI and the filling process. The participants tried out the PAI template for 20 minutes as a training exercise. All the participants were able to finish the exercise in time, showing that they will be able to use it for analysis and decision-making in the real environment (Figure 5). The participants then used the PAI template for one-month for the end-of-life patient care, after which the completed PAI's were collected. Each participant was asked to submit 4-8 completed PAI's and invited for a semi-structured interview to discuss their feelings, recommendations, and related experience. The interviews were recorded as qualitative data.



Figure 5. Palliative caregivers work in the real environment.

4. Results

This session describes the qualitative results from the semi-structured interview at the end of the study. Descriptive conversations about the use of PAI template, and reflections that have been recorded, transcribed and marked as discrete categories using content analysis methods (Bryman, 2016). Thirty PAI templates were returned, and twenty-eight were valid. Two templates were invalid due to incompletion because of the patient's death. We performed semi-structured 30-60-minute interviews with 6 participants.

There are three observations from the interview recordings. The first point is the use process of PAI, such as "I was not familiar at first but got quickly to do it, and it was convenient", "I think the tool is useful", "I will put it together with the patient medical records for reference", "It is a bit inaccurate when used for unfamiliar patients, but re-evaluating can make me think more." The second point is about reflection on their work. For example, "It reminds me of more about nursing, and maybe there are other ways of care I could provide for the patients to choose from.", "I can understand and comfort him", "I found that I could

do something more for him instead of walking away after nursing", "I began to think about when it was more appropriate to provide care for him". And there are some emotional expressions included "I think I can understand his pain and be prepared to say something to comfort him", "I think I should get his consent before I help him, and he will feel better", "I found that by carefully explaining the details of the care, he was more cooperative and thankful, and we were easier for each other", "I used to keep some questions to myself, but now I can write them down." The third point was the recognition of the differences. The participants realized that solving problems was not the same as supporting autonomy, "I think I cannot cure him, but I can comfort him", "This is a difficult problem, I cannot think of a right way, but I listened to the patient for a long time and it seemed to help".

The participants found the visual design of the PAI template to be intuitive, it helps to reduce the cognitive burden of processing information. It is important in this template to distinguish the problem-solving strategy from the strategy that supporting autonomy. We may not solve all the problems, but we can still support autonomy. It can help the caregivers to describe the problems in detail and increasing empathy.

5. Discussion

The present study found that PAI achieved the goal of supporting patient autonomy in daily care. In any doctor-patient relationship, there is an area of shared knowledge related to daily tasks that are important to support patient autonomy. Health care professionals "shared humanity" (Taylor, 1994) to understand patients is not a secure or stable knowledge. Imagination is inspiring for caregivers, helping them to think more about daily details for deeper their understanding and helping facilitate doctor-patient communication. PAI enhances the explanatory power and makes the intervention of problems or phenomena easier.

The evaluation in the PAI template is an estimation of the patient's autonomy. It can be repeatedly used for analyzing particular problems. And we should use it with the conventional elderly assessment scale and other autonomy measures such as PAQ, ADL, and PPSv2, etc. The PAI template can be digitized so that it can be integrated into medical systems to facilitate the management of the patient's knowledge. We could also adapt the PAI for patients with other disabilities such as pediatric patients.

PAI can help balance the beneficence and patient autonomy, which is essential for supporting patient autonomy. Acting beneficence is more complicated than just doing what the patient wants to do. PAI allows the perception of nonverbal cues (Scott, 1997) and pays full attention to the patient. It can suggest the timing and method of serving patients in considering the actual situation. In western countries, people tend to send elderly patients to nursing centers, while in China, patients are usually cared for by family members. The

culture of care is different. As our participants are all Chinese, PAI needs to be further tested in a different cultural context.

6. Conclusion

The PAI presented in this paper converts specific problems and event elements into patient autonomy knowledge. The patient real-life narrative becomes the core for analysing their autonomy, which leads to more appropriate and relevant intervention recommendations. According to the qualitative evaluations, the PAI can trigger the imagination and empathy of the caregiver and made them correct details of their work. Insight into the details of the problem helps caregivers understand the knowledge of the patient's condition and feelings. The PAI template provides a visualization tool for supporting patient autonomy, which is essential for patient-centred palliative medical services. As we know that cultural differences have a great impact on patient care, we will expand the scope of caregivers and explore the effect of PAI on patient autonomy support in different cultural environments in the future.

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Acknowledgments: This research is supported by China Scholarship Council and Postgraduate Research & Practice Innovation Program of Jiangsu Province (KYCX19_1845). Thanks to QELCA Jiangsu training group for cooperation, and the participants for their work.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Performativity as a language of sense-making for cultural service design in local museums

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Abstract | The local museum in the future will not only be a space to display the local culture and history, but also strive to serve as a shared place connects communities and their memories. As a promising channel for social cohesion, cultural services in museums create value through triggering social dialogue, open participation, as well as fostering relationship-building and leading users' sense-making. To create immersive experiences where visitors are both audience and performer, performance theory was introduced in this research to propose the concept of "performative cultural service". This paper, after a comprehensive review of performance studies, summarizes the performative strategies for sense-making as well as its mechanism of creating impact, to explore the possibility of achieving performativity in cultural service design. After a comparative analysis on the structure of service and performance, this research presents an initial design framework and corresponding design strategies in the context of the local museum.

KEYWORDS | PERFORMATIVE CULTURAL SERVICE, SERVICE DESIGN, LOCAL MUSEUM, SENSE-MAKING, PERFORMATIVITY, CULTURAL SERVICE, SOCIAL COHESION

1. Introduction

Nowadays, museums are shifting from a site of authority to a site of mutuality to respond to challenges posed by postmodernism and post-colonialism, through becoming more democratic and inclusive of contemporary social diversity (Soares et al., 2018; Hooper-Greenhill, 2000). Museums take toward issues of democracy and empowerment through redefining the relationship with their audiences and presenting both side opinions and interpretations (Hooper-Greenhill 2000; Wood 2010). In this context, the local museum is playing a pivotal role in connecting the community around them, not only as a carrier of shared memory, but also as a shared space for the exercise of community power(Ocampo & Lersch 2013).

As the overall social change and, therefore, the imperative in creating new opportunities for community engagement (Wood, 2010), museums social responsibilities are underlined (Sandell, 2003). Museum phenomenon, which must also be understood as a process, phenomenon, flow, or event (Scheiner, 2017), should control the representation of a community and its highest values and truths (Duncan, 1995). Different from the traditional museum, where is never the direct expression of life or reality itself and where the visitor is never in a relationship of direct and unmediated contact with the selected material artifact, Ocampo and Lersch (2013) argued that the community museums imply creativity. Visitors may not accept given solutions, but instead seeks to invent new ways of addressing challenges. Thus, the local museum could serve as a tool for constructing collective subjects to build a joint interpretation of their reality and their history for the generation of awareness.

Cultural services are sense-making activities that allow for open participation, dialogue triggering, and relationship building, which could be a strategic approach in leading and fostering social cohesion and museum inclusion(Shu& Lupo, 2020). The strategic importance that these services, for strengthening the cultural heritage enhancement actions, has long been the focus of the Italian Ministry's attention, according to guidelines issued in 2009 on the activation and assignment of services to the public in Italian cultural institutes (circular + annex of the General Secretariat No. 49 of March 23, 2009). Cultural services, as foreseen by the art. 115 of the Code, can be managed directly or indirectly. The General Direction for the Promotion of Cultural Heritage also provides for the preparation of tender bids to be used by the peripheral Institutes of the Ministry, when a tender procedure must be issued for the management of services to the public in concession to third parties.

Services have been widely associated with theatre and experience economy, that every business is seen as a stage with scripts, front-end service personnel as actors, and service encounter as a performance (Grove& Fisk,1992). Pine and Gillmore (1999) argue that staged experiences fulfill a larger subset of customer needs, therefore valued higher by customers than manufactured goods or extracted raw materials. Rifkin (Rifkin 2001) further argues that culture itself is being pulled into the commercial sphere in this experience economy. Many

cultural undertakings are dedicated to the creation and reproduction of certain special psychological experiences (Toffler,1970), that in almost all developed high-tech societies, the art-based 'experience industry' is undergoing significant development for mass entertainment, education, etc.

As an interactive and intuitive language, performance could coordinate all the elements systematically, from the physical environment to human senses, from the narrative to emotional resonance, to achieve an optimized and impactive experience. In this paper, performativity is introduced as a sensitive language to design cultural service experiences in museums. After a comprehensive review of performance and its mechanism in sense-making and impact-creating, this research explores the possibility of achieving performativity in cultural service design. This research presents an initial design framework and corresponding design strategies in the local museum's context through analyzing cases. All these results have been tested in a design workshop for the Wuxi Museum at Jiangnan University, 2020.

2. The mechanism of performance in sense-making and impact-creating

Sense-making, as defined by Kolko(2010), is “an action-oriented process that people automatically go through in order to integrate experiences into their understanding of the world around them”. It is an active concept, as meaning generates from social interaction and enactive experience that matter to the subject (Jaegher& Paolo,2007) . As Freire(1982) states that, man is a subject because he is a being of relations, capable of reflection, of critical thought, of historical awareness; a being who can choose, create and transform reality; a being cannot renounce without becoming a mere spectator of event, a passive receptor, an object. While performativity could be shared language for participation, presenting and representation, demonstration, and even for prototyping or negotiation.

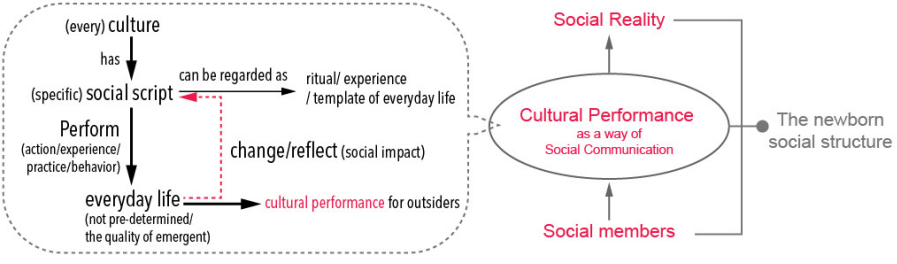

Figure 1. Cultural performance and its function on social communication imply its potential in enhancing public participation during positive social change.

In *The presentation of self in everyday life*, Goffman(1978) metaphorized everyday life behavior into the performance that people present themselves to leave a desired impression on others. Even people follow culturally specified social scripts, according to Bauman(Bauman 1984), performance has a quality of reflexivity in the social-psychological sense, as it can provide a situation that enables one to enter the other's attitude and experience and start to look at itself from other's perspective. By raising the level of consciousness, cultural performance with reflexivity could facilitate social identity achievement in any social context. Furthermore, social reality can be constructed and communicated among social members through social communication (Phillipson, 1972), from which interactive and resilient social structures are born out(Singer, 1955). Therefore, cultural performance and its social functions imply its potential in enhancing public participation during positive social change (Figure 1).

One of the most basic common characteristics among cultural performance is what was called" the shift in the frame of experience"(Bauman, 1984). We could transform ordinary or extraordinary experiences into meaningful signs and messages, through which groups can stage, display, and explain social experiences (Bakhtin 1968). However, as stated by Colebrook(2002), art may well have meanings or messages, but what makes it art is not content but its affect, the sensible force or style through which it produces content. While affect is a sensation produced in an encounter between body and event, and refers to emotional, often automatic, embodied responses that occur in relation to something else – be it object of observation, recall of a memory or practical activity(Thrift, 2007). Connect with visual art, Bennett (2005) argues that affect produces real-time somatic experience outside the frame of representation, but a diversity of encounters, processes and experiences that extend the relationships over time and in different, frequently unusual spaces. Affect, for Kim and Bianco (2007), is connected both to a capacity for action and to a sense of aliveness, where it is that vitality that prompts a person's desire to connect and engage (perhaps with others or ideas). Jaegher and Paolo(2007) defined participatory sense-making as:

> "the coordination of intentional activity in interaction, whereby individual sense-making processes are affected, and new domains of social sense-making can be generated that were not available to each individual on her own." (Jaegher& Paolo, 2007, p.497)

In this definition, it is indicated that what undermines the sense-making is not the lack of expressiveness, but the ongoing engagement that has been unhinged. So she introduced the concept "coordination", like patterned behaviour such as synchronization, mirroring, anticipation, imitation, to connect temporal aspects of interaction and their consequences for joint and individual sense-making. Meanwhile, in *The Structure and Deconstruction of Drama*, Sun(2016) proposed five types of aesthetic psychology that could improve sense-making and impact-creating with audiences' participation, that is Internal imitation, empathy, aesthetic distance, users' imagination and creation, Psychological time and space.

While critically viewed through the lens of design, sense-making is a motivated, continuous effort to understand connections, in order to anticipate users' trajectories and act effectively. (Klein et al., 2006). If people behave according to social scripts, we may succeed in codifying the environment(Van Doorn, 2007) or services to support visitors in carrying out these scripts and performing their daily life, or to lead them to a more extraordinary performative experience.

3. Performativity in cultural service

Performativity is a language which functions as a form of social action and has the effect of change(Cavanaugh 2015). The concept was first defined by philosopher of language John L. Austin(1975) as the capacity of speech and communication to act or to consummate an action.

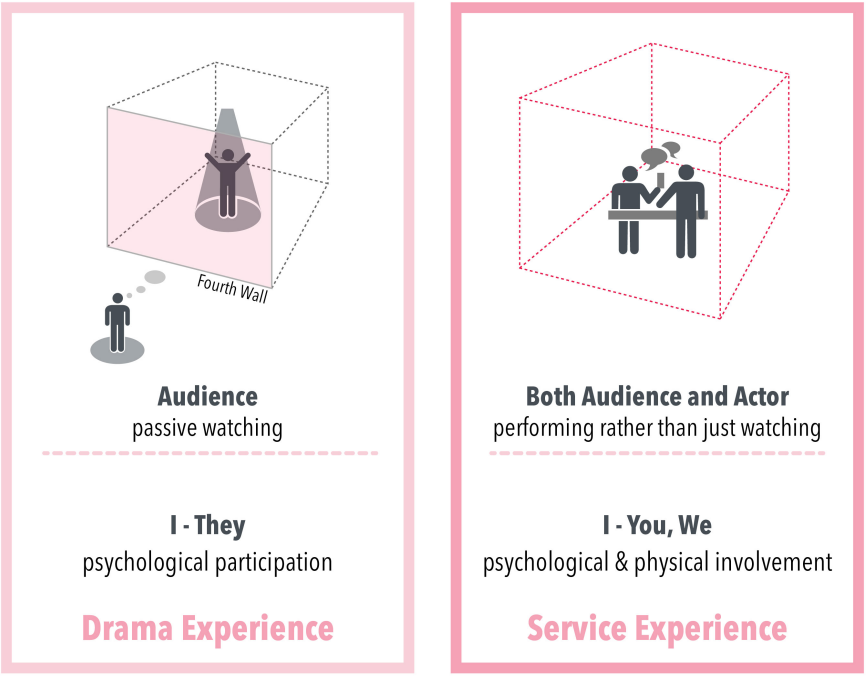

Figure 2. The theatre and the service represent two different modes of space and dynamics in the experience industry.

Performativity works through cultivating or guide the subject's sensitive richness, which includes not only the five senses like eyes, but also the so-called spiritual senses, practical senses and the senses of humanity (Sun 2016).If regard cultural services in museum as sense-making activities, performativity is to magnify the sensitivity of visitors to understand through interactive narratives, or to make visitors a witness to the historical process, or to encounter themselves through being one part of the story.

Service and performance are closely linked, and services themselves have been widely described as "performances". The metaphor that behavior is drama(Grove& Fisk,1992) engenders a framework for describing, understanding, and communicating about services experiences(e.g. rehearsal, scripts and routines, backstage, costuming, etc.) However, the theater and the service represent two different spatial and dynamic modes in the experience industry (Figure 2). The theater space is divided strictly into two parts, that actors perform on the stage while audiences sit quietly in the auditorium. While, many services' environment is more inclusive, where service providers and users could interact with each other. The difference between theater and service is whether there is a "fourth wall" (Sun 2006), an invisible wall of a set through which the audience sees the play's action. Thus, besides the psychological participation in drama, users in a service could also conduct physical involvement in a realistic environment by reacting, responding, and co-creating to change or influence the experience.



Figure 3. Dialogue in the Dark provides immersive experiences where visitors are guided by blind guides in absolute darkness.

For example, Dialogue in the Dark (Figure 3) is one of the world's most exciting life-changing experiences, where blind guides guide visitors in absolute darkness. Visitors are pushed out of their comfort zone into a world without pictures to experience daily life environments like enjoying a walk in the park, taking a boat cruise, or visiting a café in specially designed darkened rooms. A role reversal is created in these experiences whereby the sighted becomes blind, and the blind gain sight. Thus, Dialogue in the Dark could provoke empathy and advance social inclusion to the blind.

As a language for communication, exploration, and prototyping, performativity could also enhance collective sensitivity by valuing each participant's creativity and imagination. For example, 100 in 1 day is a creative activity initiated in major cities worldwide, encouraging people to spend 100 days thinking about the social problems around them, and perform their solutions together on the same day, to trigger social dialogue. Figure 4 shows the practices in Hongkong, 2016. A residents' innovative actions against the prohibition of bicycles on roads have triggered the public's reflection on the question of "who should be the user of roads."



Figure 4. A residents' innovative actions against the prohibition of bicycles on roads in Hongkong, 2016 have triggered the public's reflection on the question of "who should be the user of roads."

In a series of exhibitions Sensitive Environment designed by Studio Azzurro, different languages and digital narratives are integrated to involve the viewer in a story of images and sensations. Stories will be activated and "live" again when visitors get in touch with the characters on the screen, making himself the bearer of that story and its message. In this case, the viewers' interaction is an indispensable component for this artwork, and the viewer will activate his or her own as an echo through the encounter. Visitors' interactions are combined with digital content to achieve multiple narratives, associations, and meanings.

4. Design strategies for performative cultural service for local museum

Performative cultural service doesn't change social reality directly but isolates a space (situated context) for visitors to encounter, involve, explore, negotiate, collaborate, or even try an alternative(engaging in a process). After that, visitors back to the reality may gain a new perspective or inspirations to reflect society reality (echo) and be proactive for potential social change. The performative experience is co-created, where designers create a context to support visitors' own sense-making and provide different storylines or possibilities for visitors to explore, while visitors interact with narrative to create their personal experience and story. Therefore, we could divide performative cultural service experience into three stages: Context, Process and Echo (Figure 5).

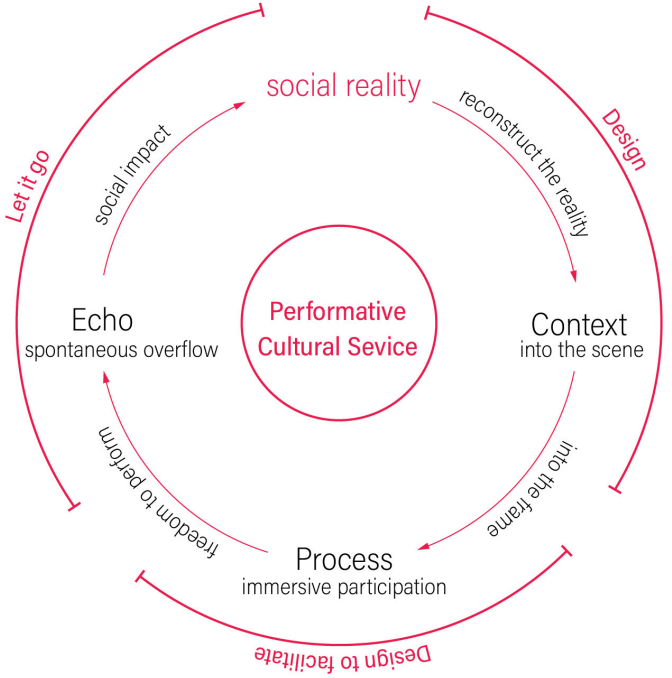

Figure 5. Performative cultural service experience could be divided into three stages: Context, Process and Echo.

According to the case study and literature review, this paper proposed a theoretical framework for enhancing the performativity of cultural service (Figure 6). After analysis relevant cases with these three stages, more detailed factors and potential strategies for

design intervention are identified in each stage. After that, the framework and strategies have been reframed into a set of toolkit for relevant design practices, which has been tested in a two-day design workshop for the Wuxi Museum in 2020 at Jiangnan University, China.

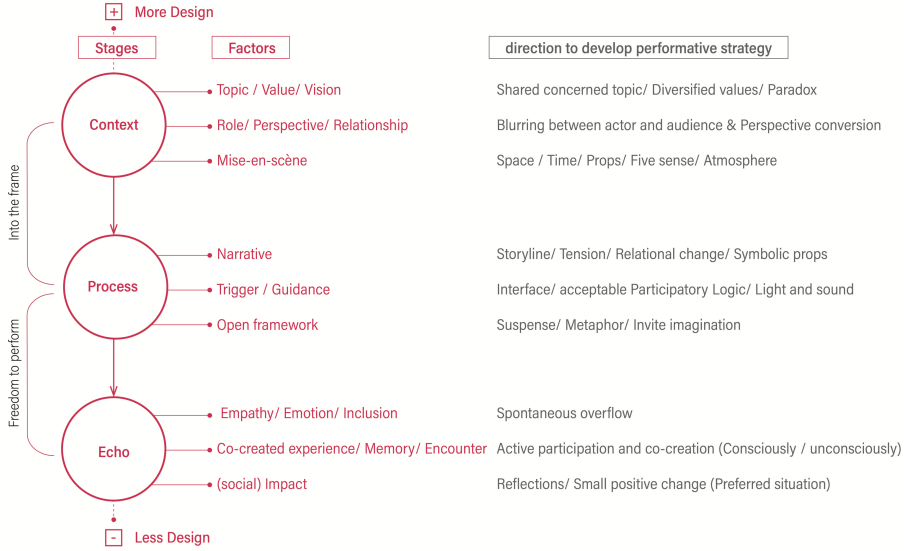

Figure 6. An initial meta-design framework indicating different stages and factors of performative cultural service experience.

- Context: Context serves as the base of the performative interpretation, including topic, role and perspective presetting, and Mise-en-scène. Local museums could select shared concerned issues as the topic and reconstruct them into situated context. In the stage Context, visitors' role and perspective will also be preset, which could be the basis of narratives. With the same scene but with different roles or perspectives highlighted, a drama would achieve different effects, focuses, and interpretations. For example, visitors consciously take the role of the blind before the experience of Dialogue in the Dark to obtain others' perspectives. That is a perspective conversion technique "from the third to the first perspective." Meanwhile, Mise-en-scène like settings, time and space, and atmosphere could lead users into the scene and prepare for an immersive experience. In this stage, the designer is a context-provider who creates a context that supports story-making. A situated context is essential for leaving a memorable experience in the minds of those who visit it.
- Process: The storyline slowly unfolds in the second stage, leading visitors to reveal the immersive narrative with guidance and triggers gradually. Technology could empower the visitors in narrative, activate the visitors as one part of the

history or a witness of a process, lead or provoke visitor's exploratory behavior in revealing the storyline with hints and instructions, as well as personalize the story with user's interaction. In this stage, the design focus is to reconcile "narrative" and "interactive", that is, the contradiction between the linearity of reconciling narrative and the nonlinearity of participants. Narrative is the product of top-down planning by designers, and interactivity requires users' input and contribution from the bottom up. To achieve well-designed interactive narratives, a balance is required between the freedom to interact when we perform and the structure that is imposed on us by our environment to create natural and memorable experiences. Thus, an open framework is indispensable for inviting visitors' own interpretation and imagination. As sense is co-produced by designers and visitors in this stage, designers could never control the whole process, but facilitate visitors' participation and optimize the balance through iteration.

- Echo: Echo refers to visitors' internal participation before fully detached from the experience, as well as their following active behaviors that respond these experience. The first two layers can be designed in advance, while the relation, reflection, emotion or other impact in stage layer is improvise, which cannot be designed but facilitated. As a successful performance is co-created by designer and visitor, the emotion and the "performance" of audience is spontaneous overflow, that designers cannot design or control , but facilitate the process and let it go.

5. Conclusion

This interdisciplinary research explores the complexity of service design by investigating performativity as a language of service encounter and addressing social issues like social cohesion in the context of local museums. Through interpreting cultural service experience as a sense-making activity, this paper is committed to breaking pre-established methods for service design like user journey and touchpoints and proposing a theoretical framework for designing performative cultural service and the directions to develop relevant design strategies. All these results have been tested during a design workshop in Jiangnan University, Wuxi, China. This paper presents a reflection of the role and the future of local museums in the digital age.

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Acknowledgements: I would like to express my deep and sincere gratitude to my supervisor Professor Eleonora for her continuous support and invaluable guidance throughout this research and my PhD study.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Solid perspectives and optical corrections of spaces in graphic & architectural design

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Abstract | Since the coding of perspective, there are many design solutions where "solid perspectives" and "optical corrections" are used to correct visual perception of spaces. Some applications are in urban areas, such as Piazza del Campidoglio by Michelangelo (1538) or Piazza San Pietro by Bernini (1629-57), others are in courtyards or small outdoor spaces, such as the Perspective Gallery of Palazzo Spada by Borromini (1652-53), and in theatrical scenic spaces, like the Olimpic Theatre in Vicenza by Palladio (1580-85). Today "solid perspectives" and "optical corrections" of spaces are used in "graphic & architectural design", where "Projection Design", "Exhibit Design" and "Graphic Design" also converge. This paper makes us reflect on the possible future developments of "solidperspectives" and "optical corrections" of spaces, and it assesses whether they will be limited to the field of ephemeral design or will also be part of more lasting solutions over time.

KEYWORDS | GRAPHIC DESIGN, ARCHITECTURAL DESIGN, ANAMORPHOSIS, PERSPECTIVE

1. Introduction

“Solid perspectives" and "optical corrections" of spaces are applied to architecture (Clemente, de Rubertis, 2001), sculpture and painting, and can be distinguished in two different groups: "solid perspectives" are obtained using the principle of vanishing line to correct urban spaces or architectural façade profiles, and they "speed up" or "slow down" effects of natural perspective; "optical corrections" refer to compensation of visual errors, through use of corrective methods closely connected with geometric optics and with physiology of human ocular system, including among these "anamorphosis".

"Accelerated perspective" is used to configure a space where, with respect to the observer's position, sides of the elements that make up the space are convergent with respect to the center of perspective framework. The space appears less deep than it is in reality. Anamorphosis is a distorted projection or perspective, requiring the viewer to occupy a specific vantage point: the space or the image are not recognizable if the observer is not standing in the right vantage point.

These methods, especially in urban field, have been used, since ancient times, to modify perception of spatial extensions in urban spaces. Purpose was, materialized in baroque urban concepts, to exploit the artifice to emphasize some scenic and expressive effects.

In fact, were studied spaces composition and their representation in function of the observer, especially in cases where figurative spatial needs were considered of greater importance than functional ones.

Ways and methods with which illusory perspective and optical corrections can transform spaces, flanked by new technological solutions, are nowadays often adopted for temporary interventions or installations. They have the same purpose as in the past: not rational, but perceptive recomposition of the urban space induces, in the observer's mood, a feeling of astonishment.
There are many design variations, and fields of application start from advertising, to get to media one, to public events field or they have purely expressive purposes.

2. Use of optical illusions in the past

Use of "solid perspectives" and "optical corrections" has already been expertly used by the Greeks.

Restricting historical field of investigation starting from the 15th century, it is interesting to observe how they are used at different scales: in squares and urban developments, in architectural elements, in decorations and in facade buildings feature.

Among urban developments, some interventions are relevant such as Piazza Pio II in Pienza, Piazza del Campidoglio and Piazza San Pietro in Rome.

Piazza Pio II is part of an urban project planned in 1459 and entrusted to Bernardo Rossellino, Leon Battista Alberti's disciple at the behest of Pope Pius II.

The small square, seen from city hall portico, is in "anti-perspective". Square's shape is trapezoidal, whose sides diverge towards the facade of the Duomo. In this way it is perceptually regularized square's shape, which is perceived as a wide and short rectangle and not as a trapeze. On the other hand, when the observer leaves the Duomo, it appears deeper with an "accelerated perspective".

Michelangelo Buonarroti used the same trick for Piazza del Campidoglio in Rome in 1538. The square is trapezoidal with larger base located on Palazzo Senatorio. This generates a "slowed perspective", compared to the point of view from the staircase that leads to the square, and Palazzo Senatorio appears closer. Such geometry transforms into a regular space the 80° angle existing between Palazzo Senatorio and Palazzo dei Conservatori, whose position is required by existing hill's shape.

In San Pietro's square Bernini (1629-1657) had to solve a visual problem: the Basilica was disproportionate, and the dome had lost its ancient central position. The construction of the new colonnade and the square had to necessarily move away the point of view, to allow a perception of the dome in its entirety (which is no longer visible today due to the construction of the Maderno's facade). Bernini uses a "slowed perspective", through the creation of a trapezoidal space perceived as rectangular.

Solutions adopted by Michelangelo for Piazza del Campidoglio and by Bernini for Piazza San Pietro were effective: this is demonstrated by printed lithographic images and by landscape painters, who represent "trapezoidal" spaces of the two squares as "rectangular", and they do not represent deformations that are present in reality.

Although it is not a real urban space, it must be mentioned the Perspective Gallery of Palazzo Spada by Borromini, who in 1635 created an "accelerated perspective". Thanks to converging sides of space and converging floors and vault's plan, he is able to compress an illusory space of about 35 m in a space of 8.82 m long. Arches and columns that surround the Gallery, at the entrance are 4.10 meters high and the vaults are 2.95 meters wide. At the end of the tunnel they reach a height of 2.45 meters high and a width of 1 meter. Illusion is possible because the plans converge in a single vanishing point; thus, while the ceiling descends from top to bottom, mosaic floor rises.

Among buildings decorations there are both "accelerated perspective" in architectural elements or parts realization (such as portals, windows or fake windows), and "anamorphosis", which often replaces elements that are not made due to lack of space or due to financial shortcomings. Some examples are Santo Spirito's portal by Bernini in 1664, Palazzo Barberini's windows (1625-1633) and Palazzo Doria Pamphili's windows (1644-1650) in Piazza Navona.

If solid perspective is often used in urban contexts, anamorphosis is an expedient often used indoors (a significant example of "anamorphosis" is visible in the fake dome of Sant'Ignazio of Loyola's church, built by Andrea Pozzo in 1685). In urban spaces, its use is limited to architectural elements on facades of buildings, often in version of "solid anamorphosis" (Figure 1).



Figure 1. Example of solid anamorphosis in a portal located in Pézenas, France. The building placed along a narrow and uphill road; it is perceived in its entirety only from a main observation point. Thanks to anamorphic deformation of edges, the portal can be perceived in the "correct" proportions. Images from web (Pinterest).

3. Solid Perspective and optical corrections in “graphic & architectural design”

Urban scene today is made up of existing buildings, and to improve architectural space’s quality, whether in urban regeneration or in artistic performances, graphic and exhibit design are used to improve and change spaces perception. Built space is transformed into a

set-up space and "illusory" effect of exhibits, based on same principles theorized in Renaissance and Baroque period, is also evolving thanks to new possibilities offered by technological evolution. In this way are configured so-called “Augmeted Space” or “Spatial Augmented Reality” (Maniello, 2018), which define a new type of public space: it arises from overlap between computer data and real space, visible in overlapping layers (Manovich, 2006). One of preconditions for the configuration of these new spaces is the continuous dialogue between real and virtual space through the development of contents.

The research investigates how it is possible to use "solid perspectives" and "optical corrections" and in which fields of application, regard from those of the past, and investigates what possible future developments will be.

In "projection design" field, "video mapping" applications, integrated with lighting systems, give rise to visual communication actions. Content information can relate to objects where video projections are made (Cultural Heritage). These forms of communication are also called "interactive light".

Main feature of "video mapping" is the close relationship between the support on which to perform the projection and information content: we often operate on buildings facades helping to define scenographic and optical distortion effects of the facade itself, thus engaging a mutual relationship between observer, space and artistic creation. As it was in the past, this solution allows to concentrate the attention of the observer on the global effect of perception.

Interesting examples are present in Rome. In via dei Fori Imperiali there are seasonal projection mapping installations which tell the story of the August’s and Caesar’s Forum with different ways of involvement.

In video projection of August’s Forum, the viewer, while he is sitting on a tribune located on the edge of the archaeological excavation, attend the story of Forum evolution and the history of Roman Empire. In the Forum of Caesar, on the other hand, the viewer moves among archaeological finds and, as he passes, video projectors, that reconstruct the history of the place, are activated. Tour ends in front of the Curia, where political decisions of the

Roman Empire were made, and "projection mapping" virtually breaks through the wall placed in front of the visitor, telling the transformations of the building over time.
Video projections overlap archaeological finds and reconstruct place's history making space's articulation and space's glory understandable to the visitor, as they were 2000 years ago.

"Projection mapping" is also used in limited periods on some facades of historic center of Rome, through artistic installations active at night, such as RoMap in September 2015 and 2016, or "Videocittà" in October 2018 and 2019. Facades are considered palettes, even if correctly mapped, where video artists release their inspiration. It is possible to add three-dimensional effect to video mapping, through stereoscopic images in the colors dominating the vision with anaglyph glasses (Figure 2).



Figure 2. Nerdworking, Solid light Festival, 2018, Basilica of Sant'Agostino in Campo Marzio, Piazza di S. Agostino, Rome. Video mapping with stereoscopic images viewable through the use of anaglyph glasses. Image by Adriana Caldarone.

Space becomes scene of a multimedia "dramaturgy" where projections are main element.

In addition to expressive content, informations content of videos are often also linked to the support: both visual and sound storytelling turns to the history and function of the building, in a unitary project of lights, audio, and architecture.

"Projection design" linked to the "projection mapping" therefore presents some

fundamental, conceptual and technical elements: conceptual aspects are linked to "storytelling" and "storyboard"; technical aspects are related to survey and 3D rendering restitution in order to know the object to be "mapped", type of video projector and its position used to "map" the object. Storytelling is a communication technique that consists of telling a story to attract the attention of a specific audience. A message is conveyed to that audience, to stimulate a certain desire in the spectators and to persuade them to perform a specific action. In few words: it's about persuading by telling a story (Scuratti, n.d.). Storytelling elements are (Nordio, n.d.):

- restrain emotions related to the story you want to tell;
- stimulate the senses to tell the story;
- put "why" at the center of history;
- create in the visitor's mind a new world or a new conception of the object being told;
- tie history to identity values;
- does not aim to convince but to involve;
- activate lateral thinking.

Storyboard provides the structure of projection mapping. It is a timeline, where individual scenes are sequenced, while providing their duration. Elements to be defined are:

- subjects in the frame, and their sequence;
- information to be transmitted (linked with storytelling);
- time between one storyboard scene and the next;
- position of the frame and if it is static or dynamic.

From a technical point of view, geometrical study and architectural survey are two essential issues in "projection mapping" design on an architectural structure. Design consists of several stages of construction and includes (Empler, 2018):

- survey of the support with direct or indirect method, where to carry out video projection. Choice of survey methodology depends on a number of factors (complexity of object to be "mapped", in terms of dimensions and details on facade). For simple objects can be used a direct method survey (it is carried out with use of traditional tools) and a photographic survey of the surface on which to project. More complex objects, such as church facade or archaeological objects, need an instrumental survey method through a 3D laser scan or a photo-modeling process. Aim of survey is to generate and control a virtual 3D model;
- generation of a measurable 3D mesh model, virtual replica that is overlap (even if scaled) to real object at the base of survey. On this 3D model it is necessary to carry out subsequent processing and transformation operations to create the performance;

- study and realization of geometric transformations, whose purpose is to make virtual 3D architectural model coincide with the real one. In this case, some principles of descriptive geometry are applied such as homotety, homography and anamorphism.

Homotety is a geometric transformation that allows a space expansion or contraction, while maintaining shape, angles and does not change relationship between them.
Having as a point of reference homotety, we continue with a homographic transformation of the object of interest, generating a second space whose points exactly correspond to those belonging to the architecture taken as a reference point. Once the animation is designed on the detected space, an adaptation of the image projected on the architectural surface takes place to correct any aberrations, the so-called "wrapping". Generated illusion consists of an image reproduced in a distorted way on the surface so that it can be perceived correctly by the observer from a main point, through the rules of anamorphism. Thanks to this methodology, architecture becomes “liquid”, mobile, it adheres as if it were a film, it deforms and detaches itself from real surface.
"Projection mapping" is a new frontier of art, technology and visual design applied to cultural heritage. It is an advanced projection technique, which transforms any type of surface into a dynamic display, transforming architecture into a new communication media. Animations, videos and light effects can communicate an advertising message, information or history of an object or environment. What you can achieve is an explosion of images, capable of totally involving the viewer. Each event is able to turn into a real mass illusion.

"Exhibit design" is another fields where we create three-dimensional installations, and where two types of solutions prevail: optical illusion through anamorphism, in a sort of "solid anamorphosis"; installations where we use "accelerated" or "slowed" perspectives, as in theatrical scenes ("solid perspective").

In the past, anamorphosis was often used in a symbolic key to spread a subliminal or hidden message (i.e., painting "The ambassadors" by Hans Holbein, where a skull in anamorphosis is visible, and communicates the inevitability of death); in the same way nowadays it is used for diffusion of a message, especially in advertising or for promotion of events.

In fact, emotion of optical illusions generates sharing and virality among users (especially on social networks), who, unknowingly, become a means and instrument of promotion and marketing of the event, an object or the artist. Examples are two exhibitions held in Paris, such as "Qui Croire?" by François Abelanet in 2011, installation of a green area in front of

Hotel de Ville in Paris (figures 3), or a 2014 installation at the City of Science and Industry of la Villette.



Figure 3. "Ephemeral garden", July 2011, Hotel de ville de Paris square. apparently it is a garden whose shape you cannot recognize. If you look at it from the main point, the garden is a globe with meridians and parallels. Images from web (artistasaturnino).

In Paris also, the Louvre Pyramid was used for two different artistic installations, one in 2016, the other in March 2019, on the occasion of the 30th anniversary celebration of the Pyramid of Pei. In the first case, a street artist has glued on one of the pyramid's facade, strips of paper with the pattern of the museum behind it. The overlap of the real and anamorphic picture, from a main point, cause, in an optical illusion, the disappearance of the pyramid (figure 4).

In the second installation, the street artist used strips of paper around the pyramid with a group of volunteers. The effect is an anamorphosis, visible from the top, that (in an illusionistic way) sinks the pyramid below the walking level (figure 5).



Figures 4. JR, Louvre Pyramid, 2016, Paris. On the left, construction's picture of the installation's construction site on pyramide facade; on the right, the overlap effect of the anamorphosis. Images from web (artribune).



Figure 5. JR, Louvre Pyramid, 2019, Paris. On the left the installation seen from a zenithal photo. On the right Anamorphosis seen from the correct visual point. (The hexagonal shape perceived from main point, is actually a polygon composed of a rectangle and a trapezoid). Images from web (artbooms).

In "Graphic Design" field, creations are mainly two-dimensional, with realizations of solid perspectives and/or anamorphosis and/or use of ambiguous figures, as in the realization of Marseille in 2013, on the Stock Exchange and Chamber of Commerce by Pierre Delavie , or anamorphoses in urban landscape created by Felice Varini or by the Madrid-based collective BoaMistura (in Saint Paul's favelas in Brazil). In Saint Paul favelas it is a real urban redevelopment thanks to the use of graphics and anamorphosis: walls were painted, with collaboration of inhabitants of neighborhoods, with brightly color tones and large letters compose words that recall positive sensations (figure. 6). The aim is to reinvigorate the

consciences of the most disadvantaged neighborhoods in São Paulo. Anamorphosis becomes both the means of transmission and the container of the message.



Figure 6. Favelas, São Paulo, *Brasil. Letters are painted through anamorphosis by the artists and locals. Images from web (disup).*

4. Conclusion

Solid perspective and optical illusions are still alive instruments thanks to modern interpretations and application fields. They are not abstract conceptions of descriptive geometry, but have a large application fields in planning and design of collective spaces. If in the past architects, artists and writers collaborated each other to study and create illusory spaces, today many more skills are integrated: designers, architects, sound designers, collectives of artists, video makers, computer scientists, street artists, performers and so on. People is often involved through active performances. Design of public spaces develop into collective moments of construction, fruition, and sharing of space. An experiment of global connection which, through perspective tools, comes to transformation, though ephemeral, of built heritage.

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Acknowledgments:

The paper is the joint result of the work of the 3 authors. Particularly:
Part 1 and 4 by Tommaso Empler
Part 2 by Alexandra Fusinetti
Part 3 by Adriana Caldarone

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Spatial construction for ideational meaning: An analysis of interior design students' multimodal projects

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Abstract | Multimodality is an inter-disciplinary approach that considers communication to be more than just language. Multimodal studies focus mostly on the analysis of two-dimensional printed, digital, and screen production. This paper explores a multimodal pedagogic approach used to teach students to create interior design projects as three-dimensional ensembles, which we reflect upon to contribute to the framework of multimodality. This qualitative research begins with a review of multimodal discourse establishing language as a system of choice, and a relationship between spatial design and language. A case-study of students' multimodal ensembles reveals how the design choices of mode, semiotic resource, modal affordance and inter-semiosis led to students producing rich and inclusive meaning, supporting a reproductive health mandate. An interpretive semiotic framework based on Hallidayan principles of Systemic-functional linguistics is developed for spatial meaning-making analysis for future projects. The findings offer a narrative metalanguage for spatial meaning-making, contributing to broader interior design discourse.

KEYWORDS | MULTIMODALITY, INTERIOR DESIGN, SYSTEMIC-FUNCTIONAL LINGUISTICS, HIV/AIDS AWARENESS, GUERRILLA MARKETING

1. Introduction

Multimodality infers that communication and representation is greater than just language, and relies on a multiplicity of modes (visual, spoken, gestural, written, three-dimensional, etc.) that people use to make meaning and to communicate with each other. Multimodal Discourse Analysis (MDA) considers how multimodal 'texts' make use of a variety of modes of communication to make meaning within the sociocultural context in which they occur. The aim of MDA is therefore to describe the socially situated semiotic resources that people draw upon for communication (Paltridge, 2012). The four key concepts that provide the basis for all MDA are: Mode, a medium of communication that is culturally shaped over time through its regular use in society; Semiotic resource, a means of meaning-making that display regularity in the way it is used; Modal affordance, what it is possible to express and represent easily with a mode, and Inter-semiosis, how modes are arranged (or designed) in a particular context (Bezemer, 2012). Understanding these concepts and their interrelationship is critical in determining how communication functions in any particular time and place, how it is produced and by whom it is produced.

The rapidly developing interest in multimodality studies reflects a shift from discipline specific to thematic structures with inter-disciplinary collaboration becoming increasingly important to address current social challenges, the democratization of knowledge, and to accommodate for emerging new forms of digital communication. Within Multimodality studies there is a stronger correlation between theory and practice with an increased focus on developing solutions to real-world problems across a range of domains, revealing a change of relationship between academia and the wider society (O'Halloran & Smith, 2011).

Currently, the majority of literature focuses on two dimensional forms of multimodal discourse with far less relating to the analysis of three-dimensional and spatial modes of communication (Forceville, 2010; O'Halloran, 2008; Stenglin, 2004), to which this study wishes to contribute. The aim of the paper is to present students' spatial design proposals that can be seen as rich meaning-making ensembles or 'texts', reflecting a set of choices made by the designers through the selection and arrangement of multiple two and three-dimensional semiotic modes, (e.g. text, sounds, colours, images, forms and texture, etc.), within a specific social context. This is done to demonstrate that three-dimensional spatial design (as an interior design practise) can contribute towards multimodality theory. We developed a 'matrix of choice' analytical framework based on the Hallidayan principles of functional linguistics. This framework is used to analyse how meaning is made in these spatial modes of communication, designed to raise awareness about HIV, and related social problems.

In this paper, we firstly present an overview of multimodal literature to theoretically position the study. We then present a background to a multimodal pedagogical approach used for the student project, purpose and objectives. Thereafter, we describe the research design and methods developed for analysing the described data, followed by an analysis of selected student's proposals using an interpretive Systemic-functional linguistic (SFL) framework to

describe how the meaning is made in the student's multimodal ensembles. We conclude with a discussion on the implication for multimodality discourse and its impact on Interior Design studies.

2. Multimodality as the theoretical positioning of the study

Multimodality, Multimodal Semiotics and Multimodal Discourse Analysis (MDA) are terms used to describe the interdisciplinary approach to the study of language that extends the concept of language beyond the written and spoken word, to include images, symbols, gesture, action, music and sound (Cope & Kalantzis, 2009; Jacobs, 2007; New London Group, 1996; O'Halloran, 2008). These terms are used to describe the study of any form of communication (media, mode, semiotic resources) other than the perceived dominant forms of written and spoken language (Bezemer, 2012). Multimodality theory draws on a social semiotic approach to language, to deliberate how multiple modes of communication in the form of 'texts' are used to make meaning (Bazalgette & Buckingham, 2013; Jewitt, et al., 2016; Kress, 2011). Kress (2011, p.36) explains

> "…texts, of whatever kind, are the result of the semiotic work of design, and of processes of composition and production. They result in ensembles composed of different modes, resting on the agentive semiotic work of the maker of such texts"

Whom the author is and how the author uses multimodal forms of communication is a key concern of MDA. It is stated that:

> "…people use semiotic resources both to produce communicative artefacts and events and to interpret them ... in the context of specific social situations and practices" (Van Leeuween in O'Halloran, n.d., p.2).

According to Jewitt (2009) multimodality theory is formulated upon the following four assumptions:

- Representation and communication always draws on a variety of modes, all of which equally contribute towards meaning-making;
- Each mode of communication realizes different meanings;
- People orchestrate meaning through their selection and configuration of modes;
- Semiotic resources are shaped and refined over time by the social conventions specific to the genre, context and time.

Michael O'Toole, who pioneered the development of analytical semiotic models for application in MDA, based his analytical framework on Halliday's theory of SFL, notably *paradigmatic dimension* and *metafunctional dimension*. The principle of *paradigmatic dimension* implies that the user has choice for meaning-making and selects from available options within the environment (Halliday, 2003). Halliday's three metafunctions of language are described as:

- *Ideational* or *experiential* function, relating to the need for people to make sense about the world around them and within;
- *Interpersonal* function for creating and maintaining relationships;
- *Textual or compositional function*, which acts on how the other two modes are arranged to create a coherent flow of discourse.

3. Background to the student project, the brief objectives and modal influences

This annual student project forms part of a larger Curriculum-integration strategy developed by the Higher Education HIV/AIDS Programme (HEAIDS) in South Africa. The HEAIDS was established as a

> "…dedicated national facility to develop and support the HIV mitigation programmes at South Africa's public Higher Educational Institutions" (HEAIDS, 2012, p.2).

This sexual reproductive health initiative is driven by government policy in response to the alarmingly high rate of HIV/AIDS infections in the region (UNAIDS 2019) and was implemented because "the age group most affected by the pandemic regrettably feed into the workplace and institutions of higher education" (Gobind & Ukpere, 2014, p.355; Shefer, et al., 2012). The University's Interior Design department's students regularly participate in this programme, in collaboration with the Institutional Office for HIV & AIDS (IOHA) whose officers are responsible for conducting workshops and educating students about reproductive health and wellness.

The brief outlined the project's objectives of designing a multimodal spatial intervention that could promote HIV/AIDS awareness, lead the viewer to the various IOHA offices and services, and disseminate information. The specific design requirements required the students to: identify and analyse a suitable location on campus, create an original slogan/message for the appropriate target market (staff and students) using their own popular voices.

The students were encouraged to incorporate into their projects[1] visual and spatial modes of communication used in related, art, design and marketing disciplines namely: exhibition-stand design, installation art, and guerrilla marketing (GM). Some of the similarities between these modes of meaning-making is that they use multi-modalities to stun, attract and engage the viewer, make use of popular and positive catchy message and encourage consumers to disperse the message. They require high levels of creativity (Hutter &

[1] All work produced by students as part of normal coursework remains the property of the university and therefore permission to use it for academic or marketing purposes is not required.

Hoffman, 2014), imagination and innovation in order to effectively engage consumers (Nufer, 2013) or viewers at a personal and memorable level; make use of the environment and its physical surfaces to convey messages (Gambetti, 2010); are usually temporary installations, and are defined by their ambient conditions.

This strategy adopted for the project brief was intended to produce an outcome that was meant to produce more than just a prototype of a multimodal awareness campaign or to tell a story. The intention here was to get deeper insight into the students' understanding of the pandemic and related social ramifications, allowing them to express themselves, and communicate in ways that might otherwise be inhibited when using more traditional linguistic methods.

The project was conducted in collaboration with IOHA who first workshopped HIV/AIDS-related themes with students and consulted with students during the development of their proposals. For final submission students submitted both two-dimensional documentation, and a three-dimensional scale model of the proposed intervention shown in relation to the existing building structure.

4. The research design and methods

This qualitative research design is ontologically interpretive and epistemologically subjective, falling within the constructivist paradigm. The authors present their research bias being facilitators of the student project over several years.

Firstly an initial review of literature is conducted to situate the study within the field of multimodality, and to establish the relationship between spatial design and language. We explore the Hallidayan principles of SFL. These include a) *paradigmatic dimension*, (meaning is choice), elaborated upon in the literature review, and b) *metafunctional dimension*, (ideational, interpersonal and textual/compositional). Halliday's SFL, is an approach to linguistics that considers language as a social semiotic system (Paltridge, 2012). A case study approach is taken to analyse a selection of student's proposals according to an analytical framework developed on Halliday's metafunctions of language.

4.1 Data and delimitations

The data analysed includes the scale models, plans and sections of two selected design proposals resulting from the student project (explained to be based on the reproductive health programme). These samples were selected as they successfully illustrated the learning outcomes of the project, and used multiple visual modes of communication. The primary data comprises of photographs of students' three-dimensional scale models (taken by the authors) that represent the existing location and its structural constraints, as well as their proposed installation.

The data included an architectural type floor plan and cross-section, indicating circulation, dimensions and structural components. The data is referred to as proposal 1 and proposal 2. We acknowledge that two-dimensional photos of three-dimensional models are only representations of a proposed spatial intervention. The photographs are taken from a fixed view point, in some cases students digitally superimposed an image of the model into an image of the existing building to create the illusion of a full-size installation.

5. Analysis of student projects

On completion of numerous iterations of this project over several years it became apparent that there was a need to develop a more substantial analytical framework, and language that could be used to analyse and describe how the design choices made by the students regarding the selection and arrangement of visual and spatial modes was used to make meaning. The development of a SFL framework could provide a useful aid for future teaching and learning, development of briefs and associated learning outcomes, and evaluation of projects in the interior design studio.

For this we borrowed heavily from O'Toole's analytical semiotic models for application in MDA. O'Toole used the principles of SFL to develop an empirical method for the analysis of various modes of visual meaning-making bringing a "fresh and theoretically powerful social semiotic perspective of systemic functional theory" (O'Halloran & Smith, 2011, p. 5) that could be applied across a wide range of disciplines. Acknowledging that each "domain has its own expertise, and registerial conventions of theory and practice for research and discoursing" (O'Halloran & Smith, 2011, p.5), this approach may be more accessible, and has universal application. O'Toole initially applied this analytical tool to painting and later adapted it for analysing other art forms such as, architecture and sculpture (2011). A further example of its application and development can be seen in O'Halloran (2008) for digitally produced graphics and video screen productions, and Riley (2012) for Fine Art drawings. Formulated on these principles we attempt to develop an analytical framework that can be used to analyse how meaning is made in the students' multimodal proposals. This analytical tool allows one to itemize a multimodal ensemble into smaller components and then describe each according to Haliday's three metafunctions of language, *ideational, interpersonal* and *compositional*.

Our developmental framework and two examples of its application are presented below.

Table 1. This table presents a matrix of choice analytical framework where the Ideational function relates to the designer's understanding of what HIV prevention is in this social context. The Interpersonal function is indicative of the designer's stance and attitude towards HIV prevention and the mood with which it is conveyed to the viewer. The Compositional (or textual) function deals with the arrangement of available visual and spatial devises, or inter-semiosis, by which means the other two functions are realised.

Design Component	Function		
	Ideational	**Interpersonal**	**Compositional**
Textual message	Statistical Factual Thematic General / Targeted Sexual Medical Social Cultural	Intriguing Intimidating Imaginative Speculative Reflective Commanding Questioning Warning Provoking Playful	Size Colour Placement Position Repetition Typography Emphasis Word composition Rhyming Tone
Spatial structure	Location Contextual integration Placement Access Formal - ordered Casual - creative	Visual metaphor Thematic Narrative Scenographic Didactic Degree of transformation Surprising	Materiality Colours + textures Dimensionality Organic / Geometric Layout Circulation Containment Shapes + forms
Additional media	Realistic / Abstract Figurative Metaphoric Numeric Illustrative	Symbolic Conceptual Suggestive Descriptive Narrative Hyperbolic	Emphasis Multi-modal mix - 2D or 3D media Repetition Directionality Placement + size Colour
Intended user engagement	Participation or observation Imposed / Voluntary General / Targeted	Level of complexity Cooperative Competitive Physical/Emotional/Cognitive Supplementary / Essential	Diffusion Physical / Virtual Analogue / Digital Degree of interaction Privacy Proximity

To create a sequential approach for the analysis of the multimodal design proposals it became necessary to sub-divide the ensembles into smaller design components as listed in the first column in Table 1. It is important to understand that the matrix of choice analytical framework is systemic in nature. This means that the ranges of available choices do not only allow meanings to be negotiated within a single function or restricted to only one component of the multimodal ensemble, but "…allow for the negotiation of meanings

through all functions at all levels", (Riley, 2012, p.5) . As in any form of multimodal 'text', all these functions operate simultaneously.



Figure 1. Proposal 1 - "Stomp out HIV" courtesy Rosetta Mpufo, 2018, © University of Johannesburg. Photograph (by author) of a scale model of a multimodal spatial intervention (colour), placed in relation to an existing building structure (white).

Many student's conceptual starting point is a slogan, as appears in this case. The target is *general* and the message is *commanding* in its appeal to eliminate HIV. The text is integrated into the structure in two components. 'Stomp out' appears as flat cut-out letters attached to the underside of the sole accentuating the action it describes. All the text is emphasised through *colour*, and *placement*, the additional enlarged *size* and three-dimensionality of the letters HIV, make it the focal point, and the topic obvious. The use of irregular and distorted fonts is intended to be reminiscent of a horror movie poster. The implied meaning is that HIV is something evil and needs to be eliminated or 'squashed like a bug' under the sole of one's shoe. The informal *typographical* solution of the text makes it appear less authoritarian to resonate with the target. The IOHA and university logos (as required) are integrated through *size and placement* with reduced significance, giving it institutional endorsement.

This spatial structure's *location* is an empty entrance foyer space through which most users of the building will have to *circulate.* The central prominent placement will require

pedestrians to walk around the structure, creating forced engagement. The scale is intimidating and indicative of the extent of the problem. The blackness of the sole and exaggerated tread, as on an industrial boot, is both serious and heavy, as is the topic, and articulates the gravity with which it needs to be dealt. The vertical dimension (approx. 3 meters) restricted by the ceiling height creates visibility from a distance, and adds *hyperbolic* meaning to the magnitude of the effort that is required to eliminate HIV. However the 'message' may not be so clearly read from all approaches. The organic black shape of the structure contrasts the monochromatic geometric interior in which it is *contextually integrated*, adding emphasis through its contrasting form. The black glossy reflective surface of the *material* creates a sense of hard, unforgiving edginess. The reflected shape on the floor helps contain the elements and is reminiscent of a shadow of gloom, a big black cloud hanging overhead to be avoided.

There is no additional media used in this ensemble.

The inter-semiosis or composition of modes results in a *visual metaphor* in which the visual and literal meaning correspond seamlessly, creating a clear and coherent multimodal message. The user engagement is both *imposed* and *physical* due to proximity, is intentionally *intimidating* due to scale and colour and strives to create an *emotional* shared spatial experience. The overall message is meant to be uncompromising and *didactic,* demanding that the viewer participates in eliminating HIV.



Figure 2. Proposal 2 – "Don't hip hop without a drip drop" courtesy S. Jacobs, 2016, © University of Johannesburg. Photograph (by author) of a scale model of a multimodal spatial intervention, superimposed onto a visual of the existing space.

The second proposal's message uses wording that has *medical* and *cultural* references. It aims to encourage the viewer to continually do medical HIV/AIDS tests, especially if they regularly change their *sexual* partners. The message seems *playful* and resonates with a particular *culture*, evoking a sense of playfulness, made possible by the *imaginative composition of words*, which rhyme, in a popular *tone*. The *typography* used helps to reinforce the message as a *warning.*

This particular interior ramp is utilitarian, and seldom showcases any design or information, and is *located* next to busy studio environments. It is fully *integrated* into its existing surrounding *context*. This is done with the use of cuboid forms which make up the signage overhead, and 2D symbols, inserted on the wall and floor. The *access* is from two sides, and the repeated message is thus multi - *directional*. The viewer is forced to *circulate* through the space until exiting at the other side, reinforcing the message over time.

The additional media used, includes *two-dimensional* symbols used on the floor (dance routine steps) and wall planes. The first symbols (arrows and footprints) are arranged in a *directional* sequence on the floor, suggesting an experience of entertainment, and instigating feelings of playfulness for the viewer. A set of life-size *figurative* dancing shapes are placed on the wall in *repetition*. They are *suggestive* and *metaphoric* for swapping partners. The repeated female figure in red, is *symbolic* of an infected person spreading the HIV/AIDS to multiple partners. The *repeated* use of the IOHA logo imagery is intended as an official branded reference to a service, thereby *diffusing* the message.

The level of engagement in this proposed intervention is intended to be *observational* (one does not need to participate in any other way). Engagement is *imposed*, as the viewer navigates down the ramp. Engagement is *general* (not targeted to a specific group), and is meant for anyone using the ramp. The experience is *cognitive* and *physical* for the viewer who is engulfed in, and navigates a *complex* set of media.

To conclude, this section presents examples of two narrative analytical descriptions of multimodal spatial texts according to the matrix of choice framework as interpreted individually by each author to demonstrate how it might be used.

6. Results and discussion

The research findings are presented as qualitative content analysis in the form of narrative descriptions of the meanings made through the use and arrangement of multiple visual and spatial modes using the matrix of choice analytical framework presented in Table 1. The use of this table (developed from SFL principles) proved a useful tool for describing how the meaning was made in the spatial-interventions analysed above when read as multimodal 'texts'. It provides an alternative method of describing how the design of these ensembles relied on the agentive semiotic work of the student, and encouraged the use of the students' own voice in a creative and expressive manner. Based on our test case we are of the opinion

that this SFL approach can contribute significantly to how we articulate the ways in which meaning is produced. It contributes to the development of a metalanguage used for discoursing the relationship between "material codes of production" and the "production of meaning in a social system" (Drucker, 1998, p.139).

6.1 Benefit in contributing to aids awareness and IOHA's mandate

The multimodal HIV/AIDS awareness proposals produced by the students have been well received by other role players within the university who are mandated to implement the institutional policies on sexual reproductive health education and awareness. These projects are executed in close collaboration with IOHA who drive the process. IOHA often showcase these students' proposal at workshops, seminars and conferences as tangible outcomes of the curriculum integration process. They are used as effective multimodal forms of communication that: provoke dialogue, and visually convey rich original messages generated by the students themselves. They are made available to other disciplines to illustrate different perspectives, possibilities and opinions for adopting alternative strategies to addressing the same problem. They also give valuable insight into the students' response to, and understanding of the HIV awareness programme. Unfortunately very few have actually been translated in to full-size installations mostly due to financial constraints and therefore remain principally academic exercises, as the potential impact of the installations cannot be tested.

6.2 Benefit to teaching and learning in interior design

This multimodal approach can be valuable in the classroom for the development and analysis of future interior projects. It presents a new method of evaluating and discussing outcomes and contributes to developing the discourse related to spatial design. It also teaches students to design spatial interventions that are more experiential and more inclusive of diverse communities, cultures and values, as they enforce their designs with universal images, symbols and text, other than just using typical interior design elements. The success of the multimodal projects in creating meaning is highly dependent on the students' spatial cognition and technical skills in executing the project. Development of these skills is embedded in most interior programmes, however it needs to be noted that some very good initial concepts never manifest as workable spatial solutions or in acceptable presentation formats.

6.3 Broader Implications for interior design

Despite this being a first attempt at using a SFL analytical method, both authors are of the opinion that it could have broader implications for the analysis and reading of multimodal spatial design. This research presents a potential alternative method for analysing meaning-making in built interior installations even though, in this case-study it was applied to scaled models. In practise this could prove a useful approach to determine how visual language

could be implemented in interiors to create meaning, how visual language is shaped by context and culture, and furthermore, it's potential for communication.

7. Conclusion

Through the analysis of these three-dimensional and spatial multimodal proposals produced by students as part of a HIV educational programme, it was revealed that interior design has the potential to contribute to the multi-disciplinary nature of multimodality by introducing aspects of spatial design, which is currently not evident in existing literature.

The multimodal approach was of benefit to IOHA allowing students to express their own voices in modes that cut across cultural and language barriers and in turn produce additional insight into IOHA's HIV awareness initiatives.

The further development of multimodal pedagogies is of benefit for interior programmes which rely heavily on visual communication. A deeper understanding of multimodality can benefit students when required to design meaningful multimodal and inclusive spaces to accommodate diverse communities.

This SFL approach and associated tool that the authors created has the potential to be used to also analyse full-scale interior installations with some adaptation to accommodate for the limitations and constraints associated with built installations. It may also support practice-led research and opens up new avenues for research and possible publications in the Interior Design field.

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Acknowledgements: Zachary Simpson (lecturer and researcher at the University of Johannesburg); all the interior design students who took part in these projects from 2016 to 2019; and especially R.Mpofu and S. Jacobs.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Tales of Surprise: Exploring Sense Making Processes Through User Narratives

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Abstract | An artifact firstly finds a voice in verbal expressions of people based on how they talk about and through them. Accordingly, products become cultural elements even before they are being used or became part of everyday live. As artifacts and their meanings are built up and contextualized in language; the language frames the meaning of artifacts, which are occurred in using. When a product comes into use, its meaning is created according to how the user interprets that product and communicates with it in a particular context. However, in the product design process, some codes and intended meanings are always assigned for presumptive uses by designers. Whether designers' intentions make sense to users or not is always debatable. Relying on the approach of design semantics, this paper aims to investigate how users make sense of the components of a product, the Surprise Egg, when they are asked to interact with this product in pre-structured scenarios.

KEYWORDS | AFFORDANCE, SENSE-MAKING, USER NARRATIVES, SURPRISE

1. Introduction

The generic concept of the Surprise Egg includes a yellow capsule-like shell resembling an egg's yolk, which contains a plastic toy, and this shell is covered with a layer of chocolate. We chose Surprise Egg since it is a multilayered product consisting of edible and inedible components, which again are distinguished as package and product.

The surprise egg concept raised as the idea of Michele Ferrero in 1968, and in 1974, the Italian company Ferrero turned this idea into a product that could be given to children so they could have a little "surprise" every day, based on the tradition of Easter, in this way also address to children and inner child in adults. ("Kinder Surprise", 2020)

Surprise egg is launched as gift for children and promises three experiences in one product with the "delicious milky taste of quality chocolate, a little toy and a BIG moment of surprise!" ("Kinder Surprise", n.d)

Moreover, it is promoted that these three elements create a world of fun and entertainment that helps children to develop their imagination while reassuring parents at the same time.

As the first step of understanding how users make sense of the components of a product, we looked over how the concept was presented throughout the history. Then, we examined advertisements as another important source to explore how the concept developed in different cultures such as Italian, French, German and so on. For instance, in one of the German advertisements, with the "how mom became the focus of the children's party?" question, it emphasizes that "surprise egg can make you [the mother] a star in the eyes of children" (Figure 1; Advertisement 1). In another example (Figure 1; Advertisement 2), children's happiness is associated with surprise egg. Moreover, with surprise egg you can fulfill your children's wishes at once (Figure 1; Advertisement 3).



Advertisement 1



Advertisement 2



Advertisement 3

Figure 1. How mom became the focus of the children's party? (Advertisement 1); Kinder Surprise fulfils three wishes at once. (Advertisement 2); The happiness that starts with good Kinder chocolate and continues with surprise (Advertisement 3).

In 1980's one of the British advertisements (Figure 2) used the Humpty Dumpty character to refer to the Kinder Surprise, as Humpty Dumpty is a character in an English nursery rhyme and known in popular culture. The character is also a common literary allusion, particularly to refer to a person in an insecure position, something that would be difficult to fix up when it is broken, or a kiddie person ("Kinder Surprise", 2020). Humpty Dumpty also appears in Lewis Carroll's Through the Looking-Glass (1872) where Alice remarks that he is "exactly like an egg"; Alice clarifies that she said he looks like an egg, not that he is one. A similar connection is carried to the advertisement: The surprise egg looks like an egg, however it is not an egg.



Figure 2. A sentient egg, styled in the similar vein of Humpty Dumpty, who murmurs about surprise egg and then suddenly fall from the wall.

Accordingly, it can be claimed that with the surprise egg concept, new associations between egg and surprise are developed for the new generation. At (Figure 1; Advertisement 2), it is shown that the child is shaking the surprise egg to guess what that is inside of it. The same gesture can be observed before opening gift packages.

All above mentioned associations and their presentation generate our consumer culture and in time, they can evolve into different forms in our narratives. Nowadays, surprise egg toys have become collectible for adults as well. Collectors often try to acquire all toys within a themed set. Some even share their unboxing experience on social media or create their own toys and re-wrap them in packaging.

Relying on Krippendorff's statement of "design as sense making" and Sarbin's understanding of the narrative as an essential component of human's world, we explored in a small scale how people make sense of the surprise egg. To do this, we organized and facilitated two

workshops with two different participant groups and collected narratives from the participants. Eventually, we interpreted the process and the outcomes in order to get insight on how two different groups, i.e., children and elderly, respond to the promise of the surprise egg.

2. Methods

Our research examines how two particular user groups, the children and the elderly, make sense of different layers of the Surprise Egg within the metaphor of 'surprise' through a series of workshops. The workshops were conducted at different times and places with the children and with the elderly separately. We visited the children (age 8-9) at the elementary school and the elderly (age 60-65) at the nursing home, which is their residence.

During the workshops, both groups were instructed to perform a number of tasks utilizing the Surprise Eggs. Our data relies on interviews with the participants as well as observations throughout these workshops. For the sensitization, interview topics are formulated to conduct casual conversations (Hassen, 2016).

Besides these informal conversations, follow-up semi-structured interviews were conducted to gain a deeper understanding of our participants' narratives and explanations. Also, observations during the workshop supported our exploration on how our participants were experiencing the Surprise Egg. This method had a particular contribution to identify possible dimensions of variations among the individuals and groups (Lapan, Quartaroli, & Riemer, 2011).

All the data was analysed through ethnographic content analysis. Eventually, we identified particular categories of narratives according to both participant groups. These categories were mainly identified based on concepts such as structures of narratives, reinterpretation and affordance (Gibson, 1977; Krippendorff, 2006; Norman, 1999)

3. Workshops

This study is conducted with two different participant groups through a combination of purposive and convenience sampling. Therefore, we deliberately chose our participants as the children and the elderly based on the distinction between their experience and familiarity with the Surprise Egg: While the elderly had no previous experience with Surprise Eggs, the children were quite familiar with the concept. The workshop consisted of two sessions: The first session which is called "unboxing session" was designed to examine the first interaction of the participants with the Surprise Egg. The outcomes of this session provided us with insight on the following issues: How do the participants read the Surprise Egg and make sense of the package and the product within the context of surprise?, and do

the intended meanings within the product make sense to the participants who had no previous experience with the Surprise Egg? Following, in the second session the participants were required to build new artifacts by up-cycling the egg-like shells of the Surprise Eggs. The second session is called as “up-cycling session” and aimed to answer the following questions in the scope of meaning in the use: What does the Surprise Egg afford in the context of usability and form?; what kinds of narratives do the participants develop in the process of making?; and, how do these narratives accompany or lead to the making of new artifacts?

To be used in the workshops, two different surprise egg brands are selected evenly according to their plastic capsule’s form. Additionally, for the up-cycling session for each workshop group, a kit of materials was prepared to support participants' attempts and inspire them for developing ideas and models. Therefore, the kits consisted of a variety of materials: Different types of ropes, piece of fabrics, EVA sheets, paperboards, balloons, plastic teacups, play dough, markers, scissors, glues, and etc. Moreover, some surprise egg toys’ were offered in a kit with empty plastic capsules.

3.1 Workshop I: A Day at the Nursing Home

3.1.1 Participants

The first group includes 8 male participants with an average age of 65 years, who did not have any prior experience with surprise eggs. They live at a nursing home, which has an additional rehabilitation centre. At this rehabilitation centre they usually work on hand crafts.

3.1.2 Procedure

In the first session in Workshop I, participants were asked to pick one surprise egg and unbox it.

The aim of Workshop I was observe how people who are not familiar with the surprise egg concept make sense of the semiotic references the product has while going through the steps of unboxing: Unwrapping the foil; ripping the chocolate shell in two or breaking it (can be simultaneous with unwrapping.); opening up the plastic capsule; and assembling the toy.

While the participants were completing the steps of unboxing, we observed interventions, which disrupted the surprise effect of the concept. Moreover, semi-structured interviews were conducted with each participant in every step, which reflect their reaction. At the end of the session, casual conversations were made about the toys that came out.

The second session started with a question to the participants by pointing the empty plastic capsules: “What can you do with this object?" In the following, we talked about their ideas.

A collective conversation took place and participants commented on each other's thoughts as well.

As a next step, participants were asked to choose one of the generated ideas and make a rough physical model of the object by utilizing the material kit. However, the majority of the participants chose to describe their ideas by talking instead of making.

3.2 Workshop II: A Day at the Elementary School

3.2.1 Participants

The second group contained 12 students in the third grade of an elementary school, who are eight to nine years old on average. All of them were familiar with the surprise egg concept. The workshop was conducted under the supervision of the class teacher at a studio-based class.

3.2.2 Procedure

For the unboxing session, the children were separated into two groups and asked to pick one surprise egg and unbox it. During this unboxing session, the children were asked to tell about their surprise egg experiences, with some stimulating questions, such as “What made you happy about the surprise egg?” or “Do you eat the chocolate first or do you want to get the toy before eating the chocolate?” As they are familiar with the surprise egg concept, they completed the unboxing session in one step and accomplished easily from unwrapping the foil to assembling the toy. At the end of the session, the participants were encouraged to talk about assembling toys.

In the following, the children were asked what they could do with empty plastic capsules and they were encouraged again for modelling their ideas. This process lasted for about 15-20 minutes. Then, participants presented their outcomes.

4. Findings & Discussion

4.1 Workshop I: A Day at the Nursing Home

4.1.1 On Recognition

Krippendorff (2006) describes recognition as “correctly identifying what something is, what it can be used for”. According to Krippendorff, the ability to recognize crucially depends on previous experiences with similar artifacts as recognition always is re-cognition; cognizing again. To get insight on how participants recognize the surprise egg, we aimed to understand how they make sense of how it works.

After the Surprise eggs were distributed to the participants, most of them firstly hesitated about how they could open the package, since they had no prior experience with the product. In this stage, some of them had difficulties in understanding and hesitated in unwrapping the foil. One of the participants, for instance, thought that unwrapping the foil was enough for unboxing it. Still, most of the participants went through "unwrapping the foil" and "ripping the chocolate shell" phases properly. Two of the participants had difficulties in opening the plastic capsule, as they had no recognition and tried to open the capsule from the hinged point (connecting line) by prying up with rasp. While one of them pointed the juncture (Figure 3), he expressed that "At first glance, it seems like it should be opened from the upper part. After I tried, I understood so, and it was directly opened from the middle of itself." In the light of this expression; we can say that the references on the product did not work as it intended.



Figure 3. Participant trying to open capsule from the hinged point (connecting line) by prying up with rasp.



Figure 4. A fish figure was out from one of the participant's egg.

At the assembly phase, most of the participants had difficulties in recognizing the toys and tried to figure them out for a while. One of the participants, got parts of a fish figure from the egg (Figure 4), and could not assemble the small parts of the toy at once. But he wanted to tell that he can understand that this is going to be a fish, indicating: "It is just a fish, nothing else." This statement initiated a conversation with the other participants on the fish when another participant came up and started to create a narrative about the toy: "It is a goldfish! It carries the other fish on its mouth to protect it from falling as a prey. This is how crocodiles do it."

Overall, we observed that participants make sense through *saying* rather than *doing*, since they had difficulties in recognizing and assembling the toys. Such difficulties basically destroyed the experience of surprise, and resulted in hesitation and uneasiness.

4.1.2 On Redefinition

In the up-cycling session, participants were addressed with a stimulating question: "What else can you do with this plastic capsule?". Following, they started to generate new narratives with the egg capsules. These more context dependent narratives focused on defining new specific functions. Participants usually had the tendency of redefining the egg capsule as a unit for "storage", where they could put their personal belongings, such as, pills, small coins, quarter gold coins, needles and buttons. Furthermore, one of the participants who was a former

fisherman, suggested that it could be used as floating pontoon for the fishing line. Additionally, two of the participants also asserted that they could make prayer beads or abacus by using modular capsules in this regard. Overall, we observed that past experiences and habits in daily life became were the main inputs in their new sense-making processes.

Participant whose plastic capsules had three holes underneath it; brought forward the "saltshaker" idea and acted out like sprinkling salt from the plastic capsule (Figure 5). At this point, we also interpreted it as building a part-whole metonymy.



Figure 5. Participants suggest the saltshaker idea and act out like sprinkle salt from the plastic capsule.

We observed that the participants tried to explore what the Surprise Egg capsule affords without much change and intervention. In this sense, they utilized a pragmatic approach, which was inspired by their daily life contexts and practices. Furthermore, generated new concepts, which are conveyed with narratives from adult-perspective, were focused on single-functional usage.

When asked to turn their ideas into three-dimensional models, the participants did not implement their formerly generated ideas. They shifted from *daily life context* and focused on *toy context*, aiming to address to a child's point of view. For instance, one of the participants started to create a playground from the EVA sheet, which was supplied in the kit. He, then,

started to pose various toys on it and asserted, “If I were a kid, I could create such a playground for fun” (Figure 6).



Figure 6. A playground created by one of the participants at the up-cycling session.

4.2 Workshop II: A Day at the Elementary School

4.2.1 On Recognition

Participants of Workshop II were quite familiar with the surprise egg context and they accomplished the steps from unwrapping the foil to assembling the toy quickly. When they opened up the plastic capsule, they expressed their excitement, such as, “Look! What we got!” and started assembling the toys. In the assembling phase, participants generally had quick

recognition on concepts and assembled the toys successfully. Most of them were not content with just assembling the toy and started to build narratives with and around them. For instance, one group got a specific bear figure (Figure 7). They associated this figure with the cartoon character *"Yogi bear and boo boo"* and then made changes on it by merging with a part of (balloon) a different surprise egg toy (Figure 7).



Figure 7. One group of the participants got a specific bear figure and made changes on it.

One of the participants got the figure toy named *creative smiley,* which has the part for creating patterns on paper (Figure 8). The participant figured out its function and assembled the parts properly. According to the instruction paper, this toy's main function was not for creating this kind of stamps. As it was designed, it was more likely for creating patterns on the paper through its holes. However, the participant wanted a piece of paper for creating a stamp by sandwiching the paper between the parts of figure. This was one of the early observations on participants' tendency in making conceptual changes starting from the unboxing session.

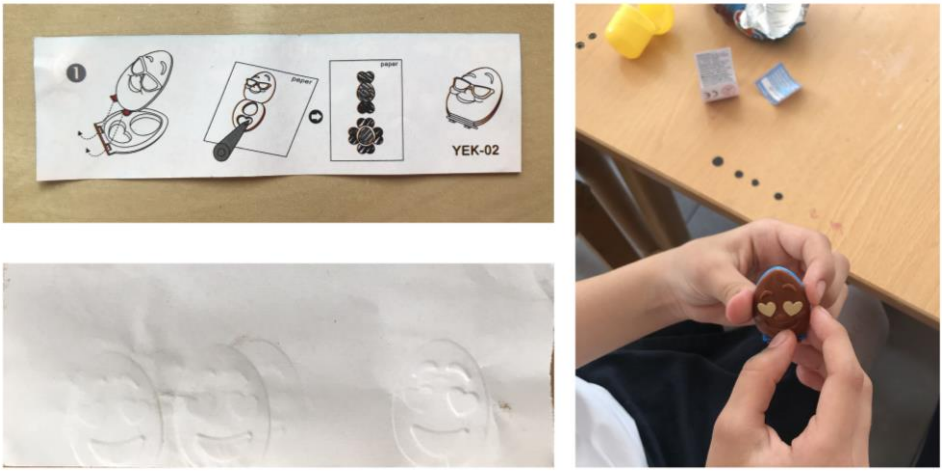

Figure 8. The figure toy's usage was changed over by participant and used as stamp instead of creating patterns.

In the unboxing session, all of the participants had a quick recognition of the toys and their concepts, and generally they did not have difficulties in assembling. It is hard to deduce about participants' abilities of decoding the semiotic references as they were already familiar with the concept and did the work almost *automatically*. Overall, we observed that participants of Workshop II experienced the surprise effect by going beyond from the surprise egg's offerings through creating new uses and narratives.

4.2.2 On Redefinition

In the up-cycling session, participants started telling their narratives. Most of them suggested to use plastic capsules for storing the *small things* as they expressed such as logo bricks, wristbands, lollipops, lovely beads, jewelry, tiny cars, and keys. Furthermore, one of the participants asserted that he could even store the shoes if it was big enough. Similar to the elderly, children created narratives in relation with their daily life and what the plastic capsules' materiality afforded them.

Afterwards, participants started creating new objects/ concepts through intervening plastic capsules by using different materials and methods. These interventions referred to making changes on plastic capsules by merging them with various materials or making changes by colouring it, and eventually turning it into a new functional object through redefining its meanings (Figure 9).



Figure 9. While participants generating new concepts with plastic capsules.

As many of, one of the participants made a surprise box as a gift for her friend's little sister. While she was presenting the concept, she expressed that, "I put some dough here to make the opening part more fun." and showed how it is opened from the hidden line (Figure 10).



Figure 10. Participant hides the opening line to got enhance the surprise effect.

One of the participants created a toy, which resembled Minion's characters. The toy figure was created from plastic capsule and was merged with a balloon (Figure 11). While indicating the knot point underneath the balloon, she expressed that, "The figure jumped on the balloon like in the cartoon. Look, the thing underneath the balloon helps for jumping!"

According to the outcomes of the workshop, it can be seen that participants redefined the toys by merging them together with other objects, colors and materials (Figure 10 and 11).

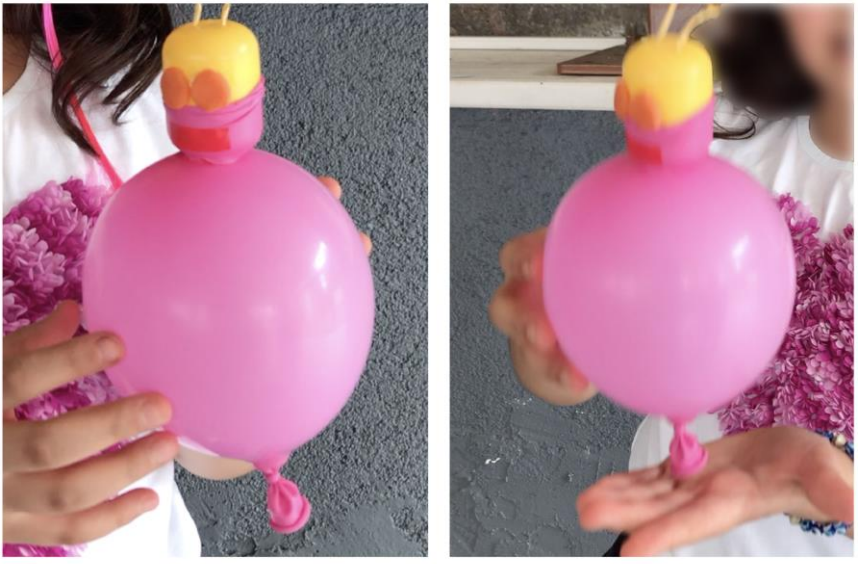

Figure 11. A toy character, which can jump around thanks to its elastic balloon body.

With a different approach, a participant created a toy, as a dinosaur figure by changing the plastic capsule by drawing on it. The participant explained while acting out the figure "It is like a dinosaur; we can play with it by opening and closing the mouth." (Figure 12)

According to the participant, this could also be used as a storage box for valuable things as well. He placed a cushion inside the capsule and indicated, "There is a beautiful place where we can store our valuable things."

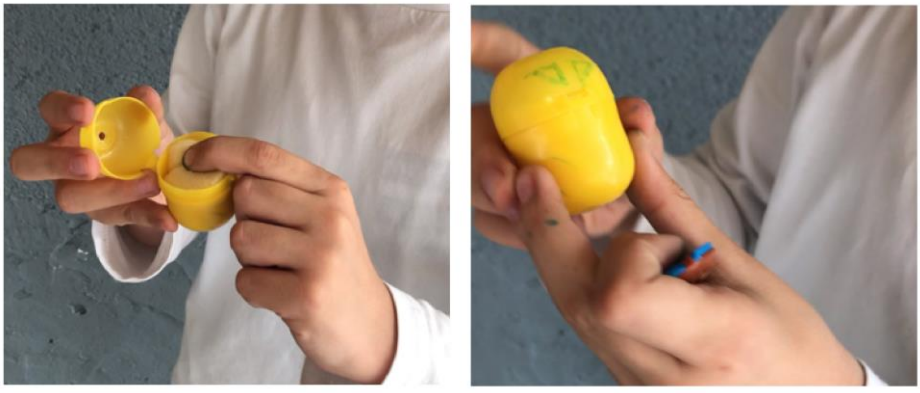

Figure 12. A multifunctional object from the plastic capsule.

In general, it is observed that both of the narratives and objects in redefinition process refer to multiple concepts, functions, and users. The participants were familiar with the surprise egg concept and also eager to redefine them benefiting and extending the capsules' affordances.

5. Conclusion

Within the scope of this study, we examined the surprise experience which is supposed to be the main element of the surprise egg concept and tried to figure out how the surprise experience changed in different layers. Furthermore, observing how new surprise effects are built up by participants helped us for understanding its usage in new sense-making processes. In this context, two different participant groups experienced different difficulties in various stages. Nonetheless, these difficulties provided us to take a new approach on “re-cognizing” and “re-defining” processes which are also related to familiarity with concepts and objects.

Designers and users cannot be presumed to see the world with the same eyes. It is also the same for different participants as their cognitive models and mythologies limit every participant (Krippendorff, 1989). At this point, starting to trace the concept of the surprise egg from a historical glance and finally integrating it with today’s narratives from different groups provided us with an initial insight how our participants made sense of this product.

As Krippendorff (2006) states children learn to see affordances by experiencing that what can they do and what the things can do for them. On the other side, most of the adults put their actions in practice without any need to reflect or decide what is next. Our findings from

this initial study support this approach: Participants who were not familiar with the surprise eggs at all, had difficulties in recognizing and thus making sense of it. In these situations, we observed that narrating on or around the object became an important part of experiencing and thus making sense of it. Therefore, stimulating narratives, which brought about meaningful worked well and encouraged new sense-making processes.

To conclude, this is a small-scale ongoing study through which we aim gaining insight on different processes of sense making, by utilizing a particular product, the surprise egg. Due to limitations based on time and resource restrictions, as well as the small sample size we cannot make a deeper analysis. However, we hope the methodology we followed can be applied for other products, participants, and cases for further research aiming at exploring sense-making processes of different participant groups.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Design of Politics: Understanding the Arrest of Cesare Battisti Through the New Media Factor

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Abstract | At present, populism is best understood as a combination of contextual issues (demand side) and the availability of successful parties (supply side). This article queries the impact of the new media factor as a third component for the fortune of contemporary populism, with the aim of clarifying how the features of new media communication can reflect or enhance the characteristics proper of populism. In order to do this, three aspects of the new media factor will be taken into account, hence the mediatization of politics, the process of disintermediation, and visual storytelling.
Specifically, the paper will analyze a controversial video posted on Facebook by the Minister of Justice Alfonso Bonafede in 2019, displaying the arrival at Ciampino Airport of the ex-terrorist Cesare Battisti. The latter will be used to explicit a coincidence of visual elements on digital media that can help political leaders better engage with their online audience, focusing on the assumptions that images can improve and facilitate the learning process, create identitarian spaces, and facilitate emotional involvement with the audience.

KEYWORDS | POPULISM, NEW MEDIA, VISUAL COMMUNICATION, CESARE BATTISTI

1. Introduction

In the last twenty years, many Western countries attended the rise of the so-called populist parties. Started out mostly as popular and/or local movements and small associations, many of them eventually shook the established political scene by gaining legislative seats, reaching government offices and hampering many accomplished traditional parties during the elections held in the last decade. On one hand, this phenomenon is being explored by scholars all over the world, reaching higher levels of sensitivity and specificity as more and more political events unfold. On the other, the word "populism" escalated to a point of no return in its popular use, acquiring an often-oversimplified significance.

In the scientific literature produced on the topic so far, it has long been a conventional procedure to begin any book or paper by stating that no one knows what populism is, and thus by noting the innate ambiguity of the term. A predictive episode with regard to this point occurred on May 1967 at the London School of Economics, where—among many academics—American historian Richard Hofstadter gave a keynote lecture titled *Everyone Is Talking About Populism, but No One Can Define It*. What was at the time a provocative title became later an actual presage, as in the last fifty years the term populism was discussed and enriched with more and more definitions given by scholars eager to bestow significance to this phenomenon.

However, this paper will not to take in consideration the many definitions given throughout the years to the term "populism" and will rather proceed to analyze the causes which allowed this phenomenon to spread, focusing on the communication modalities that co-occur with it.

2. Demand side of public opinion

Although the electoral fortunes of populist parties are open to multiple interpretations, according to almost all scholars the phenomenon of populism is articulated in demand and supply side factors, which are complementary to each other. The first factor mainly focuses on how economic insecurity affects populist support, whereas the second analyses the cultural attitudes adopted by populist parties—both left and right-wing—which allowed them to address social grievances and common concerns. Specifically, on the demand side there are two primary causal theories: the economic grievance model and the cultural backlash model. Often presented as opposing views, these two seek to provide answers to phenomena such as socialization, grievance formation, causal attribution and the formation of collective identity, which together constitute a breeding ground for the birth of populist parties.

The intuition behind economic grievance theory is that the economic fractures that were created and/or deepened by globalization generate potential public support for those movements which position themselves outside the political mainstream and oppose the rules dictated by the establishment (Rodrik, 2018). Specifically, according to this argument, economic insecurity and the ensuing perception of being forgotten fuels disdain for political

elites and institutions, reinforcing parties who bolster labor mobility and promulgate supranational governance (Andersen et al., 2017).
The second theory on the demand side is the cultural backlash thesis formulated by Ronald F. Inglehart and Pippa Norris (2016), which argues that the increasing accreditation of populist parties cannot be explained as a purely economic phenomenon but should be seen in large part as a reaction against progressive cultural change. Reactions to these developments, according to the experts, instigated a counter-revolutionary backlash among older generations and the less educated society classes which resulted in the decline of their livings standards and in their rejection of progressive values (Inglehart, 1997; 1999).
In short, if on one hand sectors once culturally prevailing in western Europe reacted angrily to the depletion of their privileges and status quo (the right-wing populist electorate), progressivists found their voice in left-wing populists' claims for inclusionary, more socio-economically inclined policies. Eventually, while examining these two theories about the demand side (the economic-inequality perspective and the cultural backlash thesis) researchers stated that

> "cultural values, combined with several social and demographic factors, provide the most consistent and parsimonious explanation for voting support for populist parties." (Inglehart & Norris, 2016, p. 4)

3. Supply side of party strategy

If demand side explanations are important to understand *why* populist parties emerged in the first place, supply side factors are valuable to figure out *how* the angry and disillusioned middle-class depicted in the previous paragraph was able to mobilize and eventually find a voice in populist parties across the Western world. The supply side of politics, in fact, applies when populist movements collect the quandaries and criticalities raised by common concerns, forge a narrative, and use that to activate political mobilization. Unnoticed (or maybe unwillingly spotted) by the so-called élite, many parties eventually pooled years of research into small communities' local vernacular, popular notions and national resentment, and mixed them with the most up-to-date tools for data analytics and advanced communication strategies borrowed from political worldwide masters (i.e. Vladimir Putin, Viktor Orbán and Donald Trump). The end result is they present a story that is meant to resonate with their base, the demand side, that says: here is *what* is happening, this is *why*, and *these* are the people who are doing this to you. According to Klandermans (2004), it is the process of mobilization that links demand and supply sides. And thus, because mobilization is the marketing mechanism of the social movement domain, the study of mobilization concerns such matters as the effectiveness of (persuasive) communication, the influence of social networks, the frames and ideologies movements stand for, and the constituents of identification they offer.

4. The new media factor

What has also been mentioned by scholars exploring the topic is that the common thread distinguishing left and right populism is their underlying ideologies. On the contrary, what binds these two types of politics together is their mobilization processes, which often involve social networks and powerful communication strategies. Indeed, as Surel (in Laclau, 2005, p. 176) claims:

> "against the idea according to which populism would represent a relatively stable and coherent trend, typical of the new radical right, we want to defend the idea that it is less of a political family than a dimension of the discursive and normative register adopted by political actors."

The introduction of a third explanatory component to unravel the intricate phenomenon of populism should not be intended here as the addition of a missing load-bearing element to previously examined theories. Nor should this component be looked at as a bonding agent between the demand-supply sides interpretations. But if we start from the assumption that politicians can be understood as strategic agents (Aslanidis, 2018, p. 1244), one cannot ignore that the advent over the past decades of new media completely revolutionized the key features and strategies adopted in the global political communication landscape.

The discursive strand in populist scholarship has been active at least since Ernesto Laclau's (1977) first take on populism. In his book *On Populist Reason* (2005), he defines populism as "a discursive strategy of constructing a political frontier dividing society into two camps and calling for the mobilization of the 'underdog' against 'those in power'." Most importantly, for Laclau populism is a form of mass politics that, far from threatening democracy, is rather a symptom of its liberating and radical horizons. Populism is thus for Laclau the latest link in a signifying chain that defines politics in terms of democratic practice, the hegemonic formation of group identities, and the play of language and discourse. According to him, populism is therefore not an ideology, and cannot be attributed to a specific programmatic content. A similar analysis of populism has also been taken into account by Taggart (2000), who associated the term populism with ambiguous definitions such as chameleon-like nature, essential impalpability or even conceptual slipperiness. To him, as well as to many other scholars (i.e. Mazzoleni et al., 2003), it is precisely thanks to this adaptive nature that populism can adjust to different contexts. For this reason, too, the distinctive nature of modern media and their capacity to affect the opinions and attitudes of mass audiences are key factors in the political arena (Mazzoleni, 2014). The contribution of such media to the rise of populist movements and parties is the research field that this paper wishes to tackle.

In order to do so, this section of the paper introduces a third causal and interpretative factor to help explain the rise of populism, called the new media factor, which will serve as an investigative query for the success of politicians' supply side through media communication. More specifically, the new media factor will center on the changes occurred in the new

realm of communication focusing on the processes of political mediatization, disintermediation, and visual storytelling.

4.1 Mediatization of politics

Throughout history, the term mediatization gained many different meanings in social and cultural research. According to Couldry and Hepp (2013, p. 197), the emergence of this concept can be dated back to the early twentieth century, with Ernst Manheim's (1933) postdoctoral thesis *The bearers of public opinion*, and later with the works of Jean Baudrillard (1981), Jürgen Habermas (1984) and Ulf Hannerz (1990). In their works, all authors refer to media in different manners, and attribute even more varied values to the concept of mediatization. Yet, the reason they all converge in Couldry and Hepp's list of mediatization theorists is their shared vision of mediatization as a way to decipher change. Specifically, they used mediatization as a concept to read the emergence of a particular medium in different historical socio-cultural processes. Far from being an established methodology, we can assume mediatization is more an investigative approach to media, "a meta process that consists of a changing everyday life, of changing identity constructions and social relations, of a changing economy, democracy and leisure, of a changing culture and society as a whole" (Krotz & Hepp, 2011).
In political communication, mediatization can be looked at as a long-term process of convergence between media-logic and political-logic occurred over the course of the last decades. This process happened mainly in two phases: firstly, with the media distancing from political power and becoming more and more marketed; secondly, with political actors strategically adapting to the logic followed by the media in order to gain visibility and attract voters (Esser, 2013). Eventually, since commercial media needed to "sell" political issues, they underwent a process of making those issues more understandable and interesting for the audience. This of course forced political actors to take into account media, who had to recalibrate and modulate their communication strategies to fit accordingly.

4.2 Disintermediation

The term "disintermediation" first appeared in Elihu Katz and Daniel Dayan's (1992) book *Media Events: The Live Broadcasting of History*. In the pages of the book, written in a period of absolute television-predominance over any other media, the authors name the presence of another television, different from the everyday kind, which they define as "a television of occasion" (Dayan & Katz, 1992). With this term, they refer to something other than the daily broadcasting of tv series or news. Some of the events reported as examples are the funerals of President Kennedy, the wedding of Charles and Diana, the fall of the Berlin wall in 1989, facts related to the Watergate scandal and many more. The intuition of Katz and Dayan, which first dealt with the innate ability of media to "spectacularize" events through media, posed some cornerstones for the future conceptualization of the process of disintermediation. On one hand, they showed how certain media have the power to clear a path for skillful public figures to talk over the heads of the "middlemen" who normally

mediate between leaders and their public, claiming that live broadcasting of media events "has redefined the relative power of organizers, intermediaries, broadcasters, and viewers, and the very essence of a public event" (Dayan & Katz, 1992, p. 217). On the other, they demonstrated how media events can work as disintermediation channels carrying the television public into the "sacred center" of society (Dayan & Katz, 1992, p. 89). Nowadays, the advent of new media extended the opportunity, for civilians as well as for politicians, to autonomously publish and spread daily events online, reaching an unprecedented level of life "spectacularisation". In the political realm, this meant for politicians to be able to independently manage their contents online, deflecting the usual mass-media "middlemen" mediation process.

4.3 Visual storytelling

In the past fifty years, studies in the psycho-cognitive field demonstrated that the attitude towards political leaders is regulated not only by the evaluation of proposed policies, but also and foremost by the emotional response to their non-verbal behavior (Masters & Sullivan, 1993; McHugo et al., 1985). At the same time, during the first half of the 1980s, philosophers and psychologists introduced for the first time the theoretical debate on narrative, acknowledging its centrality in the cognitive processes that lead individuals to the recognition of their self and/or of a specific community. These two factors, united with the explosion of the internet and the advance of communication technologies, created favorable conditions for the spreading of the "visual storytelling" model, today even further strengthened by digital media systems. By figuring as a sort of "immersion mechanism, a tool for profiling individuals, a technique for visualizing information", storytelling "establishes narrative systems that lead individuals to identify with models and to conform to protocols" (Salmon, 2017, pp 7-10).

Transplanted in political communication, visual storytelling demonstrated to be in the last decades an impeccable narration model and tool, with non-verbal language shaping largely the processes that feed the narrative of contemporary politics.

5. Visual populism

In *Understanding Media*, McLuhan (McLuhan, 1964, p. 80) correctly foresaw how advances in technology would have allowed rapid translation from one language to another. Indeed, as much as previous ones, the advent of new media brought a transformation in language, and subsequently also in culture, interactions among individuals, and modes of consciousness. They did so by adding to the spectrum of communication forms—not by destroying old means of communicating (Ong, 1977, pp. 82–91)—and by creating a new environment (Meyrowitz, 1986, p. 19) where the new medium is included in the previously set ones, adding new layers of understanding to the media matrix.
Although digital media comprise all digitized content that can be transmitted over the

internet or computer networks (which can include text, audio, video, and graphics), this research will specifically focus on visual imagery, both still and in motion. The reasoning behind this is that, due to the advent of new media and the consequent change of cultural practices related to information processing, politics has inexorably shifted onto a visual platform.

More specifically, this section of the paper questions the existence of visual populism, an expression coined to explicit a coincidence of visual elements on digital media that can help political leaders better engage with their audience on-line. Visual populism will be considered here as a proper communication mode, from which it derives a distinctive visual rhetoric which figures as a sort of algorithm for populist communication. In order to show how images on new media can foster the populist discourse, this theory will focus on three assumptions: that images can 1) improve and facilitate the learning process, 2) create vernacular, identitarian spaces, and 3) facilitate emotional involvement with the audience.

5.1 Visual learning

Since the 1960s, the role of images in the learning process has been largely explored by scholars of various fields, including those belonging to communication and political studies. In particular, starting from the 1990s, numerous researchers in this area started investigating how televised pictures, via mirror neurons, could foster a learning system able to engage the user's feelings towards the sender (Chaudhuri & Buck, 1995). In light of this, politics increasingly involved visual storytelling in communication processes through the use of media, which—besides ensuring a broader and more densely branched communication flow compared to traditional media—generate through the use of visual imagery a faster, distinctive and direct kind of learning (Tversky, 2019, p. 242).

Audio-visual communication, also, is capable of generating an accurate representation of non-familiar people and objects (Graber, 2001, p. 19), thus allowing leaders to provide their followers information on socio-political issues they might have never heard of or may have encountered only in purely verbal contexts. Political actors who make use of visual technologies to communicate with their audience have therefore the power to construct reality in a specific way, and even to frame particular situations by telling a story with the help of visual aids.

5.2 "Framing" and the process of identification

The employment of audio-visual systems by political leaders is useful not only to instruct their audience about political and social issues, but also to create a vernacular shared idiom which is unique and recognizable from the community of one particular party. Through visuals, indeed, leaders have the possibility to create virtual identitarian places, where social media become a bridge able to connect the imaginative with the real.

On the subject of identity and politics, the contribution of George Lakoff is of paramount importance. Specifically, in his *Don't think of an elephant!* (2004) the American cognitive linguist and philosopher introduced the concept of "frame", defining it as a set of

interrelated ideas which nonetheless belong to the same subject and to an unequivocal perspective on it. If effective, the frame works as a sort of setting wherein ideas assume an organizational shape, becoming persuasive when language evokes them. Through this method of cognitive assonance, the leader conveys both with words and visual representation a collective imaginary which becomes a sort of genetic heritage of social belonging. This way, the social media pages of leaders become environments able to feed and direct the "common feeling" of their followers, clarifying who is part of one community (defining the "us") and who oppose to it (identifying "them").

5.3 Emotional involvement

As we have seen so far, audiovisual systems allow anyone who use them to provide explanations on complex socio-political topics and to forge a repertoire of signs shared within a specific community. Compared to verbal communication, images are processed faster, categorized more efficiently and better remembered (Grabe & Bucy, 2009, p. 12). In fact, while in verbal communication affective stimuli have to be imagined, in visual communication they can be synesthetically, sensually, and kinesthetically perceived, triggering a stronger, more direct and faster response in the receiver. Furthermore, affective processes elaborated in the subcortex nourish conscious experiences that are complex and abstract, turning them into vivid and polysemic signs (Coëgnarts & Kravanja, 2012). Through a sort of Gestalt composed of formal aspects (such as color, movement, pacing, camera angle, etc.), objects and subjects, images carry signals that are later transformed in affective impulses able to increase the effectiveness of identification and learning processes.

6. Case study: "The story of a day we will hardly forget!"

On the 14th of January 2019, the Minister of Justice Alfonso Bonafede (representative of Five Star Movement) posted a video on his Facebook page showing the arrival of Cesare Battisti in Rome titled "Il racconto di una giornata che difficilmente dimenticheremo!" (in english: "The story of a day we will hardly forget!"). Battisti was a member of the Armed Proletarians for Communism[1] (PAC) and had been sentenced in 1979 to twelve and a half years of detention to serve out multiple life sentences for murders during the "Years of Lead". In 1981, after only two years, he successfully escaped from prison and spent nearly four decades on the run, with granted asylum in France, Mexico and eventually Brazil. His extradition here was halted by former president Luiz Inácio Lula da Silva and generated diplomatic tension between the two countries ever since. Battisti was eventually arrested on January 12th, 2019 in Santa Cruz de La Sierra (Bolivia) in an international police operation and brought back to Rome Ciampino airport on an Italian-flagged Falcon 900 plane.

[1] Armed Proletarians for Communism (Proletari Armati per il Comunismo) was an Italian far-left terrorist group founded during the "Years of Lead".

The video posted by Bonafede, which was watched over 350 thousand times in the twenty-four hours after its publication, is interesting for the reasoning of this paper under many levels. On one hand, the processes that led minister Bonafede have that video produced and spread resonate with the three characteristics of the new media factor taken into account in the third paragraph. To begin with, the event of Battisti's arrival in Rome elicited a great stir on social media, where the case lived and escalated quite rapidly through the posts of many international political personalities. Indeed, besides the posts published on Twitter by Italian politicians, the arrival of Battisti in Italy was even announced by Eduardo Bolsonaro, son of the newly elected president of Brazil Jair Bolsonaro, who responded to a tweet by Salvini with the words "Brazil is no longer a land of bandits. The 'small gift' is coming". (Figure 1) The video is thus the result of the underlying processes of politics mediatization, since politicians—in order to "sell" political issues—undergo a process of making those issues more understandable and interesting for the audience. The act of defining Cesare Battisti a "gift" is used here as a conceptual metaphor (see Lakoff, 2006), and serves as a conceptual tool for structuring, restructuring or even create reality. After that, by considering the arrival of Battisti a "media event"—as defined by Katz and Dayan (1992)—the choice of the medium onto which the video was posted is as obvious as reasonable. In fact, by using Facebook as the preferred sharing platform, Bonafede was able to autonomously publish and spread the product online, reaching an actually unprecedented level of spectacularisation and at the same time deflecting the traditional mass-media "middlemen" mediation process. With regard to the narrative choice, this episode unveils the "storytelling machine" (Salmon, 2017) with the boundaries between fiction and non-fiction growing increasingly fragile.



Figure 1. Eduardo Bolsonaro's tweet on January 13, 2019.

Dismembered in five sequences and twenty different shots, the video depicts different moments of Battisti's arrival in Rome together with his departure towards prison. To play it are three actants: the "villain" (Cesare Battisti), the "hero" (penitentiary police, who is also responsible for the production of the video) and the "sender" (Alfonso Bonafede).
In the first three seconds, which serve as an introduction, Cesare Battisti is presented through a series of five black and white pictures with a camera shutter clicking sound. These initial frames are of paramount importance because they showcase the "villain", which is going to be seen shortly after in his journey towards prison. Furthermore, the sequence composed by a series of black and white pictures with the shutter sound is a classic montage used in television fiction to frame either wanted persons or spied ones (for example, the same sequence settings resemble in an almost identical fashion the end of the sixth episode of The Sopranos first season, where uncle Tony is captured with a photo-finish by an FBI agent at a dinner party as the new boss). (Figure 2)

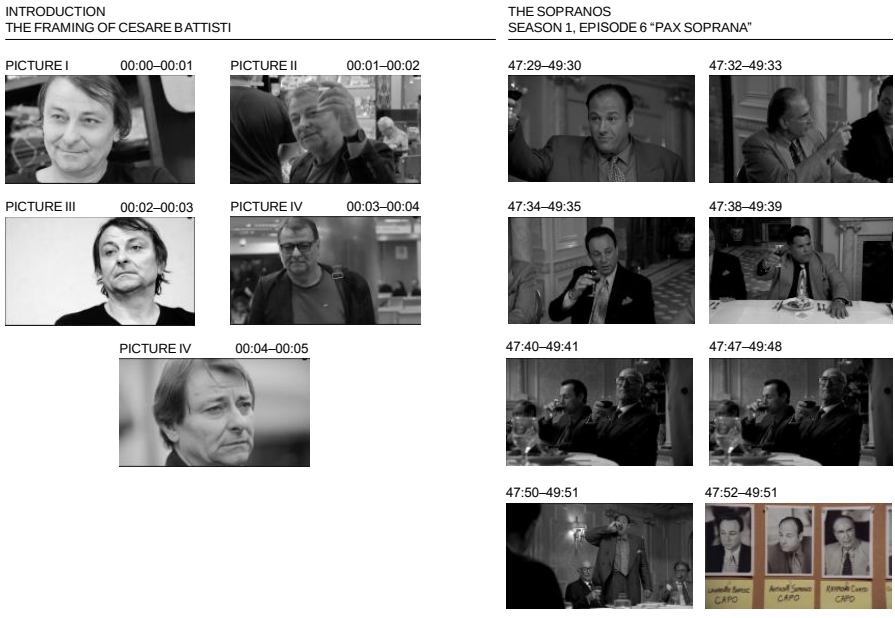


Figure 2. Introduction of Battisti's video compared with a famous sequence from the TV show "The Sopranos" (1999).

In the following five sequences, on the notes of *Comment Te Dire* by French artist Bertysolo, the heroes and the sender showcase their conquest (the capture of the villain), thus dramatizing an institutional event aimed at radically transforming the public opinion on a specific and major issue. (Figure 3, Figure 4) Besides being useful for the identification of the "villain", the video is very effective in creating a visual story which simultaneously frames a current event (Battisti arriving in Rome after his capture) and gives the viewer a key to read

the whole story: Battisti's forty years on the run, the diplomatic issues with the countries that granted him asylum, the satisfaction of the victims' families finally getting justice, and more. Indeed, by staging the detainee as subordinate to the authorities, the sender of this message is expressing a clear position on the subject yet without making use of verbal communication. In the video, both structure and content have the ability to elicit responses which direct attention to specific features of the message, which is expressed through the rise of music in key moments, with gestures of police officers and the interactions between them and Bonafede.

The last crucial aspect of this event is that the video became the subject of a great media debate, triggering many outraged judicial authorities who defined the posting of such video "one of the most shameful and grotesque pages of our republican history"[2] (*Unione Camere Penali Italiane*). It was indeed the *Unione delle Camere penali* who, on the 15th of January 2019, published a public statement where the lawyers pointed out the violation of the article 114 subparagraph 6-bis of the Code of Criminal Procedure, which states that any publication of people deprived of their liberty is strictly forbidden unless consented.[3] Also, according to Mauro Palma (National Guarantor of the rights of persons detained or deprived of their liberty) the staging of Battisti's arrival was a clear violation of article 42-bis subparagraph 4 of the Penitentiary Law, according to which detainees should be protected from public's curiosity and/or publicity during the process of accompaniment from one place to another. Before having the video removed on the 17th of January (three days after its publication), Palma on a public statement eventually warned about "sentences and images that aim to reach consensus through a language stranger to that of Constitution and that end up consolidating a culture of social disruption and tension."[4]

2 In Italian: "una pagina tra le più vergognose e grottesche della nostra storia repubblicana." The translation is curated by the author.

3 In Italian: "È vietata la pubblicazione dell'immagine di persona privata della libertà personale ripresa mentre la stessa si trova sottoposta all'uso di manette ai polsi ovvero ad altro mezzo di coercizione fisica, salvo che la persona vi consenta." Divieto di pubblicazione di atti e di immagini, Articolo 114 Codice di procedura penale (D.P.R. 22 settembre 1988, n. 477). The translation is curated by the author.

4 In Italian: "frasi e immagini che puntano ad acquisire consenso attraverso un linguaggio estraneo a quello della Costituzione e finiscono per consolidare una cultura di disgregazione sociale e di tensione". Retreived from www.garantenazionaleprivatiliberta.it The translation is curated by the author.

Figure 3. Sequences analysis (01-02).

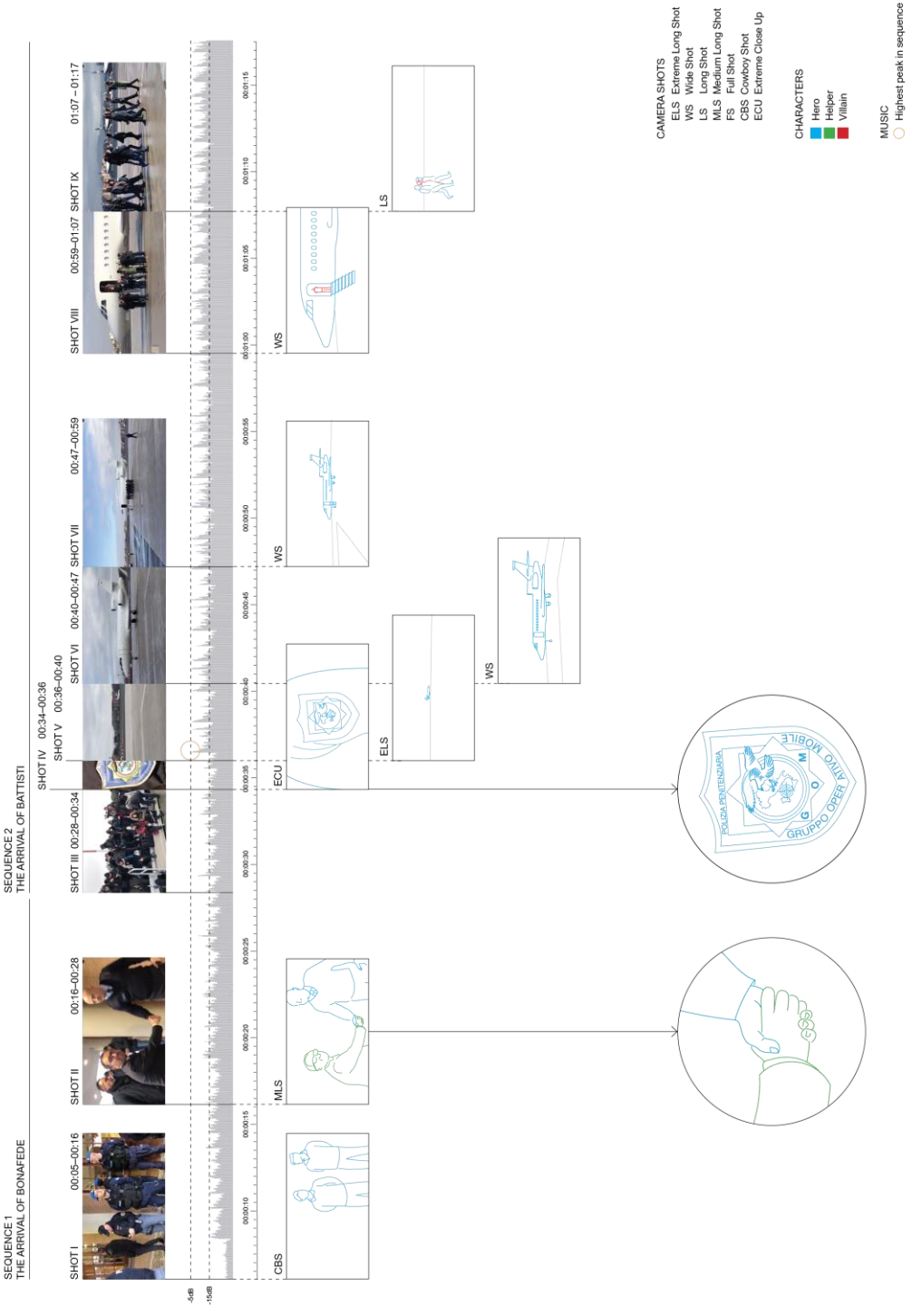
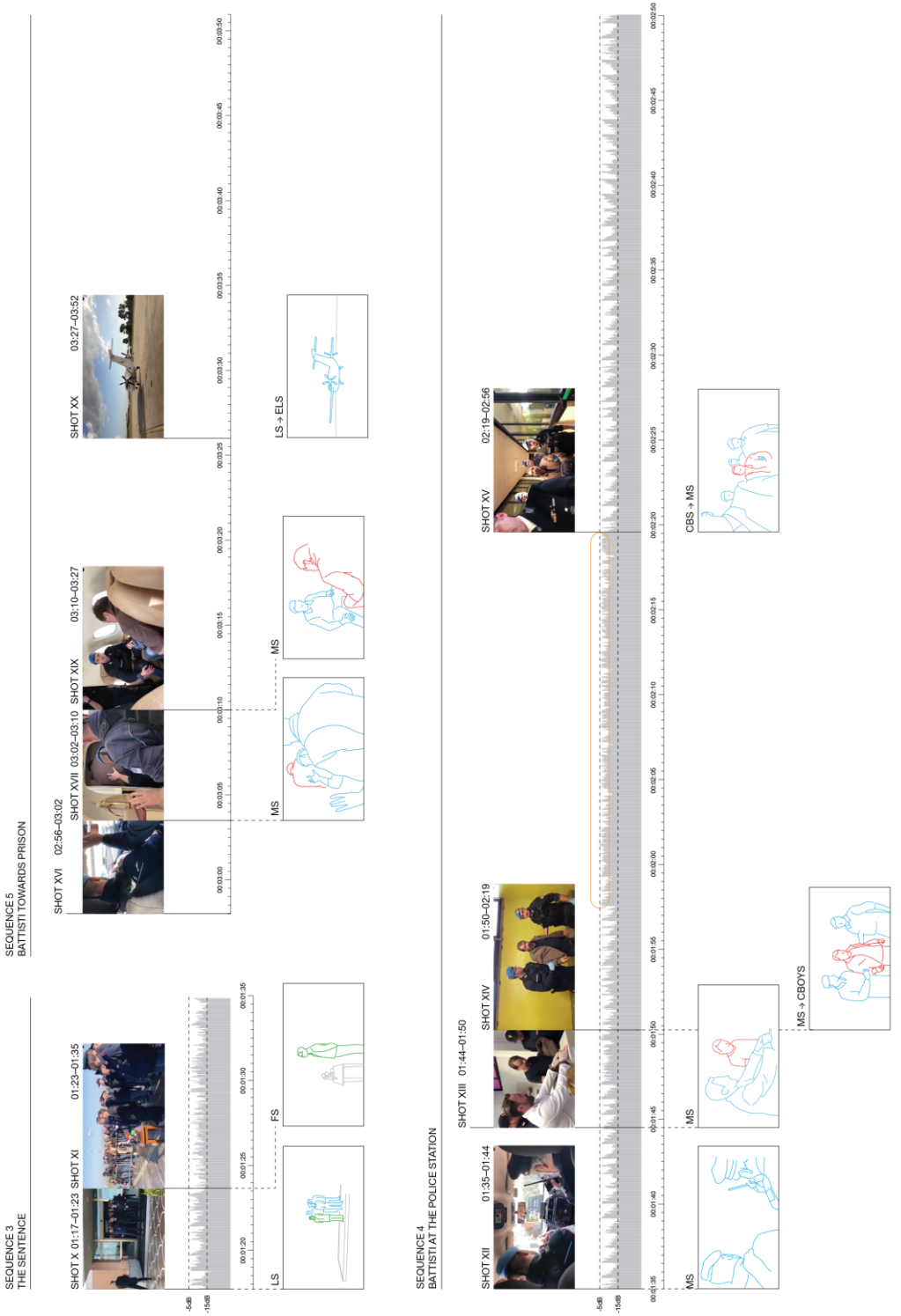


Figure 4. Sequences analysis (03-04-05).



7. Conclusion

As politics has increasingly become intertwined with the power of media to visually display reality, people's perception of politic is based to a large extent on the contents shared by politicians on social platforms. As seen previously with the case study of Battisti's video, visual populism shows how politicians can frame and construct reality in a specific way, by telling a story which is meant to resonate with the electorate with the help of visual aids. The case study also exemplifies how audio-visuals products shared on new media can enter in the public debate, overshadowing news reports by traditional media and dictating new standards of newsworthiness. Lastly, the case shows how images can elicit a juridical debate—which would have been unthinkable just a few decades ago—thus reinforcing the idea that images can do harm, whether intentionally or not.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

"The Enlightenment of the Contemporary Transformation of Chinese Traditional Visual Space Perception on Cultural Sustainability design"

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Abstract | "Visual perception," which reflects a very complex social-cultural phenomenon. How humans percept the surrounding world through vision, also how humans express or "transfer" the visual impression into the creation of artifacts such as painting and space, is the key to creating the understanding bridge between tradition and modern, western and eastern. To achieve this research goal, author explores the commonalities between Chinese and Western visual-spatial expressions through the analogy between traditional Chinese landscape painting and Western modern art, and explores different ways of transformation the traditional visual-spatial artifact codes by exploring the common visual themes maintained between traditional landscape painting and Chinese contemporary art, so as to explore the cross-cultural elements of traditional Chinese landscape painting, which is a traditional symbolic language system, and to guide the practice of design during the process of transformation from traditional to modern. The visual identity design of Art & Media College, Tongji University, was created during this process of researching. This practical design project allows people with different cultural backgrounds to sustainably, understandably and acceptably attend to, this practical project, a sustainable transformation about design approach and tools have been built up.

KEYWORDS | VISUAL IDENTITY DESIGN, VISUAL PERCEPTION , TRANS-CULTURAL UNDERSTANDING,CULTURAL SUSTAINABLE DESIGN , EAST ASIAN ART HISTORY

1. Culture is the Source of the Sustainable Development of Design

It's the sustainable development of culture the core of the Sustainable Development Goals (SDGs) stated by the United Nations. If the SDGs take economy, society and environment as the three pillars, then culture and creativity make important contributions laterally to each pillar. “Its culture shapes the way you see the world, its language informs the way you think, its customs structure you as a social being” (Willis,2006)Culture is also a constant source of the development of design, which, on the one hand, originates from human needs and the crises and opportunities that exist in human development; on the other hand, it also exists in the understanding, interpretation, and reflection of the world by human beings. Therefore, "Design is more pervasive and profound than that generally recognized by designers, cultural theorists, philosophers, or laypeople." The sustainable development of culture brought by design is to form a consensus with an international identity by creating keywords and key propositions that belong to contemporary Chinese culture in a global coordinate system, which are transformed into theoretical basis that can be used for modern design, and integrated into the modern living system under the impetus of design practice.

2.Cultural language is the Source of Diversified Development of Design

"I've always been a student of culture-I've been thinking about the importance of culture for product design, and experimenting with cultural thinking and tracking or exploring ways to influence culture. I strongly believe the way that culture designs us, so I recommend taking cultural thinking as a framework to assist us in design. Cultural thinking is a way of actively observing the behaviour of design, its impact on our culture, and the way we think about improving human interaction with others in society. While understanding, understanding itself reshapes our perception in turn. In the process of the transformation of design discourse, it is also the recreation of design culture." (Madray, 2017)

Compared with the profound human civilization, the history of contemporary design is not long, and its development time in China is even shorter. However, the perception of the same thing by people in different regions has differences in terms of cultural thinking and cognitive understanding, the relationship between design and each cultural matrix is inextricably linked. Therefore, the diversity of culture and language also provides more possibilities for the development of design.

The design community in China is currently in the transformation stage (Lou Yongqi, 2015), in universities, this is reflected in the following two aspects, I), it introduces, studies and learns from the design education system of western universities to cover and integrate China's design education practice and the innovation strategy system of enterprises -

universities - government trinity service design, inclusive design, strategic design, social innovation and other design frontier areas from point to whole; ii) "Our thoughts shape our spaces and shape our tools, our tools and space return the favour-as Steven Johnson tells us" (Madray, 2017), While adapting to Western design theories and tools, Chinese design is also constantly looking back to sort out the long historical traditions of the past. Interdisciplinary research, such as exploring the inspiration of modern design from the cultural foundation according to the characteristics of regional culture in combination with Sociology, Art History, and Anthropology, the explorer for example: Wang Xin and Wang Shu from Chinese Academy of Fine Arts, Ji Tie from Hunan University, et al. Exploring design theories that are suitable for one's own cultural characteristics in the process of development is not only an attempt to strengthen China's discourse power in international design culture, so as to make its time-honoured and modern civilization value to spread more widely, and to achieve cultural renaissance, but also a cultural reflection on the difficulty of the common design to deal with the localized development.

3.The Carrier of Visual Perception – Chinese Traditional Landscape Painting

Chinese traditional landscape painting, as an abstract artistic expression of conscious thinking, is a good starting point for studying visual perception.

Chinese traditional painting has always been different from traditional Western one, in both development and objectives. The trend of modern design theory is going towards interdisciplinary and cross-domain development. Hence, the exploration of the traditional culture in order to trace back the source of a theoretical guidance of Chinese design development seems to be the new direction along which moving forward: a perspective that will help in shaping a modern and inclusive language of Chinese design and will offer a clear understanding of the different cultural background.

The subject of this paper is Chinese traditional landscape painting, which acts as a carrier of visual space. In the process of painting, people are also repeatedly "designing" to confirm the thinking pattern in their hearts. "Visual perception" is a very complicated social and cultural phenomenon. How to "see" and how to express "what you see" are social or cultural discourse acts. There are various forms of "seeing", and the socio-cultural connotations they include are also complex and diverse. Vision is defined as a kind of "thinking" by Rudolf Arnheim in his book "Visual Thinking: Psychology of Aesthetic Intuition"; In Gestalt psychology, visual perception is the thinking that exists in vision; Susanne K.Langer, the representative of symbol aesthetics, also stated that what we see with our eyes is a form of the joint construction of sensory and intellectual organs.

4. “Kan[seeing]” and “Guan[observing]”

4.1 Thresholds of “Kan[seeing]” and “Guan[observing]”

The author analyzed the connotations of the following verbs related to "seeing" in Chinese traditional painting theory in combination with the context of ancient Chinese writing:

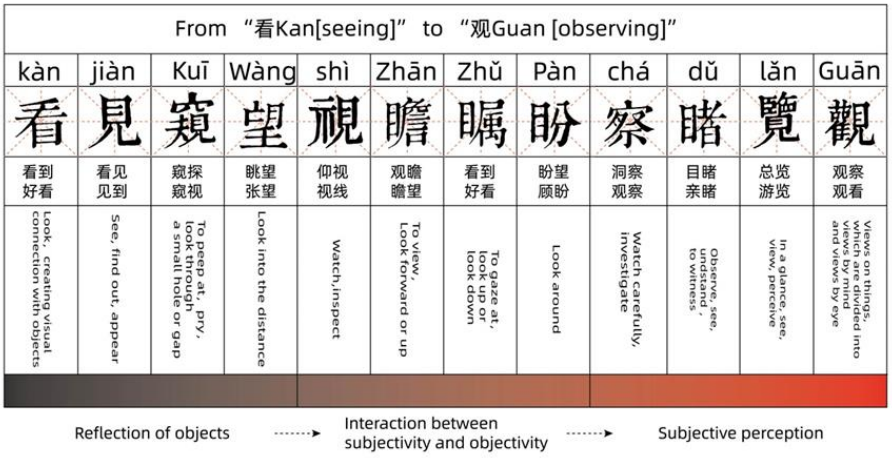

Table 1. Thresholds of “Kan[seeing]” and “Guan[observing]” [_DCs Table title].

Among them, the character "*Guan*" is obviously more in line with the deep definition of vision given by Arnheim and Susanne K.Langer .

It's originated from Xi Ci 系辞 (I) of I Ching Yi jing 易经(Book of Changes): "Looking up to observe the phenomenons in the sky, looking down to find out the laws of the Earth."

“The earliest understanding of the character *“Guan”* can be found in the I Ching .

It was stated in “Xiang 象” that “Winds moving above the Earth, *Guan*.” *Guan* are formed by the two trigrams representing one the Earth and the other Wind moving above it. “According to this explanation, both the human experience of observing the outside world and the ability to perceive it in its unity are involved: an ontological approach that connects and combines the human heart-mind experience with Nature – i.e. the Tao Dao 道, the origin of all things.”

Zong Bing 宗炳 of the Southern Dynasties said "Settle the hearts to view the Tao", as a mode of thinking that people use to experience the Great Law of universe -Tao, "*Guan*" is a verb that can be implemented concretely, and the object of "*Guan*" is the Tao. The specific creation of a landscape painting is carried out under the guidance of the thinking mode of "*Guan*", and a thinking system of visual perception completely different from that of the West has been formed.

4.2 Object of “Guan” - the Source of the Physical Images

"*Guan*" is a kind of structural "seeing". It has cultural presuppositions, among which one of the important points is the concept of "source of physical image". This also leads to the unique characteristics of Chinese landscape paintings, such as containing four-dimensional space-time in two-dimensional pictures. The reason is that the concept of "*Guan*" predestined that Chinese landscape painters do not paint what they see or what they know, but their feelings and understandings of "the source of physical images" in the world they live in. Such feelings are not a matter of being inside, but a sense of being outside.

Xu Fuguan stated in his "Spirit of Chinese Arts" that "the so-called Source of Physical Image is the nature of what physical matters are derived from, however, the nature cannot be separated from the form" and "Only when painting can express the nature of things, can it be said 'getting the truth of things'"（Xu，2001）. The above statements show that everything has common sense, and only artworks that can express the essence of nature can reflect the Tao behind the physical images. Contemporary scholar Wei Bin said in his "Explanations on the Theory of Paintings of Tang Dynasty" that "The image of landscapes, the momentum coexist with each other (Explanation: The charm and form of landscape painting complement each other)" , "Not the landscape having this momentum, but the image of the landscape reflected in my heart which move with the movement of the heart, so it is said that the spirit and form coexist with each other."(Wei,2007). It is this common sense that maps the landscape schema in the hearts of human beings, and thus arouses their perception of nature.

The source of the physical image refers to the ins and outs thereof. Only by observing the details of the things, and then the painting can get the truth of creature. People in the Song Dynasty believed that knowledge is acquired through investigating things to the utmost, and its nature should be explored by understanding the principles of things. "Clarifying the source of physical image" actually inspired the concept of "Shang Li (Advocating rationality)" in paintings of the Song Dynasty. It is also the beginning of our research on the interpretation of art works from the level of the schema of Chinese classical landscape paintings.

Generally speaking, Jing Hao's "source of physical image" is actually a reconstruction of the "common sense" of the nature that must be grasped in the space theory and creation of Chinese classical landscape painting, that is, an interpretation of the Chinese landscape painting pattern. The "source of physical image" should be understood as the essential existence of the original, inherent, natural, but also interdependent development of everything according to its own internal laws.

We can summarise the visual principles of this idea of pursuing ‘the source of objects and images’ in three main points（Accolla, A., & Jiang, J.2019）:

1. The importance of orientation The relationship between distance, direction, and position is constant and objective, regardless the subject’ s position.
2. The importance of the original proportion As advocated in the Yi Jing, the integration of men into Nature should not affect or interfere.
3. the natural state of objects and, therefore, respect the original proportions of the world.
4. The understanding of visual laws The Yi Jing also expresses that when the objective conditions of the objective world change, people’ s perception remain unaltered to a certain extent, since there is a tendency to perceive familiar objects as unaltered in shape, size, colour, brightness and so on, despite the stimuli changes may involve, i.e. the principle of perceptual constancy.

4.3 The Organizational Features of the Space Art Elements of Landscape Painting under the Influence of "Source of Physical Image"

Through the exploration of "*guan*", the inherent "schema" is gradually abandoned, and this philosophical proposition, which has the characteristics of traditional Chinese cultural thinking and the common characteristics of modernity and human visual perception, is translated into the concept and method of visual space that can be used and understood by modern design.

1. Lines - the Carrier of Art Life

In the landscape paintings after the Song Dynasty in China and the history of modern western art, the liberation and expression of lines occupied an important position. Most of the landscape paintings in the Song Dynasty were painted on scrolls, with more smudges and strong naturalism. In the Yuan Dynasty, artistic elements, such as lines, began to play a key role in painting expressions as pure art forms separated from natural objects and images. How did lines in landscape painting represent space-time? How were art elements such as points, lines and planes used in the expression of physical images? Through analysis, we find that in the plot of Huang Gongwang's Dwelling in the Fuchun Mountains(Figure 1-1), the painting dominated by line expressions:

As a carrier of natural objects and images and space-time, in the composition of mountains in this painting, it did not emphasize the quantitative change to qualitative change of artistic elements, such as points to form lines, or lines to form planes, but highlighted the expressive force of lines as an art element, and the relationship between various elements was dominated by the expressiveness of the lines.

The slight intervention of dots enhances the richness and naturalness of line transition. The combination of lines is a metaphor for the generation of planes. There is no very close interweaving between lines, but there are spaces. The relationship of "Being and Not-being

grow out of one another" between lines, and the wet and dry shades of lines that are achieved through brush and ink, continuously promotes the continuous extension of planes (Figure 1-3). However, there is no line arrangement similar to that in western sketches, that is, the mechanical superposition and intersection of lines to produce planes which are often used to express a relatively fixed momentary image, but are difficult to achieve extension in space and time.

Driven by these two kinds of relationships, the kinetic energy of visual shift and relationship change is generated, which organically promotes the extension of time and space. This relationship is particularly obvious in comparison with the works of Chinese contemporary artist Zhou Jie(Figure 1-2) . For the same motif, the tranquil landscapes, Huang Gongwang and Zhou Jie adopted very different treatment methods. Zhou Jie used long scroll painting composition, and highlighted the art element of lines , but the way of expression was deeply influenced by western painting consciousness(Figure 1-4), the lines were interweaved to express volume (space), hence the performance of the lines themselves depended on the generation of the volume image, making it difficult for the lines to be independent as an art element, and the landscapes they constructed was a three-dimensional miniature model, the space was confined in a quiet atmosphere and couldn't be extended freely, nor did it have the mental conception produced by the Gestalt completion effect.

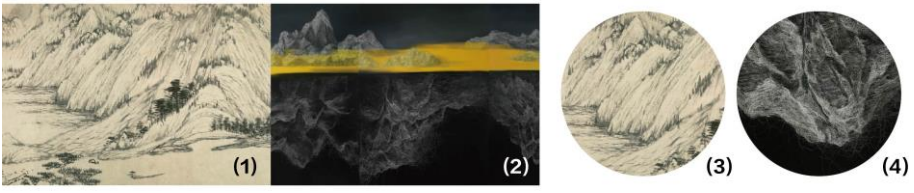

Figure 1. (1). (3).Huang gongwang 黄公望(1269－1354): Fu chun shan ju tu(富春山居图)，(3).(4)Zhou Jie 周杰：Where Are We Heading To? No.9 (artplusshanghai.com).

2. Contour and Mass - Drawing Game

Cezanne used dark lines to outline the still life, making the still life look clear and solid, and the unique role of the contours began to show. "Cubism" inherited the tradition of Cezanne's rational analysis of the structure of paintings, and tried to form a painterly space and physical structure through the decomposition and reconstruction of space and physical images to reduce the descriptive and expressive nature of the work, so as to organize a geometric structural beauty. In this process, a drawing language of "simultaneous vision" became the most important transformation of Cubism, which represented different visual images of the same object from various angles through the observation of multiple perspectives at different viewpoints. In essence, it is the deconstruction and analysis of objects (Figure 2-1).

Contours, as a sign of the transition of space, are essentially external lines to emphasize and distinguish between spaces and forms. In cubist paintings, contours are unfolded from a three-dimensional space and spread in a two-dimensional space. This is the key to realize the transition from a three-dimensional space to a two-dimensional space with characteristics of four-dimensional space-time. The role of contour is fully exerted.

In terms of the operating concept of space-time expression, cubism and Chinese landscape painting have a great degree of similarity in the composition method, but there is a problem for cubism in the expression of a four-dimensional space - the fragmentation of the image and the feeling of viewing (Figure 2-2), while Chinese landscape painting has a consistent sense of tranquility and nature without losing the narrative content. The key is that the two civilizations have different cultural origins, values and art languages (Figure 2-3,2-6).

On this issue, Purism is against Cubism's eliminating the integrity of the objects by emphasizing the change of viewpoints, hoping to further abandon the overly complicated structural details and show geometric characteristics. Purist painting also deals with the image of things by means of superimposing side contours on orthographic projection. It inherits the multi-view observation method of cubism and superimposes two different viewpoints. This processing method, has the following two effects: on the one hand, the spatial depth of the picture is compressed, presenting the expressive characteristics of shallow space; on the other hand, because the contours of all objects are very clear and interdependent, the picture maintains a strict order. Purist painting finally combines the visual image in reality with the cubist observation method of multi-perspective and different viewpoints, thus creating a new "stereoscopic" "reality".

China has a complete system of solutions to the problem, of which the two important elements are the processing of contours and the use of masses (Figure 2-4,2-5). In the Ming Dynasty, especially in the middle and late periods, the direction of art changed. The development of commerce and the civic life have enriched material civilization, so the scholar-officials did not suffer from the depression and lack of desire like those in the Yuan Dynasty; the interpersonal relationship and the relationship between man and nature also became increasingly prosperous and complicated, and the landscape painting art shifted from pure self-expression to a paradigm with more space-time experience and gamification, which required the landscape painters to have the ability to solve changing and diversified space-time. As a result, the potential of contours and masses was explored. As a single form, the mountain boundary is bound to have an end, and the perspective sense of "everything looks big in the near and small in the distance" generated by human visual perception is inevitable even in landscape paintings. In the picture below, we find that the high-altitude composition of paintings in the Song and Yuan Dynasties had been transformed into a image in depth with a space-time narration effect (Figure 2-8). For the specific composition of mountain paintings, the shape of the mountain body was no longer majestic and complete, the boundary turning points were shattered by fragmented combinations of rocks and stones or organic contours, so as to avoid the spatial isolation caused by human visual

perspective in all spatial nodes. In this way, the extension of the space was maintained and it was also in line with the practical experience of people traveling in the mountains(Figure 2-7).

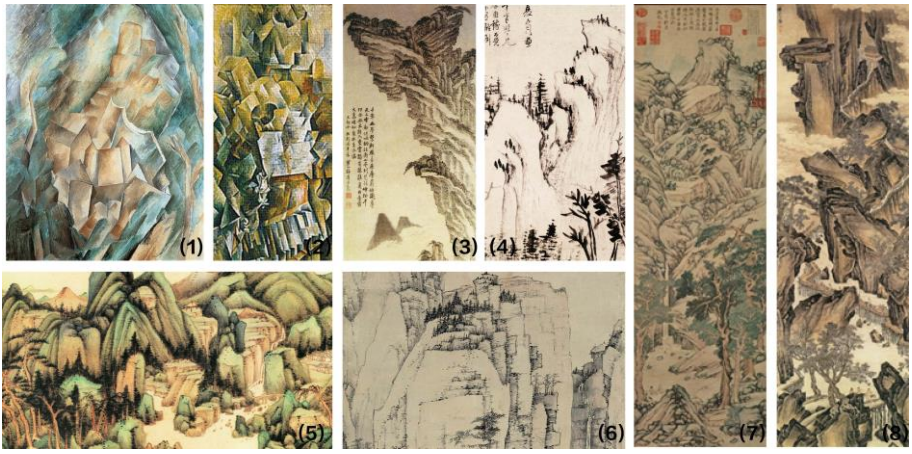

Figure 2.Representative work of (1)/(2)G.Braque(1882-1963).(3)Mei Qing 梅清(1624-1697).(4)Wang Zhirui 王之瑞(?-1660).(5).Wang Jian 王鉴(1598-1677).(6)Hong Ren 弘仁 (1610-1664).(7).Wen Zhengming 文征明(1470-1559).(8).Xie Shichen 谢时臣(1487—1567).

3. Geometry - Gestalt Completion

The overall style of Chinese painting presents a natural, casual and organic artistic language. Its object image has an internal structure with a very strong constitution law, which is covered by the rich and natural changes of artistic elements however. Although geometry exists, it does not attach importance to the shaping of the volume sense of mountains, but creates a solid and stable sense of rhythm of two-dimensional pictures, which also results in the planarized and profound space of Chinese painting, providing an expression different from the traditional western landscape painting. This is actually the way Cubism wants to explore. In Chinese landscape painting, the Gestalt method is generally used to complete the viewer's psycho visual wander, thereby abandoning the volume and the sense of existence while shaping the image of mountains.

And this also creates another opportunity, because the purpose of shaping the physical image is no longer to produce a visual perception of the sense of light, dark and volume, however it still has to show the change of the image of the mountain body, therefore the focus of each side of the mountain body does not lies in its shadow relationship different from the other sides, but the change in space implied by the artistic elements. This kind of implication of image transmission can be conveyed to the cultivated audience by arousing the schema in their mind. Images can be extended in infinite space and time, and with the unique material carriers of Chinese landscape painting, such as long scroll painting, the

audience can experience a sensory journey of mountains and rivers as if traveling there in person.

5.Paraphrases in the Visual Image Design of the College of Art and Media, Tongji University

The logo design of the College of Art and Media is composed of seven graphics that gradually change from circular to triangular. Each graphic is like a spot of light with multiple colors superimposed to form a white border on the inside and a colored outline on the outside. Its combination form is flexible, and the seven graphics can be freely combined and transformed to form a logo with a sense of movement that represents the basic order and law in art (Figure 3-1). The image poster of the A & M College was constructed by using different superposition methods in the AI software. This poster is a metaphor for the internal spatial relationship of the College, the spatial journey of the College was transformed and refined in accordance with the research results of traditional landscape painting (Figure 3-2,3-3). Combining with theoretical research on traditional Chinese garden and the practical wayfinding system design in the next step, the VI system design of A&M college with wayfinding system design had been merged into one, which created a holistic and inclusive environment for the visiting teachers and students. While visiting the School of Media, they participated immersivity in the narrative of the college space, thereby a deeper impression of the college was created.

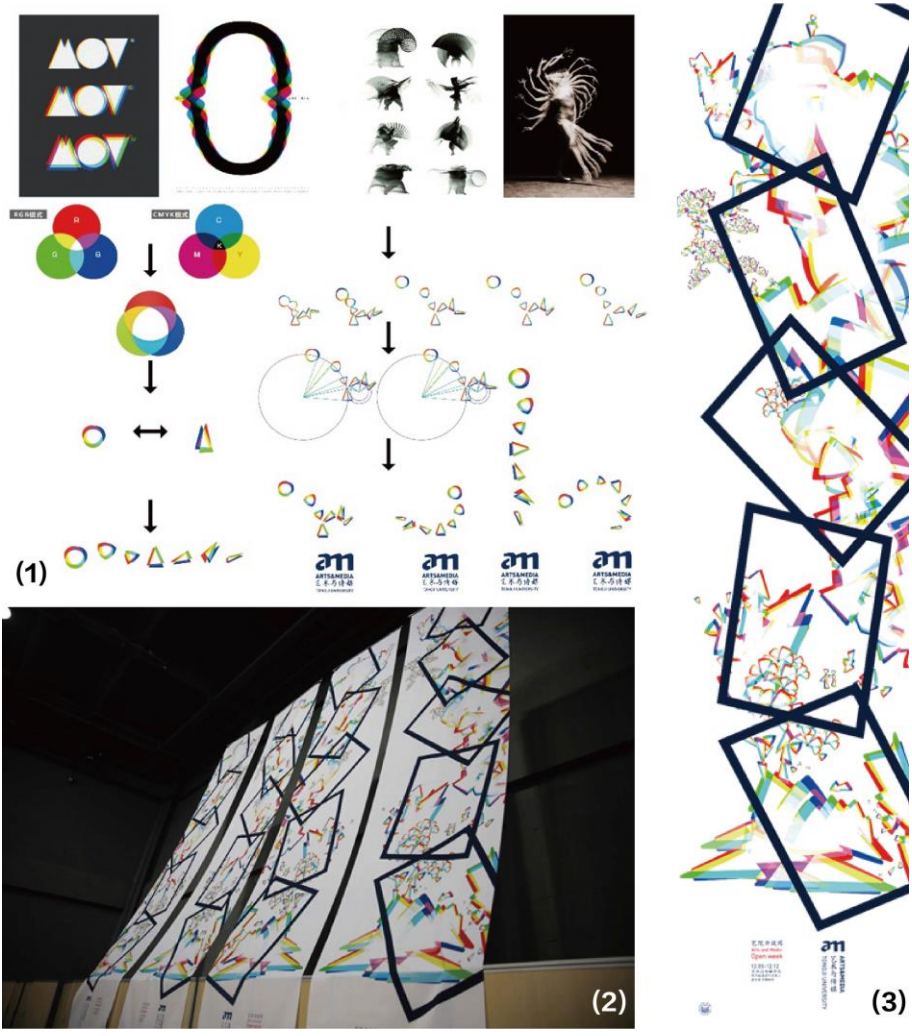

Figure 3. (1). The explanation of the Logo design process, design by Avril Accolla(2)/(3) The poster which represent the visual identity of A&M college according to the feature of space, design by Avril Accolla&Jixiang Jiang.

6. Conclusion

Human beings have tried to find the truths and mechanisms behind the cosmic space-time in the endless phenomena since ancient time, thus, different forms of carriers had been created to find and express the position of human beings. Visual perception, as the most

important sense, becomes one of the crucial parts of human creativity. However, vision is also the deepest sense that obscures us. China and the West have formed different visual and expressive systems during the past historical development independently, which continue to affect the development of their own cultures profoundly and subtly. However, in the past three years of research, what impressed me most is that human beings have more in common than what we show. The Chinese proverb says: tread different paths that lead to the same destination(Shu tu tong gui 殊途同归）, As human beings, our destiny is the same. Multicultural sustainable development and design innovation under its influence will be the source to reduce human ambiguity and to strengthen consensus. This has to be a work in progress which will never end and keep evolving.

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Acknowledgements:

I am very grateful to Professor Avril Accolla from Design & Innovation college, Tongji University, China, for her careful guidance. The subsequent research uses her practical project at A&M College as the carrier. We have sparked a spark on the common goal at the first meeting. She is full of vitality and enthusiasm for building the bridge between Chinese and Western cultures. All can get the motivation and source of inspiration for design research from her passion.

Thanks for the sponsorship and support from CSC (China Scholarship Council).

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Interplay between Ethics and Aesthetics in Intelligent Systems-Users Interaction

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Abstract | In this paper, I address the interplay between ethics and aesthetics, in the context of everyday interaction with smart systems. This study is the result of a year's time development of my PhD research, whose general aim is to understand how people's beliefs and behaviours come to be shaped by the aesthetic experience with smart *things*. The expected outcome is a set of design strategies to integrate moral reasoning in the framework of design for behaviour change, relying on aesthetics *in* interaction. Preliminary results are presented, based on a literature review in the area of *aesthetics of interaction*. Although basic, these findings are helpful for they suggest that ethics and aesthetics in users-smart systems interaction are interdependent. This insight holds promise for the development of an aesthetics of moral reasoning, in the context of users-smart systems interaction. A research-through-design approach will be adopted in the remaining two years, with the aim of testing assumptions by means of working prototypes.

KEYWORDS | AESTHTICS OF INTERACTION, ETHICAL CHANGE, INTELLIGENT SYSTEMS, BEHAVIOUR CHANGE, RESEARCH-THROUGH-DESIGN

1. Introduction

As technology advances, the production of design mutates, and so does the experience of users (Lessiter, et al., 2014). In this respect, the advent of artificial intelligence and its widespread use in all sorts of application has led to a radical change in the way users interact with products, prompting researchers to focus on a new form of aesthetic experience (i.e., aesthetics of interaction) (Iannilli, 2015; Russo & Ferrara, 2017).

What makes this type of experience unprecedented is the responsiveness of the artefacts, namely, the dynamic change of the features of the artefacts in response to the user's actions. The result is a complex relationship developing between users and systems, where meanings, emotions and actions bundle in a dense network (Jacucci, et al., 2014).

In the body of this network, ethics comes to acquire a prominent role (Latour & Venn, 2002; Lukes, 2010). Indeed, moral values crystallise into artefacts and ethical judgement actively stands behind the user's decision-making process (Verbeek, 2008). The dynamic character of such a relationship between users and products engenders a form of aesthetics that gives the user's ethical reflection a practical dimension of application. When contextualised, thus, ethics proves tightly bound to aesthetics (Saito, 2007). An exemplar case in research is that of the Kantian and Romanticist vending machines (Ross, et al., 2009), where the aesthetics of the interaction was deliberately designed to elicit *good* behaviour in users according to specific ethical values. The Kantian vending machine, for instance, adopts a rationalist perspective, representing candies through a description of their constituent parts (proteins, sugar level, etc.). While interacting, users are reminded of their body mass index and finally asked whether they really want to proceed with the purchase. In this way, the type of aesthetics epitomises a deontic proposition, that is, a statement concerning what one should and should not do.

These studies show how ethics in smart system-user interaction takes shape, literally, influencing people's behaviour. However, in the large body of research on aesthetics of/in interaction, ethics and its connection with aesthetics is hardly ever addressed and never in depth. This despite the endeavours to broaden the notion of aesthetic experience by including the psychological dimension of the interaction between smart systems and users (e.g., (Hassenzahl, et al., 2012)). Strikingly, the same applies to areas most directly concerned with changing people's behaviour through design (see e.g., (Redström, 2006; Lilley, 2009; Tromp, et al., 2011)).

Overall, a crucial aspect of aesthetics of/in interaction remains under-explored: its power to change users' behaviour by embodying ethical issues. In particular, what misses is a specific aesthetic language designed for intelligent systems, which aims at fostering users' behaviour change by stirring moral reasoning. In the context of design for sustainability, this is a great lack as moral reasoning, when conscious, can strongly affect daily behaviour by pushing people to bring into question their own individual interests in the face of collective ones.

As part of a PhD research project, this paper proposes an expansion of the notion of change-through-interaction, which includes moral reasoning as an integral part of the decision-making process at the base of users' change in behaviour. The main result of a year's time development of the project is a preliminary understanding of the interplay between ethics and aesthetics in the users' everyday interaction with smart products. This knowledge is a starting point for the development of an aesthetics of moral reasoning able to foster the users' ability to change actively their beliefs and behaviours (see 4.1).

2. Literature review

2.1 Scope of the enquiry

The relationship between ethics and aesthetics in the interaction with intelligent systems is a complex matter, requiring a multidisciplinary approach to be understood. Thus, the areas of knowledge involved are multifarious, often outside the domain of design. In my research project, I am focusing on three main areas, which can be regarded as fundamental to gain a first understanding of the mechanisms underlying the relationship under investigation: *aesthetics of/in interaction*; *user's affective response*; *ethical awareness in interaction*. In this paper, I focus on *aesthetics of/in interaction*, providing a brief account of the main approaches and theories developed in this area.

2.2 Aesthetics of/in interaction

Aesthetic (as a quality of) experience

Since the notion of *user experience design* has gained popularity, the aesthetics of products and systems has come to be conceived as part of the relationship between users and things (Hassenzahl, 2010, p. 21). Aesthetics, in this view, is not a property of objects nor is limited to their appearance. Rather, it is a dimension of the quality of the user experience, i.e., the sense of beauty springing from the subjective appreciation of things through perception.

The long-standing idea that aesthetics resides within the things being judged comes from hundreds of years of aesthetic theory searching for universal principles that allow for generalisation (Krippendorf, 2005). In this perspective, the vocabularies and guiding principles that theorists have developed focus on artefacts, neglecting the role of the perceivers. This conception, however, has been challenged over recent years by several studies claiming that aesthetics cannot be treated separately from the individual who is judging. In this light, aesthetics is deemed as context dependent as well as culturally rooted (i.e., non-universal).

In today's design research, aesthetics is conceived as a quality of the user experience, directly related to the user's affective state (e.g., see (Desmet & Hekkert, 2007)). This

approach brings the attention back to people, namely, it focuses on the empirical phenomena pertaining to the appreciation of artefacts through senses.

Interaction: where the dynamic of aesthetics unfolds

The type of experience that users have when they interact with products has changed significantly over the last few years, due to the massive spread of artificial intelligence. Indeed, the dynamic change of the features of the artefacts in response to the actions of users gives rise to a new form of aesthetic experience. For this reason, researchers in the fields of HCI and interaction design have started taking an interest in the *relationship* (i.e., interaction) between users and intelligent things, there where the dynamic of the aesthetic experience unfolds. The understanding of aesthetics in HCI and related fields, however, is anything but shared. In this respect, Hassenzahl (2008) identifies three main approaches to the study of aesthetics: *normative*; *experiential*; *judgmental*. Such a distinction is part of a larger attempt to reduce the inconsistencies emerging from different studies on the subject. Despite this attempt, the recent studies on aesthetics of interaction often combine the three approaches. Moreover, researchers adopt different epistemological perspectives on human experience, making it difficult to reach a consensus. A brief account of the different views on aesthetics of interaction follows.

Phenomenological perspective

In their study on the aesthetics of "computational things", Redström and Hallnäss (2002) developed the concept of "expressiveness", focusing on the way things appear to users. The authors draw a fundamental distinction between the notions of *use* and that of *presence*. The latter refers to the "existential definition" of things, namely the way we accept things in our *lifeworld*, giving a place and a meaning to them. The researchers position aesthetics in the relationship between intelligent systems and users, applying a phenomenological perspective to its understanding. In this view, appearance acquires importance to the extent that it embodies the identity values that users project onto it as a consequence of an inner conceptualisation. Although the authors emphasise the "existential definition" of things – their *presence* in the inner life of users – aesthetics is viewed as part of an experiential dynamic, which involves both users and things.

Pragmatist perspective

A pragmatist viewpoint on aesthetics, based on Dewey's understanding of experience (Dewey, 1980), has been quite successful among researchers in the field of HCI and interaction design. In particular, Shusterman's concept of *pragmatist aesthetics* (Shusterman, 1992) has informed various strands of research on what is termed *aesthetics of interaction*. This approach affirms the central role of the socio-cultural context in the human aesthetic experience as well as its instrumental character in everyday life. Moreover, with the concept of *somaesthetics* (Shusterman, 1999), the body is considered an indispensable

part of the aesthetic experience. This view refuses the Cartesian separation between mind and body, claiming an ontological unity between the two. Although popular, this approach has been adopted (and adapted) differently by various groups of researchers.

Peterson, et al., (2004) developed a framework for the design of interactive systems, promoting the concept of aesthetics of use as an alternative to that of aesthetics of appearance. In this respect, they are in line with Djajadiningrat, et al.'s holistic conception of design for interaction (2002), which emphasises the role of bodily experience, user's motor-skills and action-related affordances. Following Shusterman, they strongly criticise the analytical conception of aesthetics, pointing out that merely promoting visual appearance proves to be a highly reductive and simplistic view on aesthetics, given the complexity of human experience – which includes feelings, emotions, actions, and movement.

Drawing on the work of Peterson, et al., Ross and Wensveen (2010) developed their own framework, with the aim of establishing a new design approach called "aesthetic interaction through aesthetic interaction". This approach builds upon the idea that the design of interaction with smart systems is too complex to be addressed by means of non-interactive media (see (Frens, 2006)). Such a shift from theory to practice is carried out through the design of a lamp, which is intended to generate a specific aesthetic interaction by eliciting human values such as social power and helpfulness. In this respect, the researchers pursue a method to integrate ethical values in the design of (smart) product experience, connecting ethics and aesthetics.

A different interpretation of Pragmatist aesthetics is offered by Lim, et al. (2007), who look at aesthetics of interaction through the lens of *interaction gestalt*, i.e., the abstract qualities of the interaction emerging from the user experience. From a theoretical point of view, interaction is seen as an abstract entity situated between the user experience and the attributes of the artefact. This conceptual separation, it is argued, allows designers to better examine the manifestation of the interaction gestalt, turning aside from a focus on the intrinsic properties of the artefact. In this respect, Lim, et al. are interested in the immediate level of the interactive experience, i.e., the "tight coupling between human sensory and materials", which is thought to drive experience itself. This moves away from the idea of experience as something unfolding over time within a given socio-cultural and environmental context. While embracing the concept of somaesthetics, Lim, et al. focus on the abstract and intangible aspects of aesthetic experience, leaving aside the physical dimension of interaction.

Building upon Shusterman and Petersen, et al., Löwgren (2009) offers a further theoretical contribution to the understanding of interaction aesthetics. Embracing a pragmatist perspective, he seeks an "inclusive" notion of aesthetics, which combines emotions, meaning and perception. Moreover, he highlights the distinction between aesthetic judgement and "factual reports on sensory impressions" (e.g., feeling cold or warm, seeing blue or green). Overall, Löwgren stresses the fact that the qualitative assessment of aesthetic experience does not necessarily reflect the degree of allure that such experience

elicits. As an example, horror films and similar experiences seem to be appealing to people even though they elicit negative feelings. Löwgren proposes four conceptual categories that describe the aesthetic qualities of interaction: *pliability*; *rhythm*; *dramaturgical structure*; *fluency*.

Critical perspective

Marching to a different drummer, Bardzell (2009) advocates the combination of two rather different philosophical traditions – *critical theory* and *theory of aesthetics* – to strengthen and advance designerly speculation in the field of HCI. The friction between the analytic and the continental philosophy reflects the tension currently alive between the scientific and the cultural dimensions of HCI. Indeed, design has a transformative vocation, which makes criticism and speculation two fundamental requirements. On the other hand, the need to understand the phenomena pertaining to user-system interaction requires the empirical approach of science. Hence, Bardzell views the merger of science and critical theory an opportunity for the field of HCI to advance in theory development. In this regard, he strongly criticises common-sense based definitions of aesthetics that proliferate in interaction design research, soliciting an aware and rigorous use of the concepts elaborated in this long-standing philosophical tradition. As a contribution to the field, Bardzell (p.2365) identifies and discusses four strategic roles that aesthetics and critical theory can play in HCI research:

1. *"Informing the existing design process";*
2. *"Resist[ing] or innovate[ing] on the design process*";
3. *"Develop[ing] theory"*;
4. *"Expos[ing] the consequences of design*".

3. Method

3.1 Epistemology

In my research project, I adopt what may be regarded as a *constructionist* perspective on how knowledge is produced (Darlaston-Jones, 2007). Indeed, I deem reality as *shaped* through socio-technical relationships, which are situated in specific cultural, historical, economic, and political contexts. In these contexts, individuals hold and develop their own interpretation of reality through the interaction with both the environment (natural and designed) and other individuals. In the realm of scientific enquiry, I believe that knowledge is a construction that researchers articulate into a rhetoric. This rhetoric uses a specific language and semantics, with the aim of claiming the trustworthiness of what is regarded as knowledge.

3.2 Approach to design research

As a methodology, I refer to *Constructive Design Research* (CDR) (Koskinen, et al., 2013), an approach similar to *Research through Design* (RtD) (Giaccardi & Stappers, 2017; Zimmerman, et al., 2007). Compared to RtD, this approach offers a wider interpretation of the term *design*, meant as a (research) practice where methods and theories borrowed from other disciplines can be combined and adapted in a constructive way, according to both the aim and the context of the enquiry.

In the preliminary phase of the project, I addressed my research question through a classical literature review. This phase was preparatory, however, to an empirical study based on a research-through-design approach. In this respect, my process started with "thinking analysing abstracting", to use a definition from the *Reflective Transformative Design* model (Hummels & Frens, 2011).

3.3 Methods of enquiry

In the first stage of my research process, I addressed the research question by reviewing relevant literature in the areas of *aesthetics of interaction*, *user's affective response*, and *ethical awareness in interaction*. In this paper, I give an account of the studies in the area of *aesthetics of interaction*, focusing on the understanding of the interplay between ethics and aesthetics in users-smart systems interaction. In this respect, my enquiry relied on a qualitative analysis of specialised academic literature on the subject.

In the remaining two years of my PhD project, I aim to conduct empirical research in the field, adopting a RtD-based approach (i.e., CDR, see 3.2). This entails the use of a diversity of methods for data collection and analysis, ranging from ethnographic to action research-based techniques. To specify, as far as the data collection is concerned, I expect to adopt the following methods: *cultural probes* (Gaver, et al., 1999); *prototyping* (Martin & Hanington, 2012, pp. 138-139); *diaries-questionnaires-interviews* (Goodman, et al., 2012, pp. 243-272). For data analysis, I expect to adopt the following methods: *grounded theory* (Muller & Kogan, 2010); *artefact analysis* (Martin & Hanington, 2012, pp. 14-15). As mentioned in 3.2, these methods will be adapted in the context of an RtD process.

The enquiry will be carried out mainly in the home environment, although the ubiquity of smart technology – which I address in my research – makes it difficult to confine the research to a specific context. As far as the recruitment of participants is concerned, I expect to adopt a *purposeful sampling* strategy (Rapley, 2014).

4. Results

4.1 Preliminary findings

The interplay between ethics and aesthetics in user-smart systems interaction

The findings here presented constitute a basic understanding of the complex relationship between ethics and aesthetics in the interaction with smart systems. Three research areas have been addressed: *aesthetics of interaction*; *user's affective response*; *ethical awareness in interaction.* The theory in the area of *aesthetics of interaction* informs much of my first understanding of the relationship under examination.

The following points summarise my basic understanding of this relationship.

1. *Relationship of interdependence*

All technological artefacts mediate our relationship with the environment, affecting our decision-making, interpretations, and actions. As mediators, they hold the ability to direct (i.e., to change) both our understanding and behaviours as users (Verbeek, 2008).

According to Verbeek (2008), morality crystallises into artefacts, following a twofold process: "pragmatic" (related to action) and "hermeneutic" (related to interpretation). Both forms of mediation happen in the context of human experience, which is characterized by cognitive, perceptual, and emotional processes through which people attribute meaning to their own possibilities of action and the related consequences. In these processes lies much of what is termed aesthetic experience. Indeed, aesthetics consists of a qualitative (cognitive) appreciation of the features of artefacts through senses (perception and emotions). Therefore, aesthetic experience is an essential part of the mediation to which technological artefacts give rise, i.e., it contributes to the meaning-making process originated in this mediation.

As put by Saito (2007), when moral judgements are based on the "sensuous features of the objects" they can be linked to aesthetics and regarded as "moral-aesthetic judgements" (p. 210). In this view, any judgements concerning the moral character of designed objects qualify also as *aesthetic* in so far as they are based on "first-hand experience" (p.211). Moreover, there are cases in which aesthetic judgements are dictated by moral beliefs in the first place (p.215). This is the case of normative values of social and cultural type, which influence (i.e., regulate) the criteria for the appreciation of beauty. Although Saito focuses on architectural design, this interplay between ethics and aesthetics can be extended reasonably to all designed artefacts.

In all cases, the socio-cultural context – moral values included – plays a crucial role in determining the type of aesthetic experience that users have when interacting with designed artefacts. At the same time, the aesthetic experience drives moral decisions by characterising phenomenologically the mediation between people and artefacts.

In brief, ethics and aesthetics seem to be *interdependent*, in the context of the interaction between users and designed artefacts. Indulging in a simplification, aesthetics contributes to shaping moral values, as well as moral values influence the aesthetic experience. Certainly, the way this happens is anything but linear, nor it can be reduced to a simple principle of causality. Rather, the complexity of this interdependence entails multiple forms, i.e., different roles played by ethics and aesthetics in their interplay, depending on contextual factors (both at the macro and micro levels).

2. *Higher space for communication*

Intelligent artefacts give rise to a peculiar type of user experience, given their ability to respond dynamically to the users' input. Besides performing complex tasks, sensors and smart materials allow for multi-layered, highly articulate forms of communication between users and systems. Such communication can even happen at a purely sensory level (i.e., non-linguistic) without diminishing its elaborateness. The peculiarity of this type of artefacts amplifies the range of possibilities in terms of depth of communication and intensity of the experience, which makes the previously mentioned *interdependence* between ethics and aesthetics of a different kind. Indeed, the type of aesthetic experience that users have with these artefacts is phenomenologically different from – possibly richer than – that generated by ordinary artefacts (i.e., non-interactive). Likewise, the moral reasoning that such a type of aesthetic experience elicits is conceivably more elaborate, allowing for complex propositions to be articulated. In other words, the greater space for communication (whether sensory- or linguistic-based) offered by intelligent artefacts paves the way for a type of relationship between ethics and aesthetics that is multivariate and can be deeper than in the case of non-interactive artefacts.

In brief, when users interact with intelligent artefacts, the interdependence between ethics and aesthetics can have many forms and be highly elaborate, given the higher space for communication that such artefacts provide compared to non-interactive artefacts. The enhancement, in this respect, is both quantitative and qualitative. This twofold enrichment does have implications for the kind of ethical issues that can be raised through (or embedded into) the aesthetics of the interaction with intelligent artefacts. To specify, the logical chain of links that some elaborate moral issues require in terms of reasoning could be addressed by means of dedicated intelligent artefacts, whereby the space of communication is high enough to permit such a conceptual leap.

4.2 Expected results

Short-term

The main result expected in the short run is an advancement in my basic understanding of the interplay between ethics and aesthetics in users-smart systems interaction. By completing the literature review – i.e., addressing the other two areas of research previously mentioned, *user's affective response* and *ethical awareness in interaction* – I expect to gain

an essential knowledge regarding the relationship under consideration. This knowledge, I anticipate, will allow me to plan a series of experiments to be carried out in the next two years (see *Long-term*).

Essentially, by accomplishing a thorough literature review in the two remaining research areas, I expect to be able to understand what forms the interdependence between ethics and aesthetics can take. After having identified interdependence as a significant attribute of the relationship between the two, I need to examine both the mechanisms behind moral reasoning and how the affective response of users influences their aesthetic experience.

Long-term

The results I expect to attain in the long run consist of theoretical constructs (e.g., frameworks) that can be used by other researchers in the future to advance in the enquiry pertaining to the relationship between aesthetics of interaction and ethics, in the context of design for behaviour change. It is worth to clarify that the results I aim to achieve are both of propositional (i.e., pragmatic or instrumental) and investigative (i.e., hermeneutic or interpretative) type. There is no contradiction between the two as empirical research in design does have such a dual spirit, as it were.

To achieve these results, I will conduct a series of field experiments, investigating the interplay between ethics and aesthetics in the users' everyday interaction with smart products (see 3.3).

5. Discussion

5.1 Towards an aesthetics of moral reasoning

The preliminary findings of my research suggest that ethics and aesthetics in users-smart systems interaction are interdependent. This paves the way for a deeper enquiry into the *forms* that such an interdependence can take and, more importantly, into the impact that these forms have on people's beliefs and behaviours, in the context of everyday practices. Indeed, the general aim of my research is that of integrating moral reasoning – and its interplay with aesthetics – in the framework of design for behaviour change. The reason is that ethics informs (in combination with aesthetics) the decision-making process at the base of users' change in both beliefs and behaviour. As a long-term horizon for my own PhD research project, I see the development of an aesthetics of moral reasoning, in the domain of design for users-smart systems interaction.

6. Conclusions

In this paper, I presented the preliminary results achieved in my first year of doctoral research. In my project, I am addressing the problem of how aesthetics in the interaction between smart systems and users embodies ethical constructs. In particular, I aim to understand how the interplay between ethics and aesthetics (of interaction) contributes to eliciting a type of moral reasoning in users such as to influence their beliefs and behaviours in everyday life.

The results illustrated are incipient, mainly based on a critical review of relevant studies conducted in the area of *aesthetics of interaction*. Although preliminary, these findings shed light on the relationship between ethics and aesthetics in the interaction with smart systems, suggesting that they are interdependent. The various forms that such an interdependence can take determine depth and breadth of the impact on people's beliefs and behaviours, in the context of everyday practices.

At this stage of the research, the findings seem to indicate that moral reasoning can be integrated in the framework of design for behaviour change by working on the way ethical constructs are embodied in aesthetics (i.e., aesthetics *in* interaction). A deeper investigation is needed to understand how to design for an aesthetics of moral reasoning.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The pluralistic aesthetics of nowadays design

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Abstract | The paper aims to investigate some emerging phenomena of nowadays design culture, in order to find interpretative keys suitable to highlights new aesthetic dimensions of the project. The contribution results as a part of a reconnaissance in the field of international design, with reference to projects of the last fifteen years. Since the 1970s, a general crisis of Modernity, involves at the same time the founding paradigms of science and art. In this context the culture of design is nimbly able to take new paths beyond the International Style: designers responded constructively, realizing new generations of objects. The contribution proposes some cues for an interpretation of the post-industrial scenario, in order to suggest a set of key-words, emblematic of emerging aesthetics which liven up the latest design; aesthetics that result multiform and sometimes very distant from each other.

KEYWORDS | CONTEMPORARY DESIGN, MODERN SCIENCE CRISIS, NEW ART PARADIGMS, POST-INDUSTRIAL AESTHETICS

1. Paradigms of art and design at the turn point

The universal dissemination of neutral, grey, cold products has, with the International Style, was an expression of the desire to make an encoded quality accessible to everyone. The vaster attempt at conciliating industry and culture, made with great civil and spiritual strength by the School of Ulm, waivers when faced with the protest that in 1968 involves all society and the project too, and that coincides with the year the school closed. Rationalism, as a method tending towards homologation in the name of the scientific foundation of the project, excluded – at least in theory – a true aesthetic pluralism, in the name of a tendency towards formal purity.

The "dream of a world of goods ordered in a rational manner" as Stanislaus von Moos called it, fails to take hold in the new-born post-industrial society that hybrids different cultures, languages, styles and is therefore interested in new qualities of objects. In post-industrial age aesthetic paradigms fatally multiply; design hybridizes with art, confronts the new languages of the metropolis, the imaginary of goods, the new scientific imaginary linked to the advent of electronics, telematics and digital. The escalation of the environmental crisis also drives design towards eco-sustainable design and also towards Neo-organicism; the design culture necessarily interfaces in many ways with nature, also as an aesthetic phenomenon.

Two main conditions influence the transition from the modern to the post-industrial design, concerning deep changes in the paradigms of technology and art:

- the crisis of modern technical-science and the ecological matter undermine the roots of the project and result directly in the questioning a vision of the object as merely optimization;
- the modernist concept of art comes into discussion, with its idea of the existence of a mainly representative current for each period in history; instead the acceptance of a multitude of methods and conceptions takes hold. (Danto, 2008).

Although affected by this double crisis, that regards its deeper matrix, the culture of design comes out of it strengthened. In the post-industrial era design uses its ambiguity amongst the worlds of art and technology as an opportunity; it finds inspiration and new energies in all areas of science, as well as facing up open-mindedly to the world of art.

Danto claims that the end of Modernity coincides with the impossibility of art finding a single direction. Starting from the 1970s, the succession of art phenomena over time would no longer be interpreted as the obsolescence of one style through a subsequent form of art, considered able to fully represent the present era. "It is now a widespread believe that the atmosphere of the last quarter of a century, characterised by incredible productivity and experimentation in the visual arts but lacking a single narrative approach that can exclude competitor ones, has become the norm". (Danto, 2008, p. 13)

What Danto observed in the field of art is clearly reflected in what is happening almost simultaneously in the field of design culture. Starting from the 1970s, design increasingly takes on more pluralistic aesthetic.

Strange families of objects claim their presence for the first time so strongly, with the exhibition "Italy: The New domestic Landscape", in 1972 at the MoMa of New York. It's the realistic response to the crisis of a monologic aesthetics, a different sensitivity – in this case pervaded by ironic vein of Pop Art.

Starting as Avant-Gardes, Archizoom and Superstudio, UFO group, Ettore Sottsass jr, Ugo La Pietra, 9999, Heinz Frank, Coop Himmelb(l)au, Max Peintner, Haus-Rucker-Co, Raymund Abraham, are just some of those who contributed to launch a new front of projects, at first mainly provocatively; but they suggest a real, proper alternative to the black and white of International Style, unleashing a wave of aesthetic freedom that has never been exhausted to date. The objects exhausted their role as mirrors of an abstract Rationalism: people begin again to recognise itself in the warm imperfection and in the variable characters of the new artificial world.

2. Notes on the metamorphosis of object in post-industrial age

In the 20th century art gives us, as Werner Haftmann claims, the prehistory of our contemporary relationship with things. He identifies a series of approaches on the last century's painting scene that constitutes the object of values and references (Haftmann, 1972, p. 12-13)

- The power of the archaic object, the sensitivity for the magical-creatural, animistic element, the value of fetish (from Rousseau to Picasso);
- The solemnity and essential dignity of the common, forgotten things, little objects (e.g. De Chirico, Savinio, Morandi);
- The mythology of the machine or most banal device or technical object. (e.g. Léger, Duchamp);
- The mythology of lightness, fastness; the aesthetic of the energy and fluxes in technological world (Balla, Boccioni)
- The poetic potential of the refusal, the advance, the unpleasant (e.g. Schwitters, Moholy-Nagy);
- The object of dreamlike value (e.g. Dalì, Ernst, Magritte).

In post-industrial age designers take a fresh look at that part of Modernity, full of unresolved problem areas, visionary, full of creative energy, which could be fully expressed in the painting and figurative arts of the 20th century. At the same time, they demonstrate the capacity to act as a sounding board for social and personal needs and desires, to crossing new urban languages, to interact with the world of goods and that of fashion. Product design, services design, urban design, materials design, web design, interaction design,

experience design, bio design, dressing design, textile design... since the 1970s to nowadays, the discipline has progressively opened to the most varied languages, technological worlds, interdisciplinary contaminations. Crossing into so various cultural and artistic contexts post-industrial design generates objects which sometimes have an indecipherable character – and for this reason attractive – certainly difficult to catalogue according to the old aesthetic parameters.

In this context so rich, but also apparently chaotic two main guide-concepts influenced the metamorphosis of the object in the post-industrial age: the *biological* and the *immaterial*; an age defined by Michel Serres as "soft" because it can overcome the harshness of the industrial age. The two fundamental sciences of poster-modernity are identified by Serres, not by chance, with the sciences of living and telematics (Serres, 2016, p. 238).

The *biological* responds to the more general accusation brought against the traditional object: things are deaf and immobile, whilst living things are versatile, sensitive and changing. The *immaterial* regards the possibility of overcoming the solid nature of the object, in favour of a more ethereal, interactive object. The biological therefore looks to the transformation of the inorganic into the organic, to the metabolism of the object as a crucial point of view; the immaterial investigated the new artificial objects allowed by digital and electronic technology, that has redeemed the traditional things from its relational inertia. (La Rocca, 2017, pp. 68-70).

The biological and the immaterial have also acted as guide concepts by which to overcome that aridity of the object caused by its rapid emptying of symbolic, religious and magical values that took place with Rationalism (La Rocca, 2017, p. 83).

Based on this critical reconnaissance, our research has explored the international scenario of the nowadays design project, which reveals some influential categories, identified by some keyword. They help us to interpret the contemporary project as deviation from its most rigid modern matrix and, specifically in this case, to highlights new aesthetic trends. The article selects emblematic examples, by designers who are particularly active on the international scene in last years.

The nowadays design aesthetics includes not only various, but sometimes contrasting, declinations, even false affinities between phenomena of very different meaning. In the next paragraph we will analyse emerging aesthetic issues, linked to: the relationship with nature, to which the designer approaches by acquiring skills in biotechnology or, simply, for a symbolic and figurative inspiration; the two opposite poles of a deliberately modest object or a fetish-object, charged with symbolic energies and overflowing to excess; the relationship with materials and their free invention, within a direct laboratory practice by designers; a tendency towards dematerialization that stops at an impassable frontier: the inescapability of our body. So that aesthetics takes on its most literal value, as an exaltation of the five senses for a cognitive access to reality and its beauty.

3. Divergent aesthetics of the nature: living objects and bare nature

The *living object* of contemporary design can transcend two limits of the traditional object of Modernism, which is limited to being mechanical, rigid, unable to transform and evolve. The living is not an object generically inspired by nature, nor necessarily associated with eco-sustainability, but it tends to be concretely made of living elements; this implies a strong identity and aesthetic imprint.

As Blaise Cendras wrote, “life is efficiently, manifestly, formally space and time sublimed, merged, aromatised. It is honey”. Indeed the living in contemporary design is a key word that irresistibly draws in designers and without doubt the strongest declination of the *biological*.

In recent years, specific design researches move along the increasingly flexible boundary between the object and the living system. The attraction for the biological, of the avant-garde utopian aspiration (i.e. Metabolism, William Katawolos, Rudolph Doernach) today can take advantage of the continuous and fast new acquisitions of scientific research and biotechnology. Design conjugates in new forms chemical research, bioengineering, advanced materials, creating interesting short-circuits between science, technology and art.

New designer figures interact with interdisciplinary teams and several exhibitions investigated in last years these new frontiers. Among these, *Design and The Elastic Mind*, the exhibition organised by the New York MoMA in 2008; *Biodesign. Nature, Science, Creativity*, again at the MoMA in 2012; *Synthetic: Art and Synthetic Biology*, at the Natural History Museum of Vienna in 2011; *Grow your Own*, presented in 2014 at the Dublin Science Gallery.

Design takes on the governance of experiments, the purpose of which may be each time mainly artistic or technical. A great variety of researchs and projects emerges today, involving organisms on all scales, from plants to bacteria, algae, fungi or individual cells. Eric Klarenbeek e Maartje Dros with the project *3D Bakery,* Sonja Bäumel with *Bacteria Textile*, Naja Ryde Ankarfeldt with *Microbial Skin*, Suzanne Lee with *Biocouture*, Aniela Hoitink with *Mycotex mycelium textile dress* work in this direction; they are all representative of an expansive design research that includes textiles for fashion, sustainable packaging, attempts at mutating dynamic graphics, as in the project *Symbiosis* by Lan van Abbema. A special design award "Bio art and design", was assigned in 2016 to the designer Angelique Spaninks for the project *Fluid Matter.* The Officina Corpuscoli’s researches, develops a new paradigm for the project: the slogan “growing design” identify the possibility of a diffuse industrial product, processed by the action of living organisms.



Figure 1. Officina Corpuscoli, in collaboration with Sonja Bäumel, Co-de-iT, WASP e Waag Bio-logic. Living structures and swarm bodies, *2013 ongoing. Interactions between biological and digital computing, in the forms of Slime Mold and 3D printed architectures.*

Among the aesthetic trends regarding the relationship design/nature, we can identify another key-word: *bare nature*. In this case the deterministic vision strictly connecting functionality/aesthetic, which Rationalism saw in the systems of nature, is completely out of play. The substance of the project is the natural element or event, such as the growth of a plant, the chemical reaction of a mineral, grass and earth, a common stone, all in their symbolic value.

We can rather refer this new kind of aesthetics of nature to the anti-deterministic vision that Roger Caillos observes in many phenomena: “Man is free, clumsy, sometimes perverse”. In the natural world, organic or inorganic, beauty is sometimes completely enigmatic and inexplicable. “Without knowing anything, thanks to an impenetrable metamorphosis, the lepidopteran draws gaudy wings from the indistinct mixture that fills the nymph. Man puts the risk of a deliberated, doubtful decision between himself and his work” (Caillois, 1998, p. 36)

Germano Celant comments on the movement of *Arte Povera*, which in the late 1960s conquered an important role on the international art scene. “The artist-alchemist organises living and plant things into magical facts, working to discover the real heart of things, to find them and exalt them. His work does not, however, look to use the simplest materials and

natural elements (copper, zinc, earth, water, rivers, lead, snow, fire, grass, air, stone, electricity, uranium, sky, weight, gravity, heat, growth, etc.) for a description or representation of nature; what interests him is instead the discovery, the presentation, the insurrection of the magical, wondrous value of the natural elements" (Celant, 1969, p. 54).

We can adapt these words to the defining, many years later, research, projects and exhibitions that underlie new critical visions of nature. Some significant examples of a bare nature design include Sayaka Yamamoto's researches, as *Little Wonders*; Zanellato's work, *Affinità naturali*; the research by Tomás Gabzdil; Francesco Faccin, with his *Allevamento Domestico*; Ferreol Babin, with the project *Fusion Containers Drawing*. The exhibition *Post Fossil Excavating 21st Century*, by Lidewij Edelkoort – featured for the first time in 2011 at the Design Museum Holon in Israel –, mixes freely fake palaeontological findings, the matter of the fossil, and the theme of primitivism.

Designers today show a great interest for the natural element as a fragment that can be drawn from without mediation, or for a manipulation of the material with the alchemy-type laboratory style. Dissonant interpretations of a relationship with nature, however rich in symbolism and made of hidden references to the mystery that is intrinsic to it.



Figure 2. Giorgia Zanellato, Affinità naturali, *2014.*

4. Object with a mini-ego and fetish object

An object with a mini-ego expresses a design quality that has apparently withdrawn into a minor sphere, but many designers make their small gestures and discrete intervention into a form of poetry and aesthetics. A mini-ego object mainly refuses the arrogance of costly products, the object as a status symbol to flaunt.

As Maurizio Vitta observes, “the philosophical thought has contemplated the world of everyday experience with suspicion, keeping it at a respectful distance at all times. Being unable to deny it entirely, it has merely ignored it, at most very hastily noting its distant presence”. (Vitta, 2012, p. 182). But the world of everyday existence, of the object as minute being, in any case re-emerges

Already at the end of the 1970s, Félix Guattari was talking about a transformation of society based on a microscopic scale, a real *molecular revolution* (Guattari, 1977). Social utopia and revolutionary hope have made way for everyday micro-utopia, given that any overly direct critical position of society appeared to be in vain. In approaching the preparation of a design philosophy, Bruno Latour identifies an escape route from a *muscular artificiality* in the care and attention to detail, for a world of objects that instead contemplates material, morality and sustainability. (Latour, 2008)

In the book *Sale fino, Nuovi sapori del design italiano*, a design generation attentive to a minimalist object, apparently as modest as it is refined, is presented by Beppe Finessi. There are projects by Lorenzo Damiani, Paolo Ulian, Joe Velluto; but also Aroundesign, that with the simple cutlery *Moscardino* wins the XIX edition "Compasso d'Oro" Award. (Joe Velluto, 2005)

A panorama of the mini ego objects has significantly represented also in several exhibitions: *ReDesign The Daily Products of the 21st Century*, by Kenya Hara in 2000, commemorates the 100th anniversary of the Japanese company Takeo Co; *The New Italian Design*, presented by Silvana Annicchiarico and Andrea Branzi at the Triennale di Milano in 2007, that showed many projects in this line; *Microfacts* by Stefano Maffei in 2016 at the Milan Subalterno, a series of micro objecst by 14 Italian designers.

What is certain is that the objects are studied very closely indeed, not to force them into a sort of obsessive ergonomics or in the myth of the technical precision, but rather for a new attention to microsociology of the everyday, its imagination and gesture.



Figure 3. Modoloco Design, La dignità del tassello*, Microfacts 2016. Each wall plug is conceived according to a particular style, from modern to contemporary design.*

Apparently opposed to the minimal object, we find another key-word, *the fetish*. It represents a reaction to the "soul-less" object of the Rationalism, to the long exclusion of the iconic-irrational, the anthropomorphic and the zoomorphic form the project.

Gillo Dorfles was one of the first, in the 1970s, to reintroduce the subject matter of the affective relationship with objects, connecting this to the expressive intensity and mythopoeic load of the pre-industrial object. In this context, he returns to the idea of the object-fetish as a reaction to the idea of the closure of the industrial product in the pure values of rationalism and as a new tendency towards the ritual and the symbolic. (Dorfles, 1988)

From his vast anthropological research, Claude Lévi-Strauss appears to also draw the following general consideration: fetishism is not a fogging of the "wild thought", but rather it has an *excess of meaning* of which man can make the most to know the world. (Lévi-Strauss, 2010) Is it unthinkable for western, civilised man to imagine a quid of life in the inanimate object? As Marc Augé points out, "what is perhaps more unthinkable is pure material, mineral homogeneity: it has to be animated if we are to understand it and start to consider it ". (Augé, 2002, pp. 23-24) Animism, therefore, apparently diametrically opposite the inertia of the raw material, at a more careful reflection appears to complement it.

For Karl Marx, fetishism is "a device that can subvert the relations between the animate an inanimate, between the material and the imaginary and project onto things a close-knit set of expectations, symbols and affective values." (Fusillo, 2012, p. 22)

The fetish object is in fact first and foremost one that opposes pure efficiency, refuses to disappear into its mere function alone; it thus charges itself with a mysterious power, becoming enigmatic and impenetrable in its violation of the boundary between people and things. (Carmagnola & Ferraresi, 1999)
Today's fusion of the fetish with electronics, smart materials and advanced technologies introduces a particularly interesting declination: the sense of the archaic blends with the concrete possibility of making it an animated device.

The most emblematic exhibitions related to the theme is *Fetishism. Obsessions in Fashion & Design* (Trapholt Museum, Denmark March 2015 - January 2016) organised by L. Edelkoort, P. Fimmano and W. Schenk. It exhibits objects of approximately 100 designers, including, Maarten Baas, Marcel Wanders, Jaime Hayon, Iris van Herpen, Walter van Beirendonck, Studio Job, Kiki van Eijk, Bokja, Bertjan Pot, Christien Meindertsma, Claudy Jongstra, Iris van Herpen, Rick Owens, Undercover and Phoebe Philo. The settings are divided up into ten themes, including nudism, sadomasochism, absurdism, consumism, romanticism, legendism, shamanism and spiritualism, all relating to a sort of fanaticism and obsession for the object and its details.



Figure 4. Fetishism, the exhibition by Lidewij Edelkoort, in his first version at Milan Fuorisalone, 2014.

The aesthetics of the fetish and the mini-ego object, although they seem to be opposites, can they coincide? Probably in the irony of Modoloco design, where small hardware

elements, wall plugs, each one takes on an iconic value. The obsession with detail is, on the other hand, as characteristic of fetishism as it is of design.

5. Sensory and neo-material aesthetics

The *sensory* key-word identifies a reaction of design culture to the devaluation of the empirical knowledge, implicit in modernist methodology, and the exclusion of the varied sensory range from the centrality of a project, all focused on vision. The traditional object is, by its very definition, an isolated entity, unable to interact, destined only to be observed.

From the point of view of Modernism, the object lies in a space marked out by geometry, which is interpreted as a direct filiation of the renaissance: as in the Renaissance, form is reduced to abstract schemes and a system of syntactical relations, the eye therefore plays a neutral role of observation. (Payne, 2011, pp.76-77) The object is simple, glossy, made up of elementary forms and lives in a space that is basically sexless, with no noise or odour, illuminated as day with no penumbra; the fundamental qualities of an environment or object can be ascribed to the coherence of form, structure and functional needs, rather than to be experience-based.

Clino Trini Castelli and Branzi in the 1970s develop the *Design Primario* movement, focusing on the *soft qualities* of the products and the environment. They collaborated with various Italian companies on the development of products endowed with new aesthetic values: chiaroscuro, the environmental music, the microclimate, the olfactive and tactile aspects and material finishes; all the aspects of perception neglected by Rationalism become material for the project (Castelli & Petrillo, 1982). The expansion of the discipline of design beyond the hyper-defined object and towards the concept of experience today moves along this line.

The Ying Gao's interactive clothes of the project *Incertitudes*, the work *Olfattorio* of Cristina Celestino, the project *Nascosto* by Officina Corpuscoli, based on an amplified sound by bacteria, the project *Anthropomorphic Sensory* by Lesley Ann Daly, are some emblematic examples of a design propensity to valorise a large sensory range. In the work of Usman Haque, the presence of the human body can interact with devices for a single sense, as in his projects *Sonic Environment* or *Scents of spaces*. MachineHistories group with the project *Cymatics Display,* feels the need to transform pure data from the Internet into tangible matter and sensory relationship.

The user is immersed in an iridescent concatenation of flows and stimuli that tend to involve it emotionally. The aesthetics, we can say, reaches his most large meaning – once present in the vibrant, multi-sensorial interior of gothic cathedrals –, neglected by Renaissance and thus by Rationalism.



Figure 5. Bruce Munro, Tili Wiru Tjuta Nyakutjaku *, Uluru, Australia, 2017.*



Figure 6. MachineHistories, Cymatics Display, 2014. A device that generates waveforms through water, managing in real time data from an Audi's social campaign.

The key-word *neo material* is linked to the sensory but concerns the production process rather than the user's experience. The neo-material appears in fact as a reaction to the scission of thought, machine and hand, characterizing the standard production of the modern industry.

Today designers appear to refuse the hidden, separated production process and declare, in multiple manners, the value of a free invention of their material world. Producers in the first person, devoting their time in certain cases to the development of specific machinery. “The neo material comes within the folds of the most advanced experiments, moving between scrupulous laboratory research and an investigation into the machines and materials used for the direct construction of the project” (Scarpitti, 2017, p.131).

A scenario that is at the opposite end of a model in which industry is delivered the abstract matrix, the project, that the machine will automatically be set to develop and replicate. In the staff laboratory, in the individual process, instead, *something* always happens.

We can mention the research conducted by Studio Formafantasma, on natural polymers, by Lucie Libotte, on dust, or Aliki Van Der Krujs, on rain, by Jolan van der Wiel, through a blend of magnetic powders and pigments. In the project B/NDALTAAU Revital Cohen & Tuur van Balen, invents a new mineral recovered by old hard disks.



Figure 7. Studio Laura Daza, DIY Colour Recipe Book, *2014.*

"Heterogeneous, unexpected, organic and inorganic materials, digital instruments and machinery; everything is positioned in a single synaesthetic space that is the laboratory. This intersection of vision and techniques gives rise to the most unforeseeable products" (Scarpitti, 2017, p. 132). The strength that the final project releases can prove to be proportional to the energy released into the production process, the direct working of the material, with all its imperfection and rejects. The virtual and the dematerialisation perhaps reach their bank and unsurpassable limit not only in the mineral hardness – that in any case characterises the world – but in the essential corporeity of man and his hands.

6. Design at a forefront

As shown, design continues today to play a forefront role, using ever-new ways to become an interpreter of the metamorphosis of the object: softened or cruel, material as a stone or immaterial as a sensation, indifferent, minimal or excessive, ...anything but annihilated.

The multiform aesthetics in design we note today, can be interpreted as specific answers to the critiques that have progressively invested the cold object of International Style. The *biologic* and the *immaterial* however represent the underlying matrix of contemporary design sensitivity; two concepts apparently distant, but concordant for an evolutionary, light, performative artificial world. A world complex because interwoven with values and qualities: the closeness to nature and the valorization of the human experience of making, in multiform senses and perspectives. The most advanced design looks after both.

Will be so plural also the future aesthetics of design? We imagine yes, unless the future has a *new glance* in store for us, capable of flattening art, reality and technology under a new light, stronger or with the same intensity as Rationalism.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The role of vernacular typography in the linguistic landscape of multicultural Singapore: A multimodal analysis case study of a gentrified street

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Abstract | The art of typography has been receiving a fair amount of attention at the crossroads of linguistic landscape, garnering the interest of sociolinguistics. Technological advancement has pushed typography to the forefront alongside traditional modes of communication. It is therefore no longer viable to limit the analysis of communication modes to just speech and writing but to also consider typography as an important semiotic mode for meaning potential in its own right. This paper attempts to present a case study of analysing the vernacular typography of a gentrified street (Haji Lane) in Singapore through a multimodal analysis approach. The results provided preliminary insights into how Singaporeans through the creative expression of typography and language use, assert their 21st-century multicultural identity alongside the nation's de facto language – English, in a situated gentrified urban environment. The study also contributes to an on-going endeavour of semiotizing typography as a mode for rational explanation.

KEYWORDS | LINGUISTIC LANDSCAPE, TYPOGRAPHY,

MULTIMODALITY, SEMIOTICS, VERNACULAR TYPOGRAPHY

1. The relationship between linguistic landscape and typography

Linguistic landscape is an emerging field that refers to the "display of visible written language"(Gorter 2013, p.190) in a public domain taking into the social-cultural context that it's situated in. Linguistic landscape is hugely underpinned by prominent linguists Scollon & Scollon's (2003)'s concept of its geosemiotics framework, arguing that the study and interpretation of signs and language should take into consideration of its placement in the material world. The multi considerations of linguistic landscape thus require a cross-disciplinary analysis (Gorter, 2013). According to Gorter(2013), linguistic landscape is an "ecological arena"(p.197) that considers not only the modality of written text but also considers other modalities such as oral, images, objects, and placements situated in time, space, and people associated with. It can also be used as a research tool to understand language trends in urban spaces and the way in which users use the languages are also especially helpful to understand issues of multilingualism (Gorter, 2012).

Machin (2007) and Leeuwen (2006) called for the consideration of typography as semiotics in its own right so as to expand the linguistic analysis of traditional communication modes beyond that of just writing and speech. Designers Baines & Haslam (2005) also highlighted the disconnection of typographic studies and the features of language calling for more joint investigations of the two highly interconnected fields – language and typography. Machin(2007) argued that linguists have often neglected works from visual and media academics but at the same time, there is also an obvious lack of linguistic engagement within the field of visual communication.

The multi-dimensional nature of linguistic landscape thus opens up opportunities for scholars to rethink the traditional modes of communication which have been primarily speech and writing and call for consideration of other aspects of communication that language and signs are situated alongside in. The art of typography in particular has recently been receiving a fair amount of attention at the dynamic crossroad of linguistic landscapes around the world.

Creative designers, Banham (2011), Villagomez (2015), and Woodward(n.d) started documenting series of letterforms found in the urban environment and posited how cultural and historical changes affect typography evolution of the city. In Hong Kong, there is emerging anthropology and topology research of bi-lingual typography of the city's vernacular neon signs creation and other everyday signage (Lou, 2016; Chen et al, 2014). In London, designer Hyndman(2016) has been conducting typographic tours since 2013 in the Dalston area of London with the aim of paying homage towards the working-class history, also embarks on a series of typographic experiments on how the visual display of typefaces has the power to affect our everyday decision making. Curtin's(2015) research into the playful linguistic landscape of Taipei's commercial signage took into considerations not only the verbal and written communication but also the visual treatment of commercial signage

interpreted. In Singapore, academics have been looking into various shopfront signages in recent years particularly from a multilingual perspective (Shang & Guo, 2017; Hult & Kelly-Holmes, 2019).

2. Situating typography in linguistic landscapes

Typography is often seen as secondary to the meaning of the written content as it's often associated as a technical craft of aesthetical legibility instead of an important semiotic mode in its own right (Baines & Haslam, 2005; Leeuwen, 2006; Serafini & Clausen, 2016). However, the ease of technological advancement means communication work in public spaces that are used to be done only with the use of language now shares the responsibility with the art of typography making. (Baines & Haslam, 2005; Leeuwen, 2006).

The importance of the relationship between typography and linguistic landscape is further revealed by Banham's (2011) documentation of typographical signs seen around a city arguing that sign reveals cultural stories that have the potential to converge different disciplines together, allowing the audience to relate to typography to a "larger cultural experience"(p.14) and creating new avenues of heritage appreciation. Baines & Haslam (2005) likens typography to inventions of the wheel and electricity that "underpins modern Western Life" (p.10). Lupton(2010) and Hydnman (2016) demonstrates how the creative usage of typeface choices and treatments are not only of legibility or aesthetical consideration but provide contextual narratives that the typefaces are situated in. These examples highlighted by creative designers align with Scollon & Scollon's (2003) geosemiotics framework of signs and language analysis putting typography in the limelight of linguistic landscapes.

The definition of typography has hence evolved over the years from simply the study of its legibility (Warde & Lange, 1980) to the creative arrangement of text and typefaces efficiently as a visual system of processing information and word-based knowledge transmission (Ambrose & Aono-Billson, 2011; Baines & Haslam, 2005; Hoeks & Lentjes, 2015;). In recent years, the definition of typography has started moving away from the aesthetical ability and functional means to a much more conceptual definition described by Ambrose & Harris (2017) as "the means by which a written idea is given a visual form" (p.6) rendering typography's capacity to influence communication in our everyday contemporary society.

Technological advancement has made it easier for anyone to arrange text and images in different combinations (Machin, 2007). Not only do designers have greater access to software tools to express communicative functions through the art of typography, but the untrained layman can also attempt to create typography for communication with greater ease than before. Thus, it has become a comfortable subject of discussion in everyday conversation and is acknowledged as an important expressive element of our everyday culture (Banham, 2011). The ease and rise of typographic presence in our everyday urban

spaces including the retail environment testify to the importance of the role that typography plays in communication and thus in the linguistic landscape.

3. Typography as a semiotic resource for analysis

Typography – a subject area within the domain of graphic design as the art of typeface arrangements has emerged to be an important mode of analysis with meaning potential (Curtin, 2015; Hult & Kelly-Holmes, 2019; Lou, 2016; Serafini & Clausen, 2016; Shang & Guo, 2017; Järlehed & Jaworski, 2015).

This is largely due to the on-going attempts of systematically organizing the subject as a semiotic system by academics of various fields which includes linguists, semiotician, and designers (Ambrose & Harris, 2017; Baines & Haslam, 2005; Hyndman, 2016; Leeuwen, 2006; Lupton, 2010; Machin, 2007).

In order to consider typography for analysis at the crossroads of linguistic landscapes, it is important to establish typography as a semiotic mode in its own right with its own set of grammar and lexicon. Linguist Van Leeuwen (2006) noted the potential of typography as a medium with its own lexicon but noted that it lacks "complex grammar" (p.154) to consider it as a mode. Without an established set of grammar – analysis thus becomes unsystematic.

Van Leeuwen(2006) then made a pioneering attempt to argue for typography as a "means of communication in its own right" having the capacity for fulfilling Halliday's (1978) three broad communication functions of ideational, interpersonal, and textual. Analyzing distinctive features of typography such as type weight, type manipulation, type connectivity just to name a few for the meaning potential that each features produces. Van Leeuwen (2006) attempts to present a systematic way of semiotizing typography not only with its lexicon but at the same time figuring out whether it may have a set of complex grammar.

The graphic design domain whilst less established than it's linguistic counterparts had since seen various endeavours by visual design academics in recent years to conceptualize typography as a systematic resource, breaking down visual cues into basic components to develop a typographic lexicon and grammar that can serve as rational choices and explanation within a context instead of depending on abstract intuition.

Visual design academics are now presented with opportunities to reference it's established linguistic counterparts to examine typographical visual written form playing out in linguistic landscapes with its own set of typographical lexicon and grammar.

Ambrose & Harris(2017) deconstructed typography in all manners of it's visual cues from the style of typefaces to the way it's being used, at the same time providing various visual examples located in the material world of how the visual cues provided meaning potential in the context of communicating messages across. Hyndman (2016) highlighted typography in the manner of how choices of typefaces can potentially influence decision making processes

in our everyday environment. Lupton (2010) provided explanations of how layout alignment variations could communicate different moods and messages. All of these point to an on-going endeavour of demystifying typography as simply an abstract art of visual text arrangement.

4. The multimodal analysis

The concept of multimodality in linguistic advocates for the analysis of communication of both visual as well as textual. Advocates of the multimodal concept encourage academics to move away from traditional monomodal analysis, i.e analysing only just text or just visuals, and instead take on a holistic approach of semiotics analysis to move forward with the way communication advanced beyond just text and content (Kress & Leeuwen, 1996; Machin, 2007). The framework for a robust multimodality analysis is however still controversial and lacking (Leeuwen, 2006).

5. Purpose/research question

This paper hence attempts to present a small-scale case study of analyzing the vernacular typography of a gentrified street (Haji Lane) in Singapore via a multimodal analysis of both the text and it's visual form, and through the process, allows it to reveal potential cultural, social and historical narratives of Singapore's multicultural linguistic landscape.

Through this small-scale case study, the paper aims to respond to the above backdrop by contributing to the search for a more robust analysis framework of communication work done through typography.

6. Shop signage analysis through the lens of vernacular typography in Haji Lane

Vernacular typography in this paper refers to the art of creative textual arrangements created by ordinary people, who may or may not have any typographic training. Vernacular typography is usually differentiated from globally recognized standards of typography making and reading. Created by the everyday ordinary people, vernacular typography reflects the everyday voice of the environment it is situated in rendering it a suitable choice of analysis for linguistic landscapes. Amongst the variety of vernacular typography, signage has been considered as an important "visual fabric of a neighbourhood" (Banham, 2011) and shop signage is especially vernacular due to it's "bottoms-up" nature of creation (Shang & Guo, 2017) and has provided rich materials for analysis in various linguistic landscapes research (Lou, 2016). This paper hence proposes to analyse four shop signage in Haji Lane located in Singapore.

7. Methodology

7.1 Research site

Haji Lane has been chosen as the street for analysis due to it's recent years of gentrification from historically a quiet Muslim residential quarter to a trendy lifestyle hotspot for young Singaporeans and tourists alike. Independent shops set up by young designers and entrepreneurs offer an array of lifestyle options from fashionable wear made locally to eclectic vintage wear, of food and beverages that pride its' local origins and inspiration (Walk Down Haji Lane in Singapore, 2017). Haji Lane has in recent years became the epitome of an ideology determined to move away from the standardization and homogenization of offering due to the effects of globalization, providing Singaporeans and tourists alike an alternative form of consumerism.

7.2 Data collection

Four shops that operate on Haji Lane have been chosen as the sample for analysis. The four shops are chosen on the basis that each shop offers a different nature of business from each other to reflect the diversity of offering on Haji Lane. The shops were also chosen on the basis that the main language used on the shop front signage each reflects the diversity of the four main languages of Singapore - English, Chinese, Malay, and Tamil. However, no Tamil was found to be used as the main language of the shop front signage on Haji Lane. Thus, Tamil representation is missing from the sample size.

The criteria of analysis are such that each shop will be analysed for its shop front sign and one other supporting visual collateral. In the study of branding, the visual identity of a business goes beyond that of its name on the signage but is interlinked by a series of other elements to communicate the brand offering (Slade-Brooking, 2016). Hence the author attempts to also analyse a second visual collateral that supports the business communication for a more holistic representation of the typographical communication that it's situated in. As per the shop front sign, the second visual collateral must deem to be displayed explicitly in the public eye.

Table 1: Comparison of the types of supporting visual collateral in addition to the shop front signage across four shops in Haji Lane, Singapore

Name of shop	**Good Luck Beerhouse**	**The Singapura Club**	**家 Jia**	**Mokita Cuisine**
Types of business	Beerhouse	Contemporary Indian and Malay cuisine	Contemporary female fashion retail	Traditional Malay cuisine
Main signage	Shopfront sign	Shopfront sign	Shopfront sign	Shopfront sign

Supporting collateral	Secondary sign	Secondary sign	Stairways	Banner

Machin(2007) and Leeuwen(2006) both of whom are linguists attempted an inventory of typographical features which typography can be semiotized to create a 'typographic profile'. This paper however proposes to consider three other features as part of the inventory in an attempt to decipher the meaning potential behind the typographic treatment of each shop and by extension provide a more holistic overview of the linguistic landscape of Haji Lane. This paper will hence analyse the following three suggested modes employed to highlight any meaning potential:

1. **language choice** of the shops' signage
2. **typeface classification** used in the typography creation and
3. **type hierarchy methods** employed

Due to word restrictions, the author will present only two examples of analysis in each of the above categorization.

8. Analysis and findings

8.1 Language choice

Singapore is a multicultural society with four main languages (English, Mandarin, Malay, and Tamil) being used and spoken with English as the official communication. It is important to consider how these languages are being visually displayed and juxtaposition with each other reflecting the cross-cultural spirit of the street.

From table 2 below, English is seen to be present in almost all the shop front signage and in all of it's supporting collaterals. All shops have an additional language used apart from English, either as part of the shop front signage or on it's supporting collaterals. This reflects a very diverse representation of the business and the way each business wants to project its identity for the customers. The usage of Tamil language is however missing from the sample as no shop features Tamil as the main language of any shop front signage.

Table 2: Comparison of the language used on signage across four shops in Haji Lane, Singapore

Name of shop	**Good Luck Beerhouse**	**The Singapura Club**	**家Jia**	**Mokita Cuisine**
LANGUAGE FEATURED				

Shopfront signage	English	Romanized Sanskrit, English	Chinese,PinYin (official romanized Chinese)	Malay, English, Arabic
Supporting collateral	English, Chinese	Romanized Sanskrit, English	English, Chinese	Malay, English, Arabic



***Image 1**. Signage of 家Jia – contemporary female fashion retail. Left: Shopfront signage. Right: Stairways (supporting collateral)*

家Jia *(contemporary female fashion retail, see image 1*) - shopfront signage did not feature any English words but instead a romanised version of the Chinese word 家 which means *'home'* and has been translated into English pronounced as *'Jia'. 'Jia'* does not mean anything in the English language but for an audience who is bilingual in both English and Chinese, *'Jia'* becomes an accompanying English name to the Chinese name of the shop. The supporting collateral is a mixture of English and Chinese language. English is used to describe the type of fashion wear that the shop retails while the shop's name in the Chinese character 家 is repeated on the stairways. This perhaps suggests that while Chinese is used for the shop front but when it comes to the description of its products, English became the choice of communication.



Image 2. *Signage of Mokita Cuisine – a traditional Malay cuisine restaurant. Left: Shopfront signage. Right: Banner (supporting collateral)*

Mokita Cuisine *(Traditional Malay cuisine, see image 2)* - the shop front signage features Malay, English, and Arabic language. *'Mokita'* does not mean anything in the Malay language but when deconstructed, *'kita'* means *'us'* and is a recognized Malay word. Adding the word *'Mo'* to the front of *'kita'* suggests it's probably a Malay shop vendor's name. The word *'Cuisine'* is in English. By combining a Malay name with an English noun, it suggests some form of Malay authenticity to the dishes served while communicating to potential customers who are likely to be English speaking. At the top of the signage is the use of Arabic depicting an Islamic phrase of morning prayers. The supporting collateral is a combination of the same three different languages as used for the shop front signage - English, Malay, and Arabic. English is mostly used to describe the kind of dishes served in combination with some Malay words such as *'Satay'(meat skewers*) or *'Ayam' (chicken).* At both top corners of the supporting collateral is the well-known Arabic phrase pronounced as 'halal' which refers to a form of animal slaughtering adhering to Islamic law according to the Koran. This is in turn translated into its English pronunciation below.

8.2 Typeface classification

Typeface classification is often categorized according to their historical origins and by extension, its inherent characteristics (Ambrose & Harris, 2017; Lupton, 2010). This means each category typically possess some similarity of characteristics and reflects a certain narrative associated with a particular era or culture.

Table 3 below shows a variety of typeface classifications used that is beyond that of the Latin system categorization reflecting diverse creativity of representation of the business. However, as per the language used, the use of Latin type classification is still prominent in all

of the shop front signage as well as the supporting visual collateral due to the prominence of the English language.

Table 3: Comparison of typeface classification used across four shops in Haji Lane, Singapore

Name of shop	Good Luck Beerhouse	The Singapura Club	家Jia	Mokita Cuisine
TYPEFACE CLASSIFICATION USED				
Shopfront signage	Slab Serif	Modern	Archaic Chinese script, Neogrotesque	Latin script, Arabic script
Supporting collateral	Latin script, Chinese brushstroke characters	Modern, Grotesque	Calligraphic script, hand lettering, Transitional	Humanist Sans, Arabic script



Image 3: *Signage of Good Luck Beerhouse – a beerhouse. Top: Shopfront signage. Bottom right: Secondary sign (supporting collateral)*

Good Luck Beerhouse *(Beerhouse, see image 3)* – the shop front signage uses a very heavyweight slab serif typeface with British historical origins reflecting a British–styled pub appeal but yet the accompanying visual collateral features bold use of Chinese characters in brushstroke style demonstrating the desire to assert the business's Chinese identity at the same time. It is perhaps suggestive of the Singaporean's bilingual pride and patriotism while offering locally brewed beer.

Mokita Cuisine *(Traditional Malay cuisine, see image 2)* - uses the Latin script to visualize the shop's name in English but at the same time also uses the Arabic script on top of the shop's name illustrating Muslim's morning prayers of good wishes. In the supporting collateral, a banner, Humanist Sans typeface which is a very legible san serif typeface is used to describe the type of food served in the restaurant accompanied by the Halal sign in Arabic script again. Both the shop front signage, as well as the supporting collateral, uses the Latin system of alphabets as the main communication and both are accompanied by Arabic script indicating the Halal food it serves, distinguishing itself as a dietary choice catering to the Muslim community.

8.3 Type hierarchy methods

Type hierarchy is the concept of expressing the importance of communication via the arrangement of the visual written word. It can be done through a variety of typographical methods from scale to colour and can also be done via placement or orientation. (Ambrose & Aono-Billson, 2011)

Table 4 below shows a variety of methods identified used to create salience. The use of scaling (i.e. larger type sizes) appears to be prominent followed by stylizing of the typefaces and use of contrasting colour. The placement of type appears only in ***家****Jia's* shopfront signage perhaps due to the top-down method of reading the Chinese language. Despite the variety of methods employed, creating a larger type size seems to be a prominent method of communicating it's various business narrative.

Table 4: Comparison of type hierarchy methods employed across four shops in Haji Lane, Singapore

Name of shop	**Good Luck Beerhouse**	**The Singapura Club**	**家Jia**	**Mokita Cuisine**
TYPE HIERARCHY METHODS EMPLOYED				
Shopfront signage	Uppercasing, contrasting colour usage	Stylized typeface, larger type size, uppercasing	Stylized typeface, large type size, placement	Stylized typeface, large type size
Supporting collateral	Large type size, contrasting colour usage	Large type size, contrasting colour usage	Larger type size, heavy type weight	Uppercasing, contrasting colour usage



Image 4. *Signage of The Singapura Club – Contemporary Indian and Malay cuisine restaurant. Right: Shopfront signage. Left: Second sign (supporting collateral)*

The Singapura Club *(Contemporary Indian and Malay cuisine, see image 4)* **–** the shop front signage has the word *'Singapura'* highlighted via a larger type size and also via a stylized version of the Modern typeface used. 'Singapura' is an Indianized Malay word and an old name for Singapore (Government of Singapore). The word is no longer used to describe Singapore but frequently heard of in the country's national anthem that is sung and written in the de jure Malay language. By highlighting this word as the first hierarchy of the signage highlights a desire to reminiscent Singapore's nostalgic past and displaying patriotism at the same time. The supporting collateral highlighted two words *'Singapura Club"* through type size and colour in equal measures suggesting the effort to emphasize a modern twist with the *'club'* word added to the nostalgia *'Singapura'* name communicating a brand that is in creative dichotomy.

家Jia's *(contemporary female fashion retail, see image 1)* - shopfront signage highlighted the Chinese character as the top hierarchy through type size and a top-down type placement reflecting the desire to demonstrate an association of Chinese culture by reading from top to bottom, however, it's supporting collateral type emphasis turned to the emphasis of English words such as *'Accessories'*, *'skirt' or 'Footwear'* describing the type of fashion wear that the business retails. This potentially suggests that the Chinese character is used as a front façade for the shop but when it comes to the description of its products, English became the salient choice of communication.

9. Conclusion

Language is intrinsically linked to typeface classification. While the use of the English language and hence the use of the Latin type classification is prominent, this research showed clues of businesses demonstrating various cultural, social, and religious offerings though the use of other languages and typographical systems beyond that of English and the Latin system. This suggests a creative entrepreneurial method of distinguishing themselves from the homogenization of lifestyle offering that is usually found in regular shopping malls where most signs and languages are likely to be restricted by mall landlords to reflect the nation's de facto English language. The lack of language restriction use in Haji Lane means small independent businesses can assert cultural, social, and religious offerings through various "designerly" typographical modes. The study provides preliminary insight into how Singapore's bilingualism education policy of using English as the main language of communication while mother tongues acted as cultural connections have translated into an innovative vernacular method linguistically and typographically to distinguish the Singaporean identity pragmatically – using the English language and Latin system of designing to communicate it's offering while employing various mother tongues system of designing to assert it's Asian identity. This small research sample is not entirely comprehensive of Haji Lane's linguistic landscape but it provides a sneak peek into the discourse of 21st-century Singaporean youth's search of their cultural heritage through the expression of typography amidst their consumerist lifestyle.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Threshold of Language: Design and Soma

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Abstract | This paper explores the soft, fluid space in between disciplines that allow for an expansion of creativity. Disciplines often employ their own diverse modalities to express their work, including verbal vocabulary. The paper is an extended case study into a cross-disciplinary project between fashion design and dance students at LASALLE College of the Arts, Singapore. The project uses origami as a shared provocation. While origami tends to be a set of instructions aimed at arriving at a specific form or figure, in this project, paper folding, more specifically the concept of the fold itself, was used in loose, abstract and organic manner to allow students to explore it as a language responding to visual, haptic and verbal stimuli.

Pedagogically, the project resonated with methodologies utilized within the Bauhaus curriculum. The Bauhaus educator and artist, Johannes Itten, worked with material tactile play, drawing exercises and sensorial activities that were 'mediated through the body' (Jeffrey Saletnik) as part of his pedagogic practice. As Itten has stated in Design and Form: The Basic Course at the Bauhaus and Later (1963, p.8) young people who "begin with market research and practical and technical work seldom feel encouraged to search for something really new". This paper looks into the ways this project, allows students 'strengthen' imagination and creativity. Utilising preparatory workshops observations, students' journals and final performance, the paper will detail the 'collisions' and resulting tensions of disciplinary languages that results from cross-disciplinary collaborations.

KEYWORDS | CROSS-DISCIPLINARY, SOMATIC, BAUHAUS PEDAGOGY, FASHION DESIGN, DANCE

1. Introduction

This paper explores the soft, fluid space in between disciplines that allow for an expansion of creativity and vocabulary. Creative disciplines often employ their own diverse modalities to express their work, including verbal vocabulary. In this project, students from the Diploma in Fashion and Diploma in Dance collaborated together utilising shared provocations that are not specific to their disciplines, specifically rooted in the concept of the 'fold'. This paper delineates the fourth iteration of the 'Origami as Movement' project, with a focus on open, organic and porous manifestation of the technique of origami – *ori* (folding) *gami* (paper). The project, by beginning with paper folding and Gilles Deleuze's (1993) description of the fold as a process that is not fixed or punctuated, developed into choreographies and garment design that are elastic, anti-form and habitable. The paper will reflect on the project through both fashion and dance disciplines, and upon the visual and kinaesthetic language that developed in the collaborations.

2. Context

The high stakes in the world's coveted schools means that the pursuit of fashion and design education often comes at a high financial and personal cost to students (Doyle, 2020), with little space for exploration, failure and risk-taking. This has given rise to designers that enter the industry ready with a palette of result-driven and tested formulas that cater to the market. As Itten has stated in Design and Form: The Basic Course at the Bauhaus and Later (1963, p.8) young people who "begin with market research and practical and technical work seldom feel encouraged to search for something really new". For innovation to happen, creativity has to be prioritised over the market-driven design processes.

The creative process at the Diploma in Fashion typically follows prescribed steps and approaches to provide students with a consistent working style to suit the industry. These are also common steps found in several guides on fashion education (Renfrew, 2009). Studying the brief, doing secondary and primary research through observations, target audience and market research, material research, explorations with existing technical patterns or draping on an industry-standard body form. The students then move into a prototyping (the toile) stage where the garment sample is made and altered for fit. It is after this stage where the final garment is made with the actual fabric or material.

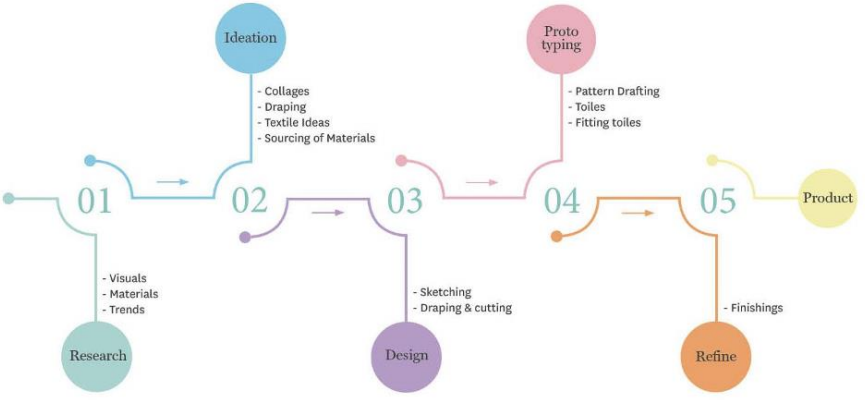

Figure 1. The roadmap in working on creative briefs at the diploma level at the Diploma in Fashion typically follows Figure 1. The process is usually linear and has limited bandwidth for circular revision.

It is important to note that the students at the Diploma level are mostly in their late teens to early twenties, with little to no experience in art and design before embarking on the programme. A large portion of the students enrol in the Diploma directly from public secondary schools. The primary and secondary public-school education system emphasises on testing as a form of meritocracy, this in turn discourages innovation, risk-taking and creativity. The project was initially conceived as a response by the Programme Leader to include a brief that was devoid of market constraints to increase risk-taking and experimentation.

At the Diploma in Fashion, students respond to targeted trends and audiences, all the while still mastering fundamental skills. In their third and final year of the Diploma, students have the necessary technical skills to approach more experimental and cross-disciplinary approaches to design. It is at the first semester of the final year that the said cross-disciplinary project takes place.

Similarly, the dance students enter into the Diploma course studies with a lack of experimental experience. Their early training tends to be focused on recipe driven forms and styles with little or no improvisational exploration to yield risk, play and agency within their choreographic making or ideas in and around the art field and performance.

The project had 3 aims:

1. To expand **creativity** through multiple modes of research, risk taking and play;
2. To encourage **fluidity** through cross-disciplinary collaboration;
3. To do the above through the experience of **somatic exploration**.

2.1 Expanding Creativity

As Paul Kleiman (2008) states in his research on creativity— the term evades strict definition and is often at odds with curriculum frameworks. There was a need to adapt the curriculum structure to accommodate a project that was not assessing the merits of the final garment as per industry. To privilege process over final aesthetic, the feedback and evaluation was centred on the aspects of the designed objects that allowed for an expansion in choreographed conversation with the dance students. Feedback and assessment for this project was thus adapted to also include a photo logging as reflection, using visual-heavy social media platform Instagram. Within this cross-collaborative project, intentional limitations set in the brief and the selection of workshops were meant to disrupt the students' usual design process.

Another way this project aimed to expand creativity was to remove market constraints. The global fashion system is firmly established root and branch in the ecosystem of fashion trends, market demands and supplies, seasons, manufacturing, supply chains and target markets. This creates challenges at the vocational level for a programme to introduce divergent forms of practices or approaches in conceptualising and developing a fashion collection. The brief intentionally disregarded these constraints and instead, the students were encouraged to collaborate with the dancers in a constant dialogue that allowed both garments and choreographies to respond to each other. The briefs, when stripped of market constraints gave rise to the exploration of new perspectives.

2.2 Fluidity

With regards to creativity, one should not be inclined to lock down a specific definition or approach. It can and should be viewed as an activity described and nested within a whole host of parameters such as: proactivity, intelligence, play, openness, courage, patience, listening, intuition, rigour, and wayfaring. Embracing these, an individual's creative practice can be elastic and ready to focus and respond to the specificity of limitations that arise in the moment. By yielding a learning place that is porous and fluid, the students are supported to go beyond their 'default mode' of working. Riding the currents to constantly question 'what if…'.

This particular project hones in on the students' process. Through each stage of the process varied obstacles arise; how can they be empowered to shift, yield, expand, distil— from their inherent modes of making? Beginning with a fluid landscape in the opening workshop, continuing through a dialogue of equally sharing body, garment/costume and movement as one shape-shifting being, this collaboration provides a buoyant platform to expand learning and creativity.

In fashion studies and academia, definitions have been important to add rigour to the study of fashion which has often been seen as a frivolous discipline. In the seminal book "Dress and Identity" Joanne B. Eicher and Mary-Ellen Roach-Higgins (1995) define *dress* as an

assemblage of body modifications and supplements. This takes dress away from the Western-centric fashion system, and can include non-Western aspects of permanent modifications such as tattoos or ephemeral modifications such as perfume. The term *garment* has connotations of manufactured clothing produced in assembly lines devoid of culture specificity. On the other hand, 'unwearable' or garments made for performance and not for everyday wear are referred to as *costume*. The definitions of garment-costume-dress shift and overlap throughout this extended case-study, at times even becoming a shell or vessel to the wearer.

2.3 Somatic Exploration

An increased interest in embodiment and somatic research methods in fashion point to a desire to better integrate the lived, physical body into fashion studies (Entwistle, 2000; Entwistle, 2015; Negrin, 2016; Ruggerone, 2017). Despite the intricate connection between body and garments, fashion is often studied and accepted as a primarily "visual, expressive, and aesthetic practice" (Robinson). Lewellyn Negrin, a feminist aesthetics scholar, points out that by shifting emphasis to the embodied, tactile and kinaesthetic experience of clothing, fashion studies focus on what the body *does* and not just how it appears.

By including the perspective of a somatic practitioner into the workshops and tutorials, the project attempts to integrate the language of movement into the vocabulary of the designers. Soma, coming from the Greek for body, "...any individual embodiment of a process, which endures and adapts through time… remains a soma as long as it lives." (Hanna, 1976, pp.30-34). Somatic movement educator and therapist Martha Eddy writes "In somatic studies, the body is perceived as the source of human intelligence - one learns through the living body." (Eddy, 2016, pp.7-8). Somatic practices, desire a quest for "tuning in", thus they incorporate methods such as touch, exploring with eyes closed, honing in on individual senses, covering mirrors and utilising language filled with rich imagery landscapes. All these activities hone in on the body, on how movement feels and its qualities, not how it looks. The focus is not on form; however, forms do arise, but from an internal stimuli. By creating a 'somatic learning environment' the somatic data not only informs, but also transforms (Batson, 2014, p.128). The instructions (or better yet invitations) are directed toward discovery, rather than goal attainment (Batson, 2014, p.131). By initiating the project through somatic tasks around the chosen theme and encouraging this knowledge to be iterated throughout the process, all students are supported within an exploratory, somatically informed environment.

3. Extended Case Study Results

This extended case study is informed by qualitative research methods including workshop and tutorial observations throughout the seven weeks of the term (October-November 2019), discussions between tutors from the Diploma in Fashion and Diploma in Dance, analysis of the final presentation/performance and individual student reflections. A total of 15 groups made up of 56 fashion design students and 15 dance students, each group worked to develop a choreographed piece. The cross-collaborative project was punctuated with a variety of intentional interventions and provocations as well as specific meeting points where lecturers from both disciplines would be timetabled for shared consultations with the students. The authors, lecturers from the School of Fashion and the School of Dance and Theatre will articulate the challenges and success of this project from their individual perspectives, including the 'collisions' and resulting tensions of disciplinary languages in cross-disciplinary collaborations. Most of the fashion design students were graded very highly in this project due to the shared workload and the focus on process, play and the allowance the garments/costumes gave the dancers in their choreography.

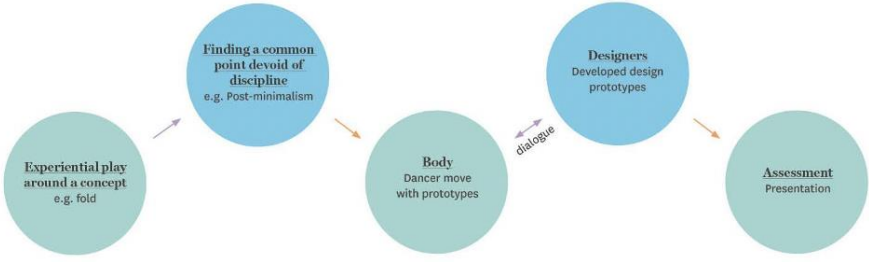

Figure 2. The roadmap for this project was unlike the student's usual linear design process seen in Figure 1. From Body to Designers, there is a constant dialogue and revision process.

Honing in on somatic practices which are process orientated and focused on embodied learning, the students were encouraged to enter into the concept of 'folding' through tools or activities including explorations involving movement, touch and the visual. While origami tends to be a set of instructions aimed at arriving to a specific form or figure, in this specific iteration, paper folding was used in a more organic manner that allowed students to use it as a language responding to visual, haptic and verbal stimuli. Furthermore, the project adopted the visual arts, specifically that of minimalism-post-minimalism-anti-form, as the thematic baseline from which each practitioner responded to. Students were explicitly discouraged from going into their individual disciplines for visual research, thus yielding a more expansive palette in their responses which can be seen in some of their reflective journals. In Figure 2, the exploratory journey is illustrated not as a linear process, but at times a to-and-fro

dialogue that supported an expansion of creativity as well as greater specificity in editing for both garments and choreographic gestures.

3.1 Preparatory Workshops

At the start of the project, the idea of the fold was introduced. To paraphrase Deleuze; the smallest unit of matter is not the point but the fold (1993). Seeing the fold and folding having infinite dimensions and possibilities. Experiential tasks stimulated a novel way of understanding the fold and engaging with the activity of folding. Working from breath and internal visualization, noticing tasks, sight and haptic drawings as well as play with paper, tissue and fabric allowed for a nonverbal 'ways in' of understanding and play.

As the workshop continued layers of other information were added helping to shape and yield specificity to their dialogue and collaborative engagement. Of particular note on Table 1, the final activity for the workshops included timed responses to images of art works projected on the screen; these timed activities were introduced to encourage intuition-based responses. First, through verbal responses, then spatial where students made 'prototypes' out of paper directly on the Dance student's body. Fashion students were encouraged to record these experiments and utilize them as design prompts for their own studio work.

Table 1. Breakdown of shared somatic workshop for designers and dancers.

Activity	Intention
Starting point from a theoretical place, *the fold.* Layering with biological, visual art, architectural sources.	Giving a basic understanding to the fold regardless of discipline.
Engaging in different experiential modalities to find ways in: meditative somatic exploration of fold/folding through breath and imagery, searching for folds within the site via sight, drawing a fold from sight, drawing the same fold from touch, exploration of folding onto paper in a more playful, roaming manner. Lastly, students invited to curate space with their folded paper sculptures and clothing they brought in of varied forms, textures and qualities. Dance students entered into this landscape improvising via language prompts into a deeper folding improvisation witnessed and archived by the fashion students.	Diverse somatic activities, encouraging play regardless of discipline.
Challenging them further with another limitation, rooted in the visual arts, the movements of minimalism, postminimalism and anti-form.	Encouraging shared vocabularies regardless of discipline, by utilising artworks from minimalism, post-minimalism and anti-form.
Introducing the technique of origami (paper folding) but not to achieve a certain form (e.g. cranes) rather drawing out its underlying principles of *hill* and *valley.*	Reducing the technical aspects of *origami* to the fold, regardless of discipline.

Using 3 specific artworks from Minimalism-Post-Minimalism-Anti-form as prompts, inviting the students into a collaborative immediate response.	Stimulating 'play' within a structured format.
First into words of activities/qualities to the examples (for 3 minutes), then transferring these ideas directly into paper (5 minutes) to the dancer's body.	

It was in this final activity that the material play, noticing and drawing of folds and even the verbal vocabulary to describe form, was synthesised. In Figure 3 one group's word association as a response to the art works projected on the screen can be seen. The vocabulary is associated with form—lines, shapes, textures and rhythms. They have no direct relation to garment silhouettes, fabrics or even colour. In Figure 4, we see the same group's timed response to Eva Hesse's artwork *Area* (1968), the words they associated with it were "constant-wavy-repetitive-layered-crawling-crumpled-uniform". In Figure 4, we see the dancer has taken an active bodily state/form inspired by the same artwork ("crawling") and the Fashion students began pleating and laying the paper on parts of his body ("layered", "repetitive"). Their body language is engaged with the dancer's 'crawling' body. Their response is highlighted as many of the groups worked in a static manner mimicking the way one would work with the dress mannequin as seen in Figure 5, with even the physical body language of the students creating a gulf between designer and 'mannequin'.

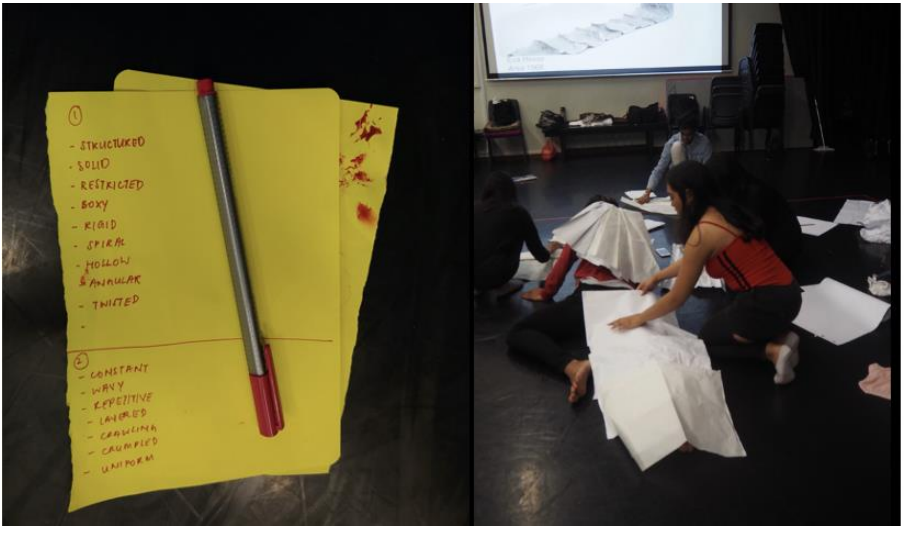

Figure 3-4. Group A's response. The second set of words on the yellow paper were key words the students associated with Eva Hesse's Area 1968. In Figure 4 (right), the students translated it into a spatial response, with the dancer adopting 'crawling' as a pose, which was one of the keywords in Figure 3.



Figure 5. Group B's response was more static, with the fashion students treating the dancer as a mannequin or dress form, instead of a moving body.

3.2 Development: Moving Away from Default Modes and Working through Conflict

After a day of workshops, the students then began working in their separate disciplines with the ideas they had generated as a starting point. The fashion students met weekly for the next five weeks during their design studio consultations where they had three supporting Fashion lecturers and a Dance lecturer. The personal process of development was archived through photo logging (Instagram), which encouraged immediate reflection with a medium that most of them use daily. The following examples are highlighted to show how the *to and fro* between dancer and designer opened a new languaging as well as possibilities of making, be that garment and/or movement. The creative focus was on risk-taking, fluidity, wayfaring and novel solutions. This was shown through projects that moved away from the habitual, migrating through conflict and expansion of their understanding of garment.

Once the fashion students were back in their studios, they tended to go back to their default modes. Shaatees from Group A, which had responded dynamically during the combined workshops, began using conventional methods to communicate such as sketching on a female fashion *croquis*- an elongated body used in fashion illustration, even though their dancer was male, as seen in Figure 6. The first prototype they made was more like a wrapping around the body (Figure 7-8), and they were told to consider it expanding to a larger scale to allow the body more space and affordance. There was resistance from the student to try ideas directly on the body, without first sketching them out, as can be seen in conversations between the student and lecturer. It took a very intentional and continuous

reminder to consider the dancer's possibilities of movement and to stay away from discipline-centred research.



Figure 6. Group A student's Instagram photo log shows the student going back to default mode in his communication of garments. Even though his group's dancer was male, he illustrated on a female croquis. An elongated fashion figurine used in fashion drawings.

Technical skill can be a constraint, but also allows different possibilities. Group A's idea was reduced further and their technical abilities developed a garment that was light, flexible and in the choreography, was treated like a 'shell' that the dancer was able to slip on, off and around within his choreographic work.



Figure 7- 8. Group A returns to conventional ways of designing to the body, with the folded fabric covering the dancer's body and creating a decorative surface with limited possibility for interaction with the garment.

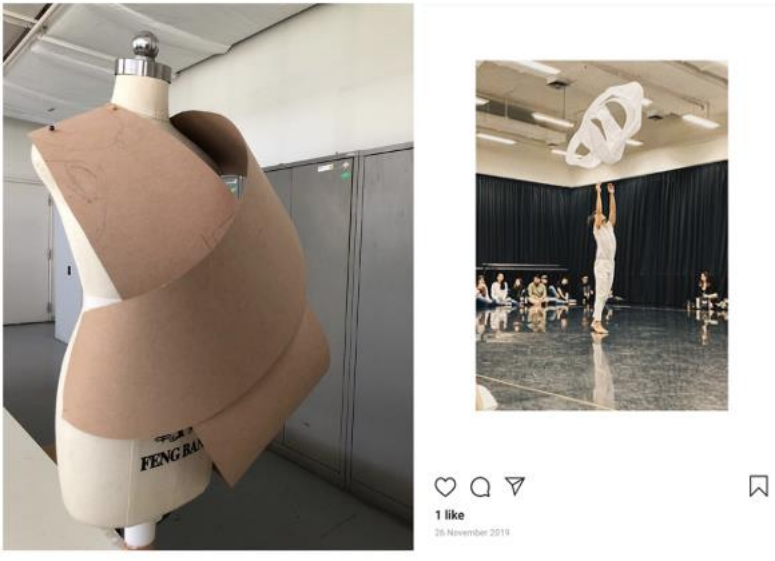

Figure 9-10. Group A is forced to return to form, and not decoration, they prototype a simpler idea as seen in Figure 9. In Figure 10, student's reflective journal shows their wonder at how their garment becomes an object in flight.



Figure 11. The final performance of Group A's garment shows the garment becoming shell and inhabited by the dancer's body.

For Group C, the beginning of the process was rife with conflict; with group members wanting to take different directions—from decorative to minimal. In the reflections of Daswani and Kim, we can see repeated descriptions about the mathematical calculations and technical know-how the project needed. In Figure 12 taken from Kim's photo log, we can see that the group prototyped different ideas, beginning with visual references to Richard Serra's work *The Hedgehog and the Fox (*2000) – far right – however, these prototypes echo conventional sleeves already seen in fashion garments. The group was challenged to think of scale, to envelop the body and not merely decorate it.



Figure 12. Photo log on Instagram by student from Group C. We see the visual references to Richard Serra's work (far right) translated into pleats for the body (far left). However, the scale has been reduced and becomes almost decorative.

> "Although it was challenging dealing with the scale, one of the best things I discovered about this project is that I didn't have to construct something wearable. This kind of project helps us to generate and broad out the creativity and the ideas we have, apart from learning the technical aspects of fashion." (Kim, 2019)

The prototyping – or *toile-ing* – process required in this process also required the students to physically use their bodies for scale, as seen in the following figures. Students literally were moving differently and viewing their work from different angles while trying to anticipate the possible journeys their dancers could take. In this manner, the groups could begin thinking about dress as a vessel and enabler for movement.

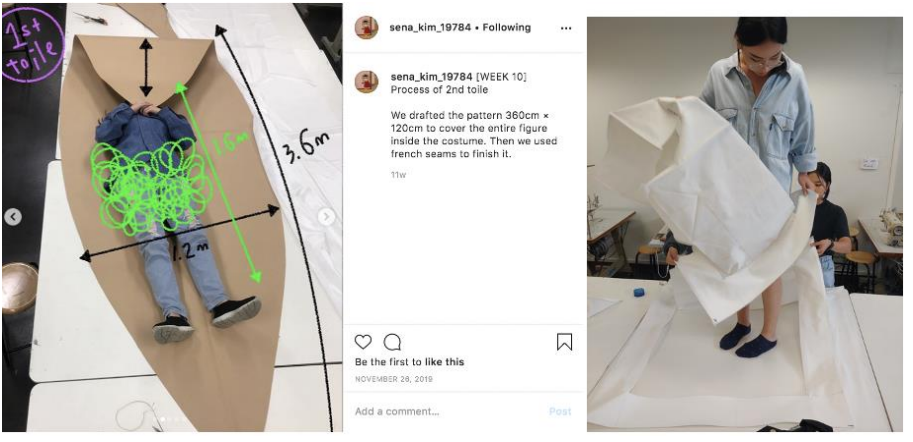

Figure 13-14. Figure 13 shows a photo log by Kim from Group C showing the scale of the garment. On Figure 14, a photograph by the lecturer shows the unusual and physical way the students took towards the construction of this garment.

It should also be noted that the dancer who collaborated with Group C was stretched clearly in her choreographic and performative norm. Not only through the dialogue with her fashion peers in decision making for the garment, but moreover in how she allowed new and playful vocabulary to emerge from working directly with the garment as another dancing body. Shifting from object, to body, to vessel, to skin and back, the choreographic work challenged the embodiment possibilities for both garment/costume and dancer. Nuance and sophistication of choices in both making and performance yielded an overall stunningly creative solo.



Figure 15-17. The garment from Group C went through several creative and technical modifications through the term as a result of a dialogue between both disciplines. The garment needs the interaction of the body to morph and develop form.

3.3 Final Performance: Beyond Garment

As the garments/costumes became finalised, the subtle shifts in garment or in solo are honed in, allowing for a further transformation into one body, rather than two. The students can view the collaboration as a hybrid of the two disciplines, forming another entity.

While many groups struggled and journeyed through different possibilities, Group D went with an initial idea that they carried through the seven weeks of the term, making slight changes to the scale and rhythm of the garment. Zulfa, one of the students' in this group, showed early engagement with the theme. In Figure 18, the initial idea was to provide a garment with multiple holes with the idea of allowing different ways of entering the garment. The scale was still too decorative and small, so the students experimented with changing the scale and material, paying attention to how the holes/gaps created forms. The results of this particular piece really stretchy the definition between dress-costume-garment-object, depending on how the dancer interacted with it.

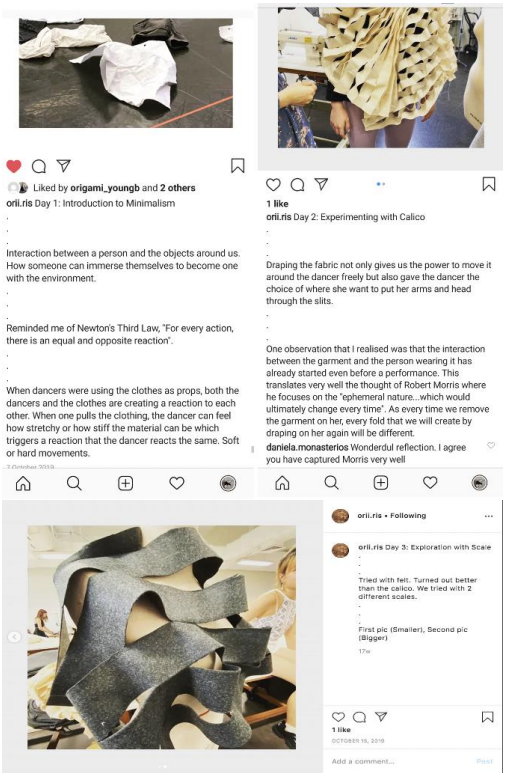

Figure 18-20. Photo log reflections from Group D shows the development of the project was smooth, and the changes made were nuanced and small—more internal and less dramatic.

The dancers, improvised and worked collaboratively with the fashion designers, an interplay of conversation between inner bodily folds and the folding possibilities inherent in the garment/costumes emerged. Form arises, but out of the exploratory internal/external movement play. In the performances, it was impossible to determine a choreographic form, shape, or style from the start or to fully 'set' or 'fix' the movement language; the solos stayed in a constant state of becoming, yielding an aesthetic through process and time.



Figure 21-25. The fluidity of Group D's garment can be seen in the choreography shown above. Group D's dancer similarly found ways to go from a traditional showing of the garment as dress by beginning to lift it up above her (Figure 21, top left), and then discard it as shell (Figure 22, top right), inhabit it as a shell/container (Figure 23, bottom) and again find different ways to wear and escape the garment.

This constant conversation of the 'choreographic making' and the needs of 'performance' opened to tone and details to shape and hold the solos. The vulnerability and surprise that each garment/costume possessed were key to the sophistication of invention within the works. They could be read and related to as another 'body', a partner/companion, each becoming a bodily extension, a nest, a container.

As the students were in process, the dancers became more aware of the necessity to yield materiality and form. Several began with a more 'aggressive' gesture and attitude towards the garment/costume, such as the dancer in Group A, but in time realised that more subtlety and a delicate lightness was needed to be embodied for the solo to be woven as a whole. Others, as in Group D, began working choreographically in a literal sense, moving in the garment/costume to reveal a more commonality of wearability. However, through the group's process, the dancer began to discover a myriad of inventive modes of dialogue, acquiring a mature and imaginative choreographic voice as the materiality and design of the garment/costume transformed into a second skin, scales, a terrain to navigate in, as well as webbed rib-like cage.

The Dance student from Group D articulated beautifully in her journal:

> " The project had challenged my creativity as the garment is ever changing due to the constant expansion of the slits and the size of the garment….I was able to morph into ideas of 'escape and release' which forms my intention…the idea of tangling and detangling, interweaving, wrapping and rolling, coming in and out of the garment, falling (myself and the garment) and of course, folding, in a sense that I would fold my body or the garment to explore and achieve the choreography."

4. Conclusion

> "To learn, habit needs a *perturbation* – a nudge to the body-context status quo. This nudge comes as a novel stimulus to the brain. It awakens and enlivens neural processes, enabling plasticity and learning. Perturbations move the perceiver away from the familiar toward new possibilities for action." (Batson, 2014, p.131)

Our personal pedagogy and way of working was also impacted in the process, as we attempted to expand the vocabulary of the project in its fourth year. After every cycle, a new set of restrictions- or *perturbations*- arose to sharpen the qualities that were important for the project: form, affordance and possibility for movement. The stripping of colour to white in the second cycle allowed for clearer shapes to arise. In the third cycle, students were introduced to the thematic stimuli of minimalism, which further abstracted their visual references. For the fourth cycle, an additional abstraction in the origami technique allowed students to prioritise play and form over attainment of the perfect technical folding technique.

The project expands not just the students' but the lecturers' pedagogic methodologies and language, providing an expansive platform for emergent creativity in design and teaching. In consultations, it was important to remind fashion students to privilege the dancer's movement over the aesthetics of the garments. To communicate with students, more bodily practices were utilised. In Figure 25, a lecturer prototypes in miniature to communicate spatial ideas to the students. In Figure 26, an example of a fashion lecturer physically inhabiting the *toile* to have an embodied understanding of its physical limits. The language of

communication of ideas extends to body/movement language and embodied understanding of design.

A somatically informed pedagogic practice stimulates greater agency and invention. Through collaborations such as this, we can begin to open the students to new avenues of making. By collapsing pre-conceived, siloed techniques and disciplines, other modalities and languages have space and support to arise.



Figure 25-26. These images show the different modalities and ways of communicating that the fashion lecturers also begun to employ. In Figure 25, a fashion lecturer utilises miniature models to communicate spatial ideas and in Figure 26, a video by a student shows a fashion lecturer inhabits one of the garments to understand the physical experience and affordance the costume enables.

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Acknowledgements: We would like to thank our colleagues at LASALLE College of the Arts, our students and the National Gallery of Singapore for their generosity, resilience and creativity.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Towards a new design culture of scientific production – Innovating the formats of scientific publication of design

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Abstract | In Italy, the normative system of evaluation of the quality of scientific production and publication of design research is becoming articulated and complex. Moreover, the cultural dominance of western and Anglo-Saxon centred vision and standards need to be complemented by a plurality of approaches and narratives on design. Many trends are permeating internationally the design field, and in particular, the ones related to digital transformation. In this respect, one of the contemporary challenges that design research is undergoing is to reach an authoritative, high impact and effective scientific production. Starting from a collection of cases and practices from different disciplines which thoroughly summarizes the state-of-the-art, this paper, describes an ongoing research project aimed at innovating the design cultures of scientific production and publications, presenting the exploration of them according to a proposal of an innovative publication lifecycle. Finally, it proposes an envision of a format of scientific publication in design.

KEYWORDS | SCIENTIFIC PRODUCTION, PUBLICATION LIFECYCLE, PUBLICATION FORMATS, COMPOSING, ECOSYSTEM

1. Introduction

1.1 Background

The topic of academic publication which, although in a different way, has always played a central role in the different historical periods of scientific divulgation, today is going through a moment of profound change. Publication is central to the making of science. Epistemologically, it is a critical step in the making of publicly accepted knowledge; sociologically, publication has become the measure by which researchers are evaluated for tenures, promotions, and grants (Fyfe, 2000). Most of the features we associate with the modern scientific journal – including originality of research, self-authorship, refereeing procedures, and standardized rhetoric and structure – were nineteenth-century developments, while big profits, the use of English as the international language of science, and the emergence of professional bodies for managing editors and publishers are largely twentieth-century phenomena (Baldwin, 2018; Moxham & Fyfe, 2018). Until the mid-nineteenth century, original research could be first published in a wide variety of places. Reports of new research findings might sit alongside book reviews and letters to the editor in a magazine devoted to natural philosophy or amid discussions of philology, antiquarianism, and moral philosophy in learned journals (Peiffer, et al., 2013). By 1790, at least a thousand scientific and technical journals had been established (Kronick, 1976). Around a quarter of these were the transactions of learned academies and societies, but the majority were independent, set up by printers, booksellers, or editors with the hope of turning a profit from the learned and/or public culture of science. As before, most of the new periodicals were short-lived. But by the end of the eighteenth century, a handful of editors demonstrated that, with the right commercial skills and a good network of contacts, an independent journal could be successful (Fyfe, 2000). Recent attempts to estimate the number of academic (not just scientific) journals globally suggest that there may be around a quarter of a million – but in 2010 perhaps only 24,000 of these were scholarly peer-reviewed journals (Larsen & Von Ins, 2010). The proliferation of scientific journals has reflected the emergence of new specialisms, the establishment of new societies, the growing number of researchers seeking to build careers, and the global expansion of the scientific enterprise in the late nineteenth and twentieth centuries, but the expansion of scientific research had placed strains on these publishing programs, with more research papers meaning more expense. Elsevier and Pergamon Press took advantage of the post-war boom in science funding – including library budgets – to increase circulations of their journals and to raise the prices charged to institutional subscribers (Fyfe, 2000).

In recent years the body of design research develops and expands, and it is interesting to examine the publication patterns of institutions and researchers publishing in the field of Design. Particularly, the scientific publication in the field of Design reflects some factors related to the recent valorisation of the disciplines, but also the richness of approaches,

fields and applications combined with a proactive and often innovative attitude that design is used to propose in terms of content and visualizations.

1.2 Relevance

The digital transformation is also permeating the field of academic publication in design on a global level: the concept of *phygital* (the interaction between the physical and digital world) blurs its boundaries and research areas, introducing new ways of intervention. In this context, the scientific production and diffusion of design, especially in the international sphere, are taking on new forms and objectives, becoming increasingly unstructured, broad and, thanks to the digital environment, rhizomatic, with the related strengths (e.g. accessibility) and weaknesses (e.g. reliability).

For example, with the *Berlin Declaration on Open Access to Knowledge in the Sciences and Humanities* (2003) the open access paradigm has acquired great importance.

Paradoxically, the Article Processing Charge (APC) system of peer reviewed scientific journals (WOS, SCOPUS), increasingly recognized as a quality criterion, remains the responsibility of the authors. Meanwhile, especially in Italy, the regulatory system for the evaluation of scientific production is becoming more and more complex, due to procedures often conflicting at different institutional levels (university criteria, VQR, ASN), in a framework of actors (ANVUR, SSD scientific boards) equally varied.

These conditions have a considerable impact on the circulation of high-quality scientific production and limit the possibility of innovating its methods and formats; one of the challenges is to enable new spaces for experimentation in order to achieve authoritative, high-impact and effective communication, pursued with a multiscale strategy, which guarantees scientific productivity and extended impact (e.g. the third mission), while maintaining rigour and authority.

The European Community's Future of Scholarly Publishing and Scholarly Communication report written in January 2019, proposes a vision for the future of scholarly communication; it examines the current system and its main actors. It considers the roles of researchers, research institutions, funders and policymakers, publishers and other service providers, as well as citizens and puts forward recommendations addressed to each of them. In structuring the context of reference recalls that the whole of the scholarly communication exists to offer researchers the possibility of participating in a distributed system of knowledge that approximates H. G. Wells' vision of a "world brain", also remembering how, starting in the '80s, the whole research ecosystem has invested the metrics with great power: overall, researchers, funders, and university assessments have come to rely too much on the evaluation function of scholarly communication as structured by the JIF.

For the UE, researchers and their needs must be put at the heart of scholarly communication of the future. This scholarly communication system must support and facilitate the use of knowledge and understanding for as wide a range of participants as possible, with as wide a

range of purposes as possible, including its integration into new lines of investigation and new forms of education, according to the principles of: *Maximizing Accessibility, Maximizing Usability, Supporting and Expanding range of contribution, Building a distributed and open infrastructure, working for equity, diversity and inclusivity, building community, promoting high-quality research and its integrity, facilitating evaluation, promoting flexibility and innovation, investigate cost-effectiveness* (European Commission, 2019). In this context, the European Community hopes that working partially against this trend new technologies and services now enable researchers to take back some control over some elements of publishing, in particular registration and dissemination. They can, for example, ensure attribution to their own work by posting versions of their outputs on web-based and open access services such as an institutional repository, or a thematic repository such as *arXiv* (Cornell University, 1991). In doing so, they maximise dissemination and accessibility to their own work by themselves.

Universities have always been key actors in scholarly communication in the context of their research and educational missions, so they are both co-operative and competitive and seek to maximise the dissemination and impact of their research but, in the last fifty years, they have partially and gradually disengaged from their roles as publishers. Digital technologies, especially in their free and open form, allow them to design, maintain, evolve and control their own dissemination tools.

In this the design discipline can be a pivotal field for the experimentation and discussion of new scientific publication formats.

A recognized academic community such as the Design one has the responsibility to discuss and innovate the contexts in which scientific dissemination and dissemination are produced and made accessible, and to propose a vision characterized by its recognizable design culture.

1.3 Related work

Since it is a work in progress research project, this section does not claim to be exhaustive but simply presents the context outlined in the analysis path, deliberately excluding from this review platforms and events relevant but mainly informative (e.g European Researchers' Night) and technical-instrumental approaches: many resources and tools are available online on how to develop effective dissemination strategies, especially in relation to research findings of projects.

By exploring the digital environment many bottom-up initiatives of dissemination, addressing visual qualities and aesthetic experience can be observed, having a potential of development in term both of novelty and authority with vantages (accessibility, contributiveness…) and sometimes disadvantages (authoritativeness, reliability…).

Among the major changes that have occurred in recent decades in the field of scientific publication, the open access movement has disrupted the way scientific knowledge is

distributed. Due to excessive commercialization and price increases, Open access scholarly journals enable users from throughout the world to access information freely, as these journals can be freely accessed online without any legal, economical, or technical barriers. (Kim, et al., 2018)

The theme of new models and tools for scientific dissemination, in relation to digital transformation, besides being conspicuous on-line at a popular and technical-practical level, is widely debated in literature. As example Tenopir and King on the subject of e-journal propose "new, electronically mediated peer review models" while some scientific fields, such as medicine, reflecting on a scenario in which traditional metrics are flanked by the more recent ones of blog e social media based on the availability of sources and accessibility to dissemination channels on effective digital infrastructures. (e.g. Jama network).

A good reconnaissance is offered to us by Kim, Chung e Lee who outline a scenario according to which new formats of articles include graphical abstracts, interactive PDFs, the application of semantic enhancements, and the utilization of research data, social networking sites, such as *Mendeley* (Elsevier, 2007) and *ResearchGate* (Fickensche, 2008), have become common sites for information exchange; *altmetrics* have been adopted to complement traditional journal metrics and *PubMed Central, F1000Research and KoreaMed Synapse* have been introduced as innovative full-text scholarly journal distribution systems. With their work they have outlined a number of current trends in scientific publication which analyses new formats of journal articles (e.g. JAMA by American Medical Association and Nature Podcast by Springer Nature), ways of improving semantics in scientific publication, the use of research data and academic social networks (e.g. ResearchGate, Academia) and new distribution systems (e.g. PMC, F1000Research, Frontiers).

In this context, therefore, even the major actors are moving to try to accompany this process of change. In November 2010, Springer announced a new product line – *SpringerBriefs* (Springer, 2011)– for works between 50 and 125 pages in length. *SpringerBriefs* are concise summaries of cutting-edge research and practical applications across a wide spectrum of fields; then the following year, 2011, saw the launch of Princeton Shorts, brief selections taken from previously published influential Princeton University Press books and produced exclusively in e-book format.

In 2012 was the turn of Palgrave Macmillan, that launched *Palgrave Pivot* (Palgrave & Macmillan, 2012), an innovative format for scholarly research offering a new mid-form format for publication.

The discipline of design is relatively young but has rapidly matured in recent decades. This is evidenced by an increase in the number of design journals and dedicated design conferences since the late 1980s, and by an increase in the amount of attention being paid to design in journals from other academic fields like innovation and marketing (Gemser & de Bont, 2016). But as well explained by the authors, a particular criticality also emerges in this area: on the one (Opening Science, 2012) hand there is cultural production that can be valorized in

terms of scientific production, on the other hand there are quality content that cannot be technically valorised, but that builds reputation and identity. It is therefore appropriate to question about the new methods of production and representation of design knowledge and, above all, about overcoming the limits of exclusively textual models of dissemination, which sometimes fail to be flatly effective.

1.4 Research questions

The ongoing research project is aimed at innovating the design cultures of scientific production and publication, starting from a structured presentation of a collection of relevant case studies.

The underlying research questions concern the role of innovative practices in the scientific publication process, the identification of those stages in which the traditional practices could be released and the envisioning of communication strategies for making innovative practices techniques available to the design scientific community.

The project is based on three main intertwined hypotheses, that are:

- The lifecycle of a scientific publication is going to be more and more circular and iterative instead that a linear one (from data collection, to authoring, peer review and publication and dissemination): the co-creation and co-contribution paradigm are already established in some works, but the circulation, use of re-use of scientific contents can be further promoted and improved, maintaining authorship. For doing this, lifecycle phases need to be individuated and empowered in order to be transformed/enriched in innovative functionalities performing a multi-layered and growing publication (i.e.: sharing, evaluation, reuse etc.);
- The size of a scientific publication is going to/can change during its lifecycle(s), due to different use, re-use and contribution, allowing to add different layers of content;
- In both the above-mentioned process, *traceability of authorship* and *assessment* of contents needs to be pursued in order to maintain rigour and accreditation.

2. Methods

2.1 Approach

The research has been structured in five phases according to the main research questions.

1. The first phase of the presented research refers to the *contextualization and framing* of the problem, considering both, inquiries related to the innovation in the scientific publication process and ground-breaking case studies;

2. In the second phase, attentive scrutiny and *classification of existing innovative scientific publication formats,* coherent with the above-mentioned hypotheses, have been performed;
3. The third phase is devoted to the envisioning, design and prototype of a new format that will further develop the concept of open lifecycle and size of scientific publication in the field of design, and eventually other disciplines;
4. Finally, the fourth and fifth phases are respectively dedicated to the evaluation of the prototype and its dissemination and spreading across the scientific community.

The paper will exhaustively present the first two phases

The research involves ten researchers coming from different fields of Design.

2.2 Evaluation Matrix Design

Evaluation Criteria

The first phase, contextualisation and framing aimed at defining the common elements of innovative practices, has led the design of a shared spreadsheet where all the innovative case studies would be collected in a matrix.

Besides straightforward classification parameters such

- Title of the project;
- Year of publication;
- A brief description;
- Disciplinary field;
- Type of accreditation;
- Type of media supported;
- Format;
- Contact person;
- Management;
- List of keywords.

The size and life-cycle stages categories were introduced being those parameters themselves results of the research. The introduction of those tailor-made categories has led the researcher to classify all the case studies according to the first phase of the research.

Size

The *size* parameter refers to the dimension of the product, according to the type of elements which contains. It could be a single item, an ecosystem or a platform. A *single item* is a single, stand-alone unit with well-defined borders even if composed by a different type of media: for instance: a book, a website, an application (National Science Foundation,

2011). An *ecosystem* is an independent system of contents, with well-defined borders and structured by single and discrete units (Howard Hughes Medical Institute, 2011). Finally, a *platform* which is intended as a service of access, research, consultation and or production of contents (JoVE, 2006) (Figure 1).

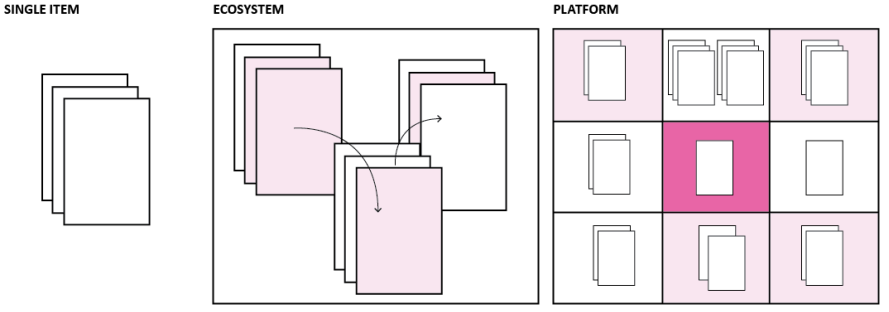

Figure 1. The size evaluation criteria.

Publication lifecycle

The publication lifecycle which is not innovative per se (Björk, 2005) is intended as a recursive chain of steps aimed at the final publication. As already introduced, the aim of the project is to transform the stages in specific processes for innovating the publication, both in the analysis of case studies, and especially in the new publication format prototype.

Indeed, during the case studies classification, the need to identify at what stage in the publication cycle the innovation had been introduced emerged; for that reason, has been added in the classification parameters.

Initially, the proposed publication life cycle included ten separate stages, which have been inferred from the analysis of the literature.

Innovation in scientific publishing at the level of exploration, means designing artefacts able to help researchers in finding articles correlated to their research interests and for some years now it has been managed by machine learning algorithms such as natural language processing which allow better customisation of interests. Moreover, some platforms allow users to save and archive material to be cited later.

At the stage of sharing, are involved platforms and websites helping users to share in-progress research. Micropublication (Micropublication, 2019) is an example such as (Cornell University, 1991) repositories which allows a direct conversation with other researchers.

Moreover, there are some examples at the connection stage, which is strictly correlated with the sharing phase. The stage of connecting refers to the dynamics adopted to connect with

other researchers. Academia (Academia, 2008) and ResearchGate (Madisch, 2008) are well-known and striking examples.

Then, especially when dealing with collaborative articles, innovative practices of writing articles are required. CodeOcean (CodeOcean, 2017) and Overleaf (Overleaf, 2014) are only two of the existing dozens.

Between the *writing* and *publishing* stage, a critical and underestimated moment is the one dedicated to the *composition* of contents. *Composing* means articulating and augmenting, giving the user the opportunity to increase the value of the research. This stage, more than the others, is crucial in the design activity. The naming itself of the stage refers to that design task which embeds the selection, structure and communication of the scientific contents.

The *publishing* stage includes all the tools and platforms aimed at accelerating the publication of peer-reviewed science. Moreover, the *reading* stage includes systems and tools which allow improving the reading experience. The annotation tool *Hypotheses* (Hypothesis, 2013) is one of those examples. The process of evaluation has been subject to innovations too, being open peer reviews increasingly common. The *re-using* stage covers tools and platforms aimed at tracking scientific contributions and ensuring that the original research is reproducible. Finally, some other cases, focus on the *innovation* of the *assessment* stage, which best practice is the assessment and check of the impact of scholarly research.

Evaluation Matrix

Furthermore, according to the ten evaluation criteria aforementioned, an evaluation matrix of case studies has been designed in order to systematically and collaboratively store the outstanding cases in the literature.

From a list of more than 400 projects, presenting innovative practices in the publication lifecycle, 50 relevant cases have been chosen as more relevant to our research, taking in consideration their level and stage of innovation, trying to cover each publication stage with a balanced number of examples.

Finally, the latest version including the most ground-breaking 20 cases has been made.

The evaluation matrix, which will be commented and explored in the Results session, will be the starting point for the third phase of the research project.

3. Results

As we mentioned above, the paper is presenting the preliminary results of ongoing research.

In this session

- The evaluation matrix;
- The updated publication lifecycle scheme;
- The *Prode* identity and the website-archive.

will be presented.

As we mentioned in the Methods paragraph, the publication lifecycle stages have been exploited for classifying case studies. The majority of the presented projects is not specifically tailored for a specific discipline or field but there are some cases such as *Jove* (JoVE, 2006), *Distill* (Distill, 2016) and *Parametric Press* (Matthew Conlen, 2019) that are discipline-oriented and very effective. By browsing the matrix (Figure 2), it's clear that the discipline-oriented cases embed innovation in the stages of *writing, composing and publishing* which lies at the heart of the cycle. Indeed, the way contents are organised, mixed, structured and augmented must be peculiar to each field of research. If the literature offers examples where ad hoc platforms have been created for medicine, biology and computer science there still seems to be room for experimentation in the Design field.

Parametric Press (Conlen, 2019) and *Distill*, are built atop *Idyll* (Heer, 2018) an open-source toolkit for writing interactive articles. Even if geared towards computer science, data visualisation and social science topics, both of them offer to the user the possibility to build interactive views and customise digital content — which is a feature to take in consideration when moving to the Design field —.

One of the main outcomes of these phases was the identification of three most promising stages from the publication lifecycle the *writing, publishing and composing* from which to start designing the final prototype. Indeed, giving the researcher the possibility to customise interactive digital content, is the stage of the publication lifecycle named *composing*. (Figure 3)

As a result of the first two phases, a website has been designed, in order to both share the research process and present the ongoing results: at the end of the research, the website will be the main touchpoint providing a framing and contextualisation of the research, an easily updatable archive of projects and the main point of access to the final prototype.

The website has been designed in order to share the results among the scientific community of the design field. For that reason, the name of the project is PRODE, which *means PRO DEsign, Scientific PROduction in DEsign.*

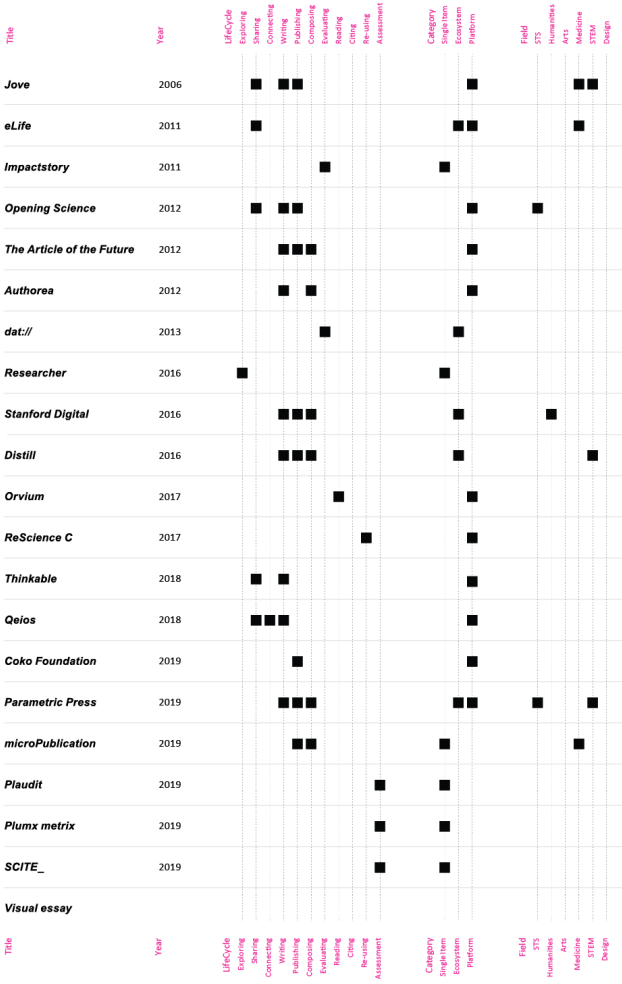

Figure 2. A matrix showing the most relevant case studies collected. For browsing the complete matrix check the website.

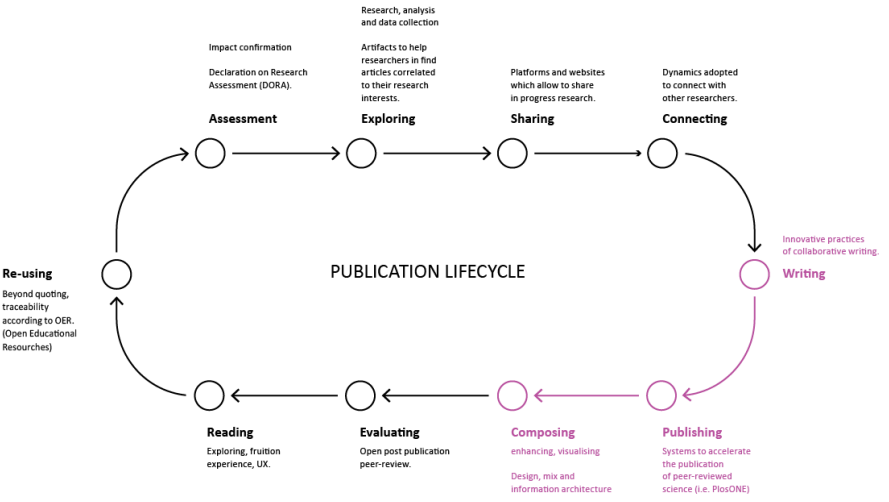

Figure 3. The publication lifecycle according to the case studies analysis. Highlighted in pink the stages of the publication lifecycle identified as promising.

Until this moment the website is structured in four pages:

- The home page: where the research project is presented;
- The about section where the produced material and the aim of the research is explained;
- The news page where activities are shared with the community;
- The case studies area, that, serving as an archive, collects and shows the analysed and relevant case studies.

In the case studies page, projects can be filtered by publication lifecycle stages through a dropdown menu. One of the most important features of the website is that the case studies area is easily editable, being directly connected to a google spreadsheet which effortlessly updates data. The spreadsheet feeding the website is organized according to some of the criteria of the evaluation matrix:

- the title of the project;
- a relevant image;
- the year of publication;
- the brief description;
- the size;
- the type of product;
- the field.

By doing so, the website becomes both *an explorative tool* and *a logbook* for the research team.

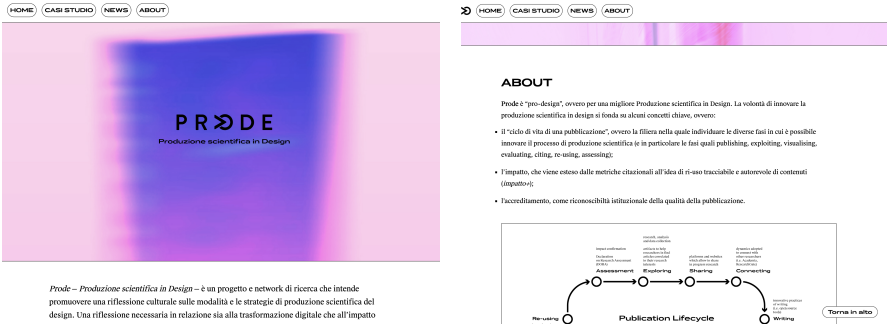

Figure 4. The Home page and the About section of PRODE.
https://produzionescientificaindesign.github.io/Prode/

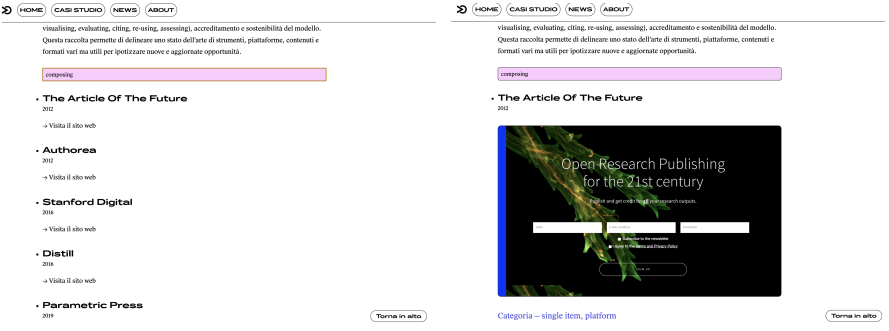

Figure 5. The case studies page. On the left a view filtered by the "composing" stage. On the right, a single case study. Users can filter data and explore single projects by reading the short description or visiting the web pages.

4. Discussion

The paper mainly highlights and distils the theoretical contribution of the presented ongoing research. The practical contribution, dealing with the envisioning and design of the prototype is still in its embryonic phase and, for this reason, it will be discussed later.

The definition of the publication lifecycle and the identification of writing, composing and publishing as the most promising stages are the main theoretical contributions of the paper. Specifically, the composing phase could be linked to common design practices and become the most encouraging one for the development of the research.

The design discipline can be a pivotal field for the experimentation and discussion of new scientific publication formats, so this is the reason why, after designing a prototype format, the aim is to have a discussion with a seminar to present the project to design-field researchers and scholars and to publishers to ask to try it and gain feedback as well first new formatted developable science.

The final output will be a prototype of a format that through scalable and implementable parameters will offer different models of visualization and units of organization of scientific content, allowing to experiment in more traditional formats, multimedia and multi-channel dissemination and sharing.

As first experiment, it is intended to draw on content already existing in the department and provided by the community itself, according to availability and interest.

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Acknowledgements: The project is funded by FARB 2018 – Fondo dell'Ateneo per la Ricerca di Base.

DC(S)
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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Translation Design for medicine leaflets. Research and innovation

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Abstract | In the context of Design for health there are many complexities and challenges that designers have to face. In this paper we will analyse the main characteristics of a specific communicative artifact "the medicine leaflet". The goal is to frame it on the basis of its textual and paratextual nature, but also to reflect on its multiple critical aspects. This analytical perspective is strictly connected to Communication Design and Information Design, but more specifically to Translation Design conceived here in term of a "transformative design activity" aimed at reformulating, transferring, transcoding or, more often, transmuting a source text into a final one. Through a series of case studies, we would like to highlight the role of the translator-designer in generating new interpretations, contaminations, simplifications or expansions of content that improve the communicative access to the medicine and consequently facilitate the relationship between the various reference interlocutors (doctors, nurses, pharmacists and patients of all kinds).

KEYWORDS | MEDICINE LEAFLETS, TEXTUALITY, INNOVATION BY TRANSLATION DESIGN

1. Introduction

This paper is based on the research project *Care for care! Shaping medication to avoid treatment inaccuracy. Design culture between identity, communication and use handling* funded by the Politecnico di Milano within the University Funds for Basic Research.
The theoretical framework, defined as a perimeter for the analysis of pharmaceutical products, takes up the theoretical issues and the most consolidated methodologies of the discipline. In particular those related to the relationship between form and recognizability; form and understanding of the product; form and ease of use (affordance); those related to the interface of products and the interaction between user and product (interface design, interaction design); those related to the role of past experience and experience design; those related to perceptual aspects that activate the user's sensorial system in cognitive processes; those that refer to the analysis and design of the product based on the user (user centred design, design for all); those that focus their attention on the product-system and the product life cycle with the specific needs that characterize the different phases and the plurality of users involved; those that draw on theoretical reflections and design experiences on packaging design and on the role of info-communicative surfaces in guaranteeing access to the product (*access design*). This contribution aims at observing the package leaflet of medicines to highlight their properties, their limits and evolutionary possibilities, starting from a reading of their primary components.

2. Complexities of the package leaflet

The package leaflet for medicines is a polyalphabetic communicative artefact of a paratextual nature, which presents a serious underlying ambiguity. As Di Pace (2019, p.9) observes, on the one hand it constitutes a model of accessible textuality, while on the other it is characterised by a highly technical and specialised sectorial language, which is often not easily understood by the primary target audience (heterogeneous in terms of age, geographical origin, levels of education, and specific skills).

The nature of the medical lexicon is hypertrophic: it is in fact a linguistic system, which has become embedded over time, contaminated with other scientific fields such as chemistry or pharmacology. It presents a type-related variety of terms that can be easily accessible to highly specialised medical practitioners, but which are particularly incomprehensible to ordinary patients.

In fact, it is a matter of an articulated and hypertrophic linguistic system, a sort of "anti-language" (Calvino, 1965), whose main characteristic is the so-called "semantic terror", that is, moving away from words with a clear and comprehensible meaning, in favour of imprecise or completely indecipherable terms. The issue becomes more complicated when the users are foreigners and their understanding of the contents of the package leaflet needs to exploit a series of translations carried out by inexperienced linguists, or, in other cases,

performed with the use of computer programs; in both circumstances the risk of error is very high; indeed, there have been numerous incidents of this kind. As an example, there is the case of a Chinese woman from Prato who, due to a misinterpretation by the translator, risked killing her six-month-old daughter with a dose of antihistamine forty times higher than prescribed; or the case of a Spanish-speaking man in New York, who, owing to a machine translation, took the same hypertension pill eleven times a day, (Capuano, 2013 p.58).

This complexity is flanked by additional extra-linguistic or extra-textual issues: the readability of the written text (the size of the characters often makes it difficult to read); the information density of the text itself; the de-personalisation and absence of a hierarchy of contents (lack of emphasis on warnings and the risks that medicines entail); the lack of textual distinction (with different distribution and hierarchy) between information intended for the patient and that reserved for the doctor; the problem linked to communication media (size of the leaflet, usability and durability of the paper that is used).

Further complications arise from the numerous constraints dictated by the legislative aspects defined by the competent authorities such as the EMA, the European Medicine Agency, AIFA, the Italian Medicine Agency, the Ministry of Health or the FDA, the American Food and Drug Administration.

Given these premises, we try to understand how the package leaflet can be improved, taking into account the different types of medicines, categorized as: OTC medicines (over-the-counter or self-medication medicines with immediate visual access; also known as GSL - General Sales List); PoM medicines, which are prescription-only (and which cannot be advertised) and finally P (standing for Pharmacy) medicines, namely those not requiring a prescription, but not over-the-counter (sold on the pharmacist's advice), (Di Pace, 2019, p.32).

3. The package leaflet as text and paratext

The leaflet is also referred to in Italian as ‘bugiardino’, meaning ‘deceitful’. As de Pace reminds us (2019, p. 15) among the various explanations, the most credible interpretation of the origin of this term concerns the medical field and more specifically the recognition of the omission of a series of information concerning the negative aspects of taking a medicinal product.

More recently, as stricter regulations have come into force, the *bugiardino* has become a more articulated informative/prescribing text, in which a series of formulations remain inaccessible and scarcely interpretable to the common patient.

We can conceive of the *bugiardino* as “text”, that is, “an expressive medium capable of conveying certain content with its specific features, recognisable boundaries, and internal procedures” (Marrone, 2010, p.5). But we can also define it as “poly-alphabetic text”

because it is characterised by the coexistence of several registers, namely the verbal and visual aspects, but also the tactile aspect (when we refer in particular to the qualities of the paper).
The cooperation between verbal, visual and tactile aspects in the package leaflet requires different decoding strategies. The three systems do not operate autonomously, but support each other, transforming the leaflet into a 'hybrid textual model', directed towards reading and interpretation.

Looking at it from another perspective, the package leaflet, as a text, must not disregard its relationship with other texts that surround it: the medicinal product as the main text, the reference label, and the packaging.

In these terms the package leaflet can be better conceived as a "paratext", i.e. a text accompanying a main text, which has as its purpose the most relevant and conscious reception and consumption of the pharmaceutical product itself.

As Genette affirms (1989, p.4), the paratext constitutes a threshold, an area not only of *transition*, but also of *transaction*: "the privileged place of a pragmatism and a strategy, of an action by the public".
More in detail, the factors that qualify it can be traced back to:

1. Its *location*: the package leaflet is placed near the main text (the medicine), or is an integral part of it;
2. Its *temporal status*: it is a short-lived text, to be updated over time in terms of content, which may last as long as the life cycle of the medicinal product, or it may be worn out, lost or confused among similar things;
3. Its *substantive status*: it is itself a text, which can be characterised by several codes and different levels of iconicity, material or factual aspects that determine its reception;
4. Its *pragmatic status*: linked to the specificities and nature of its recipients;
5. The *illocutionary force of its message*: in other words, the performative power of the verbal/visual content, which may or may not include forms of manipulation of the recipient.

4. Organisation of the contents of the package leaflet

In terms of content, the leaflet is an example of "highly binding" textuality (Di Pace 2019, p.25), modelled on technical texts (such as instructions for use), which leave the recipient no freedom of interpretation or subjective assessment of the content.

Directive 2001/83/EC, supplemented by subsequent directives of 2003/94/EC, 2004/27 EC, 2008/29, constitutes, at European level, the main reference for standardisation according to the type of drug and the choices of the relevant pharmaceutical company.

A further point of reference is the European Medicine Agency (EMA), which has set up a group of experts (the Working Group on the Quality Review of Documents - QRD) for the development of the *Guideline on the readability of the label and package leaflet of medicinal products for human use* (1998, subsequently revised in 2009). The Single Medicines Commission has developed further guidelines in order to make package leaflets for over-the-counter medicines, which can be sold without a prescription, more understandable. The guidelines are flanked by initiatives launched by AIFA (validated by the European Agency EMA), which have created an institutional Pharmaceutical Database in support of citizens and healthcare personnel.

The QRD template divides the contents into six numbered paragraphs, defining them on the basis of a question/answer method:

1. What is X and what is it for;
2. What you need to know before taking X;
3. How to take X;
4. Possible side effects;
5. How to store X;
6. Package contents and other information.

It should be further specified that this is a general reference, which is subject to further amendments and specifics. It is useful to report here the indications quoted by AIFA, which, in the development of the different paragraphs, suggest avoiding the use of impersonal or passive verbal forms; the use of technical language; any reference to unclear terms; the use of abbreviations, acronyms and symbols.
Further indications suggest the use of short sentences with fewer than 20 words, and a low degree of subordination (bulleted lists); direct and active style; expressions close to the common language (technical terms in brackets); explanation of anatomical names of organs and clarifications; and pictograms alongside verbal information.

5. Graphic-visual elements of the package leaflet

The graphic-visual elements of the package leaflet are regulated by the European Commission, Guideline on the Readability of the Labelling and Package Leaflet.
The 2009 version, (Section A: Recommendations for the Package Leaflet) stresses the need to maximise the number of people who are able to use the information (by recipients we mean sighted people, the elderly, children and adolescents, those who cannot read or the visually impaired).
To this end, it invites pharmaceutical companies to recognise the specific role of designers in the visual reorganisation of content and in conducting tests aimed at gathering feedback from the target audience.

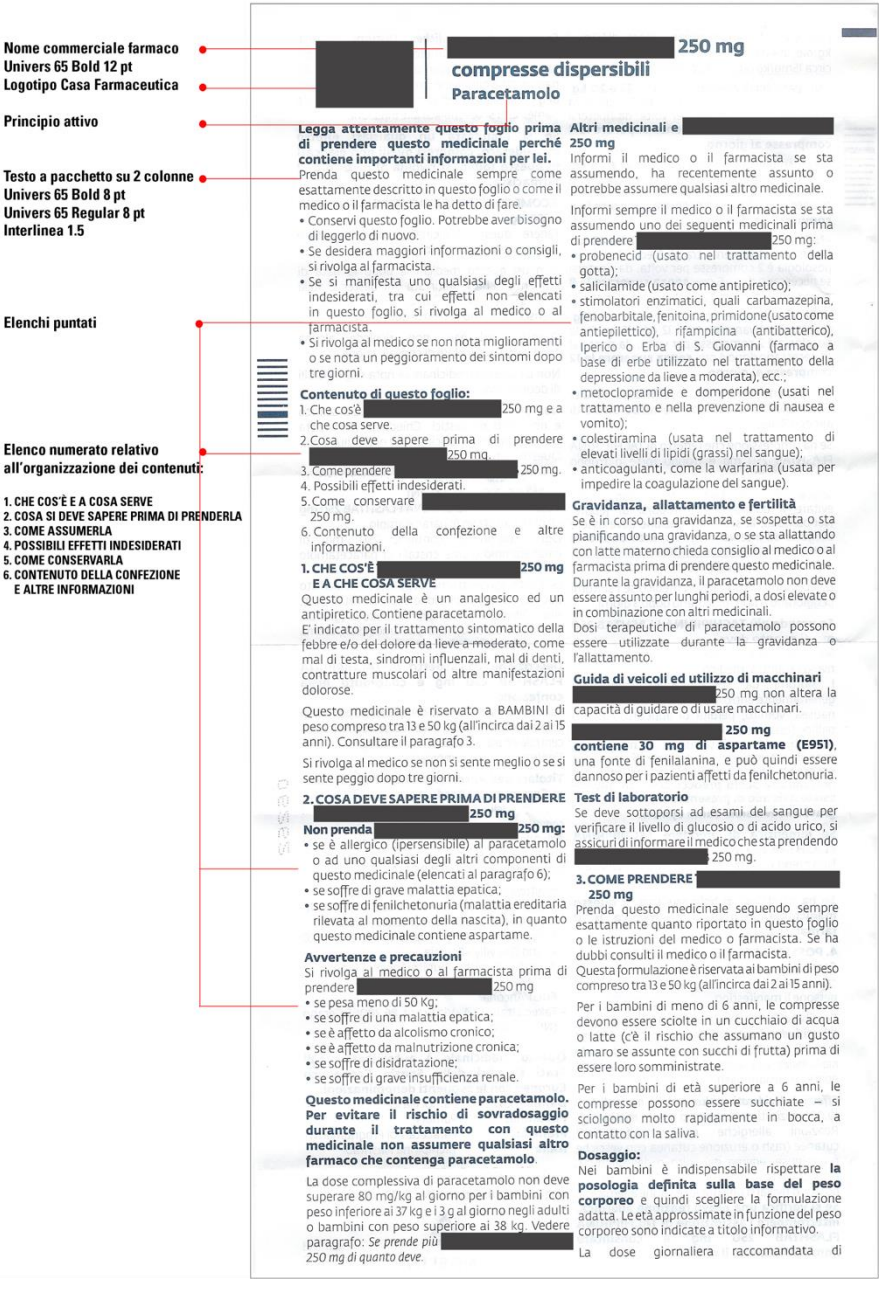

Figure 1. Structure of a medicine leaflet of a drug that does not require medical prescription.

Very briefly, the recommendations concern:

1. *Text size and typeface:* we suggest the use of readable fonts that are unambiguous when reading letters or numbers. The font size must be at least 8/9 points (as measured in Times New Roman), with a space between the lines of about 3 mm. There should be a change in size, or the text should be highlighted, to bring out relevant pieces of information (e.g. for headers). We do not recommend using capital letters or italics (italics should only be used for Latin terms);
2. *Layout and organisation of the information:* the use of a right or left flag layout is discouraged. Line spacing must be about 1.5 to ensure readability. The contrast between the text and the background is also a relevant factor, as it is decisive for the accessibility of information. The same applies to the weight and colour of the paper, the size, weight and colour of the typefaces. The use of background images is discouraged because these can interfere with the text, resulting in decreased legibility. The text can be organised in columns delimited by a space or lines in between the columns. A differentiation between columns can be useful for multilingual texts;
3. *Titling:* this can be in bold or in a different colour from the main text and must be delimited by consistent spacing above and below. Other text differentiation strategies (numbering, bullet points, colour, indentation, font and size) can be used to aid the recipient in reading the text. Subtitles may also be used if they are important for a medicinal product (e.g. information on excipients);
4. *Print colour:* typefaces can be printed in one or more colours to make the text stand out from the background; differences in size or colour make the text more recognizable and memorable. Differences in colour, or colour intensity may be used to highlight particular warnings;
5. *Paper:* the paper weight should be such that it is not transparent, which would make the text illegible, especially when it is small; even coated paper is not recommended because it reflects light and makes the information difficult to read. Uncoated paper is the best type to use. Paper folds may or may not make the contents easier to read;
6. *Use of symbols and pictograms:* the use of images, pictograms and other graphic elements is permitted, in order to aid in understanding the information, but these must exclude any element of a promotional nature. Their role is to enrich the text by highlighting functional aspects or details also reported in textual form. The use of pictograms should be tested before applying them on package leaflets because they may have different meanings depending on the cultural context.

In reality, pharmaceutical companies do not fully comply with these recommendations. As noted by Karel van der Waarde (2016, pp.73-91), their major limitation is linked to the fact

that legislators do not have an in-depth knowledge of the skills of communication designers and their ability to organize information as a whole, i.e. taking into account perceptive, semantic and pragmatic aspects that go beyond styling.

In general, there is a widespread prejudice that the communication designer is only concerned with the visual appearance of the package leaflet, and to the writing systems, in a limited manner.

According to this vision, the designer's intervention is reduced to designing only part of the information to support subsequent testing operations.

Greater involvement of visual communication professionals is desirable, in order to make the improvements that need to be made to the leaflets (beyond the official guidelines) more objective and relevant. It would be extremely useful to open up a dialogue between the various parties involved: the authorities that legislate, operators in the sector, pharmaceutical companies, and those who have the necessary skills to modernize this type of communication artefact.

6. The package leaflet and translation: recurring translation models

An initial observation and collection of case studies has allowed us to identify a series of "translation models": in some case a radical rewriting of contents and their reconfiguration, in others an evolution of formats and/or channels of dissemination. These summarise the transformations in progress and the widespread effort to make the package leaflet more functional to the needs and limitations of patients and professionals.

The reference to different modes of interpretation is inherent in the very nature of translation, but also "the inclusion of the other", beyond the pure transpositions of the meaning or signifier. Here we try to summarise the most representative models in order to offer an overview of possible interventions.

The first form of translation of the leaflets that is under consideration is *endolinguistic translation* (or reformulation or intralinguistics), namely the translation of content within the same linguistic system.

We are referring to true "rewriting", aimed at a greater clarification of some technical terms, or at reducing the semantic density of particularly complex sections. As De Pace (2019, p.112) observes, with reference to the exemplification of a well-known prescription drug, the rewritten version loses the aseptic nature of the technical information which is converted into a predicative and thematic structure in which the name of the drug emerges.

The *typographical translation* of the leaflet falls into the category of endolinguistic translation, and involves a series of rewriting operations aimed at a more rational use of the

elements of interest: print formats, the size and arrangement of text columns and images, the organisation of hierarchies of titles, subtitles and captions (macro typography), but also aspects related to micro typography, which refers to the individual elements related to the letters, the space between letters, the word, the space between words, the line and line spacing, and the text column (Hochuli, 2018, p.7). Taking these factors into account means working towards achieving greater usability and readability of the text, but also optimising page space and consequently lower paper consumption.

Through a series of tests with different types of users, David Patrick and Samuel Dickinson (2010) identified a combination of factors that improve the interaction with the leaflet:

1. A horizontal layout allows greater management of text units;
2. Shorter text blocks ensure better use of the content;
3. A reduction in text density (and therefore a better balance between the white space and text sections) facilitates reading and comprehension;
4. Breaking down the text into separate sections (e.g. between the dosage section and the side effects section), speeds up the retrieval of information;
5. Logical uses of typography, (of lists, spacing and hierarchy of text, or size of titles) are not negligible aspects on which readability and communicative access depend;
6. Highlighting parts of the text (either by using bold or increasing the size of the text), is an additional element of orientation for the recipient.

An additional project intervention is *intersemiotic translation***,** which implies the transfer of sign systems within other sign systems. This is in fact a change of code, which in the package leaflets takes the form of an extraverbal transfer into images, photographs or pictograms (Article 62 of Directive 2001/83/EC suggests that verbal forms should be accompanied by the use of illustrative images or pictograms).

The examples are notable, and equally numerous are the configurative modalities of different iconic levels: from schematic representations in black and white, to more detailed forms of representation (involving the use of colour), as well as the use of photography.

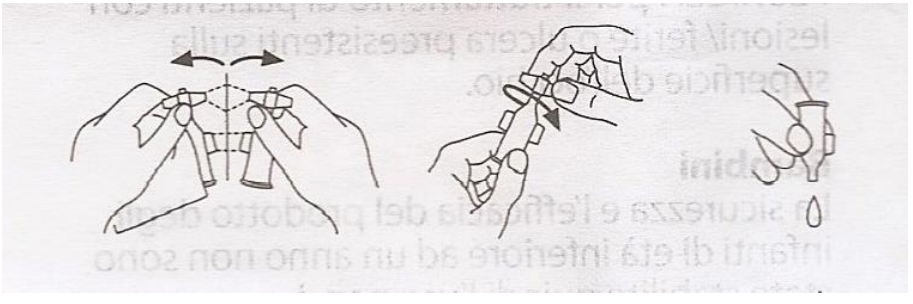

Figure 2. Visual representation of packaging use.

In terms of content, the images visually translate the instructions for use; they are found, in particular, in medicines that have complex devices or procedures for consumption, or that require specific storage methods.

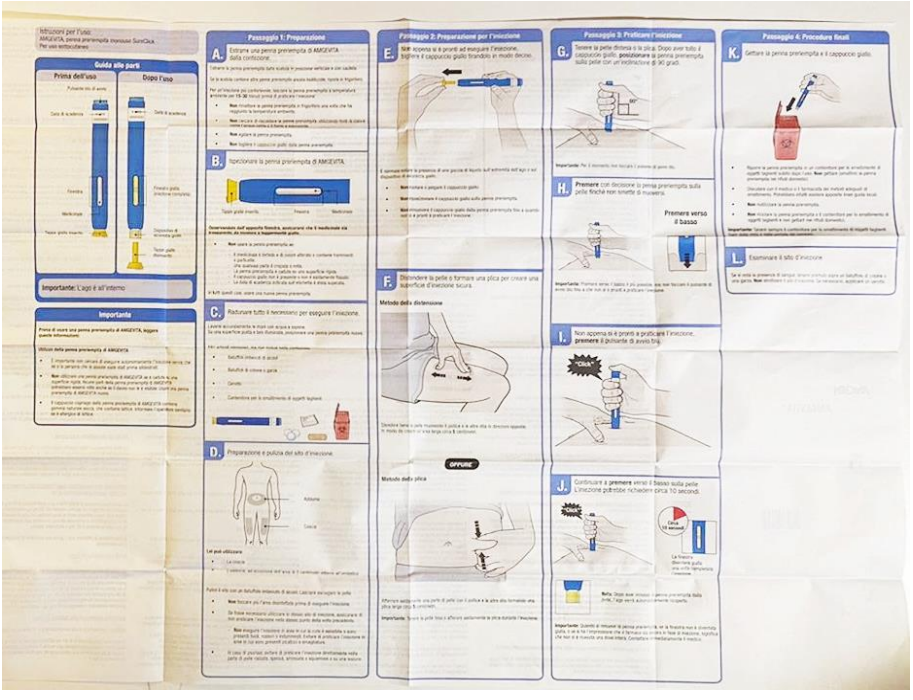

Figure 3. Visual representation of packaging characteristics and of the medicine consumption.

Other images, taking up the codes of the scientific illustration, underline the effectiveness of the active ingredients of the medicinal product; for example, by depicting the phases related to the elimination of bacteria.

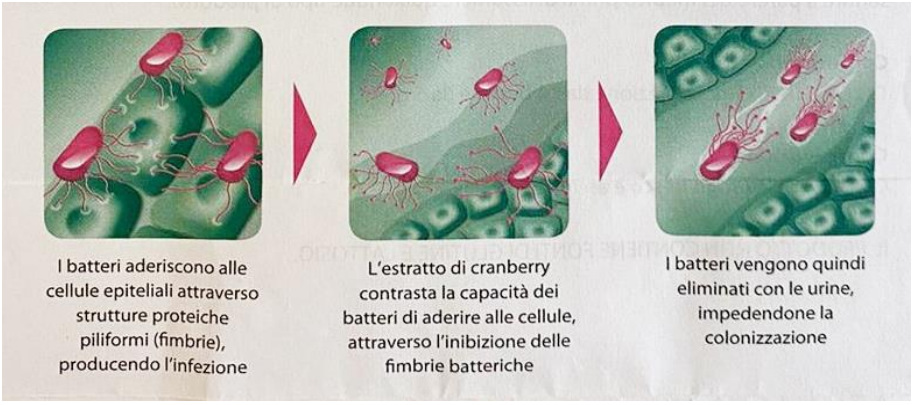

Figure 4. Visual representation of the process of elimination of bacteria.

In other cases, in particular in the package leaflets of over-the-counter (non-prescription) medicinal products, we see the use of more evocative or decorative images, or photographic images for advertising purposes to represent the different formats of the medicinal product itself.



Figure 5. Evocative use of the image.

The translation of content into pictograms is particularly significant when the reference context is multilingual, or the target audience includes: people who are not literate, the elderly, or people who are visually impaired. In general, the pictograms in package leaflets

accompany the verbal text and do not replace it completely (this is dictated by the relevant legislation).

An emblematic example is a series of pictograms designed by the American company USP (United States Pharmacopeia). Their purpose is to facilitate the understanding, storage and communication of general information, together with medical precautions or warnings.

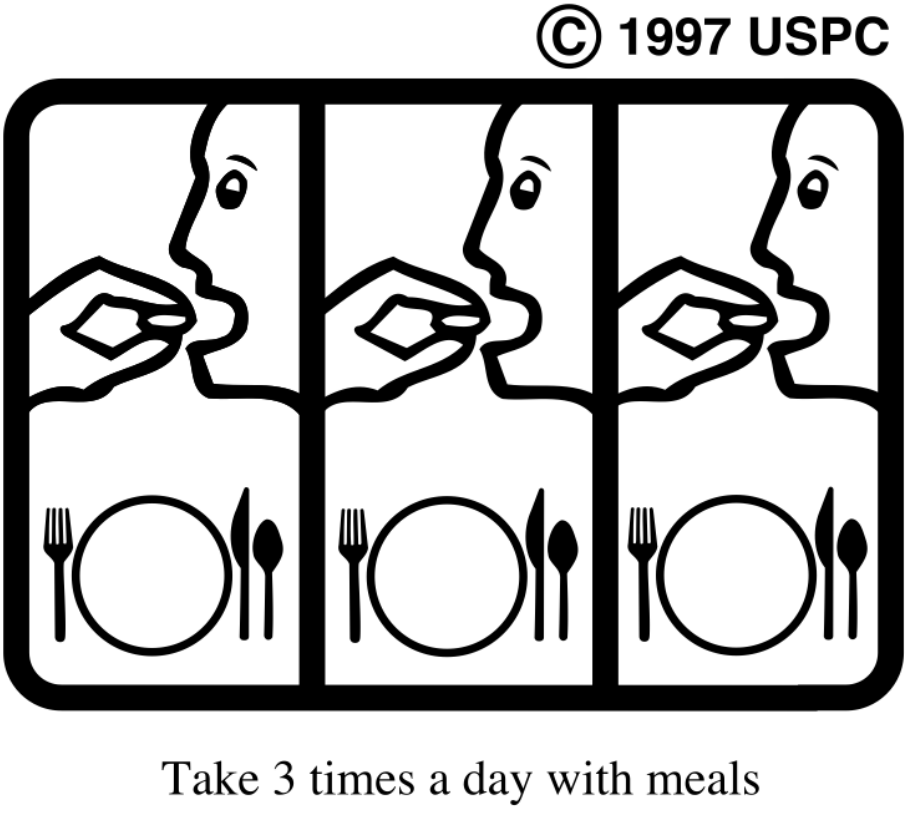

Figure 6. Example from USP pictogram system.

With reference to this project, in 2004 a Finnish research study tested USP pictograms on a category of children between 7 and 13 years of age, demonstrating their validity in terms of immediacy of communication. However, researchers stress the need for further research into the adoption of an international system of signs at European level.

Further research in South Africa tested a series of locally-produced pictograms on the non-literate population, transforming the instruction leaflet into labels to be applied directly to medicine packaging. The use of pictograms was welcomed, because it made it easier to

understand the instructions for using antibiotics. Here too, the need to raise awareness among legislators in order to promote further research in this area is reiterated.

Translating the leaflets into Braille is in fact an intersemiotic translation, because it implies the passage from the traditional alphabetical system to a coded system of symbols, which correspond to the letters of the alphabet (specifically, it is a different combination of 6 points).
The European legislation (Article 56a of the Directive on human medicines 2004/27/EC) itself states that the name of the medicinal product must be embossed in Braille, as well as the expiry date on the surface of the packaging, and suggests the availability (on request) of package leaflets or adhesive labels in Braille, for blind or visually impaired people.

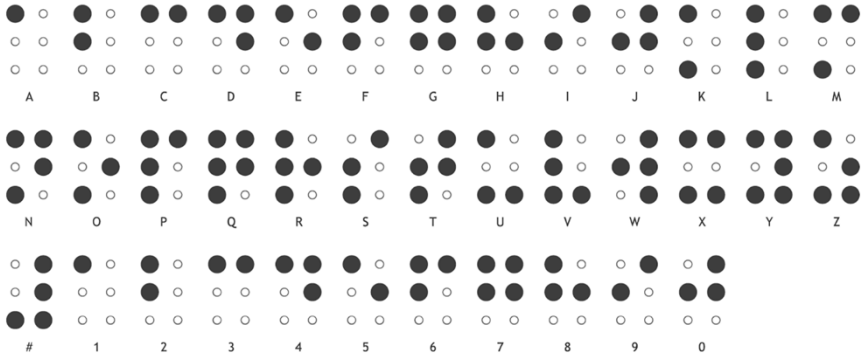

Figure 7. Pharmabraille system.

Interlinguistic translation of package leaflets should generally be entrusted to specialised professionals with high-level technical and scientific knowledge and terminology.
The need to have content translated into several languages, on the basis of EU Directive 2001/83/EC, has encouraged the practice of *inter-format translations* in the analogue field and *inter-media translations* in the digital field.

On the analogue side, given the multiplication of the contents of the leaflets, there has been an average increase of 30% in the surface area of the leaflets; on the digital side, on the other hand, work is being carried out on the transposition of multilingual contents through the use of QR codes and the design of dedicated applications.

In the first case, the change in size has led to an increase in the size of the package leaflet in width or length, resulting in a reduction in paper weight (to avoid excessive stiffness of the package leaflet), damage to the primary container, or jamming of the printing presses.

Other more innovative solutions include:

1. Leaflets folded and closed with a label or glue stitch (large printing surface but difficulty in folding them);
2. Small folded leaflets integrated into the label of the medicinal product;
3. Leaflets integrated into the case: i.e. sheets of considerable size, but folded several times so that they can be inserted into a pocket inside the package (in this case the production costs increase and the patient has difficulty in closing the package);
4. Bound sheets in a booklet format, (i.e. multi-sheet paperback or stapled booklets), particularly suitable for multilingual content and ideal for reading information and putting back into the package.

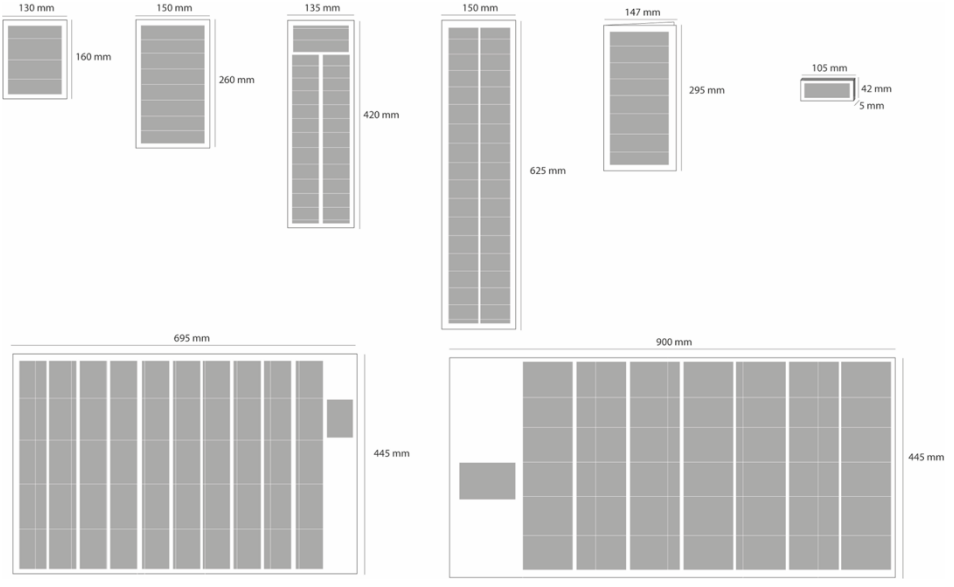

Figure 8. Different dimensions and formats for medicine leaflets.

Referring to digital, the most emblematic examples of *inter-media translation* involve specific multimodal directing practices.

In 2016 Angelini created the first multilingual leaflet (in Mandarin Chinese, Arabic, Hindi-Urdu, Russian, Spanish, English, Portuguese, German, French and Italian), the contents of which can be accessed directly from the package via a QR code (available on all self-medication headache medicines). Access through the QR code can be gained from any mobile phone or tablet enabled with a special reading application.

A further innovation is represented by "Sound Meds", created by Sifi (Società industria farmaceutica italiana) in 2015. This is an innovative audio service that allows you to listen to

the information contained in the package leaflet on your smartphone or tablet. Again, in this case, the QR code, with a large audio symbol printed on the outside of the product packaging, allows access to audio content that transmits to the patient all the information necessary for taking the medicine (alternatively the patient can access a pdf of the leaflet, which can be enlarged).

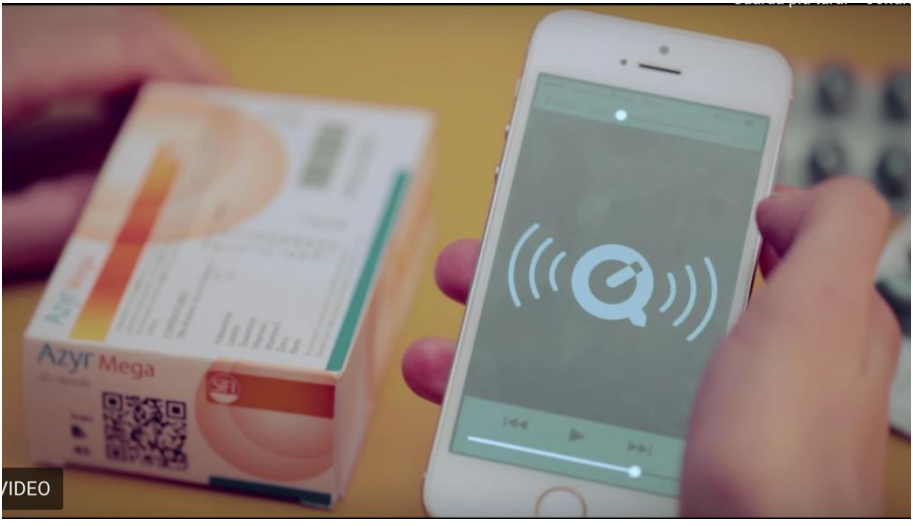

Figure 9. Sifi Sound Med system to get audio informations about the medicine.

LeggoXTe is a digital multi-platform with voice assistant that allows access to the contents of Takeda medications especially for the blind and visually impaired. This application has received the patronage of the Italian Union of the Blind and Visually Impaired (UICI) and Active Citizenship. It is available in the app version for smartphones or tablets, but also in the Google Home compatible version, for seniors who do not use a smartphone. The user can ask questions via the chatbot or with the Google Assistant, who answers the questions by reading the leaflet.

7. Conclusions

This paper consists of an analysis of package leaflets and a summary of current exemplary case studies. The aim is to make explicit a series of "translation passages" whose priority objective is to facilitate accessibility to the contents and improve the functionality of the leaflet.

We believe that a series of transformative possibilities, (rewriting, transmutations, material or immaterial transfer...), can increase the accessibility to the contents, and consequently

facilitate the relationship between the different stakeholders (doctors, nurses, pharmacists and patients of all kinds).

Referring to the translation paradigm allows us, on the one hand, to reaffirm the centrality of the recipient within the design process, (differences and specificities, interpretative skills and previous knowledge); and on the other hand, to highlight the role of the designer-translator, who has the ability to go beyond the list of basic graphic rules, and the skills to give space to improved "micro-graphic" forms of experimentation: from the experimentation of typographic fonts to the research into solutions able to optimise the use of the contents and, therefore, the efficiency of this type of artefact.



Figure 10. The LeggoXTe app makes the information contained in the leaflets of Takeda drugs available also for those who cannot read.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Visual dialects. Exploring early design sketching in various design disciplines.

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Abstract | In this paper we explore the use and rationales of sketching in different design practices such as architecture, product design and graphic design. We recognise that there are preferences, manners and specific expressions that are characteristic for different practices within design, something we label “visual dialects”. Our aim is to articulate these dialects and explore the rationales behind them. The study is initiated through a literature review to explore the field of sketching in design practice, followed by a phenomenographic study of online content in the form of “how to draw like a..”. The results showed that there is a common view on why to sketch, but a differing view on how. Conclusion is that the concept of visual dialects can be a platform for furthers studies of visual communication in early design.

KEYWORDS | SKETCHING, VISUAL COMMUNICATION, EARLY DESIGN, PRACTICE, MANNERS

1. Introduction

The focus of this paper is different practices of sketching in various design disciplines. The sketch is generally seen of as one of the most elementary tools in the design process, yet there are few studies that have explored the implementation of sketching and rationales for different manners, tools and techniques in different fields. In general, there are preferences and specific expressions in most communities of practices (Wenger, 1998), which in our view are particularly evident within the different design practices of sketching. For this reason, we in this paper probe the idea of such expressions being referred to as 'visual dialects', meaning sketching having its own particular language within design, and having different dialects within different design fields. The concept encompasses manners, aesthetics and style, but also mediums, tools and techniques since it carries the language in visual communication.

According to Gleitman & Papafragou (2005), the abilities of thought and perception are the same in all humans, while language frames and filters it. In this context, language is the communication medium that creates meaning, and depending on the structure of the language, different meanings can be generated. The question is if visual expressions can correlate to language and contribute in creating frames and filters within design disciplines.

Different design fields seem to all use visual artefacts such as sketches, but have different conducts and mediums. Goldschmidt (1994) for example states expectations and contributions depends on the design culture that one subscribes to. To our knowledge there is scarce research studies concerning this. Also, Vistisen (2015) highlights that the role of sketching in visual communication is a bit overlooked in design research. For this reason, we propose a need for further explorations of the sketch and its role in design.

The overall objective of this paper hence is to explore the implementation and rationales of sketching in different design disciplines such as product design, architecture and graphic design. Drawing on a qualitative analysis of sketching videos, and a theoretical framework of sketching, communication, and sense-making in design practice, we aim to further knowledge of discipline specific visual dialects, their representation and possible effects.

2. Theories of sketching and sketches

In this paper, we define a sketch as a rough visualization that represents key features of a design, often implemented during the early phases of design. A design sketch can be described as a particular kind of drawing, different from art and drafting in its objectives, methods and values (Kirby Lockard, 1982). Also, it is proposed that "by sketching, the designer does not represent ideas held in mind /…/but creates visual displays which help induce images of the entity that is being designed" (Goldsmith, 1994 p.123). In design, sketching is generally considered the fastest method, whether you work alone or collaborate with others (Henry, 2012). In this view, a designer does not need advanced digital tools to

make a sketch, and the speed also allows for further explorations and iterations. Sketching is also proposed to have "the advantage of conveying visio-spatial ideas directly, using elements and spatial relations on paper to convey elements and spatial relations in the world" (Tversky, 2002).

In line with this, Macomber and Yang (2011) discuss sketches often being used for receiving feedback from users and other stakeholders. In this case, the sketch quality becomes important, as the medium allows or prohibits the viewer's sense making of the designer's intent. Clean hand drawn line sketches are in this case ranked highest, before both 3D drawings and other sketches (Macomber & Yang, 2011), probably because they allow for the viewer's own interpretation but still make sense.

Verstijnen et al (1998) recognize the communicative act of combining and restructuring that takes place during the practice of sketching as inextricably linked to creativity. Goldschmidt (1991) refers to this as: "seeing as versus seeing that": the medium contributes to a systematic change dialectic, through an oscillation between performance and exploration that the act of sketching contributes to. Sketching is argued to be an introspective process, providing time for reflection and eliminating the need to rely on information processing (Galle, 1992). Similar to this, Hewitt (1985) states sketches as a "medium of thought", meaning that the practice of sketching consists of both experiential and intuitive modes, which in turn may be based on previously clearly defined methodologies or instructions. In this view, in the rapid ideation sketching the visualization becomes part of a cognitive hand-eye-brain cycle, and a positive side effect of this is that others can interact in the communication through the medium. As Van Der Lugt (2005) concludes, the sketch "starts to talk", inviting people to re-interpret ideas.

The communicative aspects of sketching and sketches is multifaceted, as "the processes underlying the production of verbal and nonverbal behaviours are exceedingly complex" (Green, 2013 p.11). A challenge is that if only one aspect is analysed, the actual processes of communication might be lost (Craig, 1999). Hence, analysing visual communication by just taking the visual sensory responses into account can be misleading.

One definition of communication is that it deals with the creation of meaning (Fiske, 1990). When a sender communicates through some representation with a receiver, the medium stimulates sense making. This might be designers themselves attempting to make sense of fleeting thoughts, or clients or users grasping the intent of the design. According to Fiske, all kinds of communication require a medium, and all mediums have its own set of perceived and real affordances.

Visual communication can transmit different information compared to spoken words or written text (Jamieson, 2007), but there are differences in how different types of visual information is generated and received. In this view, there is on one hand the surface-level, in which hidden intentions are not revealed: medium and message are seen to present the

same thing. At a more profound level, visual communication can operate from the concrete (explicit) to the abstract (implicit).

A design medium can generally be described as the materials, techniques and tools used by designers to create their design. For example, a pen is a tool and ink can be the material and the technique can be how to implement those mediums to create a sketch. It is proposed that one of the main challenges in designing is keeping a lot of factors in mind, attempting to "freeze and hold constant some limited aspects of design while other factors can be thought about" (Lawson, 1997 p.242). In this view, early sketches are usually low-fidelity, and designers choose what kind of mediums to use, depending on the situation. According to Schön (1995), the need for medium corresponds to the designers' ability to see and develop a visual representation through whatever preferred medium.

The effectiveness of a medium can be considered by how well the sender can implement it, and how well the receiver can decode what the sender has intended with the medium (Fiske, 1990). In our understanding, the first phases of design sketching often seems based on the designer's own sense-making, implemented by his or her preferred medium, which through cyclic and iterative explorations and perhaps other mediums are transformed.

3. Method

The study outlined in this paper consists of a literature review and visual analysis of video material of "how to draw like a…." in different design disciplines. The literature review was implemented to collect and analyse relevant existing knowledge. The current review followed Rodgers & Milton's (2013) five-step example through initially formulating research questions to answer and from these identify areas and key words to search for and identifying sources based on academic databases such as Scopus, Web of Science, and Google Scholar using search keywords such as "sketching, visual, dialectics, communication, design, techniques, mannerism, early design" in different combinations. In order to evaluate the literature, references with most citations were chosen. Relevant aspects in relation to the research questions were then identified and summarized in this paper.

In addition, visual analysis of videos of "how to sketch…" in different design disciplines was performed. Five videos or blogs were selected from each field. The videos were identified through searching primarily Youtube (www.youtube.com) and the web using search terms in the form of "draw like a product designer", "sketching for graphic design" and similar forms. Selection were based on view count and popularity. Some search results were omitted if they did not display the act of sketching, or if they had the same author. For one of the fields, graphic design, there was too little video content available so there the search had to extend to text based blogs. The sources are listed in Table 1. The rationale behind the choice of material for the study was that we wanted to see what was communicated from professionals to aspiring designers, before they even applied to higher education, thus contributing to the reinforcement of the culture of the practice.

Table 1. List of analysed videos and blogs sorted by field.

Field	URL	Description
G1	https://youtu.be/oKF9LsC0RaY	The Role of Sketching in Graphic Design | Basics for Beginners
G2	https://youtu.be/uA-YvKbNC_I	Does a Graphic Designer Need Drawing Skills?
G3	https://bonfx.com/50-sketches-from-a-graphic-designer/	50 sketches from a graphic designer
G4	https://millo.co/how-sketching-will-take-your-design-process-to-the-next-level	How sketching will take your design process to the next level
G5	https://www.creativelive.com/blog/drawing-for-graphic-design-exercises/	Drawing for graphic design exercises
P1	https://youtu.be/L9D9JWS29h4	How To Sketch Like A Industrial Designer (part 1 & 2)
P2	https://youtu.be/IOsDxLDl-KE	How to sketch ANY product using this ONE trick NO JOKE
P3	https://youtu.be/7hkXwC10vFg	How to sketch product design- Product design process
P4	https://youtu.be/r-UqGtsjKiU	Intro to Product Design (With a Focus on Sketching)
P5	https://youtu.be/mSE3OS6I9Ew	Form, Divide, Beautify: Design Sketching in 3 Easy Steps // Coreskills Episode 2
A1	https://youtu.be/24rnfO8s0hU	Draw like an Architect - Essential Tips
A2	https://youtu.be/eNNAnSCrrBI	Sketch like an Architect (Techniques + Tips from a Real Project)
A3	https://youtu.be/Tgw10eBjSFo	Draw Like An Architect / Essential Drawing Tips / Architectural Student Drawing Guide
A4	https://youtu.be/QgSrVd_c7Vs	Top 6 Architecture Sketching Techniques
A5	https://youtu.be/a7_Fzz-R3dU	How To Sketch Like An Architect

The videos were watched and analysed by adopting a phenomenographic approach. This a way to find variations in a context and identify the underlying factors that enables them (Adams et al, 2011). The analysis is performed iteratively, going through the material, sorting it into distinct categories of how to understand and experience the context. The relationships of the different emerging patterns are explored and described.

Phenomenographic analysis is in general based on material from semi-structured interview protocols, but the method was here applied to the material at hand. To aid the visual

analysis, one of the authors undertook what might be defined as experience prototyping (Buchenau & Fulton Suri, 2001), in the sense of imitating the different sketching practices that was introduced in the videos. The rationale for this was searching an embodied understanding of the sketching practices' enactment of mediums, space, lines and other representations. This is further described in up-coming sections.

4. Study of online material

The upcoming sections outline the results of the analysis and the experience of prototyping the video material of "how to draw like a…." in the design disciplines of product design, architecture and graphic design. A first comparison between the instructional "how to draw like a.."- videos and blogs showed that there were differences in how they explained the sketching activity. The basic assumptions about why to sketch were similar independent of the field, i.e. that it was a fast tool for ideation and communication of early ideas. Though, when it came to the more communicative sketches, differences in rationales emerged..

4.1 Categories

In the analysis, three main categories were identified. The first category is the *mediums*, the tools and materials displayed in the videos. A demarcation was made for the tools used to put mark on paper, which means that drawing aids were excluded. The second one is the handling of *space*, involving perspectives, forms and context. The third category is *line*, outlining how a line is drawn through a technical and aesthetic perspective.

4.2 Mediums: tools and materials

In the graphic design videos and blogs, the tool was a pen. There was no motivation for the use of this tool, and it seemed as it could be any pen or pencil. The materials were plain paper, mostly graphed. The product design videos had a more confined tool box compared to the architecture videos. The tools used for product design were pens and markers. Also white gel and coloured pencils, they were never used directly in the videos but shown in examples. The material used were mostly copy papers and sketch books.

In the architecture drawing videos, the tools were more diverse and consisted of pens, pencils, sharpies, fine-liners, markers, brush tips. The most dominant tools were black and some coloured pens and fine-liners, and grey-scaled or coloured markers. The materials were copy paper or sketch books with dotted or Kraft paper, and tracing paper. In summary, the different mediums can be visualised as the tool boxes for the different design disciplines, containing of different tools and materials, illustrated in table 2.

Table 2. Illustrating mediums in the different design disciplines based on the videos.

	TOOLS	MATERIALS	TOOL BOXES
Graphic design	Black ball-point pen	Paper, plan, graphed or dotted	Small, but can contain whatever mediums
Product design	Pens, markers, white gel pens, colour pencils	Copy papers, sketch books	Medium, restricted to certain mediums
Architecture	Pens, pencils, colour pencils, sharpies, fine-liners, markers, brush tips	Copy paper, sketch books graphed or dotted, Kraft paper, tracing paper	Larger, less restricted to certain mediums

4.3 Space: perspectives, forms and context

The analysis of the product design and architecture videos showed that both used theories of perspectives. Still, there were a difference in how the description of proportion was valued, and the reliance on rules. Whilst the architect videos in many cases used isometric-, planar- and 2-point perspectives to ensure proportions, the product design videos more often assumed perspective using a primitive that appeared to have some sort of perspective and intended proportions as guidelines for the rest of the sketch. It seemed that as long as the lines appeared to converge somewhere, without any construction lines to see that it actually did so, it seemed fine in these videos. The space aspect was treated somewhat differently in the graphic design videos, what we propose is due to working in a 2D instead of a 3D space. The space in these graphic design videos was understood as the interaction of content on a surface, the balance, contrasts, negative space, the reading order and visual clarity.

Table 3. Illustrating the different uses of space in the design discipline specific videos.

	PERSPECTIVES	FORMS	context
Graphic design	Not applicable	Mostly squared shapes as placeholders for content	The layout of the surface involves a constant evaluation of context, placement and reading order
Product design	Assumed 2- and 3-point perspective through guidelines	Basic primitives like a box or cylinder, or combinations, form a base structure for refining	Focus is on the artefact, context non-existent or arbitrary
Architecture	Isometric-, planar- and 2-point perspective	Basic primitives like a box or square, or combinations, form a base structure for refining	Same attention on the artefact, but more attention to the interaction with the surroundings

4.4 Line

By experimenting with different types of lines showcased in the video material, distinctions could be made between line characters. The lines used in the videos for product design are in general continuous and fast, as described in video P4, see table 1: “you want to show your confidence, like you know what you are doing.” (23:55). Drawing the line becomes more of a movement than a controlled process of getting the pen from point A to B. In many of the product design videos this is promoted as something important, i.e. to practice the movement of the arm to generate fast lines, arcs, circles and ellipses.

Generally, the architecture videos show a bit different type of lines compared to product design. These lines are also continuous, but employed a bit more meticulously, slower strokes that give them a bit more wavering, but more focus on keeping the symmetry. According to video A2, see table 1, the “waviness” should support in making the lines look straighter (3:10). In video A1 it is stated that “wavy lines generates an imperfect, sketchy feel” (3:00) which is stated as a good thing. Also, video A3, see table 1, promotes “wiggly” lines, since forcing straight lines takes too much energy and focus from the aim of the sketch. The graphic design videos have a much smaller sample, and much less expressed consensus regarding drawing techniques. The quality of the line is not discussed in these videos, and areas are drawn by tracing the pen around it.

To acquire an embodied experience of how to draw like a graphic designer, product designer and architect, one of the authors made a lot of sketches based on how the implementation of lines were communicated and showcased in the videos. A result of this was the understanding of speed. To illustrate the different kind of lines used, they were organized based on speed, see figure 2.

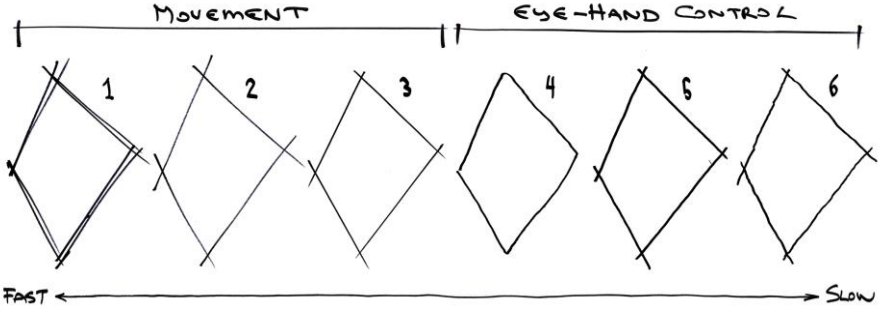

Figure 1. Visualising different lines, from fast to slow. Illustration: Daniel Öhrling

The embodied experience was that faster lines require a feeling for the movement of the line, while the slower ones require that the eye controls the movement to make sure that the tool got the right input. It was experienced as easier to draw straight lines by lowering the speed. This is of course a matter of practice, but for a moderately skilled sketcher the

fast lines never managed to get the same straightness as the slower and stricter lines. This is simply illustrating the embodied experience and conclusions cannot be made based on this experiment.

However, the findings could be displayed in a matrix using two axes: fast to slow lines, and approximate to precise. The approximation in this case means that a line only describes the character of a shape instead of depicting it in its final form, while precision is a strive to keep the lines truer to the geometry it should describe. How the measurable material from the design disciplines relate to these units of analysis is shown in figure 2. Note that the measure for graphic design is highly uncertain since there was not enough input to build upon. The plot shows that product design lines ended up in the fast/approximate quadrant, graphic design in slow/precise, and architecture also here showed a larger variety, but leaned towards slow/precise.

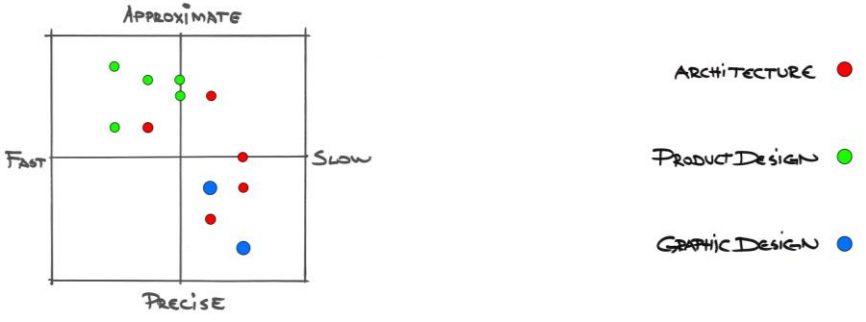

Figure 2. Illustrates the design disciplines use of lines.

The act of putting lines on the paper showed to be the largest divider between disciplines. The architects slower, careful and lively lines do not only have another aesthetic than the product designer's fast strokes or the graphic designers searching trace lines, it also appeared to give a different interaction with the lines. The faster strokes required a feeling for the movement of the line, emphasising the fluidity more than precision, and works well with broad, quick strokes. As described in for example video P4 (22:25), see table 1, the line is placed by aiming for the end destination of the line, modifying the movement depending on what curvature that is intended for it. The focus is on the intended line, not the placement of the pen. The slower lines required more eye-hand coordination and control. One had to visually evaluate the lines behaviour and adjust the movement if the line didn't go where it was supposed to. This might be the reason why the "wiggly" lines where encouraged, since the irregularity of the line conceals corrections that are made during the strokes.

5. Discussion

When someone aspires to become part of a design community of practice, it probably seems natural to conform to the discourses and expressions that the practice conveys. Watching the videos and blogs used in this study was a way to see the phenomenon from the aspiring designer's horizon, i.e. what they are confronted with when forming themselves into what they want to become.

We started out with proposing that there are specific manners and methods that are characteristic to different disciplines within design, something we call 'visual dialects' in design, and asked why these manners exist and how they might be identified. For future work, we are also interested in finding out if these dialects affect ideation- and communication space since the manners and techniques used shapes our language, and what meaning that is formed. Another question is how the conformation affects the community of practice and it's culture, and if it needs to be challenged.

The mediums used in the analysed material showed that product design had a much more limited arsenal compared to architecture. The impression is that you need a pen, some fine-liners and markers to have the prerequisites for product sketching, while there is a bit more freedom of choice when it comes to tools for architectural sketching. In one of the videos it was argued that "design sketching is specifically designed, to be able to sketch products very efficiently and quickly" (P1 (2:46), see table 1). Such statements make it difficult to argue against having to learn the manners and techniques promoted in the videos, if one wants to become a product designer, and might be contributing to the conformity regarding tools. No such statements were made in the other disciplines. In architecture, mixing up tools, mediums and techniques was promoted, as an example in A2 (5:50, see Table 1).

How perspective, forms and balance were treated differed, but mostly between graphic design and the other two disciplines. The architect- and product design videos all have a strong reliance on perspective rules, product design have a bit more "laid back" attitude but basically, they all seemed to regard it as something fundamental. Graphic design videos do not mention this at all.

The differences between how product design and architecture approach the line might be because of the object of their designs and their process. The object for architects are buildings, buildings are expected to have vertical walls, straight angles and specific dimensions for exteriors and living spaces. In their process, as it seems from the analysed material, they have a tradition of working with tracing, building on earlier drafts and drawings. This combined requires a higher precision in where the lines are placed, to make sense. Product designers work with conceptual artefacts with less specified shape, and often lines and surfaces requires tension and curvature. This seems better suited for the fast aim lines that describes the sense of curvature more than the exact placement of it.

The evaluation of the "how to.." material indicated that there were a common view regarding the usefulness of sketching in all disciplines, but differences in their views of how.

Of the three, graphic design deviated the most in this regard. The study did not give a clear answer to why. One could speculate that this is because of that graphic design works mostly in a two-dimensional space, whilst the other two works in three dimensions. Another factor could be that the graphic design process doesn't rely as much on communication of rough ideas and concepts as in architecture and product design, and therefore haven't formed a consensus around what could be described as a "graphic design style sketch". To answer this requires a different kind of study.

In conclusion, the results show that there is a foundation of techniques and methods shared between different disciplines, but also strong discipline specific biases regarding mediums, techniques and manners that may be articulated as visual dialects. Even though this study only looks upon just a small part of what can constitute visual communication, the concept of visual dialects can be a platform to explicate the character of sketching and visualisation, which can form a base for further studies on rationale and implications of how visual artefacts are generated, channelled and perceived.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Visualizing Offshore Foreign Direct Investments: The Atlas of Offshore

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Abstract | Foreign Direct Investment (FDI), or controlling investments that cross national borders, is in many respects the backbone of globalization. However, a considerable part of it is composed of "paper" shell companies used for tax avoidance and other purposes. While it is possible to reconstruct chains of FDI positions, it is difficult to raise public awareness of the full scale and shape of the phenomenon, in terms of not only the countries or amounts of money involved, but also the high levels of uncertainty surrounding estimates of these figures. In this paper we introduce the Atlas of Offshore, a visual exploratory tool meant to enable domain experts and broader publics to explore offshore finance, with a focus on clearly showing the complex webs of relationships between countries involved. Starting from a variation of the "Sankey Diagram", we propose a solution aimed at representing the topology of the network, the estimated size of investments, and the uncertainty surrounding these estimates. A prototype of the tool has been developed, testing the visual model with data describing the network of offshore investments for nine countries, enabling domain experts and others to obtain a new perspective on this issue.

KEYWORDS | BUSINESS AND FINANCE VISUALISATION, FLOW VISUALISATION, AESTHETICS IN VISUALISATION, UNCERTAINTY VISUALISATION, GRAPH/NETWORK DATA

1. Introduction

In this paper we describe the preliminary results obtained in the design of a visualization tool facilitating visual exploration of offshore financial relationships. This was undertaken as an interdisciplinary collaboration between an economic geographer, two information design researchers and two researchers with a background in media studies and science and technology studies. The working prototype, described in this paper, can be found at this link: https://offshoreatlas.publicdatalab.org/explorer.

The starting point is the economic geographer's work constructing a novel database of the estimated offshore investment relationships between specific countries. The construction of this very large network database raised an issue; namely, how to represent “complexity without spaghetti”, or, in other words, render the structure of relationships intelligible, rather than simply overwhelming. At issue here is not simply the analysis of the database, but also the question of using creative visualization tools to render complex economic phenomena legible to a relatively broad societal audience.

The visualization techniques deployed here represent an attempt to strike a balance between across two key dimensions of tensions. Firstly, as noted above, there is the desire to show both the detailed structure of international economic relationships, and the key “big picture” elements of these relationships. Secondly, and just importantly, however, there is the desire to both show our best-available current understanding of these relationships, and the willingness to avoid creating a false sense of certainty potentially shutting down public conversation (Latour & Weibel, 2005)surrounding what remains, even with the application of novel estimation procedures, a fundamentally opaque and poorly understood element of the world economy. What is particularly crucial to convey here— and what is currently not well-recognized by even many expert—is that the massive scale of the offshore data “black hole” at the heart of the world economy means that we do not really understand even many of the most basic contours of the shape of the latter (Damgaard, et al., 2019). Indeed, as Maurer (2008, p.160) puts it, “Far from a marginal or exotic backwater of the global economy, offshore in many ways is the global economy.”

Not surprisingly, these are not new dilemmas, and we can thus specifically situate the atlas project against broader debates around the knowability, unknowability and governability of transnational economic activity (Slobodian, 2018); the infrastructural configurations of relations between markets, states and citizens (Roberts, 2010); and the need for data practices that fully respond to and reflect uncertainty (Anderson, 2018).

1.1 Foreign Direct Investments

Foreign Direct Investment (FDI) consists of controlling investments by companies and individuals that cross international borders. FDI is often considered to be the backbone of the global economy, as it is created whenever a company makes cross-border investment in a factory or other facility or acquires or merges with a company in another country.

However, FDI also consists largely of “paper” shell companies used for tax avoidance and other purposes (Haberly & Wójcik, 2015). In fact, data from the International Monetary Fund (IMF) show that this offshore component of FDI —which is generated as a by-product of tax avoidance and other offshore games— may actually be larger, in total, than the amount of FDI that is not in some way linked to or distorted by offshore structures. As of 2016, roughly two thirds of all worldwide FDI recorded by the IMF —likely accounting for at least 40% of the underlying capital invested (Damgaard, et al., 2019)— was either in or from "offshore" jurisdictions whose investments are believed to consist largely or mostly of foreign-controlled shell company structures.

1.2 Dataset

Growing awareness of these problems among researchers and statistical agencies has led to a concerted effort to shed light on the contents of the offshore black box at the heart of the global FDI network. The OECD has begun to coordinate efforts by major developed economies to compile information on the ultimate, rather than just the immediate origin of FDI entering them (Damgaard & Elkjaer, 2017).

Ongoing Country-by-Country-Reporting (CBCR)[1] and beneficial ownership reporting reforms at the national and international level hold the promise of further improvements in official data (Wójcik, 2015). At the micro (company) level, databases such as Orbis[2] have opened the door to efforts to reconstruct our picture of the global shell company network from the “ground up” (Garcia-Bernardo, et al., 2017) while statistical methodologies have been applied to macro-level data to infer the structure of parts of the network that cannot be directly observed (Casella, 2019; Damgaard & Elkjaer, 2017; Haberly & Wójcik, 2015).

The dataset is the result of a methodology (Haberly, forthcoming) based on multiple micro (Orbis) and macro-level (OECD, IMF, and US BEA) datasets. It allows us to construct a multidimensional matrix of offshore FDI positions, cross-disaggregated across ultimate home country and two different layers of conduit jurisdictions,[3] in nine major economies. Each country can, therefore, have four possible roles in the network, sometimes simultaneously:

1. **Source:** “true” ultimate investing country;
2. **Secondary conduit:** “ostensible” ultimate investing country (i.e. reflecting offshore incorporations/inversions at the parent company level);
3. **Primary conduit:** immediate (conduit) investing country;
4. **Target:** destination country.

[1] to foster tax transparency OECD required all multinational enterprises to provide the global allocation of their income, taxes and other indicators of the location of economic activity.

[2] Orbis is Bureau van Dijk's flagship company database.

[3] FDI Positions are the cumulative value of investments at a given point in time.

The dataset simultaneously highlights where international investors/multinational firms claim to be based and where they are “really” based, as well as the jurisdictional pathways that they use to invest in particular host economies. The dataset is structured as independent networks based on nine destination countries that encompass more than half of the world economy: United States, Russia, United Kingdom, China, Italy, Brazil, India, France and Germany.

The constructed dataset contains a high level of uncertainty. As argued (Damgaard, et al., 2019; Damgaard & Elkjaer, 2017; Linsi & Mügge, 2019), official economic statistics and FDI statistics in particular, are far less reliable, and have much larger gaps than is often assumed. In this case, the lack of official data on offshore investment chains has made it necessary to estimate the value of these chains through a Monte Carlo simulation approach, which generates a very large number of possible scenarios of what the structure of these chains could be based on a mixture of known (fixed) and estimated (variable) data points fed into the simulation. The dataset thus does not consist of individual estimates of the value of investment positions, but rather a “cloud” of investment probability distributions, which may be wide or narrow for any given investment chain.

2. Related work

Although there is a long tradition of exploring public finances with information graphics (Gray, et al., 2016), it appears that public spending has featured more prominently in such projects than taxation or revenue (Gray, 2015). Offshore finance has been covered by journalistic media reporting specific cases of scandals that represent a portion of the phenomenon. Recurring visualization strategies include scrollytelling with data, for example “Swedes in Paradise Papers” (Hjalmarsson, et al., 2017), and explorable network graphs, mostly ego-networks (Freeman, 1982) and detecting key players (Bounegru, et al., 2017), for example in “The Power players” (International Consortium of Investigative Journalists, 2016). The project “Swedes in Paradise Papers” describes Swedish people involved, representing them by dots that are clustered according to demographic characteristics. In “The Power players” case, the stories focus on evidencing the relationship between individuals and entities, filtering leaders and politicians according to countries and world regions. A non-journalistic case is the project “How complex are corporate structures?” developed by the NGO OpenCorporates (OpenCorporates, 2013) that relies on geographical representation to show the connections and location of offshore companies related to the seven main US banks. The result is a deformed map that visualizes only the offshore companies through points, showing the financial geopolitics of world offshore "hubs". Much of the coverage associated with such leaked databases has focused on the role of specific actors (e.g. politicians, celebrities), countries, or the story of the leaks themselves, rather than what they can tell us about the structure and transnational dynamics of offshore finance. Meanwhile, in an academic setting, the CORPNET research group has produced more comprehensive (albeit static) visualizations of the structure of the global financial

networks (Garcia-Bernardo, et al., 2017) using conventional network visualization tools such as Gephi's ForceAtlas2.

3. Design approach

The dataset consists of investment relationships that pass between countries via layers of other jurisdictions. Each relationship in the dataset can be seen as an investment chain comprising all successive steps from the country where an investment originates to the destination one. Each chain can represent a direct investment from the source to the destination country, or indirect investments involving one or two "conduit" countries between the origin and the destination.

By aggregating these chains, the underlying topological structure is composed of countries (which are the nodes) linked by investments.

Two countries can therefore be linked by several kinds of investments. In other words, countries may assume different roles according to the links they have with other countries in the sequence of how the investment goes through including ultimate origin, primary (parent company-level) conduit (e.g. for offshore corporate "inversions"), secondary (subsidiary-level) conduit and destination. The main problem posed by this particular data structure is what visual model should be used to represent such a multilayered, as opposed to simply bilateral, network structure.

3.2 Design requirements

The data structure brings three main problems in the visual model design. Each country can have simultaneously multiple roles: for example, being source for some investments, and conduit for others, or either target (Figure 1). Furthermore, investments chains can be aggregated or disaggregated between each pair of nodes. Finally, these structures can easily involve loops among countries, which in practice tend to dominate the figures due to the pervasiveness of offshore "round-tripping" (Haberly & Wójcik, 2015).

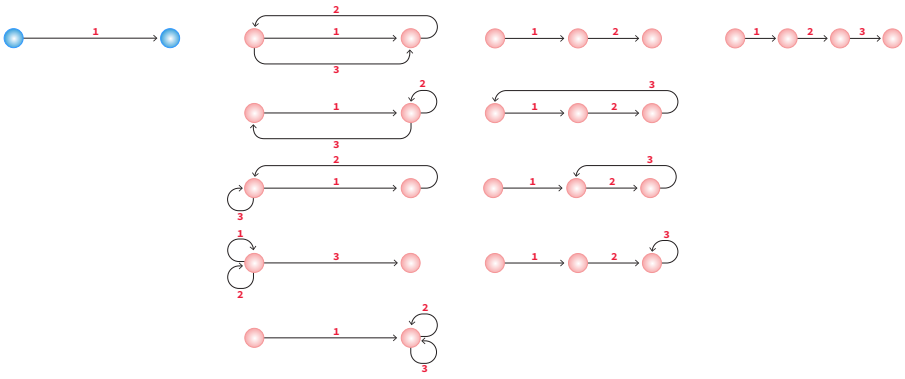

Figure 1. Diagram showing how investment chains could aggregate or disaggregate among a set of countries. Blue color chain is a direct investment while other combinations are indirect.

The described prototype has been created with the goal of representing in an efficient way to allow the database creators to disseminate results.

After discussing with the database creators, we identified the following design requirements:

- **R1.** Provide an overview of all the investment chains related to a specific country;
- **R2.** Show all the kind of chain couples (source to the primary conduit, primary to the secondary conduit, secondary conduit to the target, primary conduit to the target, and source to the target);
- **R3.** Highlights chains passing through conduits, rather than going directly from source to destination;
- **R4.** Enable the aggregation of chains passing through a group of countries;
- **R5.** Enable filtering of chains passing through a group of countries;
- **R6.** Show the value of uncertainty;
- **R7.** Show the amount of investments related to each flow;
- **R8.** Show the total amount of investments positions for each country;
- **R9.** Show the proportion of investments per country role (source, primary conduit, secondary conduit, destination);
- **R10.** Show flows directions.

3.2 Visual model design

Being a graph structure, the first tests entailed adopting a network diagram. This visual model provides an overview of all the investments targeting a specific country (R1) and would easily allow aggregation and filtering operations (R4, R5). This was indeed the first solution adopted by the database creators to represent such data.

However, the dataset is not simply composed of bilateral links between nodes, but rather by chains of links through layers of nodes. This means that the same pair of nodes can be linked by several flows following different directions. Furthermore, a conventional network diagram is not efficient in representing the different role that a country could have. It creates visual ambiguity about the nodes' sizes (i.e. the role in investment that this refers to) and make it difficult to automate node positioning due to the complexity of link chains.

In the current case, nodes are more likely conduits through which the investment chains pass. The same investment chain could pass twice through the same node in some situations, and the same node could play different roles in different chains.

Among network representations, we focused on the Sankey diagram for its ability to represent transfers or flows within a system (Schmidt, 2008). The model is usually composed of rectangles to represent the different nodes of the system and ribbons to represent the flows. The model keeps most of the advantages of network diagram and is more efficient in representing relative proportional breakdowns among flows and nodes (R7, R8). By using vertical bars for nodes, it allows to clearly show the total size of investment positions in a country as the height of the bar is proportional to the thickness of lines entering it.

Representing the nodes as bars helps visually differentiate between the roles played by each node (R9), through use of groups of stacked bars. Conceptually, each node in the diagram is in fact a group of nodes (one for each possible role in chains of investment) and therefore is possible to show how each pair of nodes is connected. For example, the node representing Netherlands in the network of investment entering the UK (Figure 2) is actually composed of three sub-nodes): Netherlands as a source, as primary (parent company-level) conduit, and as secondary (subsidiary-level) conduit, within any given chain of investment in the UK. Each of the sub-nodes can have both inward and outward investment links to any other sub-node.

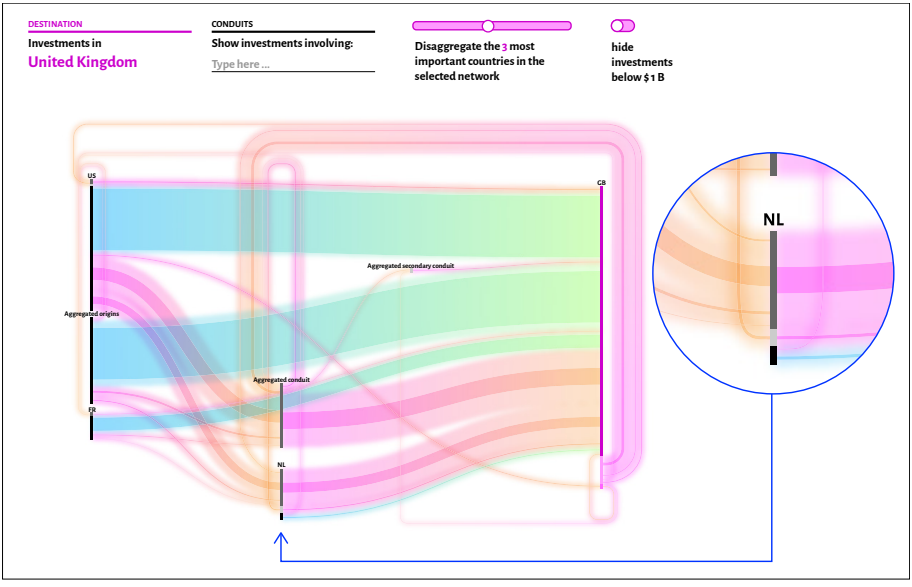

Figure 2. Example of a node with multiple roles: in the UK network, the Netherlands act as source (black bar), primary conduit (dark gray bar), secondary conduit (pale gray bar).

Through initial graphical tests, the arrangement of nodes in space (both the horizontal and vertical positioning) emerged as crucial in communicating the main role of each country. The automated layouting, as the one present in the D3.js code library adopted in the prototype (*D3/d3-sankey*, 2015/2020), was not efficient due to the large number of links among nodes: in the test, users were confused about the meaning of nodes' positions. To define a common positioning model, and to consistently highlight the role of each country in the network (R9), it was adopted a disposition based on the total amount of investment per type.

The value of all the investments passing through a node are aggregated by node role, and the most important role for each country (in terms of amount of investment) is used to define the position of nodes from left (predominantly sources) to the right (predominantly targets). Vertical node positioning doesn't encode any information and is simply optimized to minimize figure overlaps.

Finally, we designed the visual attributes of links. Two main pieces of information are shown here: the direction of investments (R3) and their typology (i.e. if direct from source to target, or conduit-mediated). Regarding investment direction, several solutions were tested, and gradient-based animations were used to graphically show which way money is moving. The types of investments are differentiated by color. Direct investments (i.e. not mediated through a conduit) were represented with green-blue gradient animations. Meanwhile,

investments indirectly mediated through conduits (including offshore investment positions) were represented with orange-fuchsia gradient animations.

3.3 Portraying uncertainty

The next task was to portray the uncertainty surrounding the value of investments (R6), which is estimated here in the absence of officially published data. For each investment, we have a "cloud" of investment size probabilities (in billions of dollars), that can be summarized in terms of statistical confidence bands. While there are a number of studies on the visualization of uncertainty (Bonneau, et al., 2014) few of them are focused on network diagrams, and in particular on uncertainty related to edges. Schwank tested several methods to portray uncertainty surrounding edge existence (Schwank, et al., 2016). The key result is that blur is a good solution to convey uncertainty. Furthermore, blur proved to be efficient in quickly enabling users to identify the most certain elements (Kosara, et al., 2002) even if not very efficient in communicating fine gradations in uncertainty level.

In the project, uncertainty is not related to the existence of a link, but rather to its weight. As out estimates take the form of statistical confidence bands, we adopted a mixed approach: the lower-bound (more certain) is drawn as an inner sharp line for each investment, while the upper-bound (less certain) estimate is drawn as a blurred outer line. The larger the blur, the larger the uncertainty (Figure 3 and Figure 4).

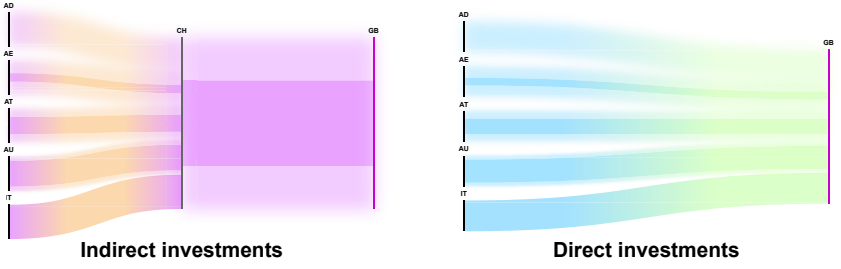

Figure 3. Example of how uncertainty level is encoded for indirect conduit (pink-organge) and direct (blue-green) investments, via blur.

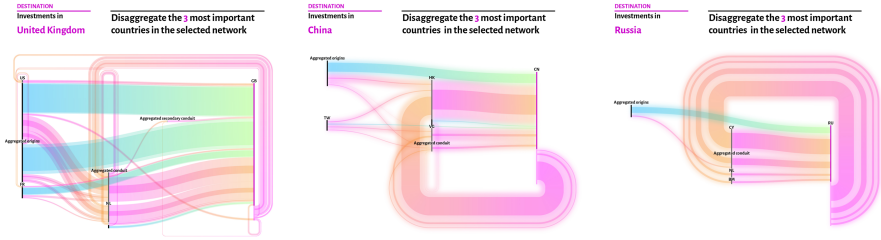

Figure 4. Visualizations of the networks of United Kingdom, China and Russia as destination countries for foreign investments, aggregated to show the 3 most important investment source and conduit countries investing in each. Note the much higher levels of blur, in general, for indirect investments passing through conduits —most of which are offshore jurisdictions— reflecting the much greater uncertainty surrounding these estimates.

3.3. Interaction design

The visual model proved to be useful in expert user tests examining a subset of data, but still too complex when attempting to show the whole database; a problem amplified by the fact that each pair of countries can be connected by several links depending on role. Furthermore, investment values fall along an enormous range, rendering the smallest ones almost invisible in the complete network. To solve these two issues, we adopted two solutions: filtering (R5) and aggregation/disaggregation (R4). The first reduces the portion of dataset visualized; the second changes its representation according to aggregation level. Both can be applied in combination.

The user can filter the investment chains displayed by selecting one (or more) countries. For example, selecting “Netherlands” will show only investment chains passing through this particular country in a role as source, conduit or target.

To reduce the visual complexity, the user can aggregate all investment chains (via a node labelled “aggregated” for each role) not involving the selected number of most important nodes in the network. At the maximum level of aggregation, only four nodes are visible: one for the target country and one for each “aggregated” jurisdiction role in the network. With a slider it is possible to progressively increase the number of individual countries that are shown in the diagram and related investments.

The interface was then enriched adding the ability to select individual nodes and links (countries and investments). Clicking on a country opens a panel showing that country’s location on the globe, as well as other key information regarding its investment pattern. Clicking on an investment it opens a panel that disaggregates all of the individual investment chains comprising it.

4. Case study / annotated lectures on the diagram

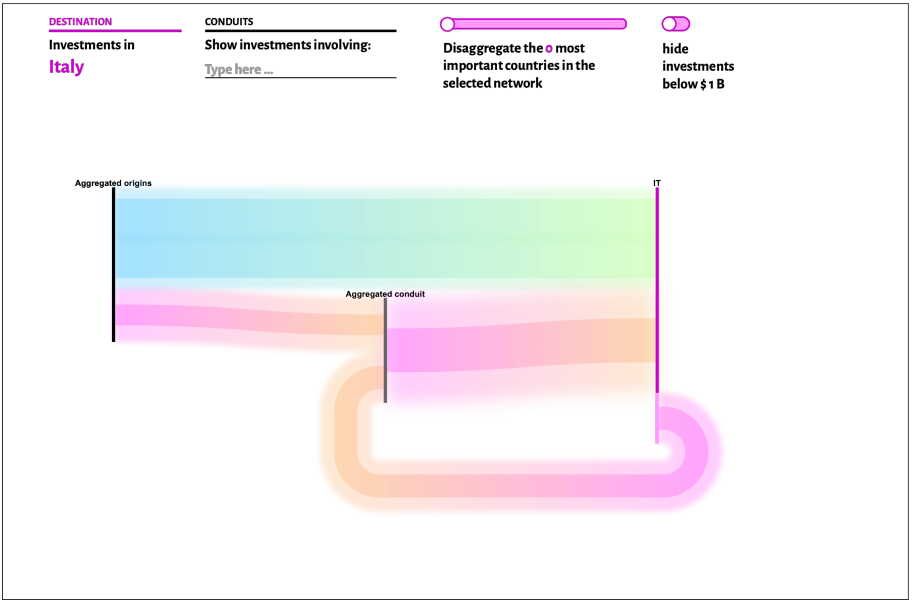

Figure 5. Network of investments targeting Italy at the maximum level of aggregation.

As an example, we can consider the network of investment targeting Italy as a destination country. At the maximum level of aggregation (Figure 5) it is possible to see that there is a single broad green-blue inflow of investment that enters Italy directly without passing through a conduit. There is also an orange-pink link entering Italy via an aggregate conduit jurisdiction — with half composed by investment ultimately originating from other countries, and half of "round-tripping" from Italy itself. From the blurriness it is also possible to see that (blue-green) direct investment that does not pass through conduits is characterized by much lower levels of estimation uncertainty than investment that enters via conduits.

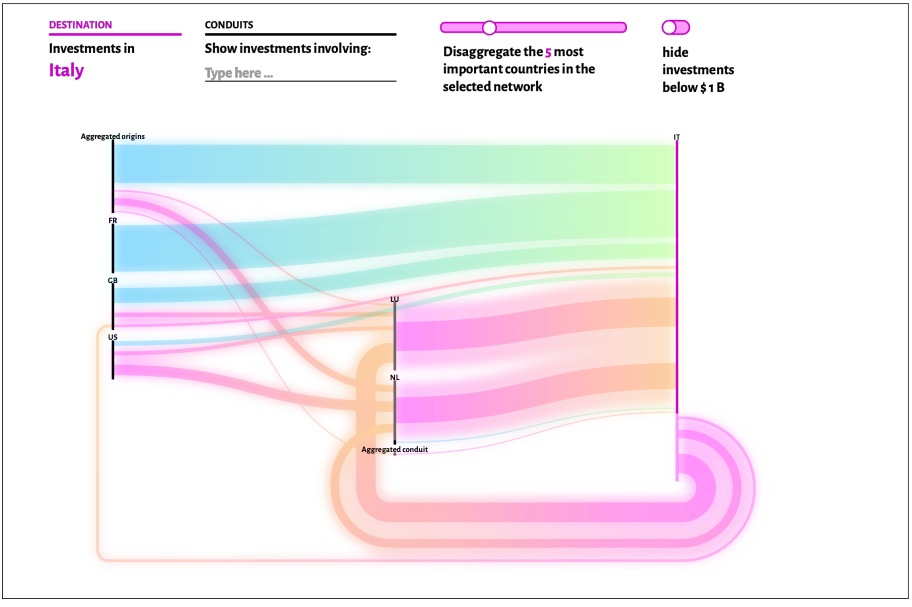

Figure 6. Network of investments targeting Italy, disaggregating the 5 most relevant countries.

By disaggregating the five most important countries (Figure 6) it is possible to see the different roles played by key source and conduit countries in the network. On the right is the target country (Italy). On the left are countries that are primary ultimate sources of investment: from France (FR) there are mainly direct ("onshore") investments, while United States (US) investment mostly enters Italy indirectly via conduit structures in the Netherlands (NL) and Luxembourg (LU). The United Kingdom (UK) plays a more complex role: it is mainly source of direct ("onshore") investment into Italy, but also both invests in Italy indirectly via conduit structures, and acts as a conduit jurisdiction itself for other countries' investments in Italy. In the middle of the diagram are the principal "conduit" countries: the Netherlands and Luxembourg. These are leading tax haven jurisdictions that both channel foreign investment into Italy, and are widely used by Italian firms and families as nodes in "round-trip" structures (i.e. where their domestic holdings in Italy are owned via offshore structures). While from the Netherlands there is also a small share of (blue-green) investment from "legitimately" Dutch companies, Luxembourg acts almost entirely as an offshore conduit, particularly for Italian round-tripping.

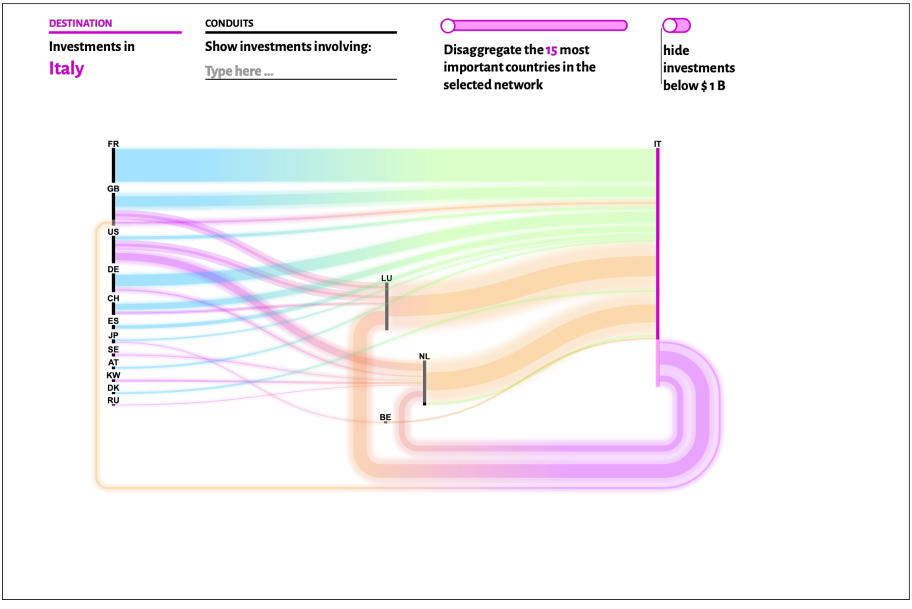

Figure 7. Network of investments targeting Italy, completely disaggregated.

Finally, by completely disaggregating the network (Figure 7) is possible to see the role of all countries providing or intermediating at least $1 billion of investment in/to Italy.

5. Conclusion / Preliminary test

In this paper we have examined the design process and decisions involved in creating the data visualization tool for an "atlas of offshore finance". We presented two design challenges surrounding the visualization of a complex multidimensional network dataset with multiple tiers of links; and the visualization of uncertainty in data based on probability estimates. After defining design requirements, a visual model and interactive strategies have been designed. The proposed solution is an interactive application based on a variant of the Sankey diagram. The application provides an overview of investments chains for a given target country; represent all the possible connections between it and layers of source and conduit countries; deals with problems of scalar differences and data overload by using filters; allowing for different flow configurations to be selectively aggregated or disaggregated; and conveying data uncertainty via the visual variable of blur.

In conclusion we offer some final reflections on what we have done and how this might point towards further work. It is important to mention that this paper focuses on the first phase of this project, namely the production of an application primarily targeted at domain

experts and initial dissemination of the results. It is also the first attempt to define a consistent visual language for the communication of such data.

While we have consulted researchers, civil society groups and other issue experts during the design process, the next phase of the project will be to enter into a public "beta testing" moment to examine broader responses to the project and to understand how this might inform further design activities.

As other researchers suggest, transparency initiatives do not only cater to pre-existing publics, they can also play a role in gathering and assembling publics (Barry, 2013; Di Salvo, 2009; Ruppert, 2015). We might thus further explore the capacities of these visualizations to gather publics and to organize material participation (Marres, 2012) in specific ways around the issue of offshore - including, e.g., relations between citizens, civil society groups, journalists, public institutions, researchers and financial industries. In future work we are particularly interested in how data visualizations may play a role beyond communicating information, including, for example, their capacities to facilitate affective engagements (Kennedy & Hill, 2018), witnessing (Gray, 2019), journalistic reporting and advocacy, the ability to create alternative narratives challenging dominant power structures (Briones Rojas, 2019).

What is particularly interesting about the case of offshore is precisely that public intelligibility is part of the issue: the numbers and estimates have been hotly contested, civil society responses have been questioned by industry, and the esoteric nature of the subject matter makes key concepts resistant to easy communication. The challenge of facilitating broader public engagement around this issue is therefore how to design visualizations which avoid misplaced precision (implying an unfounded level of certainty), whilst at the same time avoiding a kind of "data sublime" (Davies, 2015; Gray, et al., 2020) of visualizations which inadvertently reinforce the notion that offshore finance is unfathomable and publicly unintelligible. Thus, we seek to open up public debate and engagement, rather than closing it down through the affirmation of either certainty or unknowability.

Finally, the collaborative design process between researchers with different backgrounds allowed the discussion, reflection and representation of the FDI phenomenon to be conducted from multiple angles and levels. The nature of the phenomenon is not only financial, opening up issues that involve the politics of data in the construction of societies.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

What does this symbol mean? Icons as a Language for Emergency

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Abstract | In the intersection of disciplines such as User Experience (UX) and Disaster Risk Management (DRM), this paper presents definitions from a change of paradigm: From dealing with disaster towards the management of risk, establishing the conceptual notion of Before - During - After an event. In the communication of risk, different tools are combined to deliver information about subjects, events or actions. Ideally, a well-designed message allows users to visualize, understand and facilitate decisions. However, in an emergency the experience might be radically altered. Information Design (ID) has a role to optimize messages in such disruptive contexts. In order to cope with access or language barriers, instrument devices such as icons are widely applied. Following ID principles, messages and visual tools devices need to be verified in their effectiveness. Design + Research is presented: In one hand, open-source icons representing emergencies, and in the other their international testing. Establishing performance indicators, the results reveal the importance of simple visual information tools to optimize communication. Conclusions call for an open collaboration process, focusing on a multi–disciplinary integration. Finally, observations are provided as an ongoing process.

KEYWORDS | VISUAL, INFORMATION, EMERGENCY, GLOBAL, TESTING

1. Introduction

Emergency can be considered as a complex scenario with massive demands of information. Media have revealed the impacts of natural hazards and complex transitions such as climate change. These scenarios often coincide with large disruptions such as displacements or epidemics, exacerbating their impacts. However, emergencies can also be seen as an opportunity to explore inter-cultural communication. Disruptive events have triggered cultural transformations such as information technologies and platforms or the design of public policies.

This is an important scenario to transform by design: Such a process can be constituted by individual or collective transitions that respond to the need to reduce socio-natural risks related to climate change, and in some cases, to face complex multi-hazard scenarios. In all cases, designing and delivering the right information is fundamental.

In a critical human experience such as emergency, having clear and opportune information is a key for reducing uncertainty. In order to deliver information that is visible, understandable, and simple to transfer into actions, graphic elements appear as ubiquitous tools, an immediate solution to deliver information. These tools are able to transform data into an information experience, even in critical contexts. Here, aesthetics is necessary because visual language draws on elements that are familiar, visually attractive or harmonious to users. This is also an opportunity to observe how communities construct their own interpretations.

2. Emergency as a scenario for design

International organizations such as the United Nations International Strategy for Disaster Reduction (UNISDR, 2015, 2017) define that in a disruptive human experience such as emergency, managing pertinent and opportune information is a key resource for response. Based on a model by TorqAid (2016), Figure 1 shows a conceptual diagram to show stages on the cycle of Risk Management (usually known as Disaster Risk Management, DRM).

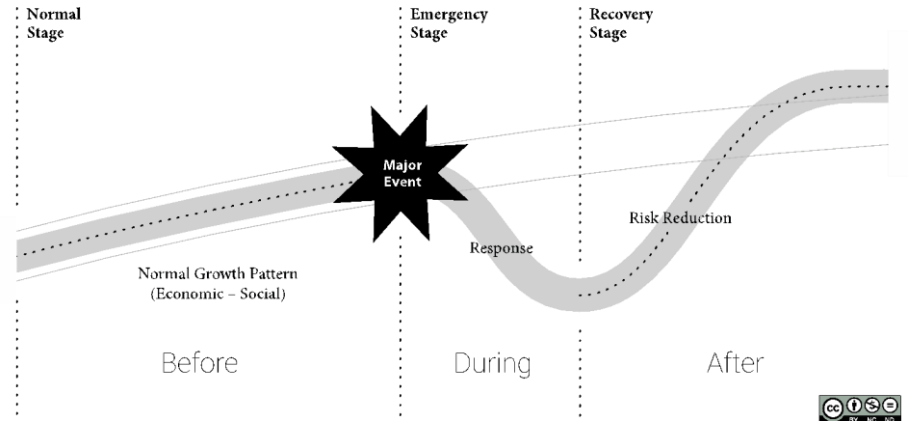

Figure 1. The Cycle of Disaster Risk Management (DRM): Stages Before - During - After. Based on the DRMC diagrammatic framework by TorqAid (2016)

Today, disciplines such as Disaster Risk Management (DRM) or Disaster Risk Reduction (DRR) are oriented to join work efforts covering different moments of cycle, promoting a multi–dimensional approach (Twigg, 2015, TorqAid, 2016). Due to human nature and its global reach, risk and emergency management emerge as one of the 'largest challenges for development' (WEF, 2017).

Concepts from the UNISDR 2015 document 'Sendai Framework for Disaster Risk Reduction 2015 – 2030' –commonly known as 'The Sendai Framework'– aims to complete risk (hazards) and emergency (disaster) as a context, consider the "organization and management of resources and responsibilities for addressing […] in particular preparedness, response and initial recovery steps". Additionally, the Sendai Framework states definitions, delivering relevant terminology to precise further discussion: i.e., Risk, Hazard, Emergency, Disaster.

Considering one from information, is fundamental to work from user needs facilitating for example to identify, learn and transfer messages into actions for a safer experience. From a human–centered focus there is an opportunity to think and apply design products and strategies to transform this scenario. As an example, the book entitled "Design for Emergency Management" (DNEM, 2019) is a comprehensive guide, a handbook on how to conduct emergency by design. Therefore, there is a transition from reducing the impact of disasters to the management of risk. Here, design is a key connector.

The International Standards Organization, ISO (2009) defines User Experience as “a person's perceptions and responses that result from the use or anticipated use of a product, system or service”. Thus, terms are extended as “user studies” or “usability”, towards disciplinary such as “prevention” or “preparedness”. This is an opportunity to increase awareness on how design can be related: Experiencing crisis is an opportunity to reshape the experience, developing simple communication tools.

A fundamental factor in an everyday experience is information, and its usual manifestation is known as Information Design (ID). Being a response to people’s need to “understand and use” large amounts of information, such discipline has been defined as the “art and science of preparing information to be used by human beings with efficiency and effectiveness” (Horn, 1999). Based on Frascara (2015) definition, ID usually draws on graphic resources such as typography, diagrams or infographics, intending to be an instrument to interact and perform with contents, constituting graphic tools that can be systematically distributed along a user experience. Figure 2 shows a sequence presented by Allard, Briones, et al (2014), a three-step virtuous cycle in ID is Seeing > Understanding > Using information.

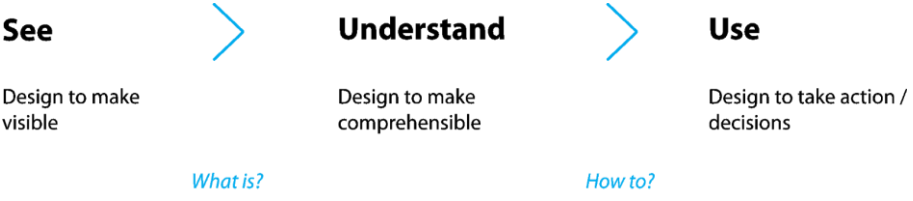

Figure 2. See > Understand > Use Information framework. Adapted from Allard, Briones et al, 2014

It is possible to transform the experience by an opportune delivered and adequately designed information, and as UNISDR (2015) states, an effective information “can avoid the escalation of an event into a disaster.” However, usually communication is less effective during a critical scenario (i.e., for reaction), thus a critical task is to observe how their components should perform.

As is stated in the UNISDR guidelines “Public Communication for Disaster Risk Reduction” by Robinson (2017), tools for effective communication such as those activated by information technologies appears to be very efficient today, and advances in technology have improved scientific risk information dramatically. Thus, some questions aims to recognize if information is visible, understandable and applicable; for example “What are factors that impede transferring information into action?; why action is ignored during an emergency?”

In a world usually plenty of information, a key to integrate UX and DRM might be identifying contents, typologies, moments and originators of information in a common way, making

visible for example: Who (i.e., responsible - originator), What (i.e., actions - options), or How (i.e., procedures).

Mixing multi-disciplinary approaches, new considerations emerge: Figure 2 shows a sequence, considering information design as a continuum to support human experience, starting from identifying hazards or understanding vulnerability, to action and reaction in a disruptive situation, towards a relief, assembly or procedures for recovery, in a continuum articulated by information.

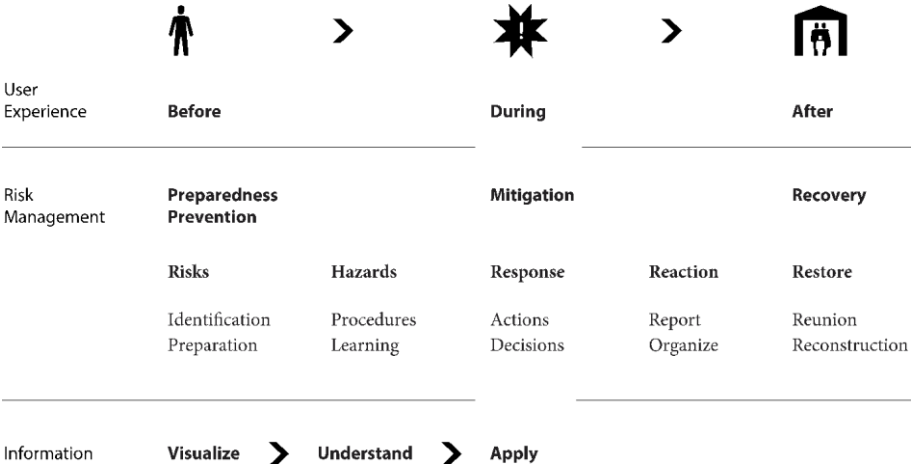

Figure 3. Figure 3. UX + DRM + Information, with focus on communication actions.

As figure 3 conceptualizes, a clear language can decisively contribute to articulate information needs in a critical context, making visible and transforming an uncertain experience into an understandable one. Here for example, information might be applied to identify, create awareness, or facilitate preparedness. During an emergency, information is a key to respond or take decisions. It may help to identify and learn from already known hazards, contributing to reducing their effects. After a critical event, information becomes necessary because such disruptive scenarios usually imply limited access to communication, probably one of the most difficult challenges for recovery. Therefore, a big challenge is how to integrate different supports in all emergency stages to conduct an experience driven by information. Considering moments such as Before - During - After an event, it is fundamental to consider a pertinent, clear language to deliver information.

3. A language for emergency

In everyday life, visual Language have multiple approaches, visual tools such as symbols or icons constitute a simple, global 'lingua franca' to create an expressive language and performance of information. Commonly called symbols, pictograms or icons, these are normalized images designed to display concrete meanings (Jardí, 2011). In everyday life, icons are a codified language integrated with communication systems displaying consistent information on multiple supports. However, presenting information that leads to action might represent a cognitive challenge for users in critical scenarios such as in an emergency. As Boersema & Adams (2017) state, different standards of symbols have been developed for diverse contexts such as transport, public spaces or safety at work, always aiming to reach "universal" interpretation.

An emergency can be defined as "a disruptive situation that transforms the expected course of an event. Here, both personal and collective relationships become affected, altering what is considered a normal experience". Due to human nature and its global reach, risk and emergency management emerge as one of "largest challenges for development" (WEF, 2017).

However, due to their technical complexity or dependence of technology, data might constitute a poor information experience. Being a complex scenario with large information needs, emergency emerges as a challenging context for the design of systems. From an Information Design perspective, this paper is oriented to present definitions and practice, crossing both user experience and cycle of risk disciplines. In this intersection, visual elements such as icons constitute a visual tool oriented to support critical scenarios by information. In specific context of emergency, different initiatives are developed considering context (i.e. a crisis) or specific actions (i.e. evacuate).

However, what about the contextual constraints in human experience? This paper is oriented to develop visual research as a method of inquiry and delivering results on performance of icons as visual language for emergency. Specifically, the application and evaluation of icons as units of meaning for global communication, preparedness and the education of risk.

Such critical context suggests that icons need to be verified in their effectiveness. An indicator to verify language performance is testing. As a literature review shows (Brugger, 1999, Frascara, 2001 ISO, 2007), a fundamental index to evaluate icons is Comprehension. This is an opportunity to explore a language and evaluate their interpretations for emergency.

An open source icon initiative to represent risk and emergency situations is presented. This is an emergent case study including the set of icons, an international testing initiative to evaluate symbols, and activities to creatively work on emergency with communities. Beyond

the design process, this case opens challenging questions about the importance of consistent visual language for disruptive scenarios.

4. An opportunity for a “Language for Emergency”

As mentioned, emergency is a complex experience usually with large demands of information. On the other hand, visual tools such as icons emerge as optimal instruments to handle multiple communication challenges (i.e. accessibility, language, technology).

As a *lingua franca* of the information age, icon systems should be able to present and understand precise meanings implemented by punctual visual elements. Articulated as part of a system, these simple graphic components can play a fundamental role delivering information for multiple moments or decisions. Therefore, a consistent visual language practice can decisively contribute to manage emergency, from identification and preparation –Before–, to reaction –During– towards active recovery –After–.

Here, Guemil is considered as a study case. Their design concept is to represent information for different stages of the cycle of risk (before – during – after an emergency).This is an open source initiative to represent risk and emergency, making available a visual tool for information, but also might activate new conversations on how to optimize preparation and contribute to community resilience applying simple, consistent resources to enhance communication, this is called a “Language for Emergency.” Moreover, the case from these icons constitutes an applied design + research project with multiple outcomes such as collaborative design and workshops. Figure 4 shows the current icon set.

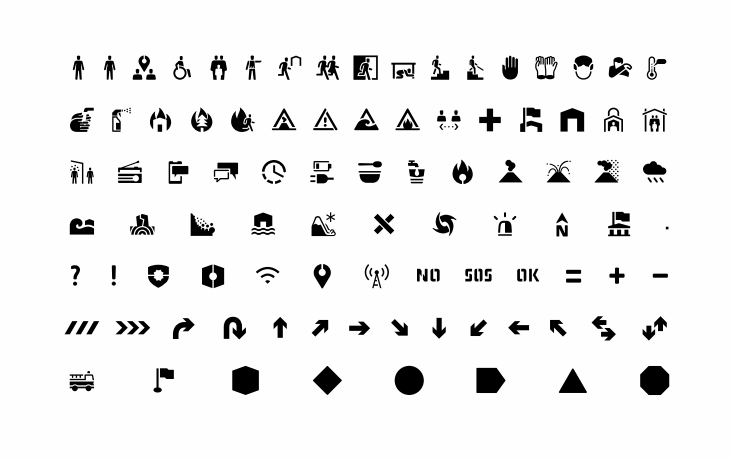

Figure 4: Guemil Icons set (v15, 2020)

5. What does mean this icon?

In communication for disaster, as Kremer (2016) remarks, providing “unambiguous iconography can make a difference […]” However, after visual design stage the implementation of public symbols is usually assumed as is. For the International Institute for Information Design (IIID), one core competency is “Initiate the testing of use and usability, evaluate the test results and refine the information accordingly.” (idX, 2007). Thereby, graphic elements such as symbols and typography appear as ubiquitous solutions delivering visible and legible information to articulate action.

In the other hand, considering only a conceptual or styling statement from originators seems not to be enough: Through a combination of perception and reasoning, evidence about communicative performance is fundamental to demonstrate their effectiveness. Oriented to perform certainly in critical situations, previously users need to visualize and learn what specific information is being represented. In other words, if visual systems are oriented to operate in critical contexts such as emergency, an evidence of performance might be provided. Therefore, performance tests were designed to complement the design of icons, complementing their visual design with interpretation indicators. In the process, data from tests was collected and divided by country, age range or education level. Figure 5 shows the initial concept, constituting a simple base to collect, observe or to compare recognition patterns.



Figure 5. The question from testing forms, in Chinese

In this case visual tools should provide cognitive evidence about what is understood (loose or precise meaning), and what is potentially generating multiple interpretations (or confusion) in emergency contexts.

6. Insights from global tests

After the visual design phase, since 2016 an international testing process is ongoing, showing different icons and asking users about two indicators: Meaning and Differences. A large dataset is generated, and a selection of results is presented for discussion.

According to international practice, evidence of performance as an index is constructed mainly by asking users about Comprehension (Brugger 1999; Olygay, 2003; Frascara 2011; ISO 2011). Thus, in the "Meaning" test responses were collected from an open interpretation of each icon. Here, the single question was "What does this icon mean?" presenting an image to be interpreted by the tester. Then, such an answer is matched with its denomination, categorizing the response according to a 6-grade scale. Therefore, beyond the visual design problem, analyzing responses collected from evaluations might reveal new relations from users' interpretations. Figure 6 shows the project's website, illustrating a performance index for each icon.

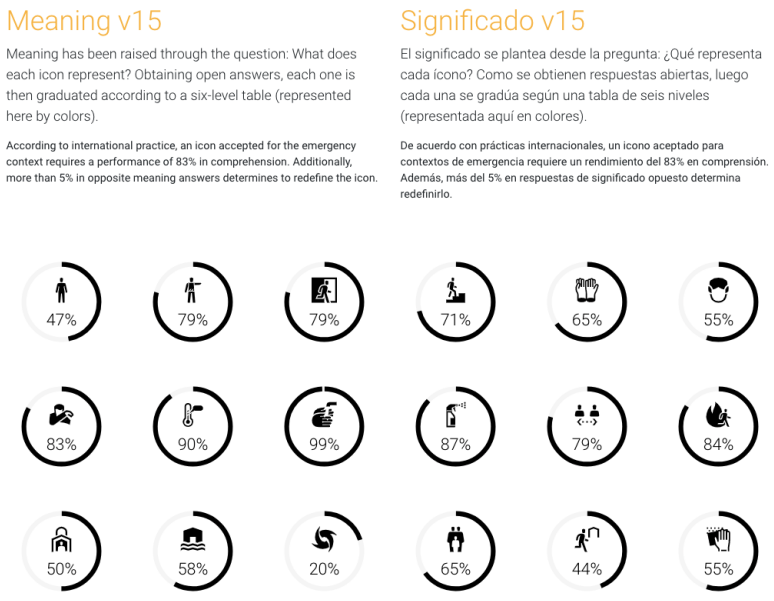

Figure 6. Guemil website, visualizing the meaning tests results, 2020. Source: test.guemil.info

In the second test, "Preferences" were collected from identifying characteristics associated to a concept among different icons, recognizing particular elements. Here, the single question was "Which of these icons does represent…?" Thereby, according to the

categorization of usability testing by Chisnell & Rubin (2008) this test might be considered as an Exploratory evaluation, where users were asked to select from a series of representations, which of those “matched” a defined concept or message.

Visualizations of results give shape to ideas about interpretation of the emergency. After this preliminary process with results being analyzed, such experience was considered to improve icons, presenting an iterated version. Also, this was an opportunity to improve the instrument. Performance validation is a way to deliver required indicators of effectiveness, but also reveals further insights connected to variables such as location, age or language. Figure 7 visualizes response patterns from the meaning tests in 2019-2020.

Practical applications

1. **Education:** As mentioned, a well–designed information should enhance preparedness, may contribute to decision making and support resilience. Topics such as design for resilience, or design for transitions can be stimulated from such initiatives. Exploring risk and emergency as an education topic is also an interesting approach to work collaboratively combining local and global impacts.

2. **Multi–cultural dialog:** A new practical significance managing such “language for Emergency”, through an inter-cultural approach to work collaboratively on disruptive scenarios. Graphic elements with common interpretation can contribute to construct meanings, then transforming a visual language into action, promoting identification of risks, preparedness, adaptation, among other factors. See Frommberger & Waidyanatha (2017).

3. **Creativity:** This is important because there is a need to raise new ways to approach crisis or emergency management. Open–access is a creative contribution to share meanings and facilitating learning by visual tools. Experiences such as by Japanese models of education suggests that resilience can be nurtured by creativity, using simple and engaging creative methods.

4. **Measuring communication:** A participative approach, collecting performance evidence is a way to measure if graphic language is effective conducting comprehensible and usable communication. This is an opportunity to explore creative and analytical approaches, balancing design thinking and doing.

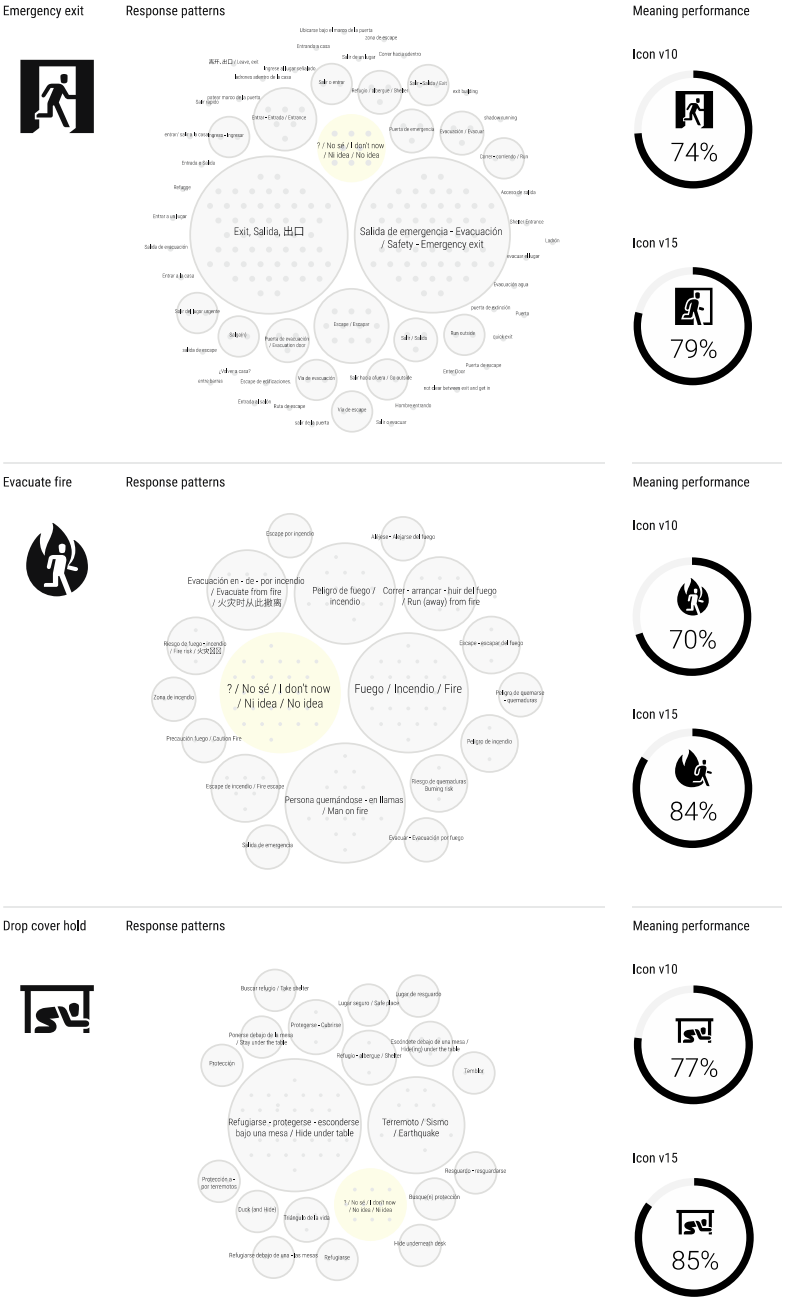

Figure 7. Test results: Icons, Response patterns and Meaning performance 2019-2020

7. Conclusion

Information Design has a relevant role –and a challenge– for visualizing, understanding and applying engaging, manageable messages in critical contexts. In other words, in a disruptive experience dealing with clear and opportune information can constitute a differentiator for the user's certainty. Guemil makes available a simple design system to visualize information for users along their experience of risk. Fundamentally, such a project constitutes an experimental research platform to explore the role of information design instruments, and to evidence how users interact with such visual language for emergencies.

Critical scenarios are posing new ways to collaborate, experiment and interact with information. In the process, tools and methods by design have been developed. Collaborative initiatives designed for “new normal” contexts and based on visual language, seems to prevail to communicate globally.

Research is a key to evidence performance, tests responses demonstrate challenging insights to share, making necessary to continue analyzing the results in a project will be iterating continuously. Figure 8 shows the responses on Differences Tests from 20 countries during 2018.

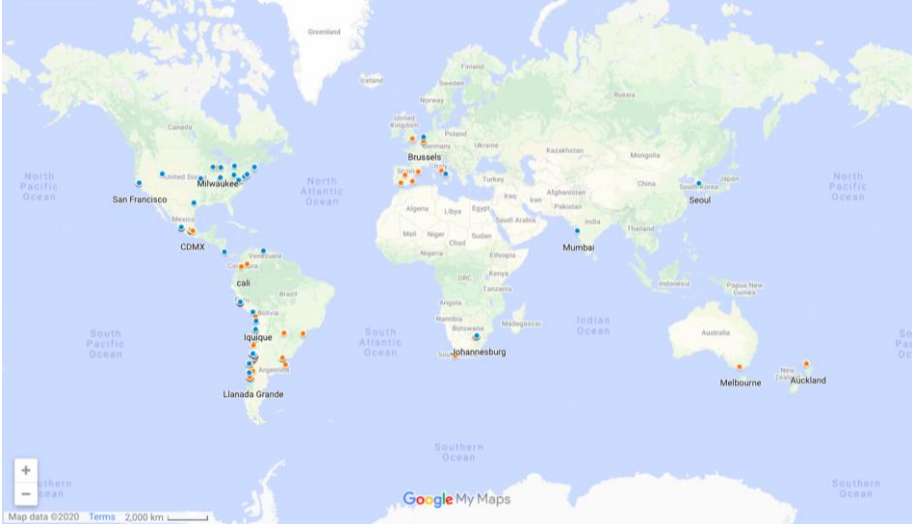

Figure 8. A map showing global responses from testing (2020). Source: Google Maps

Finally, considering that results so far are part of an ongoing process, reflections are presented to generate discussion and stimulate further collaboration:

1. Graphic language can be considered as a key resource to activate meaningful communication and promote action. ID contributes to optimize the experience of emergency, articulating information as a continuum.

However, as a research + development process this has been an opportunity to compare local–global perceptions and interpretations, Moreover, such international process allows to recognize local interpretation on icons, risks and emergency scenarios, generating relevant performance evidence and questioning their notion of “universal language”.

2. Upcoming scenarios such as climate change, migrations or adaptive education demand urgently to continue global initiatives based on common grounds such as visual language and the design of information. Open initiatives and interaction design can facilitate dialogs adding new dimensions to project–based research work. They require new ways to engage and experience the emergency, creating resilience, this is an open invitation to collaborate.

3. An interdisciplinary approach is fundamental to explore wicked challenges. Therefore, promoting such projects might contribute to their adoption and stimulate global connections, with a bottom-up approach, relying on collaboration. This might help to generate common interpretations on information for emergency, for example for preparedness and reaction.

4. Multi-cultural communication is an opportunity to open dialog. Actions are oriented to generate discussion on the role of graphic tools for emergency, from local initiatives to international communication platforms, emphasizing the role of information design as a practical, global scale activator for the experience of emergency, as figure 9 illustrates.



Figure 9. The workshop: Visual Information for Emergency, is an icon-driven, hands-on experience to dialog and create about the role of information in emergency scenarios. Image from the 2019 Design for Transitions International Conferences at Jiangnan University, Wuxi China.

As an ongoing project, results also challenge prevalent notions such as "Universal" language traditionally prejudged for icons, exploring local interpretations as knowledge. However, results and connections are going to be presented and open to discuss from multiple perspectives. Beyond just designing a "Language for Emergency", such research shows cultural implications, suggesting the need of strategies for larger-scale transformation processes in the public realm, such as creative, adaptive education or resilience.

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Acknowledgements: To the UC School of Design colleagues Felipe Cortez & José Allard and our team of design students: Josefina Carvalho, Osvaldo Torres, Monserrat Pulgar, Ferrnando Gajardo, Carla Castillo and Antonia Barberis, for their commitment and valuable feedback. Additionally, to DNEM team Claudine Jaenichen, Klaus Kremer, Tingyi Lin and Saskia van Manen.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Where methods meet form

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Abstract | Based on two study cases of product design students' projects this paper analyses how both theoretical and practical research can inform design methods' development leading to the creation of new form language and expansion of design aesthetics beyond the functionalist paradigm. This paper outlines methodological approaches to integrate design research in practice-based projects to develop new form languages. Transmitting the conceptual and discursive implications of the employed design method is, in particular, challenging within undergraduate design education, that is often depoliticised and service-oriented (Decolonising Design, 2018). Defining the choice of methods as always a political one, the authors of this paper focus on the research as a self-reflecting process that draws from the notion of "designing design" – i.e. on the notion of an open, developing methodology always under scrutiny through practice (Schön, 2017).

KEYWORDS | DESIGN EDUCATION, DESIGN THEORY, DESIGN METHODOLOGY, DESIGN CULTURE

1. Introduction

First two decades of the 21st century have witnessed the establishment of design culture as a scholarly discipline (Buchanan Margolin, 1995; Julier, 2006), which laid ground for a contextualised, theory-informed design education, contributing to the development of new design languages and a broader understanding of design culture. In this paper, we define Design Culture on different levels: as a process of carrying out design, as a context-informed practice within its societal, cultural, geographical milieu, as an agency for a transformative design action (Julier, 2006, pp. 70-72). Within this framework, we propose to understand Design Culture, not as one homogenous entity, rather as “a world where many worlds fit” (Escobar 2018; Abdulla, 2018). We believe that to foster this pluriversal instead of the universal understanding of design; we must move beyond the functionalist, service-oriented paradigm of the discipline towards critical, research-informed design practice (Abdulla, 2018). These design practices acknowledge new modes of *doing* design. In this process, theory and practice are mutually supportive, and designers – following educational theorist Donald Schön – exercise reflexivity “on action” and “in action” during and following their work. (Schön, 2017; Cal Swann, 2002). Going towards these situated practices, we have to foster design education that is student-centered and enables students to discover what is relevant for their future practice. So, we see education as future building, and the methods – developed in this process of future building – are fluid rather than constant, continuously changing and adapting, responding to the context.

In this paper, we discuss two study-cases of projects developed by industrial design undergraduate students as part of their final project and the methods they developed within the design process. Based on these two cases, this paper explores methodological approaches that can contribute to the broader integration of design research in practice-based-projects and as consequence creation of new form languages, new aesthetics, new visual worlds.

2. Context: Undergraduate Design Education at Universities of Applied Sciences in Switzerland

Following the recommendations of the Bologna Declaration, the two-cycle degree structure of design education puts pressure on delivering skills and methodological knowledge to undergraduate students. In Switzerland, Bologna reform ended the period of vocational education at traditional arts and crafts schools, which had sprung up all over Europe in the latter third of the 19th century (Ernst, 2014, p. 358). Seven Universities of Applied Sciences offer courses in design. The commotion surrounding so-called "academisation" of design belied the fact that the reform in design training led to a real wave of development, and to redefining educational practices.

The following two cases are an attempt to apply a student-centred pedagogical approach in undergraduate industrial design studies. Similar to research-based-learning methods, students develop an investigative attitude in addition to the development of necessary skills, i.e. formulating their own hypotheses and iteratively testing them in form of prototypes.

During the short three years leading up to a Bachelors' degree, students learn at least once how they have to play an active part in defining their aims and methods of a design process. The BA degree project consists of two equally weighted parts: a practical and a theoretical thesis. Referring to two study cases, we will discuss in this paper how the approaches mentioned above interact beyond, project-related enquiry and lead students to define their design methods for their future practice. It is not the aim of this paper to offer universal educational solutions, as we believe that those have proven to be ineffective, instead to focus on the situatedness uniqueness of the presented cases (Stake, 2015, p.6)

3. Case #01: Non-visual input and creation of a conceptual framework to address aesthetics in design

The first case examines a strikingly simple, but fundamental question (Halmes, 2019): How and to what extent do the sighted and the blind or severely visually impaired differ in their perception of objects' beauty? Within her project, Alena Halmes explores how people who are visually impaired understand beauty and how their perception of sounds and fluid can guide the creation of a new form language in product design. Her project is twofold; the first part is theoretical research; the second is a practice-based project informed by this qualitative study. She situates the research within a predominantly ocular-centric western world of thought, which values epistemologies based on visual or ocular metaphors. Already the Greek philosophers recognised sight as the most powerful sense; since the 18th-century European philosophers have extensively described the hermeneutical power of vision (Levin, 1997). Despite the critique on the prevalence of vision in epistemology in 20th-century philosophy, design is still heavily influenced by such metaphors. Terms like form language or semantics design are understood mainly visually, reducing aesthetic criteria in an object-related design to solely visual ones. Colours and shapes constitute prevalent aesthetic criteria in objects' description, at the same time, both design criticism and education neglect haptic and olfactory aspects of artefacts.

Halmes refers to several studies that have shown the specificity of perceiving the world by people who are blind and visually impaired as they excel in recognising shapes. They are also more accurate in detecting textures, and they estimate distances in steps better because they depend on this ability in their daily life. (Halmes, 2019, p. 1) Based on this knowledge, Halmes asks: How can we talk about beauty, itself a challenging endeavour, if we experience the world based on different epistemologies? Conducting her study, Halmes tried to gain a reflective understanding of the experience of being blind or visually impaired. At the same

time, she explored related topics such as silence and noise, or day and night. These observations would further guide her in the design process.

Methodologically, she conceived a field study that implied six participants: three sighted, two partially sighted and one person who was blind, asking them to bring three objects they consider beautiful, as the prop to begin a conversation on beauty. To limit the criteria of choice, she asked the interlocutors to bring with them objects related to kitchen, leisure, or work. In the semi-structured interview, the author asked the participants the following questions:

1. Do you find any part of the object particularly beautiful?
2. Is the function more important than the material and formal properties of the object?
3. Would your perception change if you could not see the object (for the sighted) or if they could see it (for the visually impaired)?

Following the interview, she presented a series of objects to the participants (a folding chair, salad servers and a folder, asking about the aesthetic quality of each of them). At the end of each interview, the participants had to answer spontaneously, how they defined beauty for themselves. From this conversation, she extracted beauty criteria that she discussed in detail with the participants scrutinising the use of the word “beautiful” as well as the language used by the participants. Asked about their understanding of beauty, they mentioned mainly haptic criteria as they spoke of warm and subtle surfaces, of round and soft shapes, of the organic, of nature. It led them to be specifically attentive to auditive criteria – to the sound objects make. Using a spider’s web diagram, the author compared the weighted criteria of sighted and visually impaired participants.

She concluded that despite the highly individual interpretation of functional and visually, auditive, haptic, production- and memory-related criteria by all her participants, there is a predominance of haptic interaction of people who are blind and visually impaired, grounding their notion of beauty. The author could prove further that the blind and the two severely visually impaired participants are fragmenting the experience of objects and therefore perceive them in more detail allowing them to formulate more precise judgements about haptic quality and materialisation of the objects. The constant flow of haptic perception and the importance of sound as the base of aesthetic experience described by the participants who are blind and visually impaired became the starting points of the design process. Halmes focused on glass as a specifically interesting material in this context: It is transparent, its specific haptic quality connects it with liquids, and it sounds beautifully.

The process of qualitative research does not attempt to generate a theory, instead lays ground for product development, in which the question of how we can use non-visual inputs as guidelines for developing a new form language. Exploring objects is a haptic and sonic experience, therefore using these two inputs opens up new possibilities for design. Trying to explore the sonic potential of objects, Alena Halmes started to examine the history and

typology of wine glasses. In parallel, she deformed existing glasses and investigated how the tone changed in the process. This hands-on research was both history-informed (history of different shapes and glass production modes) as well driven by the findings from the interviews. Interviewing the people who are blind, Halmes accessed “hidden knowledge” (Haraway, 1988) and learned how they interact with objects, touching them from the bottom to the top, trying to avoid “fishing around in the air”. Based on this knowledge, she sketched sounds and shapes from bottom to top.

Flipping through her sketchbook, one discovers hundreds of glasses; distorted, oblique, or fluted. The glass that represents the sound of a singer has ribbed edges; another glass resembles a column as a way of imagining the sound of an engine. (Schmid, 2019, p. 54) Drawing was a crucial and liberating part of the process, in which she broke away from a conventional theory of forms based on visual experience. At this point in the process Halmes was trying to mimic the perception of sound by the blind people and interpret it her way. Informing her project with political theory and criticism of traditional participatory design methods that take the agency of the participants was a significant turning point for the project. This shows how important it is to create curricula that encourage critical thinking and create spaces “where students can engage critically with their experiences, surroundings and reality” (Abdulla, 2018, p. 292).



Figure 1. Trying to explore the sonic potential of objects, Alena Halmes started to examine the history and typology of wine glasses. In parallel, she deformed existing glasses and investigated how the tone changed in the process.

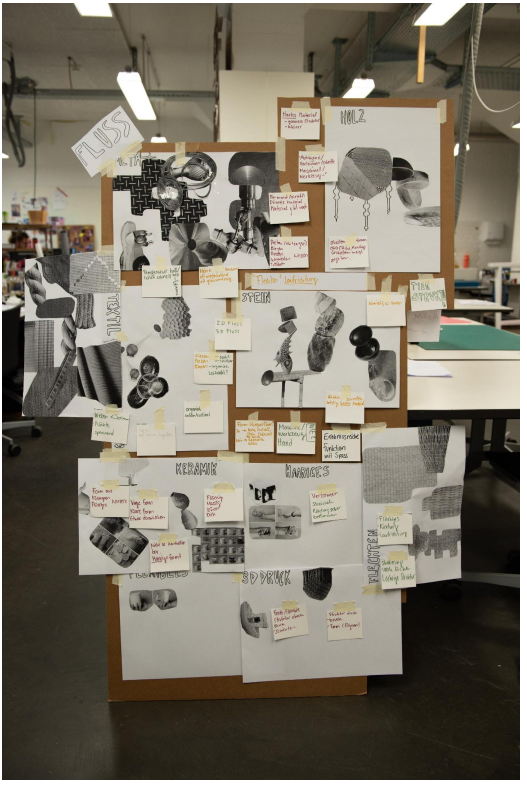

Figure 2. Alena Halmes used a pin board to keep sketches and found material available in the design process. This helped her not only to make decisions, but to argue them with mentors and to reflect the process.

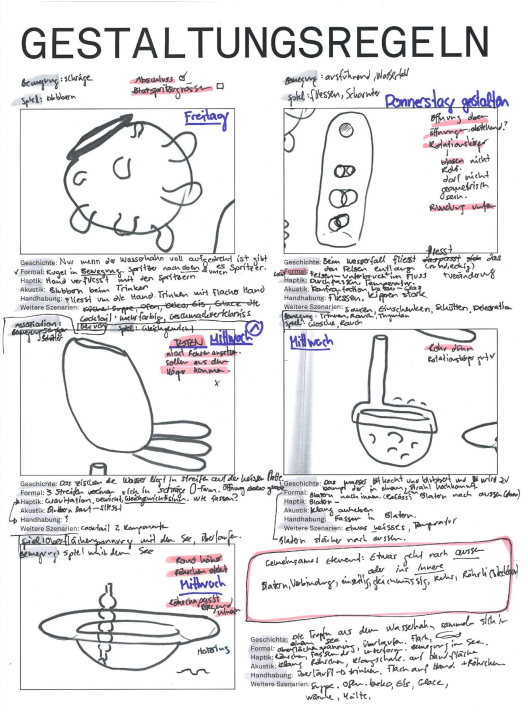

Figure 3. From the descriptions, the most distinctive features were distilled. Translated to sketches and cardboard models of the glasses, Halmes was able to check her interpretation with the blind person and define the form of the final cocktail glass collection.

Halmes finally realised that she wanted to leave the translation of sounds into glass to the people who are blind. She got in contact with two women blind from birth with whom she intensively talked about their notion of water noises – the bubbling, swirling, hissing, and dripping of water in a whirlpool, on a boiling plate, or from a tap. How can a blind person imagine the visual analogy? From the descriptions, she distilled the most distinctive features. Translated to cardboard models of the glasses in a first design round, Halmes was able to check her interpretation with the blind person and define the form of the final cocktail glass collection. She could anticipate some of the sounds of the glasses translating the sonic experience of these interviewees. Collecting qualitative data and translating them into detailed drawings was necessary to collaborate with a glassblower, who produced the glasses.



Figure 4. The form of the final cocktail glass collection.

This way a collection of cocktail glasses was created, breaking with the standard form language that praises functionality, instead an entirely new form language emerges from the perceptions of the blind people. Through the glasses, we can partake in a world of experience otherwise inaccessible. However, there is more to this project. In the process, the long-disputed binary of objects having either strictly functional or symbolic qualities is dissolved (Findeli, 1994). Using semi-structured interviews as part of her qualitative research led the design process. Through a constant dialogue which implies that the knowledge is co-created between the researcher and the researched (Nagy Hesse-Biber & Leavy, 2011) a series of glasses was created, that translates haptic and acoustic perceptions into three-dimensional forms. During the design process, the student used reflexivity to overcome her bias as a sighted person, understanding blindness as a chance to integrate the non-visual into the design. The result is a design that moves away from the purely functional and towards the integration of the aesthetics of the non-visual into the design. The student was able to overcome traditional design methodologies and found her method of exploring different possibilities of perception. Trained to listen and look carefully, she developed an approach that is fundamental for any design process. Ultimately, the project shows how research can inform methodology that celebrates diverse forms of perception.

4. Case #02: Historical research as a design tool

The second case highlights how using design history as a starting point for a design process leads to new approaches towards existing typologies and form language. At the same time, it criticises the notion of national design production and canon building. Exploring three historical debates, Elias Kopp updated and used them as a base and guideline for three chair concepts. (Kopp, 2019) This case shows how discursive and historiographical methods can be meaningful within the design process, expanding general knowledge of temporal social, and practical circumstances. The resulting prototypes show the competence to classify, criticise and continue inscribing this knowledge into new forms. In looking back, the student thought of "how to project forward", creating something that would have "otherwise not be considered" (Fry, 2008, p. 39) This approach also fosters design education that is history-informed, rather than dehistoricised as is often the case within many programmes (Fry, et al., 2015) As such and on the level of design education, the project makes a point of what Noel Waite defines as the overall purpose of design history in educating

> "critical, creative and reflective design practitioners, as well as to sustain research-informed design practice within an interdisciplinary Design Studies undergraduate programme." (Waite, 2016)

Methodologically, the author proceeds from an analysis of past debates, which he consistently summarises. He is particularly convincing in his independent interpretation of the debates in terms of their topicality for contemporary design work and in deriving his design methodology out of this analysis. Instead of discerning formal qualities of designed objects of Swiss origin and ascribing them a kind of «national characteristics» (which would have led him into a sort of circular reasoning), he examines three distinct debates of the 20th century. They centre on production, morality and emotion, headed as "typification", "good form" and "postmodern critique of functionalism". In his concise and consistent discussion of these past debates, he draws primarily on the still scarce literature on Swiss industrial design (cf. Schilder Bär & Wild, 2001; Brändle, et al., 2015). Each of these summarising chapters is followed by a reflection in which the author questions the discourses about their topicality. As the most significant contribution of the thesis, they support the design process and the decisions the author had to take in conceiving three chairs.

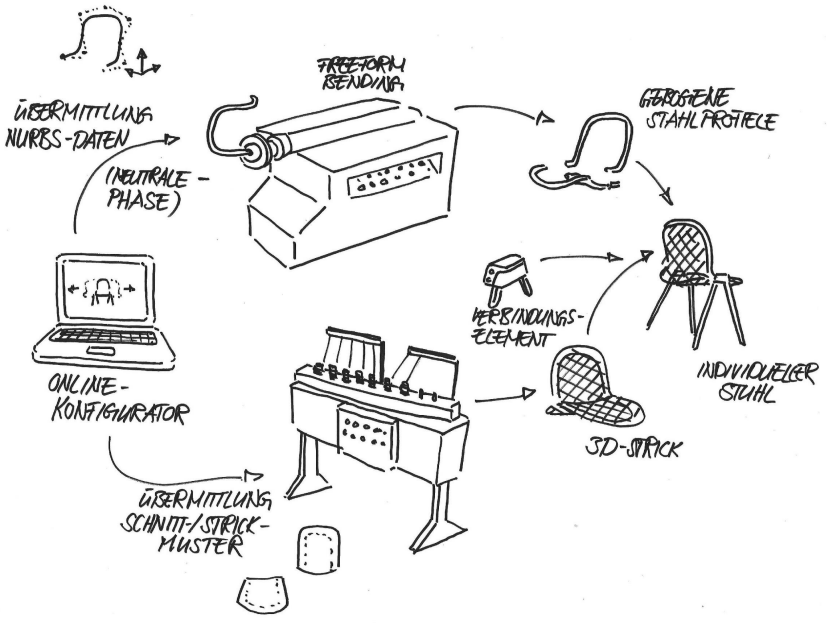

Figure 5. Today's digital production such as CNC, plotters or laser cutters enables a close interlocking of the design process, industrial production and the market. It relates historically to the struggle of typification in the early 20th century.

The first chapter, entitled "Form follows Production", is dedicated to typification, which historically links to the industrial revolution and which led to the development of the professional industrial design. In comparison to mass production at the beginning of the 20th century, today's digital production methods such as CNC, plotters or laser cutters enable a close interlocking of the design process, industrial production and the market. Thus, typification no longer has to be aimed at the conception of entire objects for easy industrialisation. Instead, it focuses on core elements which (as in the case of the chair) can be conceived as connections or complex load-bearing components defining the chair as systems design. Such arguing helps the author to liberate himself from an object-related design approach especially prevalent in chair design as the cornerstone and a cliché of design history.

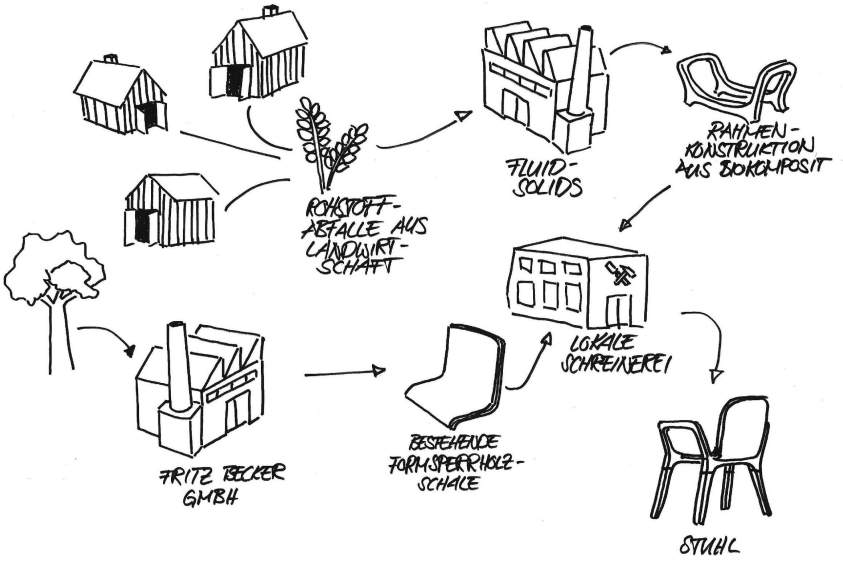

Figure 6. With «Form follows morality» the author discusses a topical debate that mirrors the historical development from design-related ideology of «good form» and the discussion of sustainability in the early seventies to the notion of a new formgiving factor of the system.

The author then updates the debate on "good form" from around 1950 under the title "Form follows morality". With a view to Burckhardt (1980), he concludes that not only an object but an entire, often opaque system must be designed "well", whereby questions of (ecological) sustainability have now joined and even overcome the intricate interaction of functional and aesthetic factors (Bill, 1949).

The third debate under the title "Form follows emotion" refers to emphasizing the symbolic function of design in the 1980s. It formulated a much-needed critique of rationalism even more growing since the late 1960s, that led to the semantic turn (Krippendorf, 2006). In its wake, it also propagated an authorial design approach primarily concerned with formal aesthetics. However, as the author points out, this attitude did not criticise consumer behaviour but, on the contrary, propagated it. Ultimately, this resulted in maintaining the economic system of fast-changing styles and fashions, mediated through the upcoming internet in the mid-nineties. Reacting to this, the author proposes instead to dissolve the product as a container of formal aesthetic meaning and thus to reformulate the industrial production apparatus. Through adapting and refreshing existing DIY concepts, utilizing Fablabs and conceiving small series, he criticizes the traditional market.



Figure 7. With «Form follows emotion» the author adapts and refreshes existing DIY concepts, utilising Fablabs and conceiving small series to overcome authorial approaches and to democratize design.

In a concluding chapter, the author summarizes his observations. Since he was not concerned with defining and debating formal aesthetics, but with the analysis of values that guide design processes, the answer to the question of whether there are specific local or national characteristics, a "CH – Design – DNA", is correspondingly general. The author mentions the "ideological focus on quality and function" and the fact that most designers in Switzerland historically took a mediating rather than an avant-garde position in design-related debates. However, he assigns a high degree of urgency to the three aspects of production, morality and emotion derived from the historical debates for past and current design work, thus acquiring a guideline for his future practice. Consequently, this enables him to knowingly and critically align himself in a specific design tradition.

A more comprehensive justification for the selection of the three debates classified as necessary would have been helpful – here; the student reaches the limits of historiographical expertise that go beyond the requirements for a Bachelor's thesis in design. Nevertheless, in a close reading of a few seminal historical debates, he not only comes to clarifications that are essential for any design practice. Together with the practical thesis, it is thus evident what an important role the confrontation with the history of one's discipline

can play for design. The student was able to develop a founded personal standpoint as a designer aiming at rewriting history through design. This is also evident in the practical thesis, which not only benefits from the examination of past debates and decisions but also updates it in the form of design-related solutions at prototype level. Thus, he creates a close link between theory and practice that is mutually supportive.

5. Conclusions

Both cases show from a different angle, the value of theory- and research-informed design practice. They postulate for design education that encourages these ways of *doing* design, where the impulse of making is accompanied by thorough research. Consequently, as teachers, we should encourage students to find their own ways in combining research methods borrowed from social sciences, critical studies and design history to enrich their practice adding a new layer of knowledge.

The first case exemplifies the importance of qualitative research within the design process. Through the outcome, the glasses, we can partake in a world of experience otherwise inaccessible. This study case shows how Halmes, instead of appropriating and mimicking the ways how blind people experience sound, shape, fluids, therefore creating the representation of the representation, and taking over the agency, made space in the project for the voices of the people with whom she collaborated. Therefore, she decided to conduct a series of semi-structured interviews with three people who were blind from birth and asked them a set of questions. This way she instead of creating a general, universal theory, she focused on the particular uniqueness of each one's perception, so the translation of sounds into three-dimensional forms would be guided by their understanding. She asked the following questions: How do they conceive the images and movements of water sounds? How can they imagine something that, like water, is so elusive and therefore impossible to touch?

But there is more to this project. In the process, the long-disputed binary of objects having either strictly functional or symbolic qualities is dissolved (Findeli, 1994). Using semi-structured interviews as part of her qualitative research led the design process. Through a constant dialogue which implies that the knowledge is co-created between the researcher and the researched (Nagy Hesse-Biber & Leavy, 2011) a series of glasses was created, that translates haptic and acoustic perceptions into three-dimensional forms. During the design process, the student used reflexivity to overcome her bias as a sighted person, understanding blindness as a chance to integrate the non-visual into the design. The result is a design that moves away from the purely functional and towards the integration of the aesthetics of the non-visual into the design. The student was able to overcome traditional design methodologies and found her own method, exploring different possibilities of perception. Trained to listen and look carefully, she developed an approach that is

fundamental for any design process. Finally, this project shows that every perception is individual and of equal value.

The second case shows how to close the often-lamented gap between theory and practice, design history and studio work, relating design historical research to current practice. Design usually looks forward, anticipating what will come, and is less occupied with what has been. However, by neglecting design's legacy, one reproduces a decontextualised and dehistoricized practice (Fry, et al., 2015). In this respect, design history is an excellent means to engage with and reflect upon emergent practices and discourses, and to trace them back to their origins to get a deeper understanding. Or, as Meikle put it: "[...] a historical approach can indeed illuminate contemporary issues without directly addressing them [...]" (Meikle, 1995, p. 74)

At the same time, we have to prevent design history as a field of academic study from getting a 'strangely instrumental and legitimizing flair', as Fallan (Fallan, 2010, p. 25) criticised Dilnot's approach (Dilnot, 1984, pp. 3-20). The best way to avoid the common pitfalls of instrumentalising design history as a resource for designers, reducing it to the status of a quick Google image search is to teach design history in a constructive, non-authoritarian way, inciting students to ask questions and build up their own perspectives on the history and the legacy they are partaking.

Asking students for their opinion in order to challenge authoritarian knowledge as well as routinely conveyed, unquestioned teaching content, as a design educator Danah Abdulla (Abdulla, 2019, p. 9) suggests, is one possible way. However, students-led discursive redesigning of content requires that they have a sound methodological basis, either sociological and in terms of observational, ethnographic skills as in the first case, or historiographical as in the second case. Teaching methods are manifold, but one approach that many would agree upon is to empower students to obtain an active understanding of how the notion of difference in experiencing past and present worlds, or of the ways «history» as always constructed perspective into the past interacts with creative processes in general, and of design in particular.

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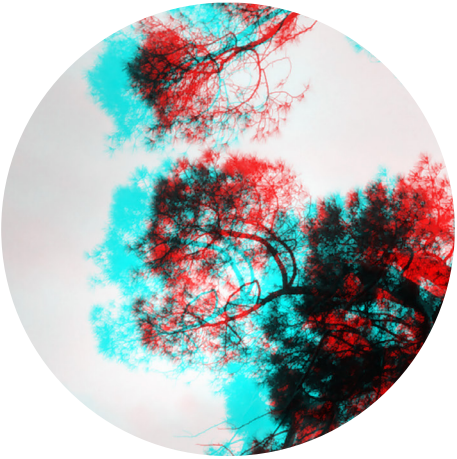
DESIGN CULTURE(OF)

LIFE

NATURE
BIOLOGY
HUMAN



TRACK CHAIRS

DESIGN CULTURE (OF) LIFE
NATURE | BIOLOGY | HUMAN



Anna Bernagozzi,
Ecole Nationale Supérieure des Arts Décoratifs, France
“Biothechnologies are already challenging all major issues concernig the living, animal and non-living world. Designers need to rapidly redefine a new ecology of practices structuring tomorrow’s human relationship with the tangible and intangible world.”



Pepetto Di Bucchianico,
D’Annunzio University of Chieti–Pescara, Italy
“Human dimension plays a central role in design of products, environments and systems for a collective or individual use, with the aim of optimising work, productivity, safety and wellbeing...”



Emilia Duarte,
IADE, Universidade Europeia, Portugal
“One of the biggest challenges that Design faces today is the paradigm shift from user-centred design, which has been advocated and taught in recent years, with great progress, towards a broader paradigm that focuses on Human but also on the community, the ecosystem and, ultimately, the sustainability of life on the planet.”



Sabrina Lucibello,
Sapienza University of Rome, Italy
“Design can simplify our daily life, even learning from living systems how to waste better in terms of material resources and energy, but also in terms of functionality, growth, self-repair and self-reproducibility”

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Adopt a costumer - to design new processes and packagings.

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Abstract | The paper describes a method of research and project developed in collaboration with the well-known food company named Barilla, which involved our Department in the elaboration of new concepts for their products. The name of the process is “adopt a customer” with reference to the close cooperation of the students with the consumer throughout the evolution of the project, from the survey to the prototype. In the first phase, the designer 'tutor' draws a broad overview of the person, to better understand the phase of qualitative collaborative research on the user's experience. The first results cross-referenced with the quantitative trends provided by the company, identify the needs and weak points to solve in the project. Everything is carried out in design for all perspective, trying to avoid exclusive elements and not to create too specific products. A continuous update would also ensure to offer a product in evolution with the needs of tomorrow's society.

KEYWORDS | DESIGN FOR ALL, ETHNOGRAPHIC RESEARCH, CO-RESEARCH, INCLUSION

1. Introduction

In order to develop marketing strategies and innovative solutions for their productions, major food companies work with the help of statistical agencies, which provide a countless number of data based on surveys. The main need of these companies would be to have eyes in the consumers' homes, to find out what people do and not say, how users spent time in real life, what are their daily habits.

The company that has commissioned us this research is Barilla, a leading company in the food sector and well established worldwide, which aims to provide to the end users a product which satisfies their needs. The request for several years has been not only to have new concepts for packaging and food but rather to understand how costumers use, consume, transport their products and, above all, which categories of users do not buy a product and why. Even if the company knows and possesses all the market data related to the purchase and consumption of their products, the macrotrends provides only a trend of a phenomenon in progress. Using these analysis, they do not extrapolate the causes and do not prefigure evolutions, which are essential elements to remain always contemporary.

The focus of this paper it's not on projects, these are the final results of the process conducted, what is important is the method designed to pay attention to the real needs of the customers. In fact, companies need to continually confirm their users' trust in a competitive and changing market. The radical changes in lifestyles, define new consumer profiles, so the packaging together with the product itself, must therefore, anticipate future trends rather than confirm the current or past ones. One indisputable trend underlined by Madhu V Swamy (2018) in the website customer think is the switch towards fresher, healthier foods. Customers are now more aware of the health benefits of the foods they consume and are actively looking for high quality products as a priority.

Forbes in 2019 shows the biggest trend driving the change in the food and beverage industry is transparency. Consumers want to know and understand what ingredients are going into their products, which is why we are seeing so many innovative products with shorter ingredient. Consumers are seeking for simplicity in addition to better quality foods. Before now, it was rare to flip to the back of a product on the shelf and read it before putting it in your cart. Consumers are reading the back of packages now more than ever. Clean labels with high ethical values are necessary, particularly to a growing segment of consumers with special dietary needs. Packaging has an important role to communicate all these elements: healthy, transportability, transparency.

Another one, in contrast, is that cooking meals and eating it is no longer a necessity. The number of people purchasing food to go, eating precooked food or ordering meals at restaurants has dramatically increased over the past few years. This had led to several new trends in customer's behaviour when it comes to food shopping.

"The novelty is these are no longer elitist choices, as happened in the past, but behaviours that affect a large number of people", says Montanari (2018) Professor of Medieval History

and Food at the University of Bologna in an article on Focus. These macro trends and data speak about numbers and masses of indistinct consumers, what is interesting for companies are the behaviours and lifestyles that products must accompany, in this competitive market: details create the difference.

The Packaging is the touchpoint between brand and customers, therefore values and necessities too. Packaging produces non only meanings (Ventura, 2014) as it names things, expresses concepts, gives information and evokes sensations, but it is also an object to use, hold, open and dispose of, thus suggesting gestures and habits that produce a consumption scene. The packaging attracts attention, informs about the past, production and content that generated the food and then becomes a means of future behaviours.

When this necessity of coherence and updating with users' trends is also associated to develop design solutions for the different target groups, the need to structure a design method emerges: the target and the brief change each time, the method doesn't change. Starting from a brief, the research team developed a method called 'Adopt a costumer', a mixed approach of Design for all and Design Thinking, tested in five consecutive years of collaboration with the company and applied to different brief on food and packaging.

The method is built on three different findings:

- target is just a starting point, it's like the focus in the picture, there is a whole blurred area that creates relationships and contrasts with the selected subject that generates a very interesting scenario.
- people are inconsistent, deny their statements with facts, unveiling a grey area between appearance and reality
- co-research/co-creation, the initial moment dedicated to the definition of the problem-setting is the most intensive part close to the user, where consumer guides the designer in understanding the scenario of the real problem to be solved.

2. Method

2.1 Target is just a starting point

Following to the quantitative market research, the Company every year select brief and target. The process of focusing on the target indicated by the Company, therefore, allows starting from investigating the reasons for the exclusion of other targets. We know that the moment of food consumption is often a convivial moment, where people interact and affect each other. This is an occasion to understand the shift or expansion of the selected target. The person who purchases the food, is not always the same person who eats, opens, transports and stores the packaging, and who cooks or customize it. All these components are elements of consideration, that lead to relate the initial target with others and combine

them in synergies that expand the scenarios for project. It's important to consider and observe who is choosing the food during purchase. There are different habits to consider: sometimes the consumer chooses for himself, other times for others. For examples, grandmothers buy for grandchildren, children shop for elderly parents, roommates sharing the meals. There are different habits of food consumption, frugal light and quick meals for some people, experimental cooking and rituals for others. It's important for the designer to understand when the brand chooses for the consumer.

The designer's task is to observe all the different behaviours during these interactions, moments of preparation and consumption. It's crucial to understand if someone is penalized by deficits in the opening or transport phases, or if a user refuses a food because of health problems or suspicion about the origin of ingredients used, or it is considered hypercaloric or low-caloric, or customer prefers another one.



Figure 1. Observation phase to find in packaging exclusions elements for users.

Design for all is the approach at the basis of this attitude, that avoids specialisms and focuses on inclusive elements. Design for All is design tailored to human diversity. The weaker groups of the elderly and children or those with debilitating diseases or allergies cannot choose some products or foods, or they are not satisfied by particular food categories that emphasize their diversity. They just want to choose their food as all the other people and they don't want someone else chooses for them. Design for All is described by the Foundation as the intervention into environments, products and services which aims to ensure that anyone, including future generations, regardless of age, gender, capacities or cultural background, can participate in social, economic, cultural and leisure activities with equal opportunities. Design for All/Universal Design should be implemented in all areas, because the human beings are diverse and everyone has the wish, the need and the right of being independent and choosing the own lifestyle without facing physical and social barriers.

These important requirements are investigated in the survey phase of existing products and then translated into new projects through the proposal of new openings, clear and readable

information, lighter and transportable formats, foods that can be customized according to diets and tastes, new opportunities within existing products. For project categories such as food and packaging the primary mission of design to improve people's lives becomes even more urgent. It is necessary to turn one's attention to reference targets during the project phase, in order to have more targeted offers, but without creating elements of exclusion towards other categories of users.

Another interesting resource to observe consumer targets from another point of view is also the food entry in social networks with the phenomenon of the #foodporn, it is a term commonly defines the practice of photographing and sharing on social media images of food, giving a lot of pieces of information about customizations, contests, interests. This is a very important phenomenon and at the time, for the word “food porn”, there are 19,500,000 results on Google, an entry on Wikipedia, a Facebook page with 2,713,143 like, 113,135,094 posts with the hashtag #foodporn on Instagram, and for designers it becomes an available data pool to watch carefully.

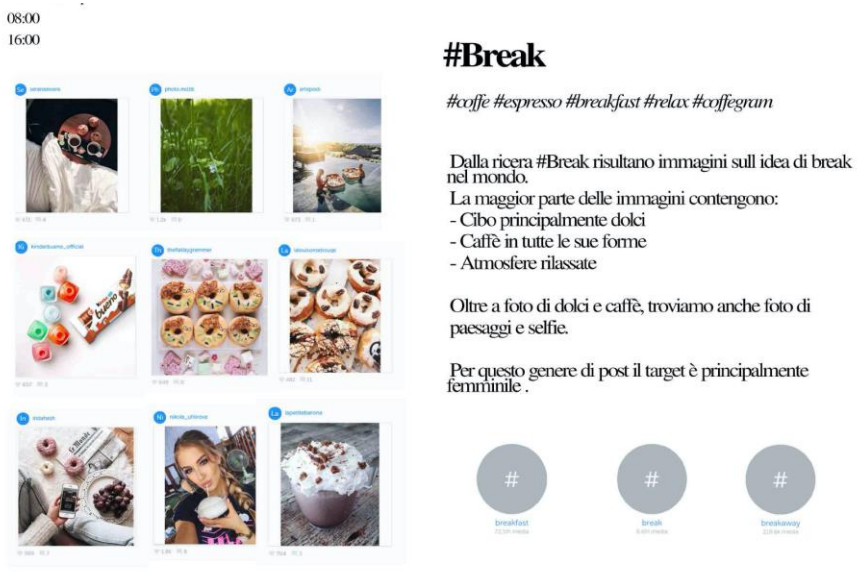

Figure 2. Foodporn research on Instagram conducted by different keywords

Yelena Mejova at the Qatar Computing Research Institute has analyzed the anatomy of the #foodporn phenomenon on Instagram for the first time in 2016. To get a global overview of #foodporn preferences, Mejova normalized the hashtag frequencies per country and then ranked the resulting foods. This list is dominated by foods with a high energy density, such as chocolate, cake, and so on. That allowed the team to explore the proportion of healthy to unhealthy dishes labeled #foodporn in each country. They did this by looking at other

hashtags associated with the food posts and by analyzing the sentiments they convey. By this reckoning, the most health-conscious country is the Netherlands, by contrast, Brazil, Argentina, and France have the highest rate of unhealthy tags. They found out that the rate of approval—of "likes"—is higher for healthy foods than for unhealthy ones. "The heightened social approval of healthy tags suggests that the community is already self-policing in promoting a healthier lifestyle," they say. As designers, who put proposals on the international market, we have to start seeing social media as a very interesting data resource, continuously updated and referred to a specific and localized users.

2.2 People are inconsistent

In the various surveys carried out over the years, we realised that quantitative, not in-depth data can be contradicted by qualitative surveys. Every year we start our research by organizing shadowing in supermarket, where students take pictures to the shopping carts of consumers, who choose the category of the product analysed, even of different brands. Then a quick interview to collect a large number of generic user profiles is done. The moment of purchase is just a fragment of a larger story that needs to be reassembled to give a more realistic picture of reality.

The quick and introductory search is followed by a slow and in-depth one that we call 'adopt a costumer' that varies according to the target audience. In this phase, we trace a specific and complete profile of the user, a sort of identity card that outlines the food, familiar and healthy status, with graphs and photos on the daily activities carried out to include personal passions and define a day in a life of character profile.

The researcher has to conduct a passive observation, a day in a life, very useful to expand the focus and to understand users in ordinary life: while they go about their everyday tasks, constantly passing from zoom out to zoom in, before entering into specifics of the product investigation. This approach helps designers to understand people's behaviour and context, to clarify how users behave backstage (Gouillart, & Sturdivant, 1994) in their home space, in their intimate dimension and environment where they feel comfortable. It is from here that the term 'adoption' and not 'interview' is born: to build trust between users and designers. In this kind of approach, users cannot hid anything, and they have to entrust their intimate reality to the researcher (Mulder, 2018). The process involves observation before collecting, interpreting and analysing data, leaving room for the user unexpressed needs, often hidden out of embarrassment about pathological and psychological disabilities.

Observations will be documented throughout the day using several methods such as taking notes, photographs, sketches or videos. These recordings often become evidence of user incoherence. In fact, if they are not asked anything they behave freely. On the contrary if targeted questions are asked, they are not always willing to tell the truth. These contradictions should also be considered in the analysis.

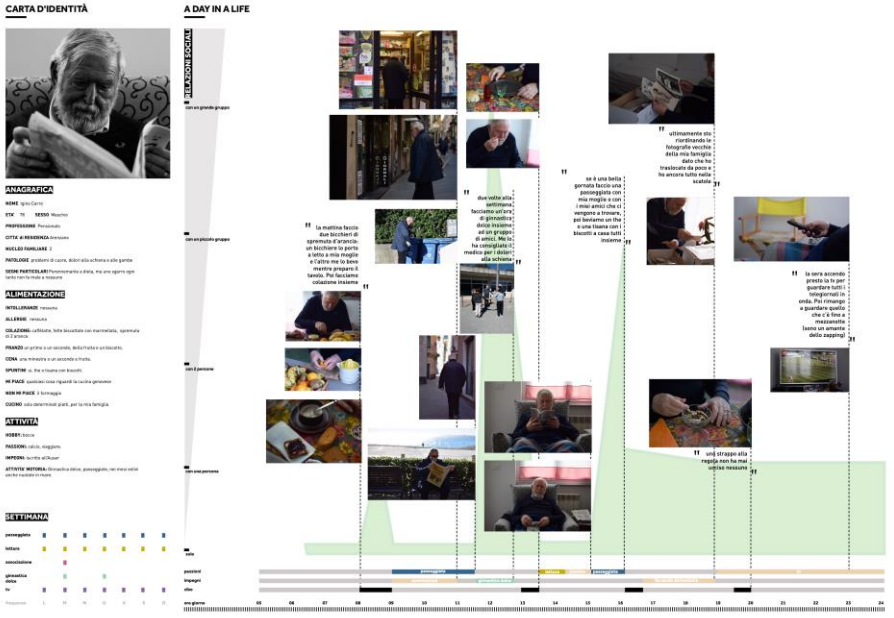

Figure 3. Identity card and A day in a life of adopted customer

Only later a specific topic is deepened through a specific and direct interview about the product of the investigation, packaging opening video, food experience and possible customizations of the product.

This is when it's very important to choose the right questions, so to set the problem in the right perspective. The 'adopted' shows the dynamics with the product to the tutor-designer, who knows the private dynamics and can understand the unexpressed needs and interpret them. Interviews take place in an easy and informal environment, to help users not to feel under interrogation. Despite these attentions, however, some inconsistencies emerge in comparison to the observation phase. For example, it happened that people showed an attitude of looking at sweets and snacks shelves during their shopping, but when directly asked they replied that they never purchase snacks nor eat outside the meals. At this point in the classroom, the storyboard is put in order, collecting all the data of the quantitative survey with the specific qualitative interview and outlining the personas taken as a reference target of the project. The personas are fictitious characters, created thanks to a combination of data that can represent a large sample of users.



Figure 4. Personas elaboration phase in classroom, as a result of realistic, specific and cross-references data

As they do not exist for real they are imaginary, at the same time they are very realistic because they are created on real data. The personas are generic, because they represent the average(s) of the data obtained and they are specific because they take some interesting details of some real people and raise them to a given meaning.This ethnographic research is the missing link between quantitative and quantitative data.

There's a reason why now, more than ever, companies are in desperate need of hiring anthropologists. It's not hard to understand why explain AJ Burt in Medium in 2019; in a world where everything is increasingly connected, everything is measured, and 97% of companies are investing in big data and AI, a question emerges: How do we consume, parse, and contextualize these massive datasets in a way that productively advances the goals the data was gathered to advance? The anthropology is an important resource, because it has been grappling with quantitative data and ways to make the best use of it for decades now, and certainly recognize the importance of context in analytical data and it can contextualize massive amounts of data about human behaviour.

Ethnography, based on anthropology, is a qualitative research study looking at the social interaction of users in a given environment. It provides the researcher with an understanding of how those users see the world and how they interact with everything around them. These types of approaches allow us to continuously cross-reference with different types of data and thus get closer to a real and coherent picture.

2.3 Collaborative Research is the intensive part of co-creation

The method of ‘adopt a costumer’ is based on an important phase of survey and research in close contact with the users, deepening and accentuating what in Design Thinking is defined as the phase of empathy through collaborative research. In a co-design process, the traditional roles change: the person who will eventually be served through the design process is given the position of 'experts of their experience', (Elizabeth Sanders and Pieter Jan Stappers, 2018) and plays a large role in knowledge development, idea and concept generation. Research collaboration is a deep and powerful research tradition that dates back beyond the recent emergence of calls for ‘co-produced’ knowledge. Co-design means that people come together to conceptually develop and create things that respond to certain matters of concern and create a better future reality, we think that the initial co-research phase is crucial. The project phase is still direct and managed by designer, while the research and post-design phase is in continuous dialogue and confrontation with the user.
At a most fundamental level, co-research is a practice where people collaborate or connect their knowledge, skills and resources in order to carry out a design task.



Figure 5. Moments of interactions and interview with users

This is the phase of the process in which an important connection with the user is established that allows you to observe, explore, listen, but above all to suspend any judgment. It is the phase in which designer and user work side by side, both on the same level.

The suspension of judgement implies a real exercise of reflection on what happens in front of us without elaborating solutions (Cristina Lavazza, 2018). The definition of empathy is the ability to be aware, understanding and sensitive to the feelings and thoughts of another person without necessarily having lived the same experience. Tim Brown (2009), describes empathy in design as a mindset, but also a fundamental cultural value that allows designers to develop innovative concepts, products, services, strategies and systems that respond to real needs and concrete desires of users. The adjective 'empathic' concerning design was introduced in the late 1990s (Battarbee & Koskinen, 2005) when companies started to realise that customers' responses on questionnaires were not enough to develop successful products (Leonard & Rayport, 1997; Sanders and Dandavate, 1999). When empathic design first appeared was described as a cultural change, because of the importance of emotion not only as a subject of study but also as a key attitude in people research.

Empathy offers palpable closeness to the other people, but it can also excuse experts from taking the broader view. As designers thinkers, we have the opportunity to step back from that singularity to consider the broader scope. The responsibility as designers should be not only to focus on the individual but to the society. Using the neuroscientific finding of "mirror neurons" (Rizzolatti & Craighero, 2004) as a biological evidence for the human ability of inner imitation, the simulation theory argues that we use ourselves as a model for the other person's mental life. This toggling between the individual and the group should be an ethical requirement for today's designer, and a principle introduced into the design-thinking rubric. A balance from individual satisfaction with system benefit, the unit with the whole, the happy customer with the enriched community. Empathy can help to frame the problem, but it takes an assertively creative mind to push ideas forward beyond today in the moment conceptualization.

Empathy is not the full story, is only one language.

While there has been significant attention paid to empathy within design literature, there has been little research on the nuances of lived experience or how to effectively integrate empathy and lived experience in co-creation. Empathy tools which involve working with physical objects or social techniques to get a sense of what users feel in their everyday life, by empathy maps, which help to visualize the experience of actors (Vink and Oertzen 2018). We become the link between the company and the consumer going into people's homes and filming them while they use and personalize the consumption of the reference product, we bring the company into the consumer's home and allow consumers to talk about themselves beyond the macro trends. Real design skill is about realizing that empathy is a small part of a much larger system of influences, causes, and effects on the situation at hand. Not only is empathy renewed and nourished throughout the process, with continuous meetings and comparisons on the interpretation of needs in concepts, projects and prototypes, and with tests and restarts for continuous improvement.

Design thinking isn't just about design anymore; it's about assembly, bricolage, sampling and appropriation. Not just craft and creation, but the bringing together of pre-existing elements

to build that which is new, and yet is not. It's important to create an open, collaborative, and connected process.

From this viewpoint, the empathic experience becomes the basic condition of disclosing intersubjective relationships and consequently grounding the sense of sociality. Nevertheless, the main difference could be synthesized in a shift from design 'with' empathy to design 'for' empathic experiences (Wendt, 2017).

3. Conclusions

In the era of rapidity of data and statistics that try to represent and visualize people's needs, in contrast, a slow and qualitative approach emerges. This is not seen in contrast with the quantitative method, but as a way to complete the picture, systematizing the automated spontaneity of actions with the weighted rationality of responses and statistics. Thanks to an immersive approach it is possible to understand cultures, needs, behaviours and develop responses that are more calibrated to the real needs of the user at the centre of the project.

The phase of investigation in close contact with the adopted costumers is followed by the design and prototyping iteration, in which the user takes part (in) of the development of the entire project, by continuous testing and comparisons, commenting on the effectiveness of the concept and the technical details of the project. The project takes into consideration the manifested and unexpressed needs of the users who represent sections of society. The designer becomes the tutor, the one who can observe carefully, dialogue, understand the unsaid wishes and interpret them.Every year the company asks us to redesign the packaging of a product and think about variations, we often put all these inputs together, and we ask students to reformulate the sensory experience of the user, intervening many more aspects related to gestures, new forms of sharing and lifestyles of the near future.

Design becomes not only a problem-solver but a careful investigator of the problem-setting, to translate the real needs and to promote a systemic design that knows how to relate the demand to a wider context, as a glue between innovation, accessibility and inclusion.

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Acknowledgements: This research method has been developed thanks to the collaboration of the company Barilla and the special support of the students involved in the Design Laboratory of the Bachelor's Degree in Product and Communication of the University of Genoa.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Autonomy as a Design Principle: Service Design for the Technology Literacy of Older Adults.

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Abstract | As people grow older, their dependency on various services increases. However, these services are being progressively mediated by digital technology. Although scholars believe that technology adoption could enhance older adults' quality of life, little is known about seniors' sense of autonomy while using technology. In this study, we conducted ethnographic research including surveys and interviews to learn about seniors' technology usage in relation to their sense of autonomy. We used qualitative and statistical analysis to synthesize patterns and used our design research findings to inform our service ideation process. In the end, we proposed four major service design guidelines to help enhance the technology literacy of seniors: a changed mindset from singular problem-solving to pluralistic motivations, a meaningful learning process embedded in seniors' everyday communication needs, ongoing educational support within a sustainable system, and the value of integrating humanity with technology.

KEYWORDS | SERVICE DESIGN, AUTONOMY, DESIGN FOR SENIORS, TECHNOLOGY LITERACY, DESIGN PRINCIPLES

1. Introduction

With the rapid growth of the aging population around the globe, there is raising interest in improving the well-being of seniors by increasing their rates of technology adoption. The Institute of Aging predicts that adults aged 65 and older will comprise 20% of the United States population by 2030 (Ortman, Velkoff, & Hogan, 2014); similarly, in the Europe Union, the elder population is anticipated to be 25.6% (European Commission, 2014).

As people grow older, their dependency on various services increases. Approximately 12.7 million adults 65 and older, 40% who are 85 and older, live alone and often rely on social services instead of traditional family care (Klinenberg, 2013; Roberts, Ogunwole, Blakeslee, & Rabe, 2018). However, older adults' access to social services is hindered by the lack of technology literacy. Many essential commercial and public services are increasingly mediated by digital technology, which is not designed with proper consideration for seniors (Barnard, Bradley, Hodgson, & Lloyd, 2013). For example, some medical apps contain helpful functions to address the needs of older adults but are extremely difficult for them to access or use. In addition, seniors lack trust in digital services and are hesitant to seek technology support due to emotional barriers concerning their sense of autonomy (Ramdin et al., 2018). For instance, older adults are often afraid that they may be perceived as cognitively declining or burdensome to other people if they seek technological help. Therefore, in order for older adults to seek out technological support, their self-esteem and sense of control must be improved.

In this study, we conducted ethnographic research to understand the factors and patterns of older adults' autonomy in relation to technology, including a survey of 94 participants and 20 interviews. Using key insights from our research, we are designing a preliminary service system to support seniors' adoption of rapidly changing technologies, while maintaining their sense of autonomy. The service system includes workshops with board games, self-learning toolkits, and technology learning courses ranging from beginner to intermediate levels. Those tools and community-based courses will connect seniors with student volunteers, community centers, and local libraries.

2 Background

Technology literacy refers to the quality and state of educated competency in technology, representing a long-term exposure to learning while using. However, due to cognitive decline, lack of education, or discontinued updates the technology, seniors often have a hard time keeping up with major shifts of new technology (DiMaggio, Hargittai, Neuman, & Robinson, 2001; V. Hanson, 2009). Scholars in Human-Computer-Interactions investigate factors of seniors' technology adoption using the Technology Acceptance Model (TAM) with a focus on perceived-usefulness and usability (Davis, 1989). Researchers propose that designing technology for seniors should focus on direct values and ease of use (V. L. Hanson,

2010; Pan & Jordan-Marsh, 2010). These ergonomic factors empower novice elderly users who are learning technology, but multiple layers of barriers, including economic consequences of technology usage, fear of vulnerability, and distrust of data security, still slow the integrity of technology in seniors' lives (Hill, Betts, & Gardner, 2015). These concerns cannot be fully addressed from the perspective of TAM, because they are more associated with the ethical and emotional issues concerning the sense of autonomy (Fairweather, Shaw, & McBride, 2014; Perkins, Ball, Whittington, & Hollingsworth, 2012).

Autonomy generally means people's capacity to act upon free will instead of external pressure. Immanuel Kant (2011), representatively, describes autonomy as an active setting of self-imposed moral rules in contrast to passively being controlled by other people or the environment. Perceived usefulness of technology adoption generally refers to the worth of offerings (Cockton, 2005). However, if we consider the use of technology from the perspective of autonomy, the goal of technology is not just to attain external worth or reward, but to increase the possibility of actions with the support of technology. Studies show that the availability of alternative options influences seniors' ability to use technology effectively (Engel & Curio, 2010; Peek et al., 2016). If seniors rely heavily on family assistance in food delivery and transportation aid, there is less perceived usefulness when learning mobile food ordering and ridesharing services. In conclusion, seniors lack autonomy in using technology not because they have fewer options, but because they are not in an environment where technology literacy is encouraged.

In service design, Kim (2018) proposes a framework to understand varying notions of autonomy in relation to service participation, presented as layers: coproduction, argumentation, experience, and commitment. Coproduction refers to the cost-value benefit and reliable quality provided by the service. This concept highlights convenience and efficiency as people's sense of autonomy. From the perspective of technology, visual interfaces that improve perceived usefulness and usability are key to increasing the sense of autonomy in coproduction. When evaluating the effectiveness of different technology, Tele-Care, Hearing Aids, and Chat Robots have high positive effects on seniors' daily activities (Khosravi, Rezvani, & Wiewiora, 2016). These technologies are easily accepted because they offer direct value for seniors, such as lowering the cost of visiting the doctor or improving micro-mobility.

However, it should be noted that catering basic needs for seniors is not enough for transitioning them into an environment that cultivates technology usage. The second layer of argumentation demonstrates a co-creation process of service, where autonomy as a rhetorical power of communication and identity definition becomes important. As Web 2.0 emerges, user-generated-content platforms, such as YouTube and Wikipedia, have become popular. Users are given the power to shape content and media. Thus, technology enhances the involvement of user participation (Van Dijck, 2009). Networked technology is not novel, but participatory communication allows different roles of players to be involved with site support, senses of free will, and other reciprocal activities. Therefore, argumentation serves

a pivotal point in technology literacy by redefining the role of service receiver to service facilitators.

The third layer of experience refers to wholeness of service as an environment, where action capability is central to autonomy. People seek a causal understanding of what the service is, why to use it, what to get from it, and how to contribute to its development. Participation in experience resonates with the narrative interpretation of technology as experience. Interacting with the wholeness of technology is a sense-making process, comprised of expectations, connection to the environment by immediacy, perceiving reasons to understand causality, and appropriating the experience with personal meanings and sharing it with others (McCarthy & Wright, 2004). Only by encountering this input-output process do people meet their action goal with technology as a self-initiated rule.

The last layer of commitment represents participation as belonging to a social group or community with shared value, emphasizing autonomy as moral conduct. Examples of participation as thought have already been observed when people support, or boycott tech companies and their products based on their moral conduct and social responsibility. For example, when the media reported about the problematic leadership of Uber, some citizens organized action to boycott Uber and support its competitor, Lyft, instead, which would align better with some people's value systems.

In this study, we apply this framework of service participation—interpreted from the perspective of technology literacy—to pinpoint elder autonomy and identify different touchpoints to nurture autonomy. Most current technology interventions for seniors are still situated in the first and second layers, but as implied from our literature review, holistic support for autonomy requires consideration from multiple layers. Based on this framework, we conducted ethnographic research to understand the factors and patterns of elder autonomy and senior's technology usage in greater detail.

3. Methods

Our ethnographic research consisted of surveys and interviews with adults 65 years and older. The research protocol was reviewed and approved by the IRB. 120 surveys were filled out in 4 senior community centers in the Greater Boston Area. We excluded invalid surveys that contain incomplete answers and consecutive identical Likert scale answers, with 94 valid surveys remaining. Interviews were conducted with 20 seniors selected from the surveys, with consideration in recruiting for diversity in economic, racial, and cultural backgrounds.

In the survey, we included three sets of multiple-choice questions: demographics, lifestyle, and technology usage. We also included three sections using the 5-Likert scale, ranging from strongly disagree to strongly agree, to study the relationship between Autonomy, Participation, and Technology. Each session had 16 questions. Autonomy questions were

designed to progress from one's sense of independence to relational respect for others. Participation questions were designed to cover their competency in taking care of themselves as well as their engagement in community activities. Finally, technology questions asked about their familiarity with technological devices and their dependence on technology in their daily living.

After a quick reconnaissance of our survey results, 20 participants were selected for a one-hour follow-up interview. The interview consisted of semi-structured questions focusing on where, what, and how they attain and use technology, problems of technology usage, motivations and values that might inform the design, and their visions of future technology. This schema helped us to understand older adults' experiences with technology and helped us to construct scenarios for journey mapping.

3. Results

3.1 Survey analysis

To measure seniors' performance in three Likert scale sections, we added up answers of 16 questions in each section up to a total score of 90. Since the score distribution did not follow the normal distribution, traditional nonparametric tests were used to explore the relationship amongst different sections. Also, as the missing data in our survey was far less than 20%, we imputed all missing data with a person mean to maintain survey reliability (Downey & King, 1998). An exploratory factor analysis accompanied by cluster analysis was used to find out the main factors of the responses. The categories of characteristics provided us data for constructing personas with varying levels of technology proficiency and autonomy. Most of the statistics results were operated by SPSS 25.

All respondents were seniors over 65 years of age, with a median age of 77. There were 23 males and 71 females. Only 28% had a higher education. 53% lived alone and 17% lived with a spouse. The remaining lived with their family members in a senior home. There were other findings of their daily behavior and the use conditions of different kinds of technology, but to narrow down the scope of this paper, the following section will mainly discuss the analysis of categories of characteristics that had direct implications on our design research.

By comparing the median score among the three Liker scale sections, we learned that seniors performed highest in Participation with a median score of 70.81. Autonomy scored 67.00, and Technology ranked last with a score of 49.50 (Table 1). From the Spearman's rank test, the correlation coefficient between autonomy and participation is 0.706, while the correlation coefficient between Autonomy and Technology is 0.347 (Table 2). Although the correlation result did not provide a causal relationship between two variables, the weak correlation coefficient did tell us that current technology does not directly relate to seniors' sense of autonomy. However, a high correlation level between Autonomy and Participation

demonstrated that social participation, such as community events, promotes meaningful values for individual identity.

Personal autonomy is different from absolute independence. Sherwin states that for people who need assistance, their autonomy is more situated in the relationship with other social identities that support their agency of the self (Sherwin, 2011). Since technology is an important resource for assistant-living for seniors, we can bridge their sense of autonomy with technology through a high degree of social interaction, like creating a technology learning environment with communal support, reciprocal help, and other participatory activities.

Table 1. Descriptive Statistics of Autonomy, Participation, and Technology

		Percentiles		
Total score	N	25th	50th (Median)	75th
Autonomy	94	60.61	67.00	70.68
Participation	94	64.00	70.81	75.00
Technology	94	40.00	49.50	61.71

Table 2. Spearman's rho correlation coefficient test among Autonomy, Participation, and Technology

Section		Autonomy	Technology	Participation
Autonomy	Correlation Coefficient	1.000	.347	.706
	Sig. (2-tailed)	.	.000	.000

Exploratory factor analysis (EFA) is used to find patterns underlying the relationship amongst different variables. Therefore, following a normal EFA analysis procedure, first, we measured the internal reliability and validity of the original Likert scale data. With a score of 0.920 in the Cronbach's Alpha test, a KMO value of 0.680, and a significant result of Bartlett's test less than 0.01, the Likert scale data assured the fundamental requirements for using factor analysis. Although the result does not meet a perfect requirement for academic research, it is acceptable for design research (Beavers et al., 2013). After several iterations of principle component analysis, we removed 12 questions which contributed less to the main factors (items of which rotated loading value < .5 were suppressed).

Finally, 10 main factors with which initial eigenvalues are greater than 1 were retained, covering a 71.9% cumulative variance (Table 3). Factors were also interpreted by finding conclusions in their corresponding questions. After using K-means cluster analysis, we concluded that there were 3 main group characteristics among our participants. To balance the number of respondents in each group and avoid having any groups be too small, we first divided all factors into 6 cluster centers. After removing the 3 clusters that had a small number of respondents, 3 main groups were generated (Table 4).

- Group 1: Seniors are independent and have a lot of control over their own lives. They have no problems with daily activities and are quite good at using technology. This group of seniors performs well in all three sections. 44 people are in this group.
- Group 2: Seniors lack total control over their lives, but they can conduct their normal daily activities. Additionally, they actively participate in community activities and treat others with respect. This group of seniors is willing to accept other people's advice. 21 people are in this group.
- Group 3: Seniors have difficulty dealing with their daily activities and using technology. Their degree of basic participation is especially low. They may have a physical disability that influences their well-being. This may also lead to low engagement in other social interactions. 20 people are in this group.

Table 3. Main factors with corresponding questions

Factor	Item (Question index)	Factor description
F1	P6, P13, P9, P7, P16, P8, P11, P5	Seniors are leaders in their community. They are willing to listen to others also give people advice.
F2	A14, A15, A16, A9, A13	Seniors are confident. They treat other people with respect while earning respect from others.
F3	T3, T2, T1, T4, T10, T14	Tech-savvy seniors. They are confident and proficient in using technology devices.
F4	T13, T12, T11, T14	Seniors are positive about learning new technology.
F5	P4, P2, P1, P3	Independent seniors. They have no problem doing household chores and other daily activities.

F6	A3, A4	Seniors have significant control of their lives and there is little that can interfere with their decisions.
F7	P14, P15	Seniors actively participate in community events.
F8	T6, T8	Seniors are confident about finding accurate and useful information.
F9	A2, A1	Seniors are flexible and positive throughout their lives. They live happily and do not worry much.
F10	T16, A12	Seniors are comfortable accepting assistance from others.

Table 4. Main group characteristics

Factor	Group1	Group2	Group3
	N=44	N=21	N=20
F1	.08850	-.12568	.32049
F2	.11806	.35683	.18739
F3	.35715	-.17207	-.78806
F4	-.12242	.10601	-.06915
F5	.48614	.30149	-1.17185
F6	.54192	-1.29074	.14318
F7	-.03253	.48803	-.35015
F8	-.08553	.15604	.26698
F9	.09591	.04766	-.25189
F10	.13898	-.22185	.29364

3.2 Interview analysis

From the 20 interviews, we summarized factors that may hinder technology adoption and others that facilitate learning new technologies. The layers of service participation in autonomy are used to categorize these factors below (Table 5).

Table 5. Barriers and facilitators of technology adoption for seniors

Layers of service participation	Barriers	Facilitators
Co-production	Lack of accessibility, Low-cost performance, Language barriers, Lack of simplicity	Voice-controlled technology and other convenient means, Excitement towards learning, Helpful teaching
Argumentation	Lack of ongoing education support	Friends and family members, Connection with the online community
Experience	Distrust, fear, discouragement, and other negative feelings	Confidence, pride, and other successful feelings
Commitment	Personal stubbornness, "Old-fashioned" ideas	Positive attitude including open-mindedness and eagerness to learn

In co-production, lack of accessibility turned out to be the main problem. Seniors' mobile devices have features such as increasing the font display size, but these settings are deeply hidden in the operating system, and seniors are commonly unaware of them. Additionally, technology terms and slang are unfamiliar to novice senior users, adding difficulty to learning. Seniors can often get free smart devices from social services or used devices from their family members, but learning the skills required to use these devices requires cognitive effort (Fitts, 1964). Although seniors often say that voice-controlled technology, like the Amazon Echo, is convenient to use, their motivation can quickly drop due to a lack of basic technical knowledge required to interact with voice-controlled assistants, including terminology, grammar, and actions. There is definitely a need to design courses that can teach them the fundamental basics of technology in a simple and low-cost manner.

Since it takes time for seniors to gain autonomy in the co-production level, we should aim to design services for the argumentation level earlier. The main aim of designing services for this level is to change the mindset of senior learners and their educators away from viewing technology education as one-off problem-solving. Instead, a more meaningful strategy for

co-production is to grasp a broad understanding of what technology is and what it could be (Shuell, 1990).

In particular, there is a need to design tasks for seniors that vary based on their personal situations. For example, it would be beneficial to make a connection between technology and seniors' relational needs with family or friends in order to enhance communicational autonomy. Meaningful interpersonal interaction already exists, such as a technology learning program with local high school students in which the older adults' relationships with volunteer students were a key motivation for the seniors to continue their participation. However, an issue here was the lack of continuity beyond sporadic interactions. It is noted that service for seniors must integrate a systematic plan for continued learning and personal connections.

The issues in the layer of experience are negative emotions such as distrust, anxiety, and fear surrounding technology. One participant who was a doctor before retirement described the emergence of the electronic medical record (EMR) as a "nightmare for doctors"— a system that hindered the interactions between doctors, patients, and their environment. As Dewey (2005) said, having an experience is to undergo the process where the subject and the object mutually adapt, ending with a balanced relationship which leads to the sense of autonomy in action possibilities. When social interactions are replaced by data and machines, the agent can easily lose the causal relationship of the whole. As noted by McCarthy and Wright (2004), unfolding the invisibility is to create meaningful movement in each step to turn invisibility to visibility by the narrative structure. The implication for design is to break the complexity of technology into an organic flow that helps seniors' learning processes with gradual steps, a clear sense of goals, and action plans that can give the seniors a sense of growth and positivity.

Another observation was the seniors' tendency of viewing technology from a moral perspective, which can be interpreted as a commitment to social values. Some of our interviewees expressed a strong unwillingness to learn technology because they believed technology would replace people and "take jobs away," thus being morally problematic to the community. Others have a positive view of technology, less because it enhances their lives, but more for the greater wellbeing of the community. For example, one person described the future of technology as "something that enhances humanity". Therefore, seniors' commitment to learning technical skills needs to also address the aspect of value-judgment and contribution to the larger society, which will, in turn, empower them with self-esteem, autonomy, and dignity.

4 Preliminary Service Design

Based on the outcome of our research, we are in the process of designing a service with multiple components, including workshops with board games, self-learning toolkits, and technology learning courses for beginners, intermediates, and expert level users. We

presented this idea to Peabody Properties, Inc., a real estate company that runs fifteen senior living homes in Massachusetts, for a partnership to test the design. Our community-based courses and tools will connect seniors with themselves, students' volunteers, community centers, and local libraries. In this paper, we will share the early phase of the design by introducing the models that we have created.

We first synthesized the survey and interview outcomes into three personas with basic information, conditions of technology use, frustrations, as well as pain points in service participation (Figure 1). The personas reveal that the technology education service needs to consider different levels of users: beginners who need to learn technology from scratch, with low motivation and a greater need for support from their peer group; intermediate users who are familiar with the basics, but require a firmer connection between technology and their daily life, and assistance for fixing issues that come up; and lastly, advanced users who are highly motivated to continue self-learning and to help other seniors. With these personas, we developed customer journey maps that show a typical scenario of the current experience analyzed with the four layers of participation (Figure 2). We then mapped the scenarios of a proposed new experience on an applied version of a service blueprint addressing barriers and fears, different stakeholders of technology services, and services and mediums based on various motives (Figure 3).

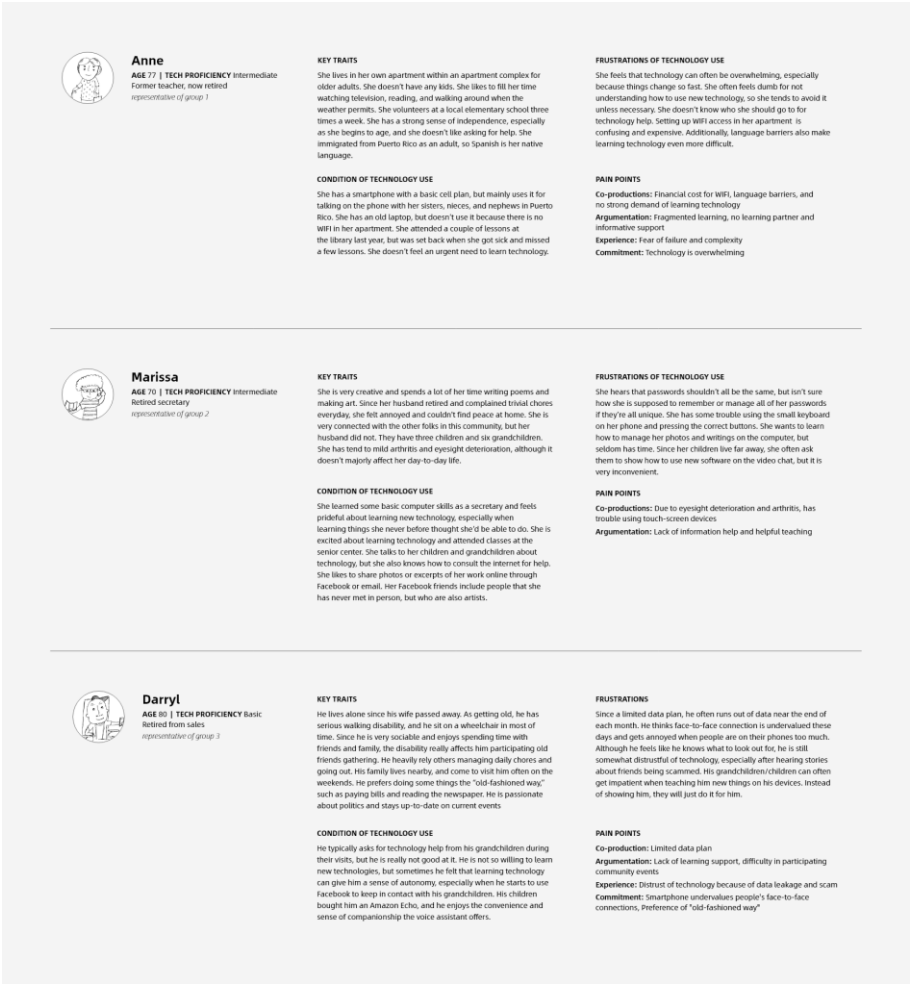

Figure 1. Personas

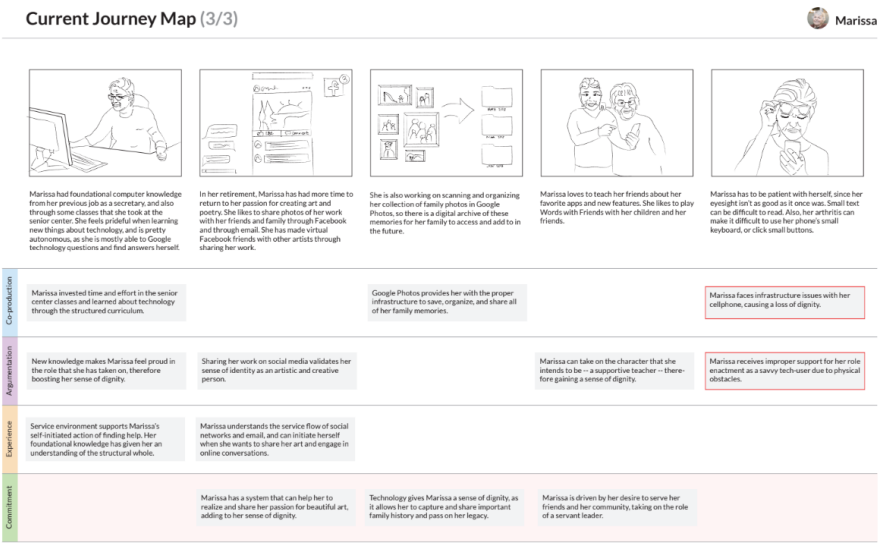

Figure 2. Customer Journey Map



Figure 3. Service Blueprint

After organizing our research findings and brainstorming ideas through these models, we came up with key service concepts for each layer of participation.

- Co-production: we propose “providing control affordances” and “creating a backdoor for seniors” as ways to teach the basics and to provide affordable maintenance tactics. “Control affordances” refers to intuitive interfaces that bridge the analog and the digital and have icons and terminology with clear meanings. A “backdoor” refers to learning how to find additional help, such as customer service or tutorials.
- Argumentation: the strategy of “improving connections” and “promoting participation,” which means teaching seniors communication-oriented digital services through a series of entry-level tasks in order to improve their connections with family and friends. These tasks will be embedded in the participatory workshop for social engagements between the seniors. Learning technology as part of the tasks that older adults are likely motivated to perform will situate technology literacy in a contextual learning process.
- Experience: the main goal is “relieving fear and invisibility” and “enabling self-guided services.” We aim to use checklists to categorize different failures and create board games with visual manual guides to remove anxiety. We will also provide take-home toolkits to motivate self-guided ongoing learning.
- Commitment: We propose “making connections with the community” and “contributing to other seniors,” including group activities, family or local volunteer engagement, and mentorship opportunities for expert-level seniors. Additionally, community-based drop-in services are also proposed to provide regular technology support.

Our service system integrates these service concepts above into three components (figure 4). The first is offline classes with group activities and games, which are provided by volunteer students and community facilitators with teaching tactics. The second is a mobile application and take-home toolkit which supports technology-learning resources and tasks and progress checking. The last is office hours as a “backdoor” for supporting seniors’ urgent needs regarding technology issues, as well as providing another opportunity for them to foster their sense of connection with the community. In developing each of these components, we will focus on basic affordance and control, communicational autonomy, a meaningful and gradual learning process with a clear sense of goals and action plans, and the social value of learning technology to contribute to the community.

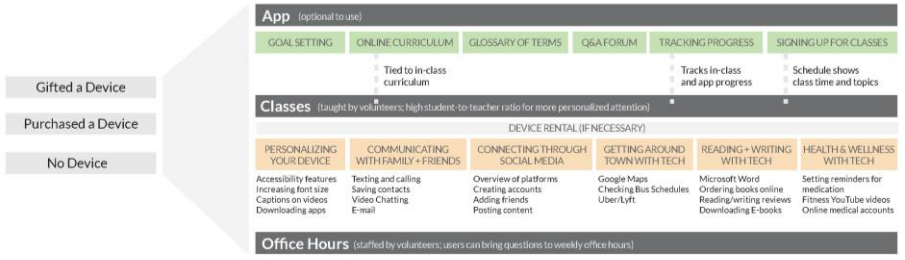

Figure 4. Service System

5. Conclusion

This paper outlines a design research process for a service to improve seniors' technology literacy. We conducted an ethnographic study and used models of analysis and synthesis, using the theoretical framework of autonomy and participation. Sustainable and systematic technology education for seniors needs considerations from communicational, emotional, and communal aspects, in addition to functional support. Humane and reciprocal services will further empower their autonomous living. In the next phase of our research, we will continue to develop the components such as the content of the class, board games, apps, and take-home manuals.

We conclude with three implications for designing a technology intervention for seniors. From the perspective of coproduction and argumentation, there is a need to shift the focus from one-off problem-solving and interface usability to a broader context of why seniors learn technology and how to motivate them. From the perspective of experience, the process of learning needs to be gradual, systematic, and holistic— embedded with meanings that are relevant to senior's everyday life and community engagement. The final aspect is technology literacy's connection to the larger society and humanity. Enhancing the humanity of technology use not only improves the commitment level of service participation, but also facilitates the pluralistic mindsets for effectiveness in learning new technologies.

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Acknowledgements: we gratefully acknowledge the support from Peabody Properties and Boston Public Libraries for recruiting participants. The project is funded by Research Collaborative Grant, Student Grant of Research, Scholarship and Creative Activities from the College of Arts, Media and Design at Northeastern University and the 2019 Social Science Research Grant from Jiangsu Province.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Bio-revolutions: radical change, design cultures and non-humans

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Abstract | This paper explores the interface between culture, design and biology. It draws on methodologies and existing literature on Anthropology and Science and Technology Studies to argue that despite predictions of biotechnologies bringing about revolutionary change in design disciplines, there is a risk of bio-design becoming a 'failed' revolution, similar to that of personal computers. To counter this, we introduce the biomaterial probe, a methodology that enables designers to find potential opportunities, challenges and limitations of introducing living systems in the practice of design.

KEYWORDS | BIODESIGN, BIOART, DIYBIO, SYNTHETIC BIOLOGY, BIOTECHNICAL, BIOTECHNOLOGIES

1. Introduction

In July 2017, Stella McCartney issued a press release showcasing her collaboration with Bolt Threads, a biotechnology company specialised in textile materials derived from naturally-occurring fibres. Prototypes followed a year later of a *Falabella* bag using Mylo, a biomaterial derived from mycelium, the filamentous, branching structure generated by fungi and bacterial colonies. A scaffold of corn starch is used to provide sustenance to mycelium, and once the filamentous structures have grown and depleted the starch, it is put in an oven resulting in a compact, dense fibre. Mycelium-derived materials have become a standard bearer of the biotechnical revolution in design, with designers and technologists developing commercial applications of the biomaterial, ranging from packaging to furniture to textiles.

The cultural semantics of the Mycelium Falabella is worth exploring. The Falabella was introduced in Stella McCartney's 2010 winter collection, modified and updated regularly since gaining a fashion item status among actresses, socialites and so-called 'it-girls'. Mycelium-derived materials gained popularity with the inclusion of Mycotecture in the 2014 MoMa exhibition 'Design and Violence' curated by Paola Antonelli. The piece, developed by artist and teacher Phillip Ross, is an arch assembled of bricks produced by mixing sawdust with Ganoderma lucidum, a fungus species that metabolises and transforms the wood into a fibrous material (Antonelli et al., 2015). The Mycelium Falabella was also produced to feature in an exhibition, this time organised by the Victoria and Albert Museum in 2018: *Fashioned from Nature* (Ehrman and Watson, 2018).

Four years apart, the use of the material in both pieces signals an evolution in its cultural status: from a promising material to desirable product inscribed in a wider narrative of environmentalism and ethical consumption, signalling an innovation cycle that heralds a long-awaited revolution triggered by a design-led 'bio-economy'. Here we argue that although mycelium and others offer clear technological improvement over traditional technologies, there is a risk that the long-heralded bio-economy and bio-design results in a failed revolution. We draw an historical parallel to the development and evolution of personal computers to suggest that the potential of biotechnologies for radical change depends on the capacity of designers to give them meaning: to construct frameworks of reference and present their artefacts in culturally meaningful ways. Doing so requires slowing down and detaching from explorations that begin with a logic of substitution, in which living systems are scoped as the 'green' alternatives to 'dirty' technologies. We present biomaterial, provisional strategies and tactics that enables designers to explore the potential opportunities of the design of living matter. We explain the use of biomaterial probes in an open-ended exploration, revealing the way different actors and non-humans, ranging from institutions to microorganisms, align to facilitate or block design.

2. Living matter and design of the living

Development of mycelium and other similar materials is inscribed in a wider discourse of *biotechnical* design (Ednie & Brown, 2013). The last decade has seen a growing body of theoretical and creative work, a *biotechnical discourse*, which operates on the premise of using living systems as part of the design and fabrication of artefacts. The biotechnical discourse is prefigured by existing traditions — there is, for example, a long-standing tradition of biological analogy in architecture that stretches from Ancient Antiquity to the Renaissance, to Modernism (Steadman, 2008). Caroline Van Eck (1994) suggests there is a continuous theme of imitation of nature that, she proposes, can be described as an alchemist's quest: a desire to transmute the products of technology — dead matter — into living beings. The alchemist quest can be traced throughout history, from Classical antiquity and the Renaissance's use of living systems as source of eternal principles of beauty and order; to the way that *On Growth and Form* influenced the work of Mies Van Der Rohe, Alvar Aalto and Frank Lloyd Wright. The biotechnical discourse however stands apart in its aspiration to use biological systems directly, as a form of *living matter* (Catts & Zurr, 2014; Ednie & Brown, 2013; Telhan, 2016).

To understand biotechnical design, it is important to review the evolving narrative of biotechnologies themselves. Contemporary discourses in biotechnologies, led by synthetic biology, aspire to reduce the complexity and randomness of living systems (Breithaupt, 2006). Broadly speaking, there is an idea of reducibility connected to notions of parts, systems, and wholes, that are related to the modification of existing organisms and the creation of entirely new ones (Schyfter, 2011). In parallel, citizen and enthusiast movements have engaged with the tools and methods of biotechnologies, infusing them with an ethos of democratization. Movements like DIY-Bio have made working with living systems widely available to non-experts (Seyfried, Pei, and Schmidt, 2014; Meyer, 2014). The combination of approaches and traditions around biotechnologies has motivated the emergence of a biotechnical discourse in design. The development of biotechnical design has created the conditions to trigger substantial opportunities for innovation and for a nascent bio-economy sector in design. Design-led efforts are underway to produce zero-emission bricks through bacterial fermentation (Dosier, 2011); bacterially-augmented concrete that repairs itself (Jonkers, 2007; Jonkers et al., 2010); alternative industrial methods to produce dye through bacteria (Chieza, 2018); and faux-leather synthesised through bacterial metabolism (Bain, 2017). These initiatives join a much-hailed 'biological' revolution that is often compared to the 'garage movement' of personal computing in the 1970s (Landrain et al., 2013; Peccoud, 2016).

2.1 Technocentrism and substitution

Biotechnologies make possible new materials, often integrating living and semi-living matter, which offer considerable advantages over existing technologies. These new technical possibilities, however, are also a good opportunity to reflect on whether talk of an upcoming revolution is warranted, and to what extent the current cultures and practices of design support radical change. If we accept the proposition that living matter represents a fundamental change from any form of material or technology ever used in design, then there is a risk of understanding the new using the framing of the old.

A relevant analogy here is *horseless carriage,* the name given to cars when they had been first released to the consumer market. As a radically new form of technology, users would often refer to cars in reference to horse-drawn carriages, a form of technology they were familiar with. Cars were similar in that they fulfilled the same function, acting as a form of transport to get users from point A to point B. Used as an analogy, the phrase describes the "shifting perception of a practice as it transforms in relationship to a new technology" (Chastain et al., 2002, p.239)

2.2 Bio-revolutions

The risk of framing the new using the terms of the old is illustrated by the development of personal computers in the 1980s and 1990s. Bryan Pfaffenberg (1988) suggests that innovators are often constrained by social processes. Following a social constructivist understanding of technology, he rejects the notion that technological innovation is driven by market demand and, instead, suggests that for technologies to 'succeed' in the market and be adopted by large numbers of people, innovators need to construct *meaning-frameworks*: a narrative that present their innovation as responding to a need that didn't exist before. Pfaffenberg draws on the notion of the heterogeneous engineer to suggest that innovators do not only manipulate technology, but also change the social world in which the innovation is meant to be inscribed. In doing so, they create new frameworks of social roles, meanings and values.

Pfaffenberg analyses how the success of the personal computer in the 1980s was influenced by the meaning-framework of its creators. Early innovators hoped personal computers would "equalize opportunity for all races, creeds, minority groups, social classes — even help save endangered species" (Bunnel quoted in Pfaffenberg, 1988, 41), influenced by disparate movements such as phone phreaking and the hacker ethic. Phone phreakers emerged in the late 1960s as a subculture influenced by the counterculture movement whose members counted technically minded people sharing an aesthetic interest in the complexity of phone networks. One of the most visible members of the movement, Captain Crunch, famously epitomised the movement when he managed to break into the international phone network to connect a call, made from a phone booth in the California Livermore Valley, and that passed through numerous exchange centres including Tokyo, South Africa and Brazil before reaching the phone booth next to him. The motives of Captain Crunch coincided with those

of another subculture emerging in parallel to the phone-phreakers, the hacker movement. The Captain wasn't so much interested, according to his own account, by the ecstasy of gaining control of a technical system; his motives were driven by a desire to learn about a system. Breaking into the system, however, was a transgressive act. He wanted to point out to 'Ma Bell', the colloquial name for the Bell Telephone Company, the many issues and weak points of their telephone network. He didn't want to "screw Ma", he wanted to "show Ma Bell how good I am. I don't want to screw her, I want to work for her".

The motivations of Captain Crunch — a wish for recognition and approval mixed with an aesthetic pull to technology — would be reformulated in *Computer Lib*, the 1974 publication that came to epitomise the hacker ethics. The author, Ted Nelson, makes an argument to demystify computers and promote a form of computer literacy, enabling laypeople to familiarise themselves with the principles of hardware and software operation. For Nelson, the way that computers developed and were understood by the public had a highly political dimension, insisting on the need to decentralise computers, a technology that had been centralised by big corporations such as IBM. Phone phreaking and the hacker ethics were highly influential in the development of early personal computers. Steve Jobs and Steve Wozniak, co-founders of Apple, famously assembled and sold 'blue-boxes' from their dorm: electronic devices that enabled their owners to break into the telephone system in the same way that Captain Crunch had done a few years before.

The meaning framework of phreaking and hacking cultures enabled early innovators to frame the personal computers in terms of a democratization of technology; they would make accessible to 'the people' tools that had so far been used for commercial gain and military purposes. Despite the hopes that the new form of technology would promote creativity and autonomy, market pressures and corporate interests meant that personal computers would end up targeting white-collar workers, professionals, and technical specialists, sectors which had already been benefited by older forms of computers. Later innovations, such as networking technologies, would consolidate this trend by making 'personal' computers less so, connecting them to larger (and often corporate) mainframes and servers. More contemporary advances, such as the much hailed 'cloud computing', would seem anathema to Nelson's cry to move away from centralisation and to hand control back to the people.

2.3 The living and radical change

Historical parallels are always imperfect — there is a danger to try and see forwards in the same way that we narrate in retrospect. It is, however, possible to argue that biotechnologies risks following the same path that personal computers. On a superficial level, both technologies involve innovations that are not fundamentally radical, but that instead repackage and make more efficient existing techniques and tools. There is a deeper connection between biotechnologies and personal computing, operating at the level of their design cultures.

The genealogy of biotechnology, and especially of synthetic biology, is often contested but practitioners in the field often locate the development of the personal computer and digital technologies in the 1980s and 1990s as a foundational point, inheriting their ideology and meaning-framework (Cameron et al., 2014). A good example is the name of the discipline itself. Drew Endy, Rob Carlson and Roger Brent, often identified as the 'founders' of synthetic biology, often referred to their initial efforts as an 'open-source biology', describing it as effort to establish a culture of sharing among developers. The design principles of synthetic biology — abstraction, standardisation and modularity — are often explained by drawing analogies to the way computer engineering isolates hardware (the substrate that enables computation) from software (the set of instructions that describe calculations, and how these should be interpreted). The aim is to generate design approaches that require no expert knowledge, in the same way that the personal computer made it possible for some people to develop software without specialised knowledge of computational logic at board level.

The slippages in drawing analogies to personal computers generate also a fluid exchange of meaning-frameworks and conditions innovation and action of biotechnologies. A good example is the arsenic biodetector project developed initially by the 2006 University of Edinburgh iGEM team, a student-led competition that has become an unofficial conference for Synthetic Biology. The project aims at producing a low-cost, easy to use detector for areas known to be prone to groundwater well pollution in Bangladesh. It involves an arsenate-responsive promoter which, when inserted in bacteria, enables expression of genes that change the pH of growth media, providing a colour-coded signalling of arsenic presence. In a close parallel to the phone-phreaking and hacker culture, the narrative of the project is suffused with references to a 'democratisation' of technology and a commitment with marginalised communities.

Despite good intentions, the arsenic biodetector is a good example of the risk that biotechnologies run of using counterculture as little more than a punchy slogan. Cristina Agapakis reminds us how the problem of arsenic contamination stems from humanitarian response efforts in the 1970s to provide water for Bangladesh. The design of the tube-wells, combined with political and social issues, ended up generating a public health catastrophe. Although the low-cost bio-detector would be, at first glimpse, a welcomed tool and a potential step towards solving the problem of arsenic contamination, it is also problematic in the way that it is framed and the ideology that animates it. Agapakis writes:

> "inexpensive diagnosis of arsenic contamination will not be able to address the underlying problems of water infrastructure and management in Bangladesh (…) this history demonstrates that looking at complex problems through a narrow, reductionist lens can lead to harmful designs with dangerous consequences." (Agapakis 2014, p.125).

Just as the personal computer was intended to empower marginalised communities, projects like the arsenic biodetector risk becoming technologies that offer some advantages over existing technologies but which stop short of fulfilling their 'revolutionary' potential as they end up targeting the same users and applications than their predecessors. From an innovation perspective, the slippage between meaning-frameworks encourages narratives of substitution and remediation, in which organisms are used as enhancement in existing processes. It also influences a design culture driven by technical possibility, having as point of departure the current state of the art in the laboratory and working backwards from there to try and fit a context of application. The combination of a substitution logic and a technocentric exploration makes it more difficult to imagine a path for these new technologies to influence radical change in design disciplines and are the implications and challenges these might bring.

3. Biomaterial probe

The example of the arsenic biodetector suggests that are several factors that have promoted the slippage between meaning-frameworks and design cultures between the personal computer and biotechnologies. From the perspective of designers however, one main issue is imagination — given the fact that designers often have limited knowledge of living systems and the techniques to work with them, their capacity to imagine their possibilities are constrained to substitution and remediation of existing technologies.

The *Bio-material probe* is a set of design tactics intended to provide a means of exploring a design space, rather than to enable a design context which, in a more traditional context, would entail working towards specific objectives and producing tangible outcomes. Instead, bio-material probes provide the setting in which it is possible to engage with biological systems from a design perspective. The term is inspired by the work of William Gaver, Antony Dunne and Pacenti (1999), and by *derives,* a technique promoted by the Situationist International to highlight the influence that geographical environment, and especially urban settings, have on the feelings and behaviour of people (Ford, 2005; Debord & Knabb, 2014). *Dérive*, translated literally as drifting, consists in suspending normal motivations to movement in cities and, instead, allowing themselves to be *attracted* by the terrain, operating as a sort of probe that is being influenced by the forces at play in urban environments. In the context of the Situationist movement, *dérive* emerges as a reaction against the average experience of cities, which they perceived as limited. The *dérive* is intended to *throw* people into the cities, allowing change to force them into situations they would otherwise rarely encounter (Debord, 2006).

Likewise, *bio-material probes* are intended to *throw* designers in the context of biological work, generating situations where assumptions and the status quo can be challenged. As an active element, they give designers a reason to explore biological systems. They are not oriented to practical applications, but rather to exploring the context, activities and

economies involved in the work with biological systems. A good analogy to describe the bio-material probe is to characterise it as a recipe for how cakes are made. It enables understanding the context, materials, technology and other assemblages which enable the cake to be made. It doesn't, however, provide a prescriptive recipe for doing a specific cake. It enables a practitioner to locate themselves in the context of biological work and, as a methodology, provides purposefulness without being tied to a specific design outcome.

3.1 Biomaterial probe in action: Bacterial Assemblages

Bacterial Assemblages is a project that explores notions of self-organisation and complex systems by engaging with form generation in bacterial colonies (see Figure 1). An earlier exploration proposed the State-Space of design, a framework to approach biological systems in design contexts. The term is derived from its use mathematics to describe the configuration of dynamic systems in terms of key variables, and a set of equations that describe their behaviour and interconnections. A state-space representation consists of a graph whose axes are the key variables, and where the *state*, or the possible configuration of the system at any point in time, can be represented as a vector.

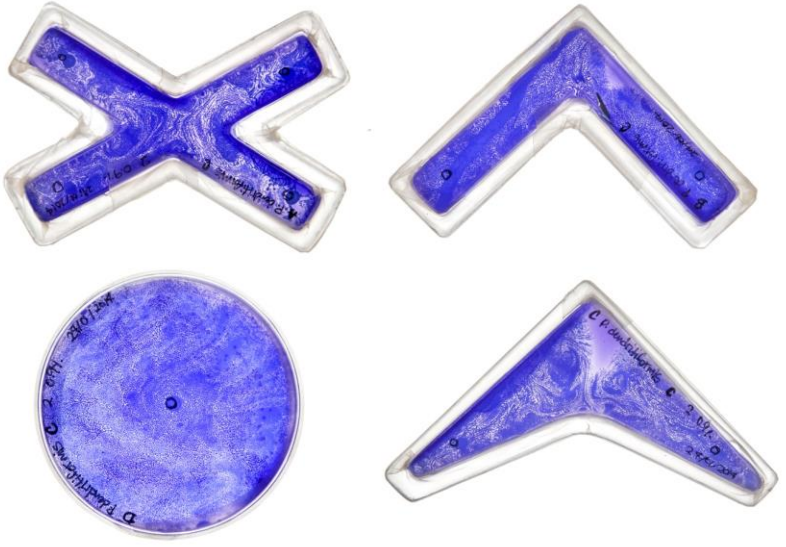

Figure 1. One of the experiments developed as part of Bacterial Assemblages. Petri dishes are custom made to influence the physical 'state-space'. Chemical conditions are altered by changing the composition of the growth medium. The growth patterns are developed by Paenibacillus dendritiformis C morphotype, Paenibacillus vorte, and Paenibacillus dendritiformis T morphotype

We defined three state-spaces which influence biological form: cellular, chemical and physical. The cellular state-space is defined by the boundaries of the cellular membrane, and it is used to define all the processes that take place within it, including, for example, DNA transcription and translation, as well as protein production. The chemical state-space refers to conditions in the environment, such as pH levels and nutrient concentration, which are thought to trigger specific sections of the genetic code that result in the development of form. Finally, the physical state-space includes the physical forces and energy within the environment and that are often confined by the agar plate such as the temperature of the growth environment, and the physical structure of the agar itself.

Bacterial Assemblages suggested that, in addition to the original state-spaces, there are also contingent aspects of working with living systems which are crucial in accounting for the interaction between living systems and human designers and that had an important effect on the design outcomes that result of this exchange. The original model of three state-spaces is expanded to include three further spaces of contingency: *spaces of practice, cultures of crafting* and *social interactions. Spaces of practice* refer to the way that the spatial configuration of workspaces and tools conditions the development of activities, in the way they embody a specific script that refers to different frameworks of knowledge. *Cultures of crafting* concentrate on the frameworks and techniques that enable things to be done within disciplinary boundaries. *Social interactions* refer to the governance of spaces that enable certain things to happen, and which depend on exchanges between individuals.

Figures 2 to 4 show some of the diagrammatic strategies used in *Bacterial Assemblages* to reveal and analyse the spaces of contingency. The influence of institutions, epistemologies, spaces and social interactions are difficult to trace directly to the development of bacterial form, like the one shown in Figure 1. These diagrams, however, operate as a form of provisional cartography

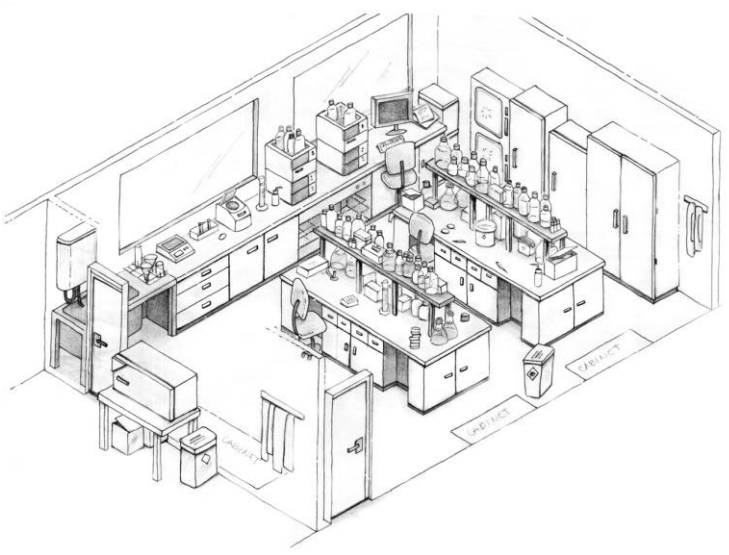

Figure 2. Isometric diagram of the main microbiology laboratory used in the exploration.

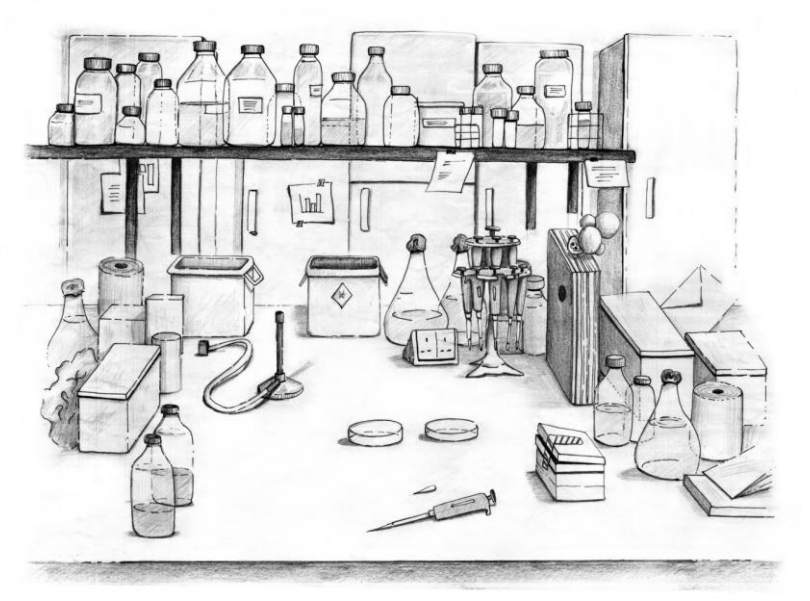

Figure 3. Composite diagram sketching working area.



Figure 4. Photographic study of the hand choreographies involved in pouring agar into a plate

4. Conclusions

More than a prescriptive framework for design, biomaterial probes are a suggestion than there are new ways of engaging living systems beyond remediation and substitution. In keeping with the lineage of derives, the methodology is intended to produce situations where prevalent assumptions and order can be questioned.

Engaging then with biological systems from a design perspective requires a form of engagement that challenges and upends instrumentality. The notion suggests not only a more thoughtful approach when integrating living systems in the process of design — it suggests an entirely different form of design. *Bacterial assemblages* suggests that designing with living systems involves engaging with a thick mesh of non-humans that go beyond the organism itself, and that extends to a number of encounters between the designer and materials, physical spaces, institutions and other researchers. The extended set of interactions involved in designing with living systems suggests that the boundary of the design space — the things a designer needs to engage with in working with living systems — expands exponentially. The living system, and the mesh constituted by the design assemblage, are hyperobjects, to borrow the phrase coined by Timothy Morton (2013).

Designing in a hypercomplex environment involves doing so without a clear idea of the outcome in advance. In this situation, there is a need for instruments that perform a cartographic function, in that they assist to navigate through an unknown design space. The bio-material probe performs this function. They constitute maps which are in constant change, drawing and redrawing their boundaries as the exploration progresses and providing a way of reading into an unreadable situation. At the same time, bio-material probes represent conversation starters — a way of developing a language to engage with non-humans.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Cognitive Ergonomics Components for Analysis of User Interface in Healthcare Industry

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Abstract | This paper shares a collaborative research in the field of User Experience and Design for Healthcare. In particular, it explores methods of Cognitive Ergonomics applied to analyze User Interfaces in healthcare industry. Specifically, the interest lies in analyzing cognitive aspects of interaction and the way it impacts user experience in terms of efficiency in perception and decision-making. Cognitive aspects of interaction were approached via the key components of Cognitive Ergonomics identified through a thorough literature review and composed in a canvas based on the sequence of mental processes occurring during cognitive interaction. The analysis of the User Interface described in this paper represents one of the tests made to check the validity and the potential of the proposed method. The paper concludes with a discussion on how the method contributes to designing affordances and on possible future developments and design in healthcare industry.

KEYWORDS | HEALTHCARE, COGNITIVE ERGONOMICS, ANALYSIS, INTERACTION, USER INTERFACE

1. Introduction

The research has started from an observation that designers should consider more and more often cognitive side of interaction due to an increased complexity in design projects they are working on, that include social, economic, and cultural contexts, affordances, technologies, etc. Therefore, there is a growing need in tools that would support designers in such scenarios. Literature and methods of Cognitive Ergonomics provide the necessary expertise to propose such a tool for an analysis of complex cognitive tasks (Endsley, 1995). In parallel, the Healthcare sector was chosen as a context of application of such methods, as the complexity of user experience and interaction is notably high while the need in new designs is rising. This observation has gained significance after conducting a User Research at a hospital in a Neonatal Intensive Care Unit, where babies born premature receive their first care. It was noticed, that doctors have to perform their job in a context that seems to be far away from 'ergonomic': multiple screens, tubes and other elements located in a manner that neither support naturality of gestures nor the ease of interpretation of the information. Medical equipment at Intensive Care units is characterized by a high quantity of symbols and signals, both visual and audio, and each of these symbols are crucial for patient safety. The reason for conducting a research on Cognitive Ergonomics and integrating its methods into industrial design practice was to provide such a tool that would guide designers in these complex contexts and to ensure that their designs satisfy the needs of their users (e.g. doctors and patients). After a thorough research on Cognitive Ergonomics, a set of Cognitive Ergonomics components was proposed (Zolotova, 2019) with a hypothesis that these components can constructively contribute to designing cognitive aspects of interaction by systemizing the analytical part of the design process and, thus, helping to achieve a cognitively ergonomic solution. The components and the hypothesis will be described in the paragraph 'Methods'.

A parallel part of this research work was specifically dedicated to observing the developments in the healthcare sector, highlighting the tendencies in user behaviors and design opportunities. The outcome of this research phase was the identification of four trends in the future healthcare (AA.VV., 2014, Tsekleves & Cooper, 2017, Giambattista, 2017). These trends cover patients' ability to make independent decisions related to their health, new ways of delivering healthcare, and novel technological achievements that improve medical tools. A more detailed description of the trends will be provided in the paragraph 'Context'. Paragraph 'Results' will describe an example of analysis conducted using the method of Cognitive Ergonomics Components. The method was applied to evaluate the efficiency of user's perception and decision-making in interaction with the design of a User Interface of a Neonatal Transport Incubator. The paper concludes with a discussion on possible contribution of this method to designing for the healthcare industry.

2. Context: Trends in Healthcare

Traditionally medical equipment was seen as a tool for delivering acute care but, due to various influences, the medical equipment now also includes psychological aspects. In recent decades, the concept of health is shifting from the idea of 'absence of disease' towards physiological and mental equilibrium and wellbeing (Huber et al., 2011). Moreover, as the healthcare industry develops, the more definitions appear to satisfy the needs of each particular scenario or context (Leonardi, 2018).

The future potential of design for health can be explored, for example, through the prism of traditional design disciplines such as architecture, communication, product, service, and interaction, while covering key areas of health, such as acute, chronic health and aging are good for the public (Tsekleves & Cooper, 2017). Theses authors have applied coding to the analysis of data and came up with a list of challenges, opportunities and new design trends in healthcare. According to their research, the trends are self-management healthcare, person-centric healthcare, holistic healthcare, community healthcare, health-promoting/preventative care.

Parallel to that, PSFK, a company that applies research to study user behaviors in various markets, has published a report on 'Future Health' (AA.VV., 2014) outlining four trends in health-related products, such as Behavioral Nudge, Empowered Patient, Orchestrated Care, and Augmented Treatment. By studying these two groups of trends and tendencies, it was possible to notice similarities between them. Particularly, both 'health-promoting/preventive care' and Behavioral Nudge speak for a need in products/services that would shift people's behavior towards a healthier lifestyle; 'self-management healthcare' and Empowered Patient speak about people being more informed and able to make decisions related to their health, and Orchestrated Care and 'community healthcare' describe products/services able to deliver new models of care. Eventually, Augmented Treatment intends with 'augmented' the new technologies that improve medical tools. In total, each trend provides the user with certain objectives and goals to pursue and proposes new user scenarios that would require new behaviors and learning to interact with new products and services.

Behavioral Nudge

'Nudge' is a concept in behavioral science, which uses indirect suggestions as ways to influence the behavior and decision making of groups or individuals (Wilk, 1999). The need

in ‘nudge’ lies in the fact that people tend to act against their interests (Koster & Van Der Heijden, 2015), and therefore nudging techniques aim at people making decisions to their advantage (Parkinson et al., 2014). At the PSFK, they have noticed a growing need of people in acting in a self-beneficial way, which would lead to a growing number of products satisfying this need. In the field of healthcare, self-beneficial behavior is considered the one that leads to both mental and physical health in the long term, which would therefore possibly exclude the acute care and would call for preventive methods. Tsekleves and Cooper (2017) also mentioned a trend in health-promoting/preventative care. Regarding Product Design, for Behavioral Nudge, reference is made to those tangible and intangible artifacts which call users to consciously manage their care, both in the prevention and management phases. Such devices tend to favor the characteristics that involve users’ emotions: embracing a holistic approach to a problem, such devices offer solutions that are functional but at the same time pleasant (Foqué & Lammineur, 1995).

Empowered Patient

Empowerment is defined as “a process through which people gain greater control over decisions and actions affecting their health” (Kickbusch & Nutbeam, 1998). The WHO defines patient empowerment as a process where patients understand their role, possess the knowledge and skills from their health-care provider to perform certain tasks in an environment that recognizes cultural differences and encourages patient participation. This is possible due to the use of technologies that facilitate access to information, such as the Internet, peer-to-peer sharing, health devices, etc. However, having ‘power’ is also a responsibility, that not every patient is ready to take. The phenomenon also includes the questions of patient’s safety. The products for Home Care have undergone a sudden increase both in terms of numbers and technical complexity (Tosi et al., 2016). Some of these medical devices are introduced on the market as consumer products that allow users to manage their health care in a more convenient and independent (also economically) way. The migration from hospitals to home is due to the increase in costs of healthcare, the lack of suitable facilities and qualified personnel (Chamberlain, 2015). As a result, the range and complexity of medical devices used outside of formal health institutions are on the rise. The risks associated with the malfunctioning and/or failure or incorrect understanding of the methods of use of the interface, of the control and adjustment elements, of the assembly/activation sequences, etc. intensify (Tosi & Rinaldi, 2015). This trend raises questions on how designers can ensure that the product is used exactly in the way it was supposed to be used.

Orchestrated Care

The scenario of this trend describes the products linked to the world of the Cloud, that use wearable and mobile technologies able to trace in a holistic way the people’s lifestyle. The healthcare sector receives more live data from apps and devices, and medical decisions will be likely made not according to the patient’s ‘feelings’ that might be wrongly interpreted but

based on real data, however, the issue will be to read it correctly. According to PSFK (AA.VV 2014), care will be delivered based on the preferences of the patient, and the relationship with the physician will become more virtual. The pervasiveness of the technological connection, the connectivity of technological supplies, the ever-increasing bio-compatibility of interfaces, these are the trends allowing delivering personalized care. Examples are all the design experiments that exploit the Internet of Things (IoT) technologies for continuous tracking and dialogue with healthcare facilities and practitioners. The design focus here is to identify user needs to provide the personalized care (Chaudhuri & Lillrank, 2013). The tools allowing to conduct deep user research will be welcomed, as they would serve as a base for creating new niches in the market of the healthcare sector.

Augmented Treatment

This trend includes high-performance technological tools, such as those for visualization using Augmented Reality and Virtual Reality, 3D printing techniques for creating implants and prostheses, and also everything related to Assistive Technology. AR/VR in the medical field is used for the surgical training, planning of operations, for open surgery sessions, endoscopy, and radio-surgery (Riva, 2002). Product designers usually prefer to work with 3D printing, exploring the properties of the materials to design prostheses and braces, as it allows adjusting them to the patient's needs, offering substantial benefits on waiting times and costs. It also opens opportunities for bottom-up solutions within Do-It-Yourself logic. The concept of parametrization and geo-localized production opens a way to new scenarios for the design of social innovation. To sum up, scientists, engineers, designers, makers are exploring the opportunities provided by the new technologies to either improve the existing medical tools or to solve economic issues related to healthcare. IT together with 3D printing technologies empower people to apply their knowledge and competence to solve the problems that otherwise would have remained ignored or inaccessible.

3. Methods: Cognitive Ergonomics Components

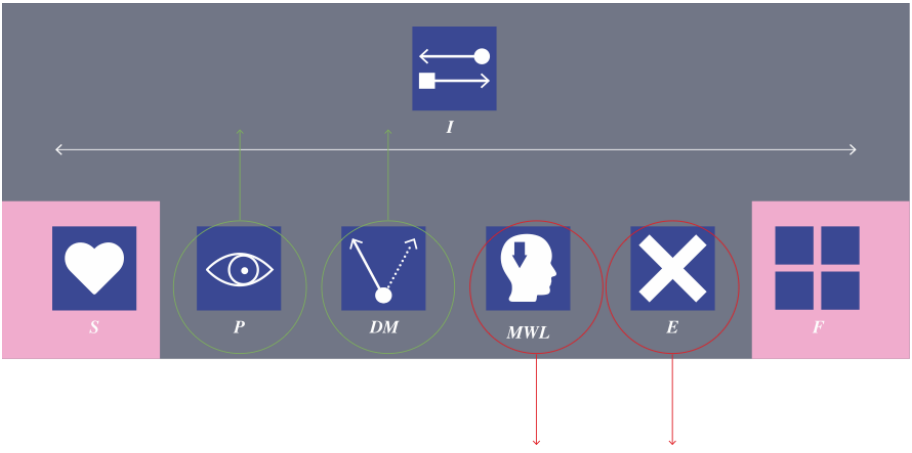

Figure 1. Cognitive Ergonomics Components: Interaction (I), Subjectivity (S), Functionality (F), Perception (P), Decision-Making (DM), Mental Workload (MWL), Error (E). The scheme represents a balanced interaction where P and DM are high and MWL and E are low.

Cognitive Ergonomics was chosen as an approach to cognitive aspects of interaction in its complexity. The aim was to find a way in which it could provide a valuable contribution for industrial designers to analyze and design complex cognitive interactions.

The research findings are Cognitive Ergonomics components composed to describe sequence of cognitive interaction (Figure 1) (Zolotova, 2019. In this paragraph, brief extracts of the theoretical grounding will be provided that would explain the methods applied to the analysis of best practices in Design for Healthcare.

Cognitive Ergonomics has three concepts that are considered of importance in this research: Distributed Cognition (DCog), Activity-System, and Situational Awareness (SA). DCog sees cognitive processes as a result of relationships between internal mental representations and the external environment (Hazlehurst, Gorman & McMullen, 2008, Hutchins, 1995). Meaning that people's cognition is not only contained in the head but distributed in the environment. Activity-System is a minimal unit of analysis of human actions where an activity means the engagement of individuals towards a certain objective (Engeström, 1987). Meaning, that every interaction is significantly defined by its goal. SA describes how people perceive and comprehend elements in the environment and how they project them to the near future (Endsley, 1995, 2017, Endsley & Garland, 2000). These three concepts have framed the understanding of cognitive interaction processes, describing where it occurs

(DCog), what is the reason for individuals to engage in interaction (Activity System), and how people perceive the environment and act in it (SA).

Two books gave key insights that eventually led to proposing the set of Cognitive Ergonomics components: "Ergonomics, project, product" (Tosi, 2005) and "Cognitive Ergonomics" (Di Nocera, 2011). Di Nocera focuses his attention on such concepts as interface, error, mental workload, automation, decision-making, situation awareness, usability, etc. While F. Tosi names the following components of Ergonomics: 'physical' ergonomics, 'User-Centered Design'(user needs), and 'New Human Factors' (emotions and other 'subjective' user needs). Further reading on these concepts has eventually led to the definitive set of the 'components'. Specifically, a big contribution gave the scheme of Situation Awareness introduced by M. Endsley, who is one of the major authors in Cognitive Ergonomics (Figure 2).

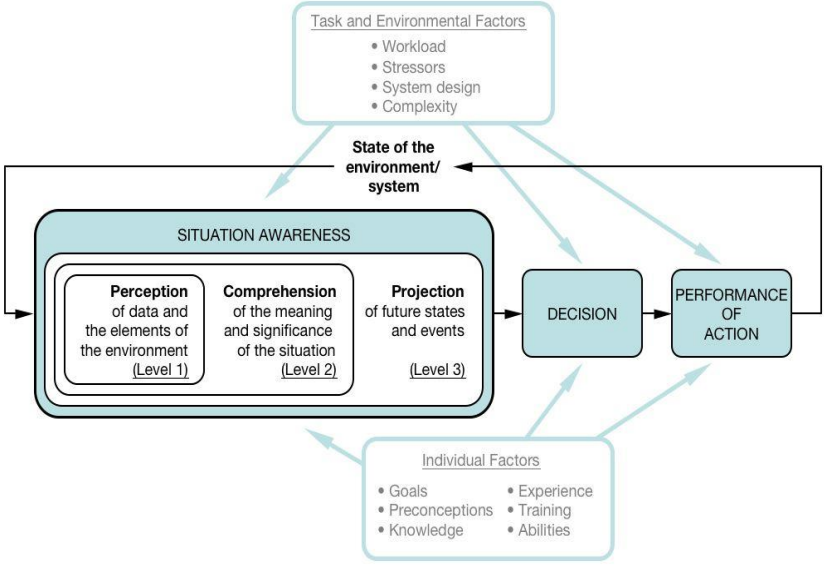

Figure 2. Situation Awareness model. Endsley's model of SA. This is a synthesis of versions she has given in several sources, notably Endsley (1995) and Endsley et al (2000).
Source: Public Domain, https://en.wikipedia.org/w/index.php?curid=11319693

The identified components are subjectivity, functionality, perception, decision-making, mental workload, error, interaction. Figure 1 shows how the components are interconnected. Each of the components has its definition and its location on the scheme, based on the relevant books and articles in the field and mentioned above. Below, there is a summary of each component's definitions.

'Subjectivity' (S) describes the user, the 'persona' (Cooper, 1999), his/her objectives and desires. Subjectivity is the starting point of analysis and it describes the goal of interaction. Just as the Human-Centered Design approach (Norman, 2013) places a person at the center of the design process, this model is based on the same principle and starts from the needs and desires of people. Taking into consideration the Activity-System model (Vygotsky, 1980), the analyzed person has to be associated with his/her goal in this interaction in order to frame clearly the analysis.

'Functionality' (F) describes the environment where interaction takes place, the products/elements, signifiers (Norman, 2008), functions involved in interaction that are significant for achieving the goal. 'Functionality' refers to both actual functions and those perceived by a person (Gibson, 1966). 'Functionality' includes issues related to the compatibility between the physical characteristics of users and the constraints imposed by the context in which they operate (Tosi, 2005). Therefore, the term 'functionality' describes all the elements/products, both physical and perceived, that serve to achieve the goal set by the user as well as the environment in which s/he operates.

'Perception' (P) is the first among mental processes to be analyzed (Endsley, 1995, Endsley & Garland, 2000). Perception is the interpretation of incoming sensory information and is activated through vision, touch, smell, taste, sound (Schacter, 2011). Both physiological and psychological stimuli are taken into consideration for the analysis. The key for the understanding of 'perception' lays in Gestalt psychology that sees an object as a whole, through 'patterns' and 'configurations', rather than its components. The knowledge possessed by the user influences the way people perceive and interpret the incoming information (Goodwin, 1994). In total, the component 'perception' describes the process of sensory and cognitive perception and interpretation of the elements involved in the interaction.

'Decision-making' (DM) describes the moment of choosing among alternatives (Patel, Kaufman & Arocha, 2002), an action. It is the second of the mental processes to be analyzed according to the adopted Endsley's (1995, Endsley & Garland, 2000) scheme. A decision made by the user inevitably results in his/her action, and it was therefore decided to unite the decision-making process with the eventual actions since only actions are visible to the observer without any specific equipment and thus, countable. In this research, the idea of Kahneman and Tversky (1974) of 'heuristics of judgments' is adopted which implies that people tend to make decisions based on the available knowledge and similar examples in their memory.

'Mental Workload' (MWL) is the mental work perceived by the user, it serves to describe the moments of a poor performance of an operator, it includes moments of stress and of long-focused attention (Parasuraman, 1998). 'Mental workload' affects all the other mental processes in an either effective or ineffective way (Di Nocera & Pasquali, 2011). The division in 'effective' and 'ineffective' mental workload serves to evaluate the quality of the overall interaction process.

'Error' (E) describes actions that mismatch the goal of interaction and/or an ill-suited result. Avoiding human error is especially important in healthcare (Carayon, Xie & Kianfar, 2014). There is a tendency to work on error tolerance since it is assumed that error is a part of human nature (Patel et al., 2011): to include a possibility of error in the interaction could decrease psychological pressure on the user. In this research, 'errors' are understood as errors in action (by the user), in perception, communication, and selection (Di Nocera 2011). Accepted methods to observe and identify errors are: naturalistic (observation and noticing errors made in a natural way – slips and lapses) and questionnaires.

'Interaction'. Cognitive Ergonomics studies the interaction between human and complex technological systems with an aim to avoid failures (Ferlazzo, 2005). However, in the design field, interaction is rather seen as User Experience (Norman, 2005) that includes psychological, emotional aspects of interaction. 'Interaction' (I) stands for both physical and cognitive interaction occurring between the user and the product/system and includes all the above-mentioned components in it.

Figure 1 represents a scheme of how the components could be unified into a formula that would work for the designers. It describes interaction (I) between human (S) and an environment (F) through 'perception' (P), 'decision-making' (DM), 'mental workload' (MWL), and 'error' (E). The low ability to perceive (P) would negatively impact the ability to make decisions (DM), that would in its turn contribute to the rise of 'mental workload' (MWL) and, eventually, to the quantity of 'errors' (E) (Figure 1). The steps that a designer should take to perform an analysis of interaction by following the scheme are:

- to describe the 'subjectivity', i.e., the user and his/her objective.

- to identify the 'functionality', i.e., all the necessary elements needed to reach this objective.

- to evaluate the user's ability to perceive and make decisions while comparing it to the level of mental workload and the occurrence of errors. The main idea of this analysis is to find the misbalance within the interaction process.

A 'correct' interaction is, therefore, the one that allows users to reach their objective in an effective, efficient, and satisfactory way, while an 'incorrect' interaction would result in actions/effects deviating from the initial objective and result in stress.

The proposed scheme sees this set of 'Cognitive Ergonomics components' as a useful tool for designers to design complex interactions because it systemizes the analysis of interaction

through the components and helps designers synthesize all the inputs related to the interaction process in a structured way.

4. Results: Designing User Interface of a Neonatal Transport Incubator

This paragraph tells the experience of analysis of a User Interface from the point of view of a user, applying the set of Cognitive Ergonomics Components as a tool to identify errors in interaction and therefore in design.

This research project was developed in collaboration with an Italian manufacturer of neonatal medical equipment, which allowed performing a test of the components applied to designing User Interface. Interface is becoming the key focus of research for Cognitive Ergonomics [Bagnara & Pozzi, 2011]. The purpose of this test was to verify if the proposed set of components is useful for the analysis and re-design of an already existing product – a digital interface of a neonatal transport incubator (Figure 3).



Figure 3. Neonatal Transport Incubator by Ginevri SRl.

This medical equipment ensures stable environmental conditions, such as temperature and humidity, for the neonate in a context of its transportation, normally, between the hospitals. The criterium of a successful result was the improved user interaction with the incubator in terms of its efficiency and usability. The incubator, shown on Fig.3 is under development and is preparing to be launched at market. The key problem of this device was in lack of usability due to complexity of operations possible to perform with this device and due to 'engineering-based' design. The original User Interface design was based on the engineering requirements, responding to the technical needs, while the user component was missing. This was a good case-study for analyzing errors in design and interaction.

The company provided access to this device for this research project in order to identify where the interaction design problems are. The testing was done without the neonate for safety reasons. Together with the engineers of this device, the author has performed interaction with the incubator. Following, the canvas structure, the experiment started with setting the goal, and the engineer has suggested possible results, e.g. "to set the parameters for temperature". Pursuing this goal, the author tried to identify possible actions based on previous observations of doctors' actions with the similar devices at a NICU (Neonatal Intensive Care Unit) and according to the graphic interface of the incubator. During these trials and following the structure of the canvas, the author has identified the sources of errors in design: misleading symbols, confusion in hierarchy and logics.

Applying the scheme of Cognitive Ergonomics Components, the analysis of the incubator's User Interface can be described as follows (Figure 4). Below is the description of one step perception/decision-making:

'Subjectivity' (S): the user is a healthcare professional, Dr/Nurse; user's general goal of interaction is to maintain the baby's temperature, whilst a specific objective (to test) is to set the parameters for the temperature.

'Functionality' (F): transport incubator, touch screen; simulation of a real-life environment.

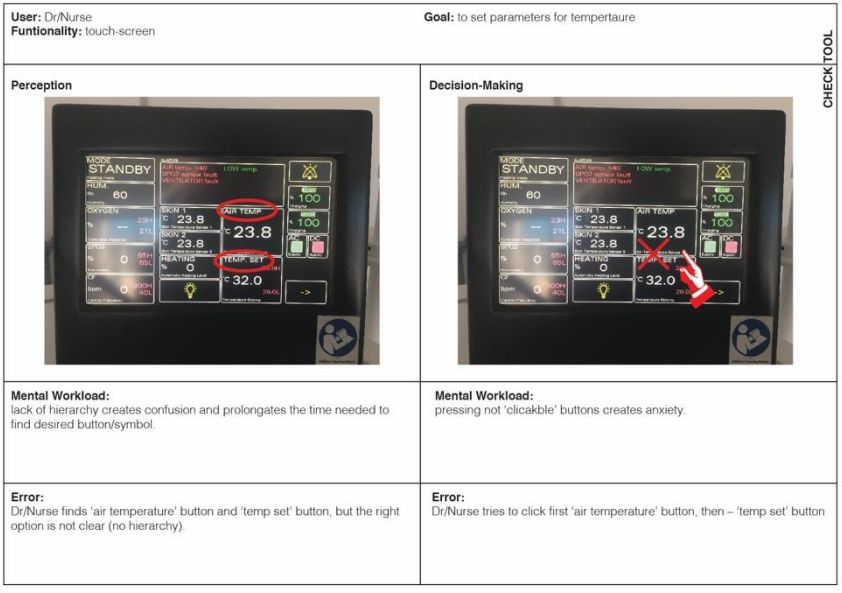

Figure 4. Analysis of User Interface of a Neonatal Transport Incubator (example

Analysis of 'Perception' (P):

'Perception' (P)	Senses involved are sight and touch; perceived elements are buttons, colors and texts of the digital interface (touch-screen); process description: Dr/Nurse is looking at the touch-screen for a button/indicator of Temperature (Figure 4).
'Mental Workload' (MWL)	Here the quantity of information to elaborate by the user is being analyzed: lack of hierarchy creates confusion and prolongates the time needed to find desired button/symbol.
'Error' (E)	Here mistakes related to perception are being observed: Dr/Nurse finds 'air temperature' button and 'temp set' button, but the right option is not clear (no hierarchy).

Analysis of 'Decision-Making' (DM):

'Decision-Making' (DM)	Mental actions are: interpreting numbers/texts from digital interface; manual actions are: pressing buttons on touch-screen.

	Process description: Dr/Nurse tries to click first 'air temperature' button, then – 'temp set' button
'Mental Workload' (MWL)	In reality the buttons are not 'clickable', pressing them several times trying to make them work creates anxiety.
'Error' (E)	None of the options ('air temp' / 'temp set') was correct – User Interface was totally misleading, external consultation needed to identify the right button for setting temperature.

This analysis allowed identifying and summarizing current problems in User Interface design. In a similar manner, a new design can be subject to analysis.

5. Discussion and Conclusions

The test described in paragraph 4 'Results' has served as an example on how Cognitive Ergonomics Components can be applied to the analysis of a User Interface. The analysis was quite detailed and laborious, and therefore is more adequate for scenarios of highly technological interaction characterized by informational overload on the user, such as a User Interface of a Neonatal Transport Incubator and other similar interfaces. The division of interaction into small steps (Task Analysis) allows conducting a thorough analysis whilst Cognitive Ergonomics Components indicate where to search for the problems in design based on user's actions and feedback. Such a tool could serve also as a report format provided by designers to their client, where all the steps, tests and improvements are fixed. Could this be a useful tool for the trends in Future Health? This tool for analysis (Cognitive Ergonomics Components) pays a lot of attention to affordances (Gibson, 1966, Norman, 2008) in design. Perception analysis is mainly based on the efficiency of the affordances and the evidence of failures in design is provided based on user's either correct or incorrect actions. Therefore, this analysis allows collecting data of examples of efficient and non-efficient symbols and other design-elements that are important affordances for a satisfactory interaction. This database could be seen as a collection of best-practices and mistakes in design to be implemented or avoided in designing future innovative healthcare products where users will need to confront with the unknown interactions.
Paragraph 2 "Context: Trends in Healthcare" describes the four trends in future health: Behavioral Nudge, Orchestrated Care, Empowered patient and Augmented Treatment. Behavioral Nudge aims at supporting user behaviors through delicate suggestions and indications. These could be APP notifications, color codes, specific shapes based on ergonomics or archetypes and other incentives and affordances. Testing the correctness of their perception by users would be useful to ensure the efficiency of the new designs: do these shapes and elements nudge users in the right direction? Orchestrated Care provides services via cloud interconnections, which implies designing clear hierarchy and intuitive User Interfaces that allow users navigate through complex healthcare data. Analyzing users'

perception of such systems would allow identifying the most optimal path for achieving their goals. Empowered Patient trend suggests that users will always need to be more and more informed and have power over their health. However, this implies risks in making harmful decisions if made uninformed or based on emotions. There is an ongoing discussion (Kleinpeter, 2017, Chiruvella & Gudatti, 2021) on ethical implications of exposing medical data to patients: to which extent the patient can be informed? Ergonomics and Human Factors (Carayon, 2014) is often employed in Healthcare with a purpose to ensure patient's safety. Thus, integrating Cognitive Ergonomics Components at a User Research phase in design would provide more guaranties that patient safety is thoroughly considered. Observing users' perception of medical data and their reaction to it could allow identifying aspects that provoke an intense emotional reaction and therefore harmful for patient's psychological health and avoiding them in design. Augmented Treatment trend describes medical tools based on newest technologies, such as using rapid manufacturing to produce prosthesis and other elements of care, VR/AR technologies to simulate various scenarios or to create a distracting ambience for children, etc (see examples in Paragraph 2). Applying Cognitive Ergonomics could be beneficial for designing such ambiences, because users would need to feel safe and confident while exploring a new territory. Designing elements that would guide users to interact efficiently with such ambiences would help designers satisfying users' needs.

The limitation of this canvas is that designers would still need to be trained to perform Task Analysis and have enough of design expertise to identify quickly and precisely the affordances and the actions they provoke. Possibly, to achieve more precision, designers could be assisted with available technologies typically used by the ergonomists, e.g. an eye-tracker. On the other hand, the fact that this analysis can be still performed without any equipment and based only on the designer's expertise, makes this tool accessible for any designer in need.

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Author contribution statement: The article is a product of a concerted effort. All authors contributed to the writing, with responsibilities as follows: Section 1 and 2 A.G., Section 3 and 4 M.Z., Section 5 both the authors.

Acknowledgements: authors express their special gratitude to the company Ginevri Srl, an Italian manufacturer of neonatal medical equipment, for an opportunity of a fruitful and experimental collaboration.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Connect art and science for a functional biomimicry in design

Andrea Forges Davanzati

Abstract | Nature provides a immense variety of visible and invisible forms trying to hide from our eye, strange and mysterious, in continuous movement and evolution.
Many contemporary artists have been inspired by nature forms, mostly after the invention of the microscope which revealed endless worlds, extra small and definitely evocative for form and colour: diatoms, ciliated, protozoa and mold, paramecium and radiolaria.. Microorganism, in addition to having a strong scientific interest, have become source of inspiration for multicolor patterns and sophisticated stuctures. These forms, normally invisible, have been discovered and analyzed, have been approached, multiplied, magnified, overturned and hooked on other elements of the modern visual language in such a way that they lose their original concept to become a abstract work of art.

KEYWORDS | ONE, TWO, THREE, FOUR, FIVE

1. Science and art: today

1.1 The American biomimicry

Even if the discipline of biomimicry is still little known in Italy, in the rest of the world in a powerful word, associated to an unceasing blossom of new applications and professions, a real core of a new cultural knowledge, therefore also of power, which stimulates the growth of a new market and a new managerial specialization.

A brief history: during the first half of the twentieth century, a small group of American scientists thought of applying physics to the study of biological functions in a multidisciplinary way, this led to the definition of a new discipline that they called biophysics.

In 1957, Otto Herbert Shmitt, American scholar and inventor, at the height of his studies on nerve endings and bioelectric interactions, first used the term biomimetics, from the Greek bios: life, and mimesis: to imitate, to better define the new field of Research. (1)

Shmitt was part of a generation of scientists eager to get out of the narrow confines of their specific disciplines to embrace a new interdisciplinary way of studying and research that included different scientists and especially different groups of specialized technicians.

In 1958 another American scholar, belonging to the military, Jack Steele, used the term Bionica for the first time to define the science of systems (processes), having functions copied from nature, or having similar characteristics. (2)

Today biomimicry is a multidisciplinary approach in constant growth, active in the most important academic sectors such as science, technology, engineering and mathematics. This exponential development of study has created the exclusive Biomimicry institute in Montana, Janine Benyus has theorized the ten laws of Biomimicry, other research centers have been formed in America and in the world, in university and industrial centers. In England in 2013 the study of biomimicry was introduced as a subject of technology and design study for children aged 11 to 14, in the rest of the world the application study of this matter remains reserved for specialist studies of engineering and architecture. From this brief historical mirror, the specific interest that this theme arouses for possible investment developments in industrial research is evident.

A few examples, to start with: the velcro, invented, but it is better to say patented in 1955 by a Swiss engineer, derives from the study of a seed of the lapola plant, very common, covered with tiny hooks that make it annoyingly capable of sticking to the hair and fabrics that naturally allow it to reproduce in distant places and thus favor a territorial diffusion. Today the velcro, produced in different plastic types, has become common in any object that needs an adjustable temporary locking system. It also represents the safest and longest coupling used in aerospace engineering.

Likewise, from the study of the water-repellent properties of the lotus plant (the leaves) it was possible to derive a paint or a treatment that repels water from surfaces and fabrics, together creating a self-cleaning coating; from the shapes of the seeds at the mercy of the wind new formal schemes for efficient and revolutionary wind turbines, from the structures of the termite mounds and anthills new systems for efficient and extremely low energy consumption air conditioning. The study of natural form and function (other example from the gecko's paw = a new substance or super adhesive structure) now also includes the study of principles (the social structure of bees as a specialized social model to be applied in the company). The examples are now many and develop in numerous application fields, but let's go back to look at the historical development of the research process in general terms.

1.2 Meanwhile in Europe:

As I introduced, while in America the words corresponding to this natural study were invented, signed and patented, in the Central European cultural cradle of Freud and Piaget, as a natural continuation of C. Darwin's naturalistic studies in the late nineteenth century, the study of nature took directions less strained towards profit and immediate industrial application and more focused on pure research. In 1948 Karl von Frisch published in Germany: "Animal architecture. The scholar's attention is mainly focused on the analysis of the construction structures of different animal species, in particular the world of arthropods, insects, because with just under a million species it represents the most numerous and varied in absolute; just think in relation to the entire list of mammal species that only counts a few hundred. Immediately following, Konrad Lorenz's study lays the foundations for understanding animal behavior, thus founding modern ethology.

1.3 Bioapplication: wright or wrong?

This is to better outline the global historical landscape responsible for creating the foundations of natural and naturalistic research. Beyond the immediately positive and praiseworthy aspects regarding the study of natural elements or processes aimed at improving our life, it is also necessary to underline the possible risks that this passage competes in a global vision. I have already mentioned how the search for new products derived from natural examples is actually dictated by a profit logic, but the real risk is represented by the fact that this could lead the relationship between natural and artificial towards a substantial modification. On the one hand, in fact, the new biomimetic sector could modify the artificial to make it more efficient and morally acceptable, on the other the artificial could have the power to modify the natural. An example is the biocapitalist landscape in which, due to the need for greenery, the forestry industry creates new forms of nature based on industrial requests, trees become elements of a production process thanks to genetic modifications aimed at speeding up the growth and efficiency of the production. Biocapitalism offers great possibilities (just think of the creation of green species capable of purifying the atmosphere, but it represents serious risks for the ecosystem and especially for bioversity. (Can a homogeneous, controlled, serial nature be considered natural according to

the needs of the human being alone?). This reflection is worryingly reflected in any breeding or cultivation, but also, more generally, to the assumption of the term "natural" with the implication of an increase in market value. I am reminded of the example of the apple sold in the stalls of any supermarket in New York, we go from the normal apple without any further wording, so we can suppose that it is controlled, genetically modified to resist pests, frost or weather resistance, perfect in shape and color, but almost artificial, to the slightly more expensive "biological" apple, then to rise in price for the "organic" apple and finally to the "amish" apple, expensive because it is not perfect, sometimes misshapen and often buggy, expensive as it totally "natural".

It is curious to think that the use of pesticides and fertilizing elements still implies a production surcharge that small farmers cannot sustain. The formal camouflage of the natural world could be attributed, even in modern architecture, to a criticism that had already arisen in the analysis of some organic forms that have now become real stylistic features of an expanding current. Without diminishing the importance of bio-inspiration in many buildings, conceptually we can see the ever closer link between ecology and economy, in a new definition that Rhem Koolhas defines Ecolomia. In his text, Junk Space, Koolhas theorises "oxygen banks, chlorophyll fort knox, eco reserves such as blank checks to obtain further pollution" and also "stations unfold like steel butterflies, airports sparkle like cyclopean dew drops , bridges join shores often overlooked as grotesquely enlarged versions of a harp, with each stream its Calatrava "(3) This vision is pessimistic and negative, however the study of the natural world aimed at new organic structures and the general attention for the bio-inspired method can however open new horizons. Not only forms, but processes and systems can in fact be inspired by nature, and it is in this direction that the greatest results can be obtained.

1.4 Science and art, art and science

In parallel with the formation of the applicative and functional study of nature, the cultural movement Art and Science has developed since the early 1980s, aimed at uniting the two worlds often kept separate from institutions and by a part of scholars who are wary of scientists. art understood by them as chaotic and unruly. In reality, the interdisciplinary research of Art and Science has historical roots in the Renaissance and has always been the bearer of excellent examples. Nature has always been celebrated and analyzed to reveal its hidden laws capable of inspiring and justifying the new canons of beauty and perfection, and science has been the suitable means or instrument to transmit and apply it. A direct application of this research could for example positively transform the function and usability of the traditional museum, in crisis due to the low turnout of the public who increasingly prefer a more dynamic vision, videos, or multimedia or multi-sensorial experiences. Overseas, the American museum has been able to modernize by inserting sets, projections, objects and direct applications in games, manipulations and multimedia experiences in structures previously exclusively dedicated to collections. The public generally cannot stand the still collections of animals or natural species kept behind the glass. The artistic creation,

intended as a formal search for celebration of nature, inserted in a museum context, could find the real consideration in the plants or animals on display, so as to make the point of origin and belonging of the research legible, at the same time inviting the viewer to imagine other applications and variations possible. In this way the municipal museum centers such as aquariums, natural, scientific and anthropological could expand their themes and their didactic panorama.

Science applications in the rapid progress of interactive systems and modern media need art, through which they can in fact aspire to be a little more lasting, absorbing a part of eternity to which art tends. Art, for its part, in its most current sense, including all its forms, with installations, videos, its many conceptual applications, needs science to rejuvenate itself, renew itself, communicate and transmit, and bridge the gap cultural that otherwise relegates it to an elitist environment.

Another interesting development of the relationship between Art and Science can be found in the structure of Arte Sella, the only example in Italy of the largest international movement Art in Nature. Located near Trento, it unfolds as an outdoor exhibition museum, in a forest, and for many years has exhibited examples of natural works, often ephemeral, made exclusively with natural materials such as stones, branches and leaves, or simply earth brought back. You can observe real sculptures, but also Land Art architectures and applications, stimulating for creativity and remarkable for the rigorous respect for the ecosystem.

It represents a way of expressing refined artistic concepts through the construction of elaborate often geometric structures (tensile structures and concatenations of modules) derived from natural scientific study.

A modern Biomimesis, or Organic Design, or Nature Design Thinking should reunite and merge with Art and Science, where the main task of artistic research intended as a subtle search for pleasure is to provide an un-utilitarian vision of natural forms and functions, of pure celebration and praise of beings, in the vision of social progress certainly even less expensive in terms of energy and consumerism.

1.5 Organic Design Thinking

I also believe that in teaching disciplines as design thinking linked to natural study, with its current issues related to climate problems, species conservation and resource management, can also be directed towards a type of speculative research, pure, less focused on the frantic achievement of immediately applicable results and unique solutions.

The fuel of research is passion, this must gratify study in its perhaps most tedious and compiling moments; therefore also pleasure, fun and irony, upsetting and overturning the pre-established data and patterns.

Without a doubt, it is useful to consider the analyzed topic by changing perspective and perspective, or to change the points of view, also from a conceptual point of view.In this sense, the application of an artistic "system" helps to unleash creativity beyond the boundaries of utilitarian and finalized research.

I give an example. Recently some students (the formation of heterogeneous study groups is always advocated), have proposed the adhesive as a research theme, analyzing it towards the design of an innovative cellular glue; a very ambitious undertaking in itself since it requires a lot of data belonging to chemistry, anatomy, medicine and physics not easily available in a design study facility nor within the reach of a single student.

The theme is certainly very current, recently we have witnessed the spread of modern and innovative inventions in this sector, cyanoacrylates, silicones, various adhesives, reactants to catalysts, grape rays, white light, oxygen heat and so on. However, the general and speculative study of this topic could also include its conceptual meanings, linked for example to a perfume or a smell that adheres to it, or a nickname that remains stuck, or even the persistent memory, the repeated gesture and the follow one another and take root in the same pattern.

Spamming is adhesive. The irony and cultural deregulation like that of Bruno Munari who not only invents, as a designer, a chair completely distorting the ergonomic rules and creating a strongly inclined seat that makes it impossible to sit down, but even gives it the name of "chair for visits very short ", helps, stimulates and frees the boundaries of design thinking.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Development of a test setup for validating a cognitive assessment platform within ICU's

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Abstract | Medical care is one of the most important and urgent areas to obtain insights and better understanding of the workflow of the caregivers using a human-centred approach, particularly in departments where caregivers' activities are crucial to human lives, such as the intensive care unit (ICU). Within this paper, we used a combination of quantitative and qualitative approaches to investigate role stress on ICU-caregivers. The aim of this preliminary study is to develop a test setup as preparation towards the development and validation of an instrument to monitor cognitive states, namely a Cognitive Assessment Platform (CAP). This resulted in (1) a task analysis, which we translated into an app for easy task registration, (2) a selection of sensors to measure cognitive states at caregivers of an ICU and (3) a questionnaire based on the Stress Questionnaire for Health Professional (SQHP).

KEYWORDS | COGNITIVE STATE, PHYSIOLOGICAL MEASUREMENTS, WEARABLE SENSORS

1. Introduction

The basic principle of human-centred design is that products and services result from a thorough understanding of the physical, cognitive and emotional needs of users. This approach enhances effectiveness and efficiency, and improves human well-being (ISO, 2010). To understand human functioning in highly stressful and complex environments, a human-centred approach can provide a better comprehension of the needs of the different kinds of people who interact with each other in such an environment. Moreover, it counteracts possible adverse effects in human health, safety and performance (Van Zyl and De La Harpe, 2014).

Safety critical environments, such as medicine and healthcare, are very important and urgent areas to obtain insights and better understanding of the workflow of the staff using a human-centred approach. Particularly in departments where performed activities are crucial to human lives, such as the intensive care unit (ICU) (Ohmura et al., 2006). Adverse events, defined as injuries or complications that are provoked by a medical human error rather than the patient's underlying disease, occur in about one-third of cases in adult ICU patients and the risk of error is cumulative (Baker et al., 2004; Orgeas et al., 2008; Seynaeve et al., 2011; Molina et al., 2018). The risk factors of adverse events include high nursing workload, caregivers' sleep deprivation or fatigue, communication failure, a high patient-to-nurse ratio and poor management (Valentin et al., 2006; Bucknall and Tracey, 2010; Ksouri et al., 2010; Pagnamenta et al., 2012; Steyrer et al., 2013; Faisy et al., 2016). Cognitive limitations such as fatigue, mental workload, arousal or stress, may result in errors during task intensive activities and deteriorated performance.

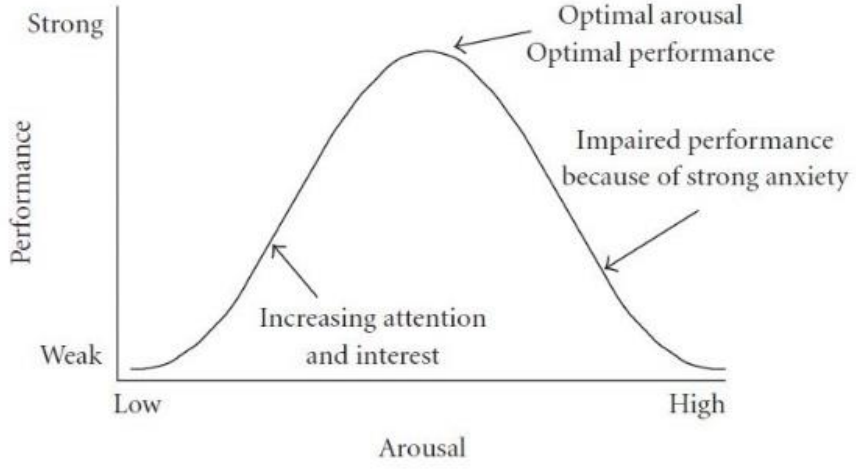

Figure 1. Illustration of the Yerkes-Dodson law (Dodson and Yerkes, 1908)

The principle which states that performance and the mental state of arousal or stress are directly related, was proposed by psychologists Yerkes and Dodson (Dodson and Yerkes, 1908). They indicated that behavioural performance increases with physiological or mental arousal, but only up to a certain point. This means that if the arousal-level is too high, people not only experience psychological discomfort such as stress and/or anxiety, but can no longer function optimally due to a reduced level of attention, memory and cognitive processes. In conclusion, the Yerkes-Dodson law (see Figure 1) is a well-cited century-old principle, which shows that the relationship between arousal and behavioural performance can be linear or curvilinear, depending on the difficulty of the task.

Physiological parameters allow monitoring of cognitive states such as stress or arousal by quantifying responses from the brain and nervous system, cardiovascular system and visual system. For example, heart rate variability (RR-interval) allow gaining insight in stress levels (McDonald and Soussou, 2011), while EEG's allow quantifying arousal levels through analysis of brain waves, see figure 2 (Berka *et al.*, 2007; Stikic *et al.*, 2014; Liu *et al.*, 2016; Webster *et al.*, 2017). Through wearable computing it is possible to monitor these physiological parameters in real-time. Additionally, wearable computing is rapidly becoming a major research direction due to new developments in smart technologies, which may hold promises for enhancing product intelligence. In conclusion, workload intensive tasks, smart technologies and interpersonal variations in cognitive capacities induce a need to better understand human cognition and adjust care products and interfaces accordingly.

Several review papers regarding wearable sensor-based system (Pantelopoulos and Bourbakis, 2010; Banaee, Ahmed and Loutfi, 2013; Lakudzode and Rajbhoj, 2016) provide inventories of the most commonly used physiological parameters for health monitoring in literature and are summarised in Table 1.

Table 1. Summarisation of the most commonly used biosensors used for health monitoring according to current literature.

Type of signal	**Type of sensor**	**Description of measured data**
Electrocardiogram (ECG)	Chest electrodes	Electrical activity of the heart
Blood pressure - systolic and diastolic (BP)	Arm cuff-based monitor	Refers to the force exerted by circulating blood on the walls of blood vessels
Body (skin) temperature	Temperature probe or skin patch	A measure of the body's ability to generate and get rid of heat
Respiration rate (RR)	Piezoelectric sensor band around chest	Number of movement indicative of inspiration and expiration per minute
Oxygen saturation (SpO_2)	Pulse oximeter on finger	Indicates the amount of oxygen that is being transported in the blood
Heart rate (HR)	Pulse oximeter on finger or skin electrodes	Frequency of the cardiac cycle

Photoplethysmogram - Skin conductivity (PPG)	Galvanic skin response sensor	Electrical conductance of the skin (activity of the sweat glands)
Blood glucose (BG)	Strip-based glucose meter	Measurement of the amount of glucose in blood
Electromyogram (EMG)	Skin electrodes	Electrical activity of the skeletal muscles
Electroencephalogram (EEG)	Scalp-placed electrodes	Measurement of brain activity
Body movements	Accelerometer	Measurement of acceleration in 3D spaces

The aim of this preliminary study is to develop a test setup as preparation towards the validation of an instrument, namely a Cognitive Assessment Platform (CAP), which consists of a set of sensors that allow synchronous data acquisition of the different physiological measurements. The caregivers will also be questioned to verify whether the subjective results match the objective measurements. In a follow-up study, the CAP will also enable identifying stressful situations that require excessive workload or may degrade performance, and allow a synchronisation between the physiological data of its wearer and specific care tasks. Ultimately, this research shall contribute to the development of a full operational CAP to gain fundamental insights in and a better understanding of the workflow of the caregivers, which in turn could provide rich opportunities for further examination and discovery. For this research, we closely cooperate with the ICU department at the Antwerp University Hospital (UZA). This precursory study is an initial exploration regarding different aspects of the follow-up study and consists following research activities:

1. A task analysis based on therapeutic intervention scoring system (TISS-28) and observations. We translated this task analysis into an app for easy task registration, which will enable linking the performed task with the physiological data of the caregiver;
2. A selection of sensors to measure cognitive states – fatigue, workload and stress – at caregivers of the ICU of UZA. This based on literature reviews and on observations on their current working conditions (required for ethical approval);
3. Lastly, a questionnaire, which will provide a general qualitative overview of stress and fatigue levels specifically within the ICU of UZA (required for ethical approval).

2. Method

2.1 Task analysis and app development

Within this study, we performed a task analysis to analyse main cognitive activities of the ICU-caregivers at UZA and to set up a task inventory, which was crucial for the development

of the app. In a later study, the caregivers will use the app as a system to register the tasks that they are performing at that moment. This way, we can synchronize the monitored physiological data with the performed tasks and explore possible continuities.

We conducted the task analysis based on observations within the ICU of UZA and on the Therapeutic Intervention Scoring System-28 (TISS-28). TISS-28 is a tool used to assign scores to patients according to severity of illness and is used as an indicator of nursing workload in ICU TISS-28 (Miranda, de Rijk and Schaufeli, 1996).

2.2 Selection of wearable sensors

A selection of wearable sensors to measure cognitive states at caregivers within the ICU of UZA was made based on current state-of-the art according to the literature (see table 1) and on observations regarding the conditions within the environment of the ICU. This selection of sensors will be used in a later follow-up study.

2.3 Questionnaire

The questionnaire was set up in consultation with head nurse and confirmed by head of the ICU at UZA and the ICU team. The aim of this questionnaire is to obtain qualitative insights in the stress and fatigue levels of caregivers and to capture the professional experiences of nurses in aspects related to occupational stress. Therefore, we used the six sources of occupational stress according to the Stress Questionnaire for Health Professionals (SQHP) (Gomes and Teixeira, 2016). These six sources that we took into account consider aspects related to work and family affairs (managing clients, relationships at work and home-work interface), aspects related to specific nursing tasks and the time available to achieve them (leading training activities and work overload) and also aspects related to career progression and salary. The questionnaire was set up using Qualtrics software since it provides an extensive variety of types of questions (other than multiple choice or open questions), and since it is possible to combine it with SPSS software for analysing the data.

3. Results

3.1 Task analysis and app development

The task analysis resulted in a task inventory of all key activities within the ICU of UZA. Additionally, all key activities were classified in thirteen main categories to make task registration easier for caregivers, which are shown in Table 2.

Table 2. Task inventory based on TISS-28 and on observations.

1. Register parameters ○ General registration (every two hours) ○ Record an ECG	2. Hygienic care ○ Body care (hair, brushing teeth, shaving, etc.) ○ Change bed ○ Corpse care	3. Medication ○ Prepare medication

	○ Intimate toilet ○ Ostomy care ○ Offer bed pan ○ Offer kidney dish ○ Wound care	○ Via Intravenous infusion ○ Via syringe ○ Orally
4. Respiratory care ○ Oral care ○ Clean endotracheal tube ○ Aspiration ○ Intubation ○ Install non-invasive ventilation	5. Administrative task ○ Receive briefing ○ Write patient report ○ Prescribe medication ○ Order material ○ Fill out the Electronic Patient Dossier (EPD) ○ Fill out score form ○ Meeting	6. Nutrition ○ Offer food ○ Offer a drink ○ Feed the patient
7. Communication and support ○ With patient ○ With visitors ○ With doctor ○ With external staff	8. Mobility patient ○ Install patient ○ Transport patient ○ Turn and position patient in bed ○ Move patient to another bed	9. Acute care ○ CPR ○ Intubation
10. Logistics ○ Collect medication ○ Collect equipment ○ Call technical service ○ Unload medication ○ Order material ○ Refill carts ○ Refill boxes ○ Clean devices	11. Technical skills ○ Insert probe ○ Assist doctor (place catheter, bronchoscopy, …) ○ Place Intravenous infusion ○ Take blood ○ Take samples ○ Continuous veno-venous hemofiltration (CVVH)	12. Breaks ○ Short break (toilet, coffee) ○ Dinner break
13. Other ○ Supervise student ○ Educate a colleague ○ Other: …		

Further, we translated the results of the task analysis into an app, which will enable easy task registration for the ICU-caregivers. The main interface of the app is shown in Figure 2.

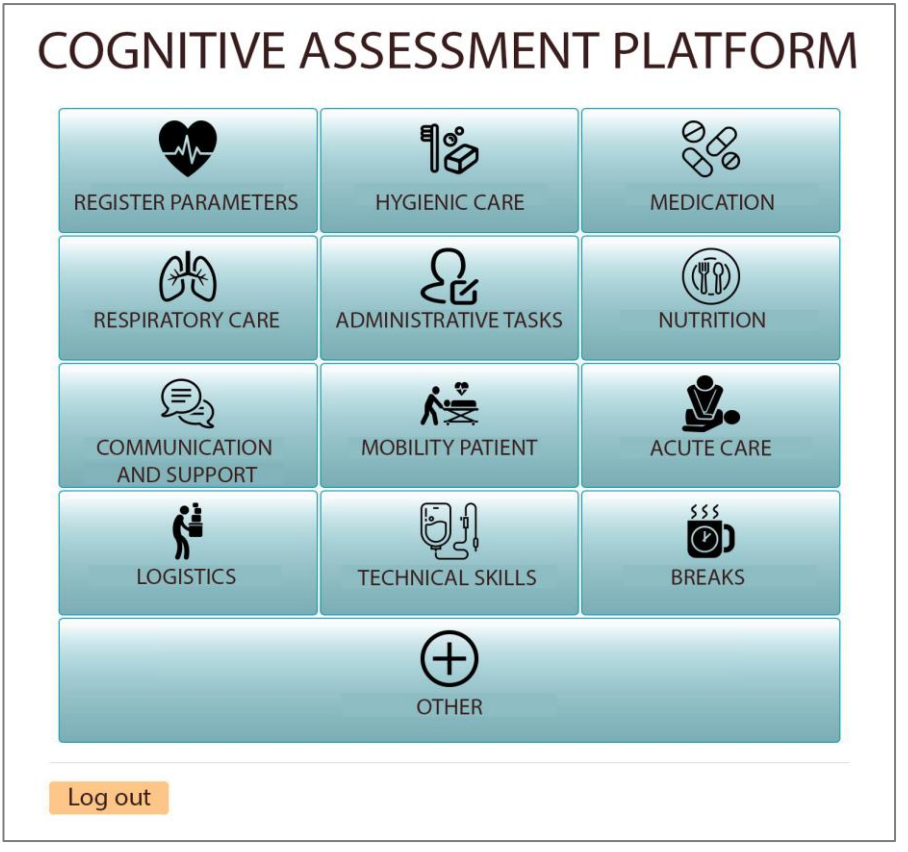

Figure 2. Illustration of the interface of the app, showing the thirteen categories of the tasks.

Every category has a list of tasks (see Figure 3a) that can be selected by the caregiver. By selecting a task, a timer starts recording the time (see Figure 3b) such that the monitored physiological data can be synchronised with the performed tasks and possible continuities can be explored (e.g. how does recovery occur, what is the importance of breaks, which tasks are most demanding, do the results correlate with the results of the questionnaire, etc.). Anytime, the user can go back to the previous page.

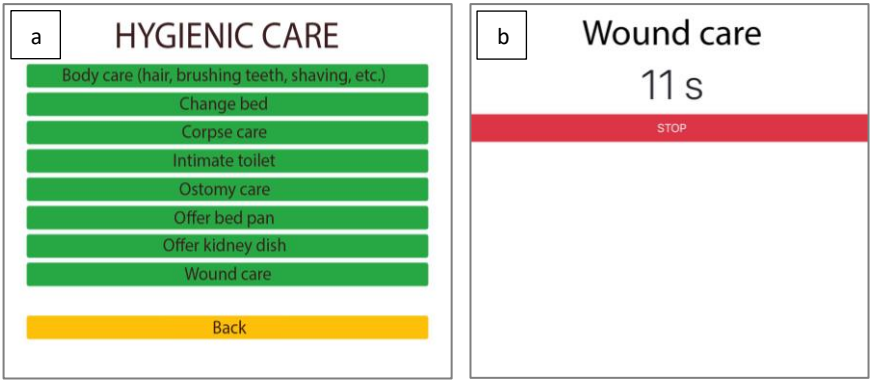

Figure 3. (a) Illustration of the interface after selecting a random category and (b) after selecting a specific task (in this case: "wound care").

3.2 Selection of wearable sensors

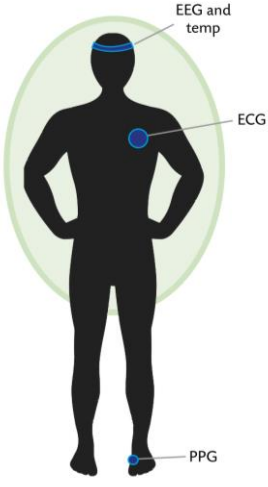

Figure 4. Placement of the selected sensors.

Based on field research, we encountered that the ICU-caregivers need to keep their hands and forearms sterile during their work, which means that we cannot place any sensors on these locations. Consequently, BP, HR and SpO2 could not be measured within this research (see Table 1). Further, body movements and EMG would not provide significant results within this context because of the caregivers' constant movement. BG would be too difficult to measure and RR would be too intrusive for the caregivers. Finally, these wearable sensors

and cables were attached unobtrusively to the body so that they would not interfere with the tasks of the caregiver. Considering the different sensors to measure cognitive state according to current literature, we selected ECG, skin temperature, PPG and EEG as shown in Figure 3. PPG is typically recorded non-invasively from the surface of the palms and fingers. However, the caregivers need to keep their wrists sterile. Therefore, we opted to perform measurements at the foot location. From a physiological point of view, the feet are known to serve as a suitable measurement location for GSR (Healey, 2011; Govoni, 2012; Gravenhorst et al., 2013; Phitayakorn et al., 2015). Further, we placed the ECG on the left side of the chest because the closer the pads are to the heart, the better the measurement (Babu Prasad, 2018). Since a cap would be too intrusive, only a limited number of channels were used to record electrical activity of the brain.

3.3 Questionnaire

Based on the different sources of occupational stress according to the SQHP – namely aspects related to work and family affairs, aspects related to specific nursing tasks and work overload and aspects related to career progression and salary – a questionnaire was set up. The head of the ICU at UZA and his ICU team then reviewed the survey. Within our questionnaire, we evaluate seven different dimensions of stress factors that ICU-caregivers face in their activities: (1) socio-demographical questions, (2) personal questions, (3) questions regarding working conditions, (4) stress-related questions, (5) fatigue-related questions, (6) questions concerning home-work interface and finally, (7) questions about career and salary.

Different types of question formulations (such as multiple choice, matrix table, slider or rank order) were used to prevent monotonous questions. This preparation of the questionnaire is required for ethical approval.

4. Discussion

The aim of this preliminary study was to construct a test setup as preparation towards the development and validation of a Cognitive Assessment Platform (CAP) for monitoring cognitive state. Ultimately, the CAP will enable identifying stressful situations that require excessive workload or degrade performance, and allow a synchronisation between the physiological data of its wearer and specific tasks.

This preliminary study applied a user-centred design approach, providing a better understanding of the needs of individuals working in a highly stressful and complex environment such as an ICU, with the aim to enhance teamwork and work efficiency. Therefore, we developed a test setup that will enable us to gain an explicit insight in the ICU staff, their tasks, and environment. The results of this study - which were required for ethical approval of our follow-up study - consisted of (1) a task analysis, which we translated into an app for easy task registration, (2) a selection of sensors to measure cognitive states at

caregivers of an ICU and (3) a questionnaire based on the Stress Questionnaire for Health Professional (SQHP).

The herein presented test setup will be applied in our follow-up study to develop and validate the unobtrusive, user-friendly CAP. The sensors that we have selected within this study will be used to design a CAP prototype. To validate the CAP prototype, experiments will be performed on twelve caregivers within the ICU of the Antwerp University Hospital (UZA). During the experiments, the caregivers will need to use the developed app to register the tasks they are performing, enabling us to link the performed task with the physiological data of the caregiver. They will then be asked to fill in the questionnaire to obtain a general qualitative overview of stress and fatigue such that we can verify whether the subjective results match the objective measurements.

To conclude, this preliminary study was essential to create a test setup, which we will use in our future study to gain insights in the ICU caregivers, their tasks, and environment. Based on these observed healthcare insights, our future design prospects are to develop and validate the innovative CAP, purposed to be a user-friendly wearable tool to enhance ICU workflow and work efficiency.

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Acknowledgements: We would like to thank the head of the ICU Prof. Dr. Philippe Jorens and head nurse Jo buys for their contribution. For this work, the University of Antwerp (BOF-STIMPRO 2019, grant number 39764) granted funding.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Food design as a tool for social development: experimental study in the evaluation of child smell

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Abstract | The study is part of a food design research having the aim to assess the relevance of the olfactory experience on social development and the improvement of public health. Its immediate and primitive connection to the emotions zone establishes an experience of direct connection to motivations and desires, transporting memory to the construction of a moral consciousness about what we smell and eat, contributing to the physiological sanity although conditioned by culture. However, the organoleptic diversity in early life can condition the citizen's flexibility concerning the adoption of innovative practices and, consequently, of a greater aptitude related to public health, environmental sustainability, and, most importantly, cultural creativity. Recognizing the implication between the capacity to adopt new behaviors and the extent of children's organoleptic learning, this exploratory study (inquiry) covering a universe of 20 food smells was carried out in educational establishments, considering children aged 3-5, from polarised socio-economic groups.
The data treatment of the study led us to conclude that the most depressed socio-economic group presents a more reduced organoleptic lexicon than the other group, implying, consequently, a lower aptitude for the creative adaptation to the different, a condition for innovation.

KEYWORDS | FOOD DESIGN, SOCIAL INNOVATION, SMELL, SUSTAINABILITY, EDUCATION

1. Contextualization

> "A brain does not suit only to think but to act […] a living creature is an acting memory." (Laborit, 1979)[1]
>
> "The first brain is the gastro-intestinal one, the second one is the intellectual." (Damásio, 2019)[2]

Being invisible, the odour is potentially ambiguous, indexing itself to the memories of each existence. Smell activation in the brain takes place in the emotions' area. This immediate and primitive connection to the *complex emotions' building* (Damásio, 2017)[3] means that, from the point of view of experience, here lies the structure of one of the first senses that the human being detects which, maybe for that reason, is intrinsically connected to pleasure and the survival instinct. This is not about mere pleasure, but about pleasure as a survival function. Smell relevance and its comparison to other senses has acquired a growing prominence nowadays. According to Herz (2018), for example, in feminine gender prevails the sense of smell, to the detriment of vision, sound or touch, as its attraction highest determinant.

Birnbaum (2014)[4] observes that the sense of smell is at the origin of life, as an agent, conducting the spermatozoid to the egg, as throughout individuals' life, as an analytical "chemical laboratory", preserving individuals from toxic contaminations, thereby constituting a vital biofunctional factor, not only for mammals. However, the sedimentation of a nutritional heritage in human collective unconscious could be in the origin of the universal adherence to certain foods such as wheat (in the form of bread, for example), capable of provoking almost addictive behaviours. The neuroscientist Herz[5] identifies the sense of smell as one of the main affective stimuli: it is desire's anticipatory sense, memorizing relevant emotional experiences that will influence the preferences to the rest of our lives (Herz, 2018).

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1 (1914-1995), human and animal behaviour Philosopher. Developed the first neuroleptic used in the treatment of schizophrenia.
Laborit applied his theory on the human behaviour to examples in the movie from Alain Resnais, Mon oncle d'Amérique, Paris, 1979, where he also plays a role.
2 Ciclo Diálogos do cérebro – encontros de mentes diversas "O Cérebro, o Corpo, e a Naturalidade da Consciência", Fundação Calouste Gulbenkian, 2nd June 2019.
3 António Damásio (1944-), Portuguese Neurobiologist that has developed research in University of Southern California.

4 Molly Birnbaum (1982-), Writer. In the "Empire of Scents" documentary she describes the accident that made her lose the sense of smell and that originated her book "Season to Taste: How I lost My sense of Smell and Found My Way" (HarperCollins Publishers, 2011).

5 Rachel Herz, Psychologist and cognitive Neuroscientist, acknowledged for research on smell psychology, teaches at Brown Universit

The human being is the only animal that does not present a separation between the passage canals of air and food, though experiencing the most exquisite flavour perception[6] when compared to any other species, given the exceptional anatomy of the throat, mouth and nose trilogy[7]. In addition, the human being is also capable of distinguishing and identifying more than 1000 million odours. According to Ron Winnegrad[8] (Nguyen, 2014), the sense of smell is intrinsically linked to taste and flavour, evaluating that 90% of flavour is on smell. In that investigation field, the neuroscientist Gordon Shepherd[9] developed[10], in 2015, the human model of retronasal smell, generated among the throat, the mouth and the nose, activating in the human brain an extensive system of flavours, the origin of a new field of study, the Neurogastronomy[11] — which goal is the comprehension of the contributing factors to problems such as obesity and other eating disorders.

With this investigation we aim to understand and assess how can *food design* explore the sense of smell, as a factor of analysis, pleasure, memory and social mobilisation, not disregarding its contribution to social development, sustainability and development of a democratic regime.

6 80% of food flavour derives from its aroma (Philpott, 2015: 156).
Carl Philpott, honorary consultant and surgeon of the smell and taste clinics at James Paget Hospital, Gorleston, England.

7 On the contrary, the dog, belonging to the family of carnivorous mammals and wolf's descendant, has 32 times more olfactory canals than man, that is why "The dog does not let fool itself by television." (Providência, 2018).

8 Perfumer and Director of IFF Perfumery School, New York.

9 (1933-) Neurobiology Professor at Yale School of Medicine, Connecticut, USA.

10 Through 3D printing technology.

11 A new society and an annual meeting were constituted around The International Society of Neurogastronomy. The same principles were applied to wine tasting in Neuroenology.

2. Declination from the relevance of the sense of smell on science

> "(...)Quand d'un passé ancien rien ne subsiste, après la mort des êtres, plus frêles mais plus vivaces, plus immatérielles, plus persistantes, plus fidèles, l'odeur et la saveur restent encore longtemps (...), à porter sans fléchir, sous leur gouttelette presque impalpable, l'édifice immense du souvenir." (Proust, 2012:57)

According to Deborah Lupton (1994), memory operates at several levels: personal memory (of personal experiences), personal memory of not experienced things, social or collective memory and, finally, the academic memory (of History and the past). Even though memories are not always individual, given their social character, they lay on a cultural construction that operates beyond the individual level; olfactory memories are, almost always, more intimate and personal experiences. Given the inaccessibility of each individual's intimate memory (even to the individual himself), the success of its repeated convening, triggering an emotional state of happiness might only derive from one of three situations: chance, self-knowledge or the production of new memorable pleasure experiences.

Despite odours are not savoured, they are regularly categorized into sweet, bitter or salty (Herz, 2018). Samakradhamrongthai (2020) is more rigorous in this classification, opening up the range to groups such as spicy, floral, fruity, resinous or balsamic, burnt or bad. When we repeatedly experience an aroma in the context of these flavours during the act of eating, a pairing between flavour and smell properties is established[12]. Proving the association learned between smelling and tasting, the psychologist Dick Stevenson[13] (Herz, 2018) developed a study based on participants that were unaware of the smell of lychees. To one part of the sample a lychees flavoured sweet water was administered; to the other part, lychees flavoured bitter water. The sample that tasted sweet water classified the natural smell of the fruit as sweet, the ones who tasted the bitter water associated the fruit to a bitter flavour.

A detailed analysis of literature allows us to state that for medicinal purposes sweet scents can be used to minimise pain perception. A team of experimental psychologists[14] proved this concept through the painful experience of immersing the arms in water at a very low temperature for the longest time possible. The participants who, during the experience, tolerated more than twice of the time (2 minutes) were exposed to the smell of sweet

12 For example, when one adds vanilla aroma to milk this one will stay substantially sweeter than without it.

13 Professor at the Psychology Department from Sidney University, Australia, whose investigation areas have been evolutionary psychology, food, the act of eating and applied experimental psychology.

14 John Prescott, specialist in experimental psychology, editor of Food Quality and Preference Journal, along with Jenell Wilkie, specialist in psychology, James Cook University, Australia

caramel. The group exposed to a pleasant smell (but not sweet) could only bear for 15 seconds. The origin of the results will be in the caramel smell — based on memory associations to sweet foods — setting off endorphins that will relief the pain. However, the patient who has never eaten caramel or a sweet flavour (such as crème brûlée or caramel aroma) will not benefit from the same effect. The relationships we have with smells refer to the attributed meaning by our feelings and emotions, emerging from our body or the memory of existential states (more or less positive or negative) autobiographically associated. Experiences with professional perfumers (Scala & Allante, 2017)[15] in order to the research of their extraordinary olfactory abilities[16] called brain development, by associating the feeling to the memory, and not a particular difference of nasal sensors, what conditions their creative work more to the imagination than to experience. From here we highlight the fact that the human sense of smell is a mental phenomenon and not sensory such as the one from dogs, whose caption ability is 10 times higher.

The senses of taste and smell are functionally exercised by the foetus before the birth, through the contact with amniotic fluid. The learning of flavours by the baby, before birth and during breastfeeding, explains how, apart from biological differences, cultural differences are so rooted in food preferences in early stages of life — *influenced choices* (Damásio, 2013). In addition to the taste conditioning through maternal transmission, human behaviour will develop itself oriented by the need of avoiding pain (also used as educational punishment) and repeatedly achieve pleasure (used as educational reward), in a perennial negotiation between the individual's will and the social conditioning of his behaviour. For that reason, the social promotion of a food morality (against sugar, salt, fat and carbohydrates consumption) more and more mobilised through education (against obesity and children's nutritional disorders), by condemning as guilty the "bad foods" forbidding them, will promote them as more desired ones, acquiring a status of *reward*[17]. This behavioural standardisation of the *food reward* through the right to the sweet and the fat, as a consolation for the suffered frustration, will follow all the adult life of the human being (Lupton apud James 1990:679-682) and his choices, shapping his food attitude.

15 "Unveilling our senses", documentary directed by Scala & Allante, 2017.

16 The professional perfumers were submitted to tests to evaluate the origin of their extraordinary olfactory abilities, memorising up to 5000 aromas after 10 years of experience, concluding that they were based on brain development and not on the nasal sensors.

17 Damásio reports an experiment with two individuals exposed to the resolution of complex problems. At the end they were offered a food reward and freely choose either a piece of fruit or a tasty slice of cake. The volunteer who solved the problem felt entitled to prefer the cake; the second volunteer chose alternatively the fruit, therefore compensating his low performance by choosing a less pleasant food, even if healthier. The food reward is usually sweet or high in fat, eliciting a feeling of security and indulgence.

A complex correlation of memory, olfactory experience and the individuals' emotional performance is observed, which, conditioned either by their autobiographical experience, or by numerous factors associated to education and to culture, make the olfactory experience depend more on a more psychocognitive system than a physiosensory one, though justifying a scientific approach with a semantic nature.

3. Declination from the relevance of the sense of smell in public health and social development

Considering food as an expression of material culture and, therefore, a communication vehicle with the social past (etnography), in significant forms (cooking) on the promotion of an individual or emotional experience (anthropology and psychology), it appears that the relationship between food preferences and memories can be considered *symbiotic*, once we tend to recognise as *good* (tasty) those foods that result from a certain culture, adapted to a given territory. Food rituals, seasonality, the foods' supply territory and the elective preferences of each consumer constitute the foundations of a dietary preference not always beneficial, that results from the association between memory and emotion — *we do not favour what is good, but because we like something, we will consider it good* (Espinoza, 2009).

The proposed symbiosis between memory and emotion, declined from Damásio's aphorism, *we cannot have consciousness without feelings, nor feelings without consciousness, — we cannot have emotions without memory, nor memory without emotions* — will constitute a valuable instrument not only for the social development of the most protected classes, but also for its opposite, for the stagnation of the others' more unprotected. Varied food, the openness to new experiences and flavours, the adoption of healthier systems and foods, will inexorably depend on the degree of organoleptic literacy founded in the first years of individuals' life. Individuals submitted to richer experiences will be in better adjustment conditions and, mainly, of innovation. On the contrary, individuals submitted to more limited and poor dietary practices will experience greater difficulties in transcending their own culture, demonstrating themselves less suitable to the new, the food progress and, consequently, to the adoption of healthier and more creative practices, thus prolonging the poverty cycle they inherited. The present acknowledgement elevates children food problem to a social level, being considered as a relevant instrument to guarantee democracy and, mainly, as a contribution to the construction of a society not stratified in social classes. In that sense, the phenomenon must be addressed in the structuring of education and school meals programmes, promoters of a society based on knowledge and social development.

It is, therefore, determinant the role of social policies and the appeal to education so that it contributes to a more conscious and free choice of dietary practices of the human being. As early as the eighteenth century, Savarin believed that *the destiny of nations was hostage of their dietary choices* (Loefer, 2012), supported principle by Marion Nestle (Cavallini &

Tedeschi, 2015) that highlights the importance of the speeches conveyed by state organizations and institutions concerning the approval or repression of decision-making on food.

In a study of Dazeley, Price et al. (2012) on the dietary preferences of British children[18], fat and salty foods were predominantly classified as the most popular ones[19] and vegetables as the less appreciated[20]. It appears that only 16% of children in preschool ages reach the recommended daily dose of 5 portions of fruit and vegetables (at school and not at home) — cause for alarm, given that it is in the first years that the eating habits are developed which will persist throughout life. This circumstance is common in many countries with educational social policies (integrating the food service), therefore acquiring an authority and urgency which public policies cannot neglect[21]. A detailed analysis of the researches and projects developed in this area highlights that the preference for foods such as fruit and vegetables is only developed as a result of the frequency of their administration; in other words, there is a causal link not only between food diversity and its posterior deliberate choice, but also with the age at which this exposition takes place (at the age of 2, choices and preferences that will be chosen at 8 will disseminate).

That is why it is important that parents and educators, the education institutes[22] and the local and national governance should be more and more aware to the necessity of implementing food intervention programmes, promoters of healthier and comfortable citizens, through the increase of fruits and vegetables.

In that sense we introduce the projects that have been developed in the scope of the European network of bio-canteens, a program of the European Union Regional Development Fund involving more than 400 city centres), attached to the Mouans-Sartoux model of good practice, characterised by 100% organic meals, with local products and without waste, associating the food activity to an educational function of awareness concerning food sustainability. In Portugal, the municipality of Torres Vedras has subscribed to this network, raising the quality of the 1300 daily meals (2019-2020), with which supplies its nursery and primary schools, whose funding worths currently EUR1,80, to which adds more EUR1,20 on its own resources, in order to correct the actual cost of EUR 3,00 per meal. to Laura

[18] A sample of 1291 children.

[19] Salt increases the flavour, fat amplifies the flavour and makes some possible textures appealing, acid balances and heat determines food's texture (Nosrat, 2018).

[20] In a selection of 115 foods.

[21] Anonymously, 1 out of 3 children suffer from overweight, 90% of them regularly eating *fast food* (Nuno Queiróz Ribeiro, Melting Gastronomy, 15th November 2019, Alfândega do Porto).

[22] Preschools and primary schools.

Rodrigues, Vice-President and Councillor for Education, it is urgent the importance of well-fed and nourished children so that they can develop and grow up better, emphasising that in pandemic times the school meal should be even more cherished for the probable lack of resources or economic conditions in the domestic setting.[23]

Having seen that one of the children's barriers to fruits and vegetables consumption is based on lack of knowledge and alienation of those goods, educational projects such as "Let's grow", in United Kingdom (Dazeley, Price et al., 2012), involve children at different phases of agricultural production. After 8 months of involvement, children revealed a natural predisposition to taste the foods previously unknown (vegetables and fruits) and in which culture they were involved, taking part in their plantation, growth and transformation, a determinant factor to the awareness to foods' origin.

The group that took part in the gardening project was observed eating significantly more vegetables at mealtimes at the school canteen, demonstrating that the participation in experiential activities such as the vegetable garden are, possibly, more effective than theoretical classes about healthy eating, in an attempt to encourage children to make healthy eating choices.

The results of the project, analysing the questionnaire applied to children, revealed that, after the camping, the participants were more attentive and available, asking parents for the regular acquisition of fruit and vegetables, confirming the potential of the involvement in outside interactive activities (garden, vegetable garden), originating positive and significant changes on their daily eating system.

Another children nutrition programme with successful results is the *Alliance for a healthier generation* (2011)[24], that invests on children's involvement in interactive shared reading, dramatizing vegetables and fruits as characters providing super powers, thus contributing to the modelling of healthy eating behaviours. The repeated exposition to this kind of inciting exercises will obviously involve children, teachers and parents to potentiate the tasting and consumption of new foods and, consequently, incrementing health in their participants (Droog, S., Valkenburg, P. apud Heath, H. & Kennedy, 2014).

The school model from Reggio Emilia[1], internationally recognised since 1991[2], is one of the most consistent projects in education for the development of eating (and art) skills and knowledge, motto to rethink the way how we eat, how we prepare food, how we socially interact and how we consume, requirements of children's educational system that might favour learning and social development through inclusion, participation and involvement of all its stakeholders, from coordinators to cooks. At Reggio Emilia, the kitchen is at the center

[23] 7º Simpósio Nacional "Promoção de uma Alimentação Saudável e Segura - SPASS 2020 (7th National Symposium "Promotion of Healthy and Safe diet - SPASS 2020), organized and promoted by the Instituto Dr. Ricardo Jorge, on 25th November 2020."

[24] Virtual organization involving different communities.

of school, constituting its biggest knowledge laboratory. The eating system is an important means of human affirmation and, for that reason, should be a part of the central core of children's education, transforming school into a space of social connection and sustainability.

The present national eating overwiew of low offer on fruits and vegetables consumption, excess of industrial modified products (snacks) and the growing eating neophobia in children (mainly for nutritionally good or healthy foods), reflect on the overweight of 30% of children, confirming the urgency of the execution of educational programmes since first childhood, implementing a healthier eating culture, personalised and mainly under the principle of pleasure, the use of the senses, the manipulation of raw materials and the social conviviality (Alessandra *in* Cavallini and Tedeschi, 2005).

4. Organoleptic literacy experiment: a field study with a preschool population

After the case studies about the correlation between children's olfactory emotional experience and the acquired eating acquis that will condition the future of their eating preferences in adult life, and based on the researches by Herz (2018) and Cavallini & Tedeschi (2015), we aimed to develop field study, investigating the correlation between the organoleptic literacy of 34 children (preschool aged from 3 to 5), guaranteeing their gender parity, from different economic classes. The sample characterisation was divided into two social and territorial different groups, from the district of Porto; one (School 1) located in a suburban economically deprived region (Avintes); the other in a residential urban and economically favored area at the center of Porto. The former, the social charity, a foundation, supported by the Portuguese Government, with a monthly subscription maximum cost of 120€, including food, adjustable to the economic means of the household. The meal system of this school is provided by an external company, that ensures its daily delivery.

The latter (School 2), located nearby one of the main central arteries of Porto, is a private entity with a monthly subscription of 350€, including daily eating service (plus the extracurricular complementary activities with a specific payment). Here the meals' system is managed internally and prepared at its kitchen's facilities, under the technical supervision of a Nutritionist.

The experiment consisted in a selection of 10 olfactory samples related to eating, in glass jars properly isolated from light and sight, to which children (8 subjects aged 4 years old, 5 aged 5 years old and 4 aged 3 years old) from each one of the schools, were submitted blindfolded to their smell. The samples were selected according to industrially processed

foods (vanilla, coconut, strawberry yogurts, pineapple and strawberry jellies and chocolate), aromatic herbs and spices (oregano, lemon peel, rosemary and cinnamon).



Figure 1. Samples to smell

Children were submitted to an olfactory survey structured into three questions: identification/recognition ("Do you know what this is?"), appraisal ("Does it smell good or bad?") and association of the smell to the tasting experience ("What does that remind you? Have you eaten it already?"), complemented by research field notes by the author about each subject characterization and its correlations with the environment. In the group of 17 children from the School 1, one of them presented special educational needs — though his pleasure for eating and mainly his will to taste every sample he smelt —, and other presenting respiratory problems inhibiting the full functioning of the nasal system. It was found that, in this school, children were less open-minded to the experience and its novelty, showing a state of inhibition and apprehension, by contrast with School 2, where the interest and the motivation to implement this essay exceeded the expectations, demonstrated by children's great enthusiasm and sharing with their colleagues about the obtained results. There were two children that particularly stood out in this group: one for his great olfactory and imaginative skills, deeply smelling every provided sample, as he was sharing his daily routines and eating preferences, revealing a full knowledge about every sample. The other one, eventually supported by familiar stimuli, presents a great sensorial experience with food, revealing experience in kitchen shared practices and food preparation at home (naming his parents), confessing his enjoyment for cooking.

In the Table 1 we present our results in both schools organised in this way: 0 right samples (0 right answers), 10 right samples (10 right answers), more than 50% of right answers (at least 5 or more right answers) and less than half of the right answers (at least 4 or less right answers). From the comparison of the results from both schools we recognise a difference of more than 30% concerning the recognition of a greater number of aromas at school 2, as well as the presence of an individual that identified all the scents to which he was submitted.

Table 1 – Evaluation of the extension of the scents' asset for a total of 10 olfactory samples

	Was not right in any sample*	**Was right in every sample**	**Was right in ≥5 samples**	**Was right in ≤ 4 samples**
School 1	12%	0%	41%	59%
School 2	0%	6%	71%	29%



Figure 2. Child smelling

* including the child with respiratory problems.

In the Table 2 we include both categories and afterwards we divide them between recognition of food and recognition of seasoning. In the first column we include both categories and afterwards we divide them between recognition of food and recognition of seasoning.

Table 2_ Evaluation of recognition of food and seasoning aromas for a total of 20 olfactory samples (10 + 10)

	Recognition of food and seasoning	**Recognition of food**	**Recognition of seasoning**
School 1	38%	51%	28%
School 2	54%	54%	49%

Comparing the results in the identification of food and seasoning, for 38% (School 1) against 54% (School 2), one can verify a difference in School 2 of +16% than in School 1. But, comparing only the identification rate of the group "Seasoning", one verifies a difference of +21% from School 2 (49%) than from School 1 (28%).

Comparing now the results in the identification of scents related to processed food (as, for example, sausages, scented yoghurts, chocolate, jellies), the difference of the rate of recognition — although maintaining the advantage for School 2 against School 1 — , is of lower magnitude (3%), which leads us to suppose that the major trait of differentiation comes from a more sophisticated and wider gastronomic culture of the pre-schoolers of School 2, marked by the resort to herbs and spices, granted by a more educated and protective family setting. In figure 3 we present the nature of the identified scents (experience 1 and 2) and the percentages in each sample, on both schools.

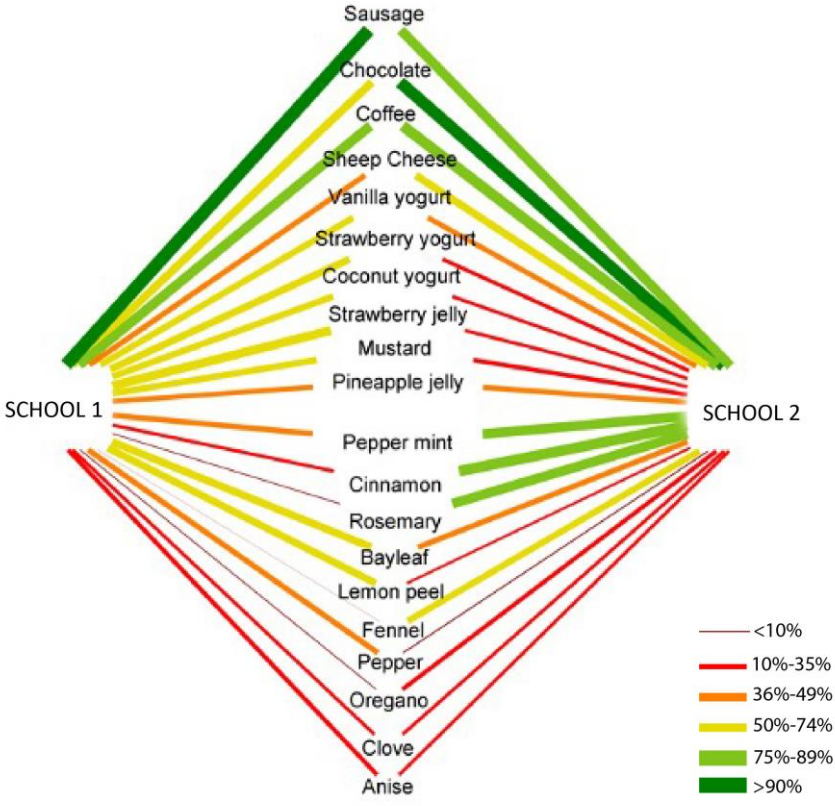

Figure 3. Percentages of each smelled sample in both schools, 1 and 2.

5. Conclusions

Although we had the intention of giving continuity to the empirical work, repeating the inquiry to validate results, the growing difficulties concerning the access due to the sanitary conditioning imposed by the covid19 pandemic would not permit us to proceed with our intent.

After observing the state of the art and the literature review (studies on children food behaviour habits) and understanding the sensorial and neurological correlations between the individuals' autobiographical experiences and the possibility of changing their food

habits, we realised that education, mainly pre-school (Carvalho and Sâmia 2016; Dazeley, Houston-Price, and Hill 2012, 2015; Geller and Dzewaltowski 2009; M. de Droog, Buijzen, and M. Valkenburg 2014), plays a crucial role in building a better future. The openness to the new and the cultural variety of sensory experiences may definitely contribute to the upbringing of more flexible, creative, free (Damásio, 2013), responsible individuals, and, therefore, more suitable for the future and, consequently, more thriving.

Therefore, recognising the implication of the skill to adopt new (food) behaviours, as a result of the acquisition of a bigger organoleptic repertoire, we concluded that the public school may have a decisive responsibility on food education and culture, as we infer from the inquiry conducted in the two schools.

This study data treatment led us to conclude that the most depressed socio-economic group presents a more reduced organoleptic lexicon than the other one, thus implying a lower skill for the creative adjustment to the different, the foundation of innovation.

This experimental study, though incipient, allows to observe other patterns, namely when comparing behaviours between genders, enabling further studies and conclusions to which we intend to give continuity.

The study observes the relevance of the olfactory knowledge, not only as a diagnostic predictor but, and above all, as an enabling feature of a bigger adaptive skill of individuals through the cultural diversity of their repertoires and childhood organoleptic experiences. If the inciting interest of this investigation was guided by a subjective intuition of its author on the acknowledged relevance assigned to smell, it now appears that its impact through food design exceeds the pure sensorial dimension, to acquire a social, sanitary and political ambition.

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Acknowledgements: This research is financed by FCT (Fundação Ciência e Tecnologia). I'm grateful for all the support and generous openness by the management and coordination teams of both schools (1 and 2) where the exploratory studies were carried out. Finally my recognition to the contribution of Cátia Martins, post-doctoral student who produced the cytoscape images.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

FUTUR.DRESS. The Superskin for the Human Body in nearspace.

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Abstract | Access to space is limited to humans due to a number of effects that cause anomalies on the functioning mechanisms of the human body. The rapidly growing phenomenon of space tourism, driven by the economic and commercial flywheel, contributes to medical and scientific research. Thanks to economic interests, space tourism, which seemed like a long-term project, is rapidly advancing medical and scientific research and tests.
In this avant-garde scenario, Futur.Dress is a research project that intends to develop clothing in contact with the skin and interface with the spacesuit and/or with a normal type of clothing and will have all the characteristics of a "functional superskin", suitable for future space travellers. The "superskin" will be characterized by a particular impalpable fabric, structured in such a way as to be able to act specifically on the main problems that microgravity causes on the human body, it will not be invasive because it acts as an "underwear" garment and, therefore, does not interfere the action.
The main objective of the project will be human well-being and well-being, in consideration of all the possible physiological, postural, ergonomic and perceptual changes registered so far.

KEYWORDS | HUMAN, NEAR SPACE, SKIN, BIOLOGY, BIOMIMICRY

1. Introduction

Our Age is characterized by a strong technological acceleration and sees the unfolding of a series of innovations that influence the development, expansion and human life in space. Living and producing in the Fourth Environment, therefore, becomes one of the main scientific objectives for the expansion of man in Space, through the implementation of advanced technologies expected or foreseeable for the next decades. The work for the realization of space tourism has come a long way in recent years, becoming the new world economic and commercial frontier and changing our global perceptions in terms of adaptation, permanence and procreation in space.

The scenario described is the reference for the development of the research project which involves the design of a structured underwear for the space that enhances the main characteristics of a real "super skin", to protect the human body from problems deriving from the effect of microgravity on the human body, in a natural and non-invasive way.

The focus of the research, therefore, is the adaptation of the human body in a new environment characterized by microgravity. In addition to providing the tools of critical analysis and interdisciplinary methodology, the design project is at the centre of the creation of a 'new skin' which will constitute the “sensor suit of the future”; an impalpable film that will protect the human body, thanks to natural principles and an imperceptible set of interconnected sensors.

Man and his actions are immersed in an open system, therefore the dress is also seen as an underwear object capable of continuous exchanges with the new environment as well as relational, economic and social context to be built future.

The dress will be a functional and performing underwear garment characterized by a specially designed modelling, which takes into account the principles of biodesign and is based on the criteria of biomimetic design, inspired by the functioning and structure of human skin. The observation of the mechanisms of the living, described in the broad scientific narrative, represents the condition of the existing to be imitated because it has demonstrated the greatest expressive creativity of the potential of complex phenomena. Biology has observed, collected, catalogued and classified the phenomena of life for decades. Being able to take advantage of biological knowledge to reproduce natural solutions and processes in the design of clothing opens up a broad scenario for imagination and experimentation.

The "superskin" will present a particular impalpable fabric, structured in such a way as to be able to act specifically on the main problems that may occur during the stay in space, becoming the means of safety and the guarantee for the well-being between the human body and the space environment.

In order to obtain maximum results, the work carried out to date has been conducted in close collaboration with a team of medical researchers, cardiologists and dermatologists for

the medical-scientific part and a team of physical, mechanical, aerospace and textile engineers for the specific design of the material and sensors to be integrated into the garment to be made. The "superskin" will also be designed according to an anatomical study distinguished by gender, with more elastic zones to guarantee the compression movements bands to provide micro pressures on the human body and control the diversification of fluid distribution (in space they tend to move towards the upper part of the body).

The objective of the research will be to design a clothing solution that is like a "superskin" and has safety and fit requirements through an "anatomically correct, structured and performing design".

2. Research development

The first phase of the project development focused on theoretical research aimed at analyzing the effects that the human body undergoes in space. Venturing into the space environment has proven negative effects on the human body. Living for a short or long period influences the functioning mechanisms in three different ways: loss of proprioception or loss of the ability to perceive and recognize the position of one's body in space; changes in fluid distribution; deterioration of the musculoskeletal system (for long-term permanence).

These effects are connected to a series of other dynamics that could jeopardize the well-being, safety and success of the tourist's stay in space (tourist 2.0). Starting from these assumptions, in-depth medical-scientific studies were conducted on the various causes that microgravity causes, carefully analyzing the standard health values for both a man and a sample woman and comparing them with the results of the experiments conducted and published on the website of NASA and ESA.

The microgravity we are dealing with in this study is that present in the Near Space, that is the region of the Earth's atmosphere that varies from 10 km to 200 km above sea level, included in the low Earth orbit. The term "microgravity" refers to a state in which the absence of gravity is not perfectly achieved due to small residual forces, such as air resistance or solar pressure. Microgravity is expressed as a fraction of g, where g is the gravitational acceleration on the Earth's surface, with an average of 9.81 m/s 2. In this environment, it has been observed that a change of cells, tissues and organs adapts to the conditions in which the unaccustomed body on Earth is found.

Without the effects of gravity, in fact, the functions of the human body undergo some changes in the posture and functioning of bones and muscles. The muscle/skeletal system is in fact no longer necessary to maintain posture and the muscle groups used to move in a weightless environment, differ from those required in terrestrial locomotion. Another problem encountered by astronauts is skin reactions and a series of pathophysiological changes, most likely due to the lack of gravity. Skin problems play an important role alongside those related to circulation and balance disturbances. In addition to itching and

dryness of the skin, thinning of the dermis and increased sensitivity combined with delayed wound healing and in part also a greater tendency to skin infections have been found.

From this first analysis, the network of voluntary collaborations, specialists and specialist researchers in this field was configured, to give answers in a targeted way to pad any problem highlighted in the superskin project. The specialists involved in this project are: dermatologists, to deal with the problem of dry skin; cardiologists and hematologists, in order to understand cardiac function, blood pressure in stressful conditions or in conditions as similar as possible to the space environment; textile engineers, to characterize an innovative and functional advanced non-woven fabric; aerospace engineers, to understand in more detail some dynamics of the ISS (International Space Station); physical engineers, to detect new data (e.g. skin surface temperature) and technologies, Peltier cells and nano-textile sensors to be integrated into the "superskin".

2.1 State of the art technology and knowledge transfer

Having established the ecosystem of interdisciplinary collaborations, the first step was the analysis of the human body from an anatomical point of view, with particular attention to the muscle fascia and, in parallel, an in-depth analysis of biomimetics. The anatomical features examined in the first step were: the control of the diversification of the distribution of fluids to counteract the problem of proprioception. For this purpose, the focus has been on the compression to be implemented on the body to mitigate the effects of the different distribution of fluids.

The research was therefore developed on the basis of the prevention methods used in sports for limb, tendon and muscle injuries, such as braces and bandages. Attention was focused on the bandages, in particular the functional bandages, of the *Theratogs TM system* and *Kinesio Taping*. These latter adhesive bandages, in particular, relieve the physiological load by exerting traction and transferring force directly to the skin. The bandage can act both at the joint and at the tendon-muscular level, depending on the application technique for unloading, stabilization, support or compression.

Theratogs is a system used to facilitate movement and postural alignment; takes on the function of a second skin with a totally adaptable strap system. Provides a foam lining, breathable and comfortable. In addition to the strap, the straps offer rigidity on the vertical axis to improve joint balance and flexibility on the horizontal axis to ensure fit and comfort.

Kinesio Taping is a taping with therapeutic and biomechanical effects. It is a hypoallergenic tape with excellent elastic qualities, has the same thickness as the leather and is resistant enough to withstand for several days even in the presence of sweat and the use of showers. It works with the fascial, lymphatic and muscle/skeletal systems. When the tape is applied to the skin in a normal position, an effect called "convolution" occurs, so as soon as the body moves, the tape acts as a pump, continuously stimulating lymphatic circulation and muscle correction.

One of the characteristics of Kinesio Taping is to improve the perception of body movement by counteracting the swelling of the tissue due to compression. Considering that the human body is a perfect machine and capable of adapting to extreme environments autonomously, the first hypothesis is that of acting in a completely natural and non-invasive way, providing support to the human body through the study of structured modelling, designed *ad hoc*, based on the Kinesio system. The theoretical reference to biomimicry has also provided the elements for the functional characterization of the superskin.

Life is "the condition of organisms endowed with a specific form, a specific chemical constitution, able to maintain themselves in a situation of dynamic equilibrium, i.e. to have a constant internal environment despite exchanges with the external environment (homeostasis) and to reproduce these properties in other similar organisms" (www.treccani.it/enciclopedia/tag/vita).

The most interesting feature is that nature not only undergoes changes with time, but also evolutions and innovations. The mechanisms of evolution are complex and very slow and include several aspects. The uniqueness of each individual is one of the most ingenious expedients of this mechanism, because each specimen is in fact an experiment.

In an ever-changing ecosystem, the only chance of survival is in change. In each generation a particular character (perhaps a mutation) can manifest itself that, between attempts, mistakes and lucky coincidences, can become fundamental to survival in a changed environment and then spread in the following generations.

The biological strategies that we can imitate manifest themselves at various scales, there are examples of materials inspired by nanometric structures, but it is possible to inspire the design of the functional underwear to the resilience of macro-organisms such as prairies or Mediterranean scrub.

There are solutions more suitable for experimentation in the chemical-physical field, others in the technological field. Imitations can be of interest to living organisms themselves, but also to their group behavior, or one can draw inspiration from the constructions that animals erect as a refuge or den, as an indirect imitation of biology. These biological strategies have been modelled and perfected over millennia and reach high performance levels.

"Biomimetics introduces us into an era based not on what we can extract from nature, but on what we can learn from it. Shifting the focus from learning about nature to learning from nature requires a new method of investigation, a new set of lenses, and above all a new humility" (Benyus, 2011, p. 35).

The in-depth study of biomimetics marked the transition to the second phase of the development of the research project: the study and analysis of the structure of the fabric that will constitute the super-skin and the first hypothesis of the morphology of structured underwear.

Different living beings such as plants and trees are taken into consideration as examples to be imitated to increase the positive effects of some solutions adopted as we have seen in Kinesio Taping, especially for body thermoregulation. For the superskin project, we proceeded by analyzing the structure and functions of human skin. In fact, the concept of superskin tends to highlight and increase functional and behavioral characteristics already. present in human skin.

The skin, also known as the integumentary system, is a tissue of separation between the individual and the environment and, acting as a mediator, performs multiple functions: it protects from harmful external agents and constitutes the first defense barrier of the organism; detects changes in temperature and pressure; controls evaporation; regulates body temperature, dispersing heat or reducing heat loss through a system of vasodilators or vasoconstrictors.

Starting from the assumption that the imitation of form and function is the basis of most of the projects defined as biomimetic, the creation of a fabric structured in three different layers, inspired by the structure and functioning of human skin, was hypothesized. The consistency will be slightly porous, to contain substances capable of maintaining skin hydration; the thickness will be a few millimeters and will incorporate micro-sensors to constantly monitor the health of the tourist, in a completely invisible and non-invasive way. This innovative fabric will form the new separation membrane between the human body and surfaces or the external environment.

As for the morphology of structured underwear, in order to obtain a more efficient emulation, the imitation of the process that leads to a particular functional form and the imitation of the logic of the ecosystem, or an open system full of connections with elements of the context has been taken into account.

3. The interdisciplinary network

The third phase of the development of the research involved consulting with specialists, doctors and engineers, in order to obtain more results on the basis of the assumptions endorsed. The first consultation was on skin dryness with the dermatologist of the Policlinico Nuovo of Naples: Dr. G. Argenziano. Together with him and two other collaborators: Dr. Elisa Fulgione and Dr. Caterina Fulgione we examined in detail the causes of epidermal dehydration by examining a study conducted by the Institute for Experimental Dermatology, University of Witten/Herdecke, Witten, Germany.

Clinically relevant side effects on astronauts' skin in space play an equally important role as blood vessel-related side effects. It has been reported that problems related to dry skin, skin irritation and dermatitis occur with a frequency of 39 % over a short-term space stay. To date, there are no extensive studies on the effects of a stay in space on human skin and in particular on skin changes during a long-term mission. Ultrasound measurements have only

been performed during a short-term mission, i.e. under the influence of ship alteration. Further numerous examinations concern the influence of the absence of gravity on the vascular system. Naturally, the physiological measurements of the skin are also influenced by an adaptation of the vascular parameters to the absence of gravity.

Within about 3-5 days, however, the displacement of the fluid (blood and tissue fluid) is completed. The adjustment of the blood composition takes about 4 weeks. Epidermal measurements have provided evidence of thinning of the stratum corneum and prolonged cell moulting time from the basal layer to the stratum corneum. The results obtained from the tests revealed a high rate of skin dehydration, epidermal thinning, dryness, itching, thinning of the dermis, increased sensitivity, increased tendency to skin infections, delay in wound healing, loss of elasticity and mild skin ageing.

Note the results of this first study, together with Dr. Caterina Giorgio and Dr. Elisa Fulgione we considered the option of treating the parts most affected by the problem (legs, arms, forearms, feet, groin) with highly nutritious and moisturizing substances such as ceramides, fatty acids and glycerol. In particular, the use of glycerol was the most recommended as it helps to maintain skin hydration for a long time and therefore to slow down the appearance of signs of ageing and skin deterioration; glycerol also helps to stimulate cell renewal.

A one-sided treatment with a skincare emulsion while in space would lead to an improvement in the hydration of the horny layer and an improvement in the barrier function of the epidermis. However, in order to obtain more precise results, additional tests are necessary, especially with a larger number of test subjects, using optimized test conditions and additional measurement methods. In this way, side effects on the skin related to a long-term stay in space can certainly be minimized and general medical risks can be recorded through physiological skin parameters.

This applies especially to the causes of skin changes, e.g. the influence of weightlessness, which can then be determined. Another suggestion, therefore, was to act preventively while waiting for future results, preferring tissues that are antibacterial, antifungal and antiseptic, as conditions in space tend to proliferate bacteria and try to develop a nano sensor that has the same function as the chronometer that can be used to monitor skin health constantly.

3.1 Design for Spatial Human Beings

The conquest of Space by man, from the Apollo 11 mission that allowed the first human being to set foot on the Moon to the last flight of SpaceX, has known various phases projecting man towards boundaries once considered utopian and impossible.
Today we can consider ourselves humans living in the *New Space Age* and "space tourism" is inserted as a luxury experience accessible to the elite classes of planet Earth.

The tourists 2.0 in fact can be defined as users looking for unique travel and experiences, exclusive and far from the old paradigm of mass tourism; They use space as a form of

consumption, leaving traces of their status not only terrestrial; They fit into a market governed by new social and cultural trends and that determines new needs.

They wish to live an extraordinary and otherworldly experience to dissociate themselves from the terrestrial habitat: they seek new spaces, configure new temporal dynamics to define a new normality.

So defined according to recent literature, the Space Hub has opened new cultural images of space and has also caused fashion design and space wear engineering to intervene in the configuration of a true space wear system, *spacewear.*

The design and implementation of a 2.0 tourist-centric clothing system is based on research and experimentation of new methodologies that respond to specific criteria dictated by microgravity and weightlessness, as well as conditions that may occur during the short stay in aerospace. To maximize safety conditions by advanced and customized materials or electronic components using innovative and smart textiles, the human being can face the foreign environment that involves the so-called space pathologies, i.e., alterations in his/her vital functions.

The spatial clothing system for the 2.0 tourist composed of several parts, must also express the luxury status of the user that translates into an original design, comfortable but also sophisticated while responding to the limited aesthetic concept of the technical components.

The first design phase involves the modeling of a space undergarment, the "super skin", which based on the principles of biomimicry, configures a base layer in close contact with the body. This is followed by interchangeable elements that define a mid-layer and an outer layer: a jersey, a pant and a jacket replace the current space suits, in a configuration specifically designed to ensure maximum comfort and convenience during non-vehicular activities, configurations made possible thanks to the symbiotic relationship between the field of wearable technology, computer science and evolutionary design of space systems where the multidisciplinary nature of the project collides between the subjects of engineering, design, medicine and ergonomics.

The design of the individual items that make up the system, consider the *Mechanical Counter-Pressure*, a specific technology still in its experimental phase (MCP) that replaces the pneumatic pressurization used in previous spacesuits. Using this technology, mechanical counter-pressure is applied directly to the body with temperature management mapped to the body to provide perfect heat and humidity management while preventing overheating or cooling. The system so configured would bring increased flexibility, dexterity, and comfort as well as ease of donning and doffing of parts.
The configuration of the space clothing system is intended to redefine design practices in terms of type follow function" concept of garments that conform to the exact shape of the body, for precise innovation that best interprets the "from fit, under critical conditions where locomotion and mobility are a top priority as is decreasing weight and equipment. The application of ergonomics requires considering human capabilities, abilities, limitations

and needs with a design of new clothing elements that does not find superstructures or superficiality but takes up the concept of Bauhaus not as reduction and minimalism but simply of consistency from design to prototyping.

3.2 Discussions

From this data, a plot has been developed of how the amounts of glycerol can be distributed over areas of the human body (Figure 1). The second consultation was with the research cardiologist, Dr. F. Coppolino. During the meeting with Dr. Coppolino, questions were also raised with fellow dermatologists in order to provoke a debate on the same issues but addressed from a cardiovascular point of view. All the examples of monitoring instruments used on the International Space Station in order to control the vital parameters of the subjects performing medium and long term missions in orbit were exposed. Also in this case, in order to obtain precise data on cardiac function in space, we made use of some studies carried out by NASA and specialist institutes on heart pressure. It is well known that the absence of gravity during short-term space flights (from days to a few weeks) causes a displacement of 2 litres of blood and fluids from the lower body segments to the upper part of the body, which is accompanied by a heart increase of 20%, despite an unchanged or reduced heart rate. However, blood pressure remained unchanged or decreased (mainly diastolic pressure) and heart rate decreased by up to 15 beats per minute during weightlessness, despite maintaining high sympathetic nerve activity. Another analysis carried out concerned about the difference in behaviour between men and women in space.

Tests carried out by NASA showed that women are subject to orthostatic intolerance linked to vascular problems that occur in microgravity conditions and have a greater loss of blood plasma volume. The response to the stress they undergo while onboard the ISS results in a more pronounced increase in heart rate in women than in men, while the latter responds with an increase in vascular resistance.

With Dr. Coppolino, therefore, needs in terms of spontaneous adaptation of the body to the new environment were highlighted, which should not be limited with a preventive intervention in order not to inhibit natural reactions that are instead useful to the body; therefore it was decided to pursue the path of preventive rather than functional monitoring. Having selected some preliminary parameters to be included in the functional clothing that is being designed, a functional/adaptive textile project has been configured with a predominantly "diagnostic" and then adaptation purpose.

From this data, a trace of how the patches for cardiac and pressure control can be positioned on the human body zones has been elaborated (Figure 2). The third consultation was with engineers M. Masullo and M. Scorpio. After the first analysis of all the results obtained and the problems on which we are proceeding, it was proposed to intervene through a specific sensor that can monitor the surface temperature (F-skin), creating a Peltier effect to calibrate the heat. Through this thermoelectric phenomenon, originating

from the Peltier cell, the electric current flowing between two different metals or semiconductors placed in contact produces a transfer of heat.

From this data, a trace of how the sensors for temperature control can be positioned on the human body zones has been elaborated (Figure 3).

4. Conclusion

Being a research project still in the development phase, there are no conclusions on the project itself but experimentation still to be carried out and the design phase to be started. The study converges on the problems caused by microgravity on the human body and biomedical research turns towards solutions to support and control them.

The research involves the development of a specific fabric: a type of impalpable non-woven fabric with microencapsulation of glycerol that will allow the dermis constant hydration. The design of the structured spatial underwear includes the specific study of new high-performance modelling, studied on the basis of biomimetic design.

The aforementioned will be presented as a "superskin" modelled in such a way as to follow every movement of the body and consider all possible physiological, postural, ergonomic and perceptual changes, giving comfort and safety to the tourist 2.0.

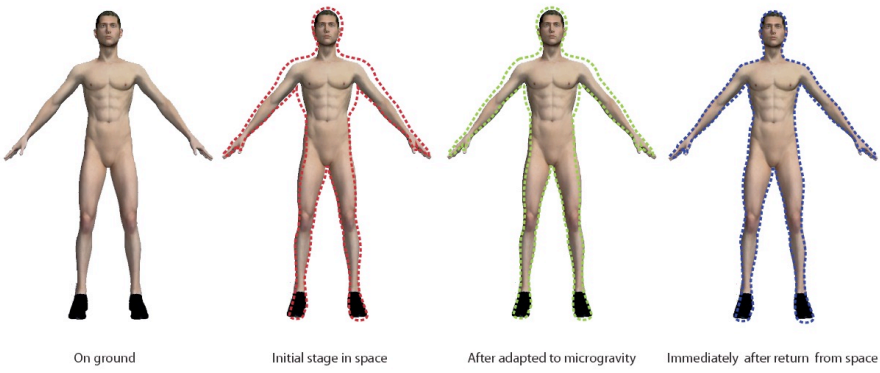

Figure 1. Diversified distribution of body fluids.

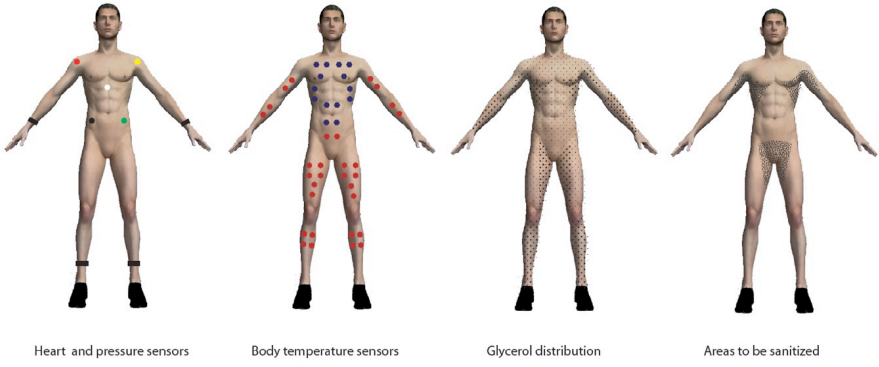

Figure 2. The hypothesis of patch distribution for cardiac and blood pressure control and hypothesis of distribution of sensors for regularization and control of body temperature.

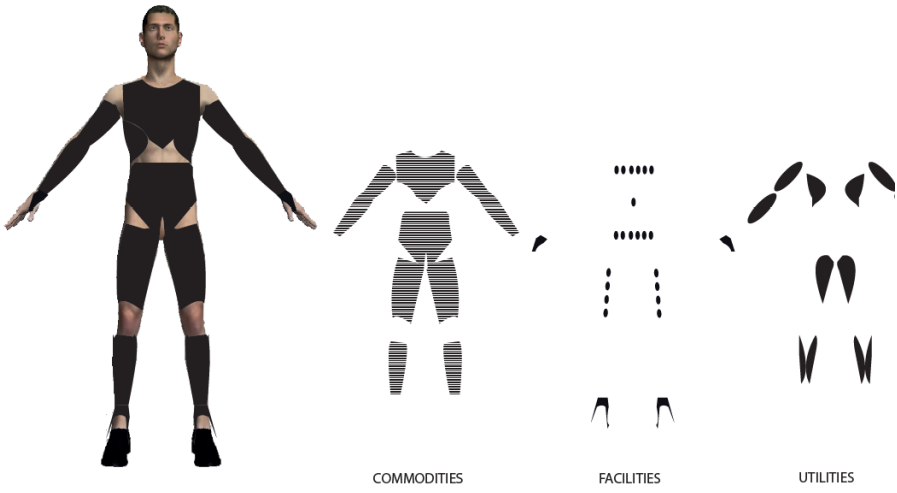

Figure 3. System study (Work Dress Design)

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Acknowledgements: We would like to acknowledge the following experienced professionals who follow the research and with their precious collaboration we have created an interdisciplinary network, which are: the dermatologist of the Policlinico Nuovo of Naples: Dr. G. Argenziano, and two other collaborators: Dr. Elisa Fulgione and Dr. Caterina Fulgione; cardiologist, Dr. F. Coppolino; engineers M. Masullo and M. Scorpio.

Although the authors have shared the general line of the paper, however, the chapters are attributed as follows.

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Ilaria Giampetraglia has drafted the following chapters: 2.1 State of the art technology and knowledge transfer.

Alessandra De Luca has drafted the following chapters: 3.1 Design for spatial human beings.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Hybrid systems of human | technological | biological products: a road to a greater sustainability?

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Abstract | As designers we have an obligation to design taking into consideration the complexity of reality; the only way to face it is to adopt a multidimensional and dialogical design thinking. If it is true that the goal is to understand the qualities of the complex system in which we live not as a simple sum of its parts but as a system of complex interrelationships, where the qualities derive from the relationships and interrelationships between the components of the system itself, the quality of a product-system is measured not so much by its ability to create useful value by its individual parts, as much as its ability to create relationships between its components. The paper will present a research project where products equipped with technology have been created to make the human, technological and natural systems interact [1].

KEYWORDS | COMPLEXITY, SYSTEM, PRODUCT DESIGN, SUSTAINABILITY, TECHNOLOGY, IOT

1. Introduction

In terms of sustainability, designing for the complexity of reality is, according to many scholars, the only way to achieve a correct balance with the nature that surrounds us. The human condition, however, is at odds with the second law of thermodynamics according to which the energy used for any process is transformed into entropy; as Rovelli argues (2017, p. 140) the entire history of the universe is characterized by the constant increase in entropy. All living things are composed and defined by similar processes that trigger each other. For example plants thanks to photosynthesis collect solar photons, animals (including men) feed on low entropy by eating. As Rovelli argues (ibid., p. 141) within each living cell the complex network of chemical processes is structured in such a way as to allow a constant increase in entropy. Life is a complex network of interrelationships between heterogeneous elements that stands and evolves thanks to the constant increase in entropy.

As McDonough W. and Braungart M. claim (ed. 2013, p. 99) only two essential elements make our life on earth possible: the earth (mass) and the sun (energy). The sun is the only thing with constant entropy (Korhonen J. et al., 2017, p. 42 and Morin, ed. 2015, p. 336) which thanks to photon irradiation allows life on earth and shows the most admirable example of natural and spontaneous organization.

> "This fabulous machine that made itself, in and through the fire, and not only once, thanks to an incredible stroke of luck, but billions and billions of times - this machine swirls, manufactures, works, regulates itself without a convector, engineer, specialized parts, without program and without thermostat"(Morin, ed. 2015, p. 185) [translation by the author].

The action of man, unlike that of the sun, has instead demonstrated systemic planetary limits (Meadows D. H. et al., 2004) which require us nowadays to review and redesign our development model. As awareness of the damage produced by anthropic force on natural systems has matured, in recent years we have been witnessing important changes in the way we think, design, produce and consume.

On the basis of this consideration, it could be said that the role of the designer may be to build relationships in antithesis to the parcelling out of areas and knowledge.

Designing the complexity of reality does not mean guaranteeing the development of a single system (economic, for example), but of increasing the capacity of relations between systems (social, cultural, natural, political, economic), making them cooperate as an organic whole. Design, as Paola Antonelli (2019) argues, is a mental and political form just as nature is. According to the renowned curator, design and architecture can help us deal with a life that also deals with other species and that looks beyond immediate interests.

In terms of sustainability the world should be considered as a set of complex systems interacting with each other. As Thackara (2008, p. 13) argues, as designers we must face the

imbalance of multiple systems that interact with each other such as energy, climate, food, culture.

Capra F. (2013) introduces the concept of qualitative growth which, in society, ecosystems and living organisms, consists of an increase in complexity, refinement and maturity. The concept of qualitative growth must therefore be understood as in biological systems, where there is quantitative growth when an organism is young and qualitative growth in the next phase, characterized by slowness, maturation and decline or, in the case of ecosystems, with 'succession' and therefore an increase of complexity. Understanding the system in which we design as a complex set of heterogeneous relationships including technological, social, cultural, biological aspects could lead us, taking up the concept of Morin[2] (ed. 2015, pp. 336-346), to conceive active self-producing organizations and consequently generators of the negentropic character necessary for greater sustainability.

If we consider the system that is created between people, nature and digital technologies we can consider it as a complex system (Gandolfi, 2008) which includes within it complex elements which act in a differentiated but unitary way. Systems are, as claimed by Ghajargar M. et al. (2018), to a large extent, related to the relationships between people, activities, objects, technologies and places. Recent digital technological developments have increased the daily use of "intelligent objects" which systemically interact with each other and with those who use them. However, as Ghajargar M. et al. (2018) argue, very often the design of IoT devices focuses on the product rather than on the relationships it generates between people and with other products. The relationship of reflection that could be established between the user and the product (material and immaterial) according to the authors could bring benefits in terms of sustainability (Baumer et al. In Ghajargar M. et al., 2018).

In this scenario, design can certainly make an important contribution especially thanks to the ability to adapt and integrate between and in different types of knowledge. The disciplines of the project are transforming very rapidly in recent years, by their nature they are called into question whenever there is a need for innovation. In particular, today the progress of technology on the one hand, which has led some technologies defined as "enabling" to have very low costs (commodities) and an exceptional diffusion (Celaschi, Di Lucchio, Imbesi, 2017), and the development of science on the other , in particular biotechnology, have offered and continue to offer design important challenges of development and connection with other sciences.

This article will present a recent research project relating to an outdoor furniture system where different systems dialogue: the 'vegetable', the 'social', the technological (cloud and sensors) and cultural systems. The project presented therefore attempts to keep the social, cultural, technological and biological aspects together to make them act as a single hybrid system (human - technological - botanical) which aims to regulate itself for a common goal, life.

2. Natural forms to emulate

Looking at nature to learn its complexity developed over billions of years is a challenge that man has proposed for centuries (Mascitti J., 2018, p. 17). From the preliminary studies of Papanek (1973), to the scientific theories of Benyus (1997), thanks to the important scientific advances, we have now come to know in depth the structures, processes, logics and operations that underlie the natural world (Ranzo P. in Langella C., 2007). The close and microscopic point of view that scientific studies have reached are allowing us not only to observe nature as a source of inspiration but also as an instrument of innovation (Langella P., 2007, p. 20).

After all, the human system is in continuous interaction, even involuntary (positive and negative), with natural elements and precisely for this reason a design that brings the human system closer to the natural and biological system could be a promising road to greater sustainability.

The idea of establishing a dialogical relationship with the plant system seems absurd and science fiction, but recent discoveries confirm that interspecies forms of communication already exist in nature (Beiler K. J. et al. 2015). For example, if we consider the 'forest' ecosystem we can see that under the surface a vast and interconnected network of life connects trees through their root systems, but above all through other species: mushrooms. As the authors explain (idemI) the process begins with the oldest and tallest trees in the forest, these have greater access to sunlight and through photosynthesis, they produce more sugar than necessary. Mushrooms, which need sugars to survive, develop most of their body underground, which is made up of a dense mass of threads called 'mycelium'. This grows in the root system of trees to absorb excess sugars. In return, the mycelium supplies the tree with the nutrients it needs from the soil. This symbiotic relationship is known as mycorrhiza which derives from the Greek words myco = mushroom and rhiza = root. These tree-to-mushroom relationships connect the trees of the forest together, forming an underground communication network to exchange water and nutrients useful for growing sprouts and even send warning signs when plants are threatened (TED summit, Simard S.W., 2015) .

To get a better picture of these relationships, the team of researchers from the University of British Columbia used DNA analysis to map a fungal network in an area of the Canadian forest. Surprisingly, they found that on average each tree was connected to forty-seven other plants. Even fossil remains have been found which confirm the existence of mycorrhizae already 450 million years ago, at the same time as the appearance of plants on the emerged lands, and it is believed that they were fundamental in the process of colonization of the continents and the development of life (Beiler KJ et al., 2015).

Since design has the ability and the duty to set in motion dialogue processes between the parts of a system and the surrounding environment, affecting society through the production not only of objects but also of new relationships and socially more sustainable

behaviors (Rossi M., 2014), isn't studying this type of exchange a clear example of interspecies communication where IoT could help us to achieve greater sustainability?

3. The project

3.1 Interdependence between man and plant. a mutualistic relationship to be rebuilt.

In line with the definition of Smart City issued by the European Parliament (2014) "A smart City is a city seeking to address public issues via ICT-based solution on the basis of a multi-stakeholder, municipally based partnership" the project invites people to get closer to nature and proposes strategies for the development of a balanced urban ecosystem. The goal is to stimulate human-plant relationships by reconstructing, thanks to IoT technologies, the bond that makes these two life forms a single biological machine.

If, as Edoardo Fleishner (2014) says, the future belongs to the metropolises, cities and villages, then they must cross-mediaialize and it is only in this way that they become smart. The first step towards cross-mediation is awareness, that is, that everyone is aware of the ongoing process.

This process, according to the author, consists in the construction of the nervous system, that is, the brain, of cities. For example "In Italy this evolution finds fertile ground, because we are already a pre-cross-media people, that is webbico, social, mobile and multiscreen, but above all creative" (Fleishner, 2014, p. 15). The designers therefore had to start confronting a more diversified design reality, considering the product as part of an eco-system, adopting a multidisciplinary approach and interrupting that designer-craftsman relationship typical of Italian design (idem). But what exactly does being smart mean? Considering the origin of the term, in the IT field, being smart (intelligent / brilliant) means being able, within a complex reality, to process the information available and consequently make the correct choices. So what is smart design, in the true sense of the term?

> "Smart design is the one that finally has the courage to take on all the ethical and social implications of design to improve the reality that surrounds it, analyzing the systems behind the new contexts of life and creating objects that can promote and convey behavior environmentally and socially more sustainable" (Mometti M., 2014). [translation by the author]

3.2 SMAG PROJECT (Smart Garden)

SMAG project, coordinated by the technological leader Nuvap Srl and with the supervision of Distretto dID (Distretto Interni e Design), involves two research entities, DIDA Department and DAGRI Department, and two companies in the stone sector: UP Group Srl and Arredo di Pietra Srl.

The project involves the creation of a hybrid product / service system that will allow companies, including traditional manufacturing ones, strongly focused on the product, to develop new paradigms that are attributable to the Smart Service Welt (World of Intelligent Services) much more based on the relationship with the user, and above all it will allow to combine products with third party services on digital platforms, contributing to the creation of new digital infrastructures: intelligent spaces (smart spaces) or environments where objects, equipment and machinery that are intelligent and enabled to connect the internet, connect to each other.

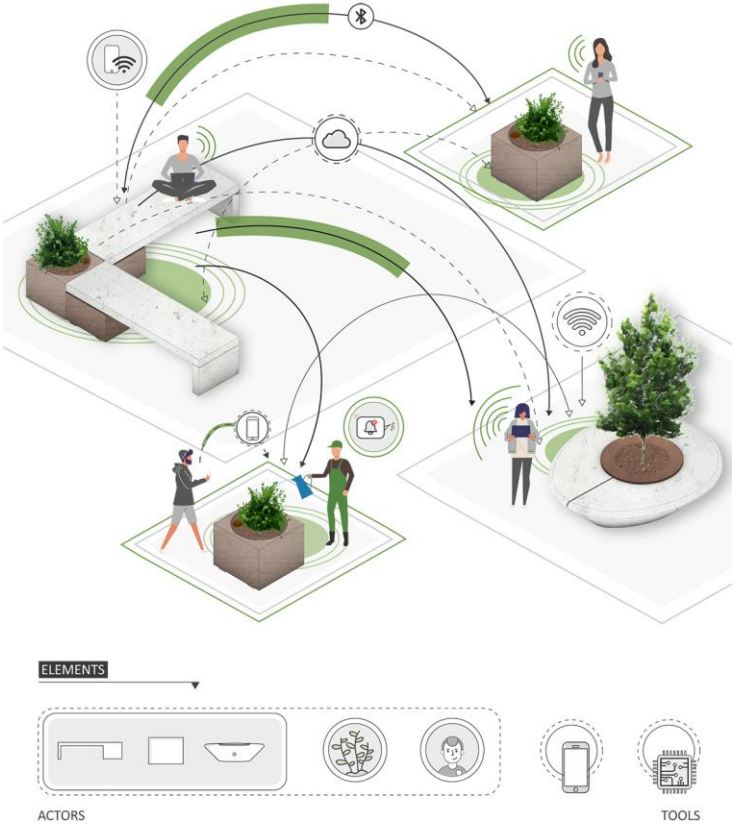

Figure 1. In figure no. 1 we see how the technological set-up relates the needs of the vegetal system with the inhabitants of the urban park or with maintenance workers such as

gardeners (product, people, plants and tools - sensors and devices -). The vital parameters of the plant and air quality are collected through sensors integrated into the furnishings and sent to the cloud. The user or the park maintainer can access this data at any time through a specific app, which informs him about the quality of the urban air and the health of the plant. In case of need by the plant or if certain air quality parameters are exceeded, the application will warn the user.

The project has been developed strategically on two market sectors: urban furniture for public spaces and that for private outdoor spaces. As regards the public sector, two collections of Rapolano travertine objects belonging to the same system have been developed. Both in the Alessandra Galli's concept 'Water Value' (Fig. 3) then in the Mirko Romanelli and Jonathan Lagrimino's 'Litus' collection (Fig. 4) the objects were designed not as mere isolated products but as part of a product-system, small synapses aimed at building a distributed network of objects in the city that exchange information between them using WiFi and bluetooth technologies. Everything can be monitored through a WEB management interface (Fig. 3, right). The goal is in fact to build a sort of widespread intelligence capable of self-regulation and regeneration following those homeostatic principles that are the basis of any living being. The urban pots that house the plants are therefore equipped with sensors that measure the parameters of the soil from which the needs of the plant are deciphered. These data are sent to the Cloud and the intervention of man takes place therefore to satisfy the specific need, but what does the man get in return? Nothing but the oxygen it needs to live (Mancuso, 2019, p. 87). The shape of the product (Fig. no. 2) in particular is designed to accommodate a medium-sized shrub and also provides a sitting space. The surface of the seat is manufactured with an inclination of 2% towards the interior in order to assist rainwater in a channel that supplies three underground terracotta pots (Fig. no. 2). The "olle" (trans.: jar) method, a multi-millennial irrigation technology, keeps the soil moist but not wet and this discourages the proliferation of bad herbs; in addition, the water is distributed directly to the root level, avoiding surface washout and evaporation. Each jar, thanks to the porosity of its walls (porosity is determined by a percentage of organic substance in the clay mixture that disappears during the cooking phase), keeps an area moist with a diameter approximately equal to three times its size, for a period that varies according to the season and the place. The design of these elements for self-irrigation is designed following the physical law of Darcy ($\Delta P = k \cdot q$) which determines the motion of a fluid (in our case rainwater) through a porous medium (terracotta). In dry periods, when the water reserves run out, an ultrasound sensor, placed inside the jar, signals the need for irrigation and a dripper provides the refill, ensuring constant irrigation. When the volume of soil becomes saturated in rainy periods, a canal, also inclined at 2% towards the outside, drains excess water avoiding compensation for the roots.

"Water Values" and "Litus" therefore become objects aimed at triggering homeostatic phenomena; where homeostasis is understood as the aptitude of living organisms, whether they are cells, individuals or communities, to maintain their characteristics in a state of equilibrium with varying external conditions: the living being (in our case the cities) a open-

system, the maintenance of internal conditions is carried out by automatic mechanisms (homeostatic devices, in our case the furniture system) which regulate internal flows through the system itself. An example of this is the ability, typical of mammals and birds, to maintain the optimum body temperature as the external conditions vary and the quantity of heat produced in the metabolism processes. This project therefore has the ultimate goal of



Figure 2. In Figure 2 we see the integration of the technological set-up within the urban furniture element. Rainwater irrigates the underground jars through the inclined plane and the system of channels (a), a channel inclined towards the outside allows the water to flow out when the containers are completely full (e). The jars uses the principle of capillarity feeding the plant in an optimal way (b). In hottest months, when the jar is empty, an ultrasonic sensor will inform the user to fill it manually or will activate an automatic filling system (c). Inside the pot there is a soil humidity and temperature sensor that allows the user to monitor the parameters (d). On the side there is a control unit designed to process data relating to the quality of the air and soil (f).

eradicating the old city / countryside, built environment / natural environment to make man and the plant coexist, promoting exchanges and synergies between these two forms of life. In parallel, has been a collection of objects for the private sector. The SMAG project involves the development of a system of intelligent furnishings for the care of the home garden. Also in this case, the objects have been designed to improve the relationship between man and nature and to build forms of interaction between them. The project (fig. no. 6) is built on a fairytale (Snow White and the Seven Dwarfs, concept by: Giacomo Da Re) and each environmental parameter is communicated through feedback associated with a specific 'nano' (trans: dwarf). For example, the air quality will be reported by Sneezy (Sneezy / air quality, Dopey / air humidity, Grumpy / atmospheric pressure, Sleepy / soil humidity, Bashful / temperature). The sensors for the evaluation of environmental parameters (PM10, PM2.5 PM1, VOC, CH4, CO2) and the control unit are all contained within the 'Doc', the central element of the collection, slightly larger than the others. These sculptural elements conceal the irrigation system beneath them, which is activated when the soil moisture sensor signals dehydration of the soil.

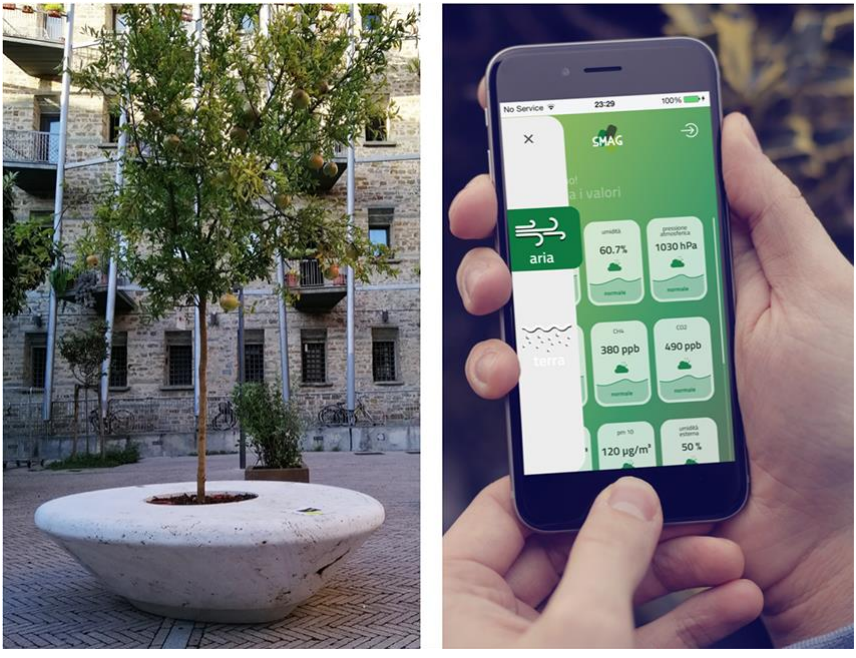

Figure 3. (left and right). On the left, the product of the Water Value collection; on the right, a screenshot of the SMAG system control application





Figure 4 - In figure no. 4 is shown the Litus system of seats and pots



Figure 5 (left and right) - In figure no. 5, on the left, is shown the control unit position in Litus collection; on the right a detail of the jar positioned into the Litus vase

It can therefore be said that the Smart Garden is, in essence, a garden that uses resources (water, energy, fertilizers, etc ...) and information (soil parameters, air parameters) in a good way, making use of ICT technologies and the possibility of monitoring capillary and in real time of the variables involved.



Figure 6 - In figure no. 6, is shown the Seven Dwarfs collection

4. Conclusion

The aim of the project was the creation of a system of intelligent objects capable of relating to the various actors who interact with the system: on the one hand with the gardener for aspects concerning health and maintenance of greenery; on the other with people, from an emotional / experiential point of view, with particular reference to the concepts of wellness and health.

The presented project could be defined as a behavior design project, that is, as a project aimed at conveying new behavior paradigms. The system designed monitors air quality and collects rainwater - sensitizing the user on the importance of plants for the absorption of CO2 and on proper management of resources -, helps garden maintainers to keep plants alive thanks to the constant monitoring of soil moisture and weather conditions.

As Mara Rossi states "The added value of design consists in the ability to create new paradigms, capable of directing organizational structures towards the construction of new behavioral forms (in our case, behavior with the natural environment). And with this assumption that it is possible to interpret design as a tool that guides society towards paths characterized by unprecedented forms of 'intelligence' (Rossi, 2014). Rullani reinterprets the concept of intelligence by affirming that we can speak of

"fluid intelligence, that is, knowledge that is not incorporated in machines or in automatic codes, but that is in people's brains and in the sedimented knowledge of their relationships" (Rullani 2008 in Mometti 2014, p. 87). [translation by the author]

In this scenario, life is considered a fundamental and essential element of innovation on which the designer's ability to implement processes that generate social and cultural change intervenes, to weave new and complex forms of relationships.

From these affirmations we can believe that the project activity must be able to systematically interact different cultural, social, technological, territorial aspects in order to direct the project to collective well-being.

To build this new paradigm of behavior it is therefore necessary to build a dialogue, a bridge between the two systems involved, human life and plant life. It is therefore necessary to guide a cultural change aimed at building an 'interspecies empathy'.

"Empathy defines an active involvement, that is, the willingness on the part of the observer to become part of the experience of the other and to share the emotions triggered by it" (Rifkin 2010, in Mometti 2014 p. 89). [translation by the author]

As Mometti argues (idem) regarding empathy between individuals belonging to the same species, these principles already exist and are scientifically demonstrated by the discovery of mirror neurons. But what happens when it is necessary to build empathic relationships between different species?

If empathy uses listening and analysis of accurate social feedback as a way of knowing the other, the role of the designer is also to build these feedbacks through the use of ICT in order to activate innovative processes capable of trigger social-behavioral transformations. In a world where we are destined to produce entropy, the project, taking up Morin's concepts (2015, see note 2) must be able to establish negentropic processes also of a social, cultural and behavioral type in order to re-establish a dialogical relationship with the natural world.

The boundary between the real world and the virtual world appears increasingly blurred and what we are experiencing can be defined as a real hybrid world between the materiality of the products, the immateriality of technology and the still unexplored world of science. Design is responsible for keeping these realities together in a scenario that is no longer that of the form of products but that of the form of relationships and, as Di Lucchio (2018, p. 5) argues, the development of new behaviors.

As Stefano Mancuso says:

“So this is our home: an area of 510 million square kilometers; enclosed in a volume that, roughly, ranges from 10,000 m below sea level to 10,000 above it; 20 total km that enclose the only place in the universe - as far as we are concerned - within which life exists" (Mancuso 2018, p. 15). [translation by the author]

A house, however, very small and fragile if we think that the Sun, which provides us with life, is over 1,300,000 times larger. However, this 'home' of ours is the only place in the universe known so far that has developed life. As Mancuso (2018, idem) states, therefore, it is not dimensions, but life that makes our planet special.

This is therefore the premise from which the designer should start: to design in order to protect the uniqueness - in diversity - of the earth, to guarantee the preservation of life.

Notes

[1] the text was conceived and structured by the three authors. However paragraphs "Abstract", no. 1"Introduction" and no. 4"Conclusion" are attributed to Marco Marseglia; no. 2 "Natural forms to emulate" and no. 3.1 "Interdependence between man and plant. a mutualistic relationship to be rebuilt" are attributed to Francesco Cantini; no. 3.2 "SMAG Project (SMArt Garden)" is attributed to Alessio Tanzini.

[2] Negentropy is not simply the opposite of entropy (negative entropy), the two terms, although constituting the positive and negative character of the same magnitude, correspond to antagonistic processes from the point of view of the organization. Entropy is disorganization and degenerescence, negentropy is reorganization, regeneration, development and complexification. Each negentropic self-producing process expels entropy as a byproduct of its activity and inscribes the complexity that is proper to it in the ring: disorder-interaction-order thanks to organization.

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Acknowledgements: We thank the Design Laboratory for Sustainability, in particular Manfredi Sottani and Marika Costa for the development of the application; a special thanks to the scientific director of the laboratory Prof. Giuseppe Lotti; the students of the Master's Degree course in Design and in particular Alessandra Galli, Jonathan Lagrimino, Mirko Romanelli, Giacomo Da Re; All the research team, Arredo di Pietra, Up Group, Nuvap and the Department of Agricultural Sciences and Technologies (UNIFI).

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

No more whining – natural smart textile.

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Abstract | Today, we are exposed to several thousands of chemicals via e.g. our living environment, cosmetics, textiles, clothing, drugs, and food. Most of the chemicals used in the textile and clothing production are harmful or dangerous to humans and nature. Harmful synthetic chemicals are applied in textiles especially during the finishing procedures e.g. to prevent mold growth in textiles. Natural, non-toxic substances used in textiles and clothing, are needed. F.BAD-project is an innovative combination of natural sciences, technology and textile design. Material applications of natural materials and non-toxic plant-based active ingredients will be combined with textiles. The promising preforms will be conceived and prototyped to combine organic active ingredients and materials solutions. The research generates information applicable in global context: antimicrobial activity, especially antifungal activity, insect repellent properties, and UV-shielding and/or color anti-fading properties in textiles.

KEYWORDS | HARMFUL CHEMICALS, SAFE PLANT-DERIVED SUBSTANCES, INTERDISCIPLINARY RESEARCH, BUSINESS ACTIONS

1. No more whining – natural smart textile

What is one part of your body where you most definitely do not want a mosquito bite? What mosquito repellent has the nicest scent? What kind of textile would keep mosquitos away? Answers to these questions and more are collected at mosquito-themed activity stations in the Future Bio Arctic Design (F.BAD) project.

- The project develops a natural, toxin-free and long-lasting textile to repel mosquitos. At activity stations, potential users of the textile can participate in its design process.
- Tests on different plants, active compounds and materials and results from mosquito-themed activity stations provide Lapland-based companies with the latest information from the textile industry.

This is a joint effort of the University of Lapland, Lapland University of Applied Sciences, and the Natural Resources Institute Finland (Luke). The working group represents a combination of art and sciences, with researchers from the textile and clothing industries, agrologists, chemists and material engineers working side by side.

At the innovative and interactive *No more whining (Nyt loppui ininä)* exhibition and at the mosquito-themed activity stations, people can watch and listen to interesting information about F.BAD research, design processes, and the life of mosquitoes. The aim of the mosquito-themed activity stations is to reach as many people as possible. This means that exhibition visitors have the opportunity to participate in research and design processes, and in the use of research results. The first mosquito-themed activity stations were held during the Helsinki Design week as a two-day event at the Helsinki Railway Square (5 and 6 September 2019). Following the *No more whining (Nyt loppui ininä)* exhibition held at Galleria Kopio, the next activity stations will be arranged during the northernmost design week in the world in Rovaniemi (Arctic Design Week, 16-22 March 2020). Results obtained from the activity stations will be taken into consideration during the final analysis of the project in the autumn of 2020.

The aim of the F.BAD project is to find replacement compounds for harmful and hazardous chemicals used in the textile industry from Lapland's nature, for example, to produce mosquito repellents and anti-mould agents, and to build a safe and natural smart textile from natural materials offered by Lapland, with active plant compounds included. Different methods and alternate materials will be tested to build the best possible smart textile. Alternate materials will also be tested with textile and clothing companies from Lapland, and they will be provided with an opportunity to use the Jacquard weaving method used by Finnish textile manufacturers. The Faculty of Art and Design at the University of Lapland has the only machinery intended for the design and weaving of Jacquard fabric in Lapland.

2. Mosquito-themed activity stations for multiple senses

Mosquito-themed activity stations are based on experiences provided for multiple senses. Visitors can test their sense of smell, vision, and touch. Even though the samples cannot be tasted (sense of taste) or the mosquito whine does not irritate visitors (sense of hearing) at the exhibition, natural raw materials and woven natural fabrics carry visitors to the atmosphere of a bilberry forest. Then again, not many of us think that, when we are walking around in a forest, we are also in close contact with the world's deadliest animal. More than 2,500 mosquito species are spread all over the world, apart from the Antarctic, and some three million people die of infectious diseases transmitted by mosquitoes every year. (World Health Organization (2013).

At the first activity station, visitors must attach a red F.BAD mosquito sticker to that part of the body that should most definitely be protected against mosquitoes. We all have been bitten by mosquitoes. Although different people react differently to stings and bites, and a broad range of products for insect stings and bites are available on the market, nearly all people are sensitive to mosquito bites. Mosquitoes can smell the lactic acid and carbon dioxide we produce from a distance of up to a hundred metres (Dekker, Geier & Cardé, 2005). If you do not want to be the number one target of mosquitoes, stay calm. However, many of us swing the air and jump around to get rid of mosquitoes, creating just the opposite effect. Could natural compounds and fibres (from plants and trees) sought in the F.BAD project replace some or all of the currently used harmful and hazardous chemicals?

The F.BAD project offers significant opportunities to use plant extracts and fibres as mosquito repellents and anti-mould agents. At the second activity station, visitors can smell different powdery products made from marsh Labrador tea, common nettle and tannins separated from spruce bark, and select the nicest scent for a mosquito repellent. The task is made more difficult by adding a commercial chemically manufactured mosquito repellent to the group. How many will select a natural repellent extracted from Lapland-based plants instead of the commercial product? Each scent has a F.BAD sticker of a distinctive colour (violet, green, orange and turquoise). Visitors need to attach a selected sticker to a cardboard figure located in the exhibition space to indicate the part of the body for which the selected scent would be the most suitable (Bog Myrtle, 2019; Labrador Tea, 2020; Nettle, 2019).

3. Mosquito repellent textile

At the third activity station, visitors are asked to draw or write their ideas of an ideal mosquito repellent textile. The aim is to gather information about how the project's results could be used later (Warmfamily Safari Patio Curtains […] ,2019); Zebra-striped jumpsuit, 2020; Zebra Wild Sun […], 2019).

There is already a range of mosquito and insect repellent textiles. (Menghe & Xin, 2018) However, they include permethrin, which is highly hazardous to the environment, fish and certain mammals. (Oxborough, 2015). Thousands of chemicals are used in the treatment of textile fabrics alone, most of which are harmful both to people and the environment. (Menghe & Xin, 2018; Oxborough, 2015; Thite & Gudiyawar, 2015) What is more, we are exposed to chemicals every day through medicines, cosmetics, nutrition and the environment. As yet, we do not have a sufficient amount of reliable information about the long-term and joint effects of these compounds. (Koniecki, Wang, Moody & Jiping 2011)

Not all chemicals used in textile manufacturing are necessary, and not all chemicals are transmitted into the organ system. Then again, it may be difficult for consumers to protect themselves if manufacturers use hazardous chemicals in their textile manufacturing processes. (Menghe & Xin, 2018) Chemicals make textiles more comfortable to wear and more long-lasting when used, for example, in different finishing methods. In addition to different cleaning processes, fabrics undergo anti-mould and anti-static treatments, biological protection and different treatment processes to make them easier to iron, prevent them from wrinkling, make them softer and make them more fireproof, water-repellent and durable. (Menghe & Xin, 2018; Marechal, Križanec, Vajnhandl &Valh, 2012) During long transport and storage periods, textiles are also exposed to microbes, mould, fungi and various insects. As a result, textiles are biologically protected, for example, by using organic chlorine, tin and chromium compounds that are very harmful to people and the environment. (Marechal et al., 2012)

The European Chemicals Agency maintains a list of chemicals hazardous to health that are used in textiles. For example, the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation sets strict requirements for the textile industry, as it requires that the safety of all chemicals be ensured, transparency be increased, and eco-friendlier innovation be made (Koniecki et al., 2011; Marechal et al., 2012).

The F.BAD project focuses on toxic-free methods and compounds. At the same time, new material and product ideas will be prepared for the textile and clothing industry in the arctic region, and research, competence and innovation clusters will be developed in Lapland on the basis of the region's strengths. Tests of different plants, active compounds and materials, and results from mosquito-themed activity stations provide Lapland-based companies with the latest information from the textile industry. Lapland -based textile and clothing companies are also able to test the results of material research during Jacquard weaving workshops at the University of Lapland and Annala Oy. The F.BAD project considers, among other questions, whether a natural mosquito repellent smart textile prototype can be built by combining natural materials and scents from Lapland and the weave design enabled by the Jacquard technology. (Design, Weave, Show, CAD/CAM Software […], 2019; Fernström, 2012)

The goal of the F.BAD project is to develop options to repel mosquitoes without any health-related risks, and its research applications also include different mosquito repellent equipment. Covering all parts of the body helps to reduce the number of mosquito bites. However, mosquitoes can also bite through clothing. The colour of clothing is an important factor. Dark colours are known to attract mosquitoes, while light clothes keep mosquitoes better away.

Commercial mosquito clothes are worn over other pieces of clothing, including hats, overcoats and trousers made from mesh materials. There are also mesh gloves and mittens and sock-like footwear available. This means that it is possible to cover the entire body with mesh fabrics to prevent mosquito bites. What is characteristic about mosquito repellent clothes is that they are usually dark green or feature the military camouflage pattern. From this, it can be concluded that the mosquito repellent clothing imitate natural colours and camouflage the wearer in nature, but not repel mosquitoes.

As a result, the F.BAD project focuses on the best colours and patterns to be used in mosquito repellent clothes and materials. It is widely known that mosquitoes select their targets through three phases: their sense of smell drives them towards carbon dioxide, their sense of vision helps to approach their target and, finally, they pinpoint their target on the basis of body heat. Textile pattern design could focus more on the way mosquitoes navigate to their targets.

What kinds of optical illusions could be used or developed to this end? Optical illusions have been used in clothing in different ways at different times. Optical art (op art) was a significant international art phenomenon, for example, in London, Paris and New York in the 1960s. It was based on visual arts, while many fashion designers applied its visual side to patterns and woven fabrics. Clothes were simple in design, but their bold colours and textile patterns made them sort of move on their own. In recent years, interest in optical illusions has increased. Experimental designs have been demonstrated at fashion shows in different parts of the world. Fashion shops offer various textiles, clothes and accessories with different animal patterns, such as panther, leopard, tiger, zebra, and giraffe patterns. (Hasbullah, Westland & Cheung, 2016; Elshafei, 2015; Ridgway, 2014).

Although zebra and leopard stripes seem to stand out easily from their surroundings, they act as a protective colour, distorting and blurring the predator's vision and, therefore, helping animals to hide and camouflage in their environment. Zebra stripes are known to protect zebras from bloodsucking insects. This knowledge has been used when studying the behaviour of horse-flies. A striped blanket was put on a few horses. Researchers discovered that zebra stripes interfere with the fairly weak vision of insects so that it became more difficult to land on the animal, which in turn reduced the ability of horse-flies to bite animals and suck their blood (Caro et al., 2019; Caro et al., 2014; Horváth et al., 2019; Klein 2019; Melin, Kline & Hiramatsu, 2016).

Could a scented moiré pattern act as a mosquito repellent textile in the future? Usually, the moiré pattern is never seen out in the wild, while it is fairly common in an urban environment, for example, in the folds of window curtains or worn by a TV presenter. Moiré is an interference pattern made by overlaying a specific type of woven fabric or lines on a printed fabric to produce a new pattern.

The moiré pattern is usually regarded as an unwanted pattern or an error that needs to be fixed. Recently, it has been added to experimental and commercial clothing, and also to horse blankets. In the F.BAD project, the study of textile pattern design focuses on the production of a moiré pattern by both stacking transparent material layers one on top of the other and by using colourful printed textile patterns. Both ways can be used to produce new textile patterns and illusions of movement. The goal is to develop the material so that it can be used as a visual mosquito repellent.

The cleanliness, health and safety of Lapland´s nature are significant values that are used in marketing and branding in many sectors. Arctic quality has also been studied scientifically in the fields of natural resources and tourism, as well as in different services. To develop, Lapland needs innovation and new technologies. This is only possible with true cooperation between people from different fields – without any whining. (Bog Myrtle 2019; Labrador Tea 2020; Nettle 2019)

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Paving the way to post-digital smart materials. Experiments on human perceptions of a bio-inspired cellulose-based responsive interface.

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Abstract | The paper aims to frame the emerging scenario of hybrid interactive systems, and pave the way for post-digital interactive materials, proposing organic material interactive interfaces as a potential alternative to digital and electronic-based ones. Supported by the theoretical background and related works, a case study developed by one of the authors is presented: a cellulose-based interactive interface where the material itself work as a sensor and an actuator. This new generation of smart materials enables and implies novel experiential patterns to observe and discuss. An exploratory workshop on this novel typology of material interface carried out by one of the authors is then described addressing the critical issues of users' perception and appreciation. The methodology of the activity is based on quantitative and qualitative data collection through a questionnaire made of scale questions and open-ended questions, plus direct observation and discussions with the participants. The activity integrates the lens of Materials Experience, in order to overcome the missing understanding of the experiences enabled and implied by this interface. Prominent findings unfold the relationship between temporal and static expressions. Finally, biomimicry arises as an approach to transfer the feeling of nature and to create more intuitive interaction.

KEYWORDS | MATERIALS EXPERIENCE, BIOMIMICRY, CELLULOSE-BASED INTERFACE, HYBRID MATERIAL SYSTEMS, RESPONSIVE MATERIALS

1. Introduction

In the research and practice around material design, different post-digital scenarios are currently emerging. Computers, as we know them today, will disappear into things that are, first and foremost, something else (Negroponte, 1998).

The paper aims to frame the emerging scenario of hybrid interactive systems and pave the way for post-digital interactive materials, proposing organic material interactive interfaces as a potential alternative to digital and electronic-based ones. Supported by the theoretical background and related works, a case study developed by one of the authors is presented: Transformative Paper (Holzbach, 2015a), a cellulose-based interactive interface where the material itself works as a sensor and an actuator.

Comparing to traditional electronic-based smart materials, this newer generation of hybrid interactive materials enables and implies novel experiences and opportunities of combining dynamism and authenticity. The experiential patterns mediated by the formal and behavioral qualities of such materials need to be explored and discussed. Therefore, an exploratory workshop on this novel typology of material interface carried out by one of the authors and involving a selected group of participants is then described addressing the critical issues of users' perception and appreciation. From this activity, promising preliminary results on people perception emerge and set the base for further research actions.

2. Theoretical background and State of the Art

2.1. Hybrid Interactive Systems

Today, besides objects equipped with artificial "intelligence," materials themselves may be informed and rewritten by micro-scaling digital or procedural activities. Micro-scaling can lead to the hidden information of traditional materials and everyday objects surrounding us. This results in an aesthetic and functional augmentation of existing materials that infuse materials of "living" or "intelligent" qualities. At this stage, new properties are usually constructively linked to the material on a macroscale level and in a traditional way – for example, through layering.

This brings to the emergence of materials with responsive behaviors that can detect, process, and manifest data. "Smart materials" is a relatively new expression used to identify materials that have changeable properties, in opposition to traditional materials that are latent (Ritter, 2006). They can change some features like shape or color in response to physical or chemical influence from the environment or the users' body.

It is often possible to combine several materials with smart properties together to create *Smart Material Composites* (Barati et al., 2019), and to combine actuating, sensing and controlling electronics into *Smart Composite Material Systems* (Kelly, 2017) in order to

increase the smart qualities of the final product. The combination of organic and inorganic components, including micro components such as electronics leads to the definition of *Hybrid Materials* (Saveleva et al., 2019; Ritter, 2006). As a result, *Hybrid Material Systems* (Parisi & Ferraro, 2021, p. 127) are defined as “material-based systems encompassing different components such as inactive materials, smart material components, sensors, actuators, computational layers”.

Due to the increasing miniaturization of technologies, the seamless integration of sensors and actuators into materials have been theorized and envisioned in the notion of *Augmented Materials* (Razzaque et al., 2013*), Expanded Matter* (Brownell, 2014), *Computational Composites* (Vallgårda & Sokoler, 2010), *Material programming* (Vallgårda et al., 2017), and *Interactive, Connected, and Smart (ICS) materials* (Ferrara et al., 2018; Rognoli & Parisi, 2021).

While at the beginning the first wave of digitality affected drawing and visualization tools for design, then digital production tools and the process chains derived from them followed. The resulting connection of the digital with the physical – or the material – results in directly derivable hybrid structures with their own hybrid property profiles. This results in a formal and functional augmentation of existing materials, that infuse materials of "living" or "intelligent" qualities. Hybrid materials are multi-layered and heterogeneously informed. As a result, materials are becoming increasingly informative and intuitive.

Some hybrid Interactive systems are designed by using designed Materials. This leads to the question of whether the discussion about constructions that are suitable for the material or design which is suitable for the material is outdated or not. Today, materials are developed to perform a task. The question of materiality arises as a central decision and development at the beginning of a design task and not as a selection from existing materials at the end of the project (Parisi et al., 2020). Material-oriented design is increasingly turning into “design with designed materials” (Holzbach, 2015a).

2.2. Material Authenticity

Many of today's material solutions integrate new technologies and components, and their scale and complexity no longer allow conclusions to be drawn about their performance or function. This is also the ambivalence of the material solutions presented here in the paper. In the articulation of these new and hybrid material solutions lies the important cultural mission of material design (Holzbach, 2015a)**.** In most cases, designers look for a suitable material for their design or design the product with a specific material in mind. This "material authenticity" – i.e. what a material intrinsically is and naturally does – seems to be overcome.

Today, the world of materials, substances, and semi-finished products meets digital design and production methods, changing the conventional idea of material “authenticity”. This fundamentally changes the way design concepts are conceived and leads to entirely new

ways of thinking. Today, materials are rather developed for their task. "Materials with sensitive, smart, or gradually varying properties lead to new and complex design concepts. This opens up new possibilities at the level of concept, form, structure, and surface. The path from static to dynamic, process-oriented properties is thus smoothed." (Holzbach, 2014a, p. 69). As Sabine Kraft writes:

> "The relationship between form and material has become as diverse as it is ambiguous. A recourse to clear rules and specifications as to what can be conceived and constructed in which material and how, and which aesthetic message would be transported by this, is hardly possible anymore - if it ever existed." (Kraft, 2004, p.24)

"Informed" or "augmented" materials with sensitive or smart properties, thus lead to an increasing blending of different contexts. Mixed forms emerge that no longer allow a clear separation. As a being of our time, the increasing intertwining of the most diverse areas of life and knowledge can be seen. New material and design concepts are also acting in this context, resulting from the overlapping of digital and analog, nature and artifact. It is the interdisciplinary process that see and define material, form and construction as a holistic unit. Where is the border between real and fake, natural, and artificial?

What meaning can the term material authenticity still have in our digitized world? The digital, in particular, is predestined to connect different sensory levels. In the digitalized world surrounding us, and especially in contemporary art and cultural positions, such border crossers in the intersection of Art and Science or Design and Technology are of increasing importance. To what extent do nature and the artificially created interact to create a new form with its own hybrid characteristics? Where does something begin, and where does something end?

A permanent comparison of information and materialization takes place. In addition to the digital programming of materials, specific material parameters can continue to be embedded in the digital models. "It is precisely the dialogue of the "real" material with the "virtual" and "dematerialized" digital world that leads to new formal and functional impulses and contexts" (Holzbach, 2014b). The virtual and the real are interwoven and thus lead to new hybrid property and design profiles. Analog and digital material concepts and their hybrids become the carriers of information. Materials become informative or even intuitive, enter into a dialogue with their environment and thus have new functions of meaning. The material acts at the interface of the digitalized and real world. The traditional thought pattern of "material-authentic design" is broken through the link between digitization and materialization. Here a substitution of important digital components in favor of natural materials is taking place. The material itself takes over essential tasks and increasingly seems to have intrinsic qualities.

2.3. Post-digital Interactive Materials

In a future perspective, the possibility to substitute traditional electronic components, even with bio-based or bio-inspired ones, is not remote. In the first German edition of Domus,

Mateo Kries (2013), director of the Vitra Design Museum, writes: “Museums today must treat design as what it is – as a cross-sectional discipline between art, science, and technology”.

Nature, with its structures and constructive laws, often serves as a valuable source of inspiration for material design as well as new technologies, through biomimicry (Salvia et al., 2009) and the cooperation of digital manufacturing (Langella, 2007). Recent definitions of *Bio-Smart materials* (Lucibello et al., 2018; Ferrara et al., 2019) and *Bio-Synergistic materials* (Parisi & Shetty, 2020) elaborate the mechanical and biological response to stimuli of natural-based materials as a medium of smart behaviors.

One challenge for the development of hybrid material systems is the one of sustainability, in particular the use of non-toxic, renewable, and biodegradable materials. The integration with biodegradable materials and fibers may allow the separation of components. This is the case of interactive wearables and objects using mycelium as a support and structure for electronics (Lazaro Vasquez & Vega, 2019), or the use of bioplastics for robotics (Kretzer & Mostafavi, 2021) or transient electronics (Tao et al., 2012). An example of design experimentation is a conductive bio-skin made by growing bacterial cellulose with conductive compounds by designer Giulia Tomasello (Fig. 1).



Figure 1. Conductive Bio Skin experiments by Giulia Tomasello.

However, the use of materials with changing properties is not an invention of modern times, and those responsive behaviors can be found in nature (Ritter, 2006). Examples of organic materials and micro-organisms enabling aesthetic and functional dynamic responses in fashion and product design can be found in the literature. In this respect, biological organisms can also be used as biosensors and bio-actuators to replace synthetic ones.

This is the examples of BioLogic (Yao et al., 2015), a textile which uses the mechanical behavior of Natto bacteria masses deposited on portions of textile to respond to moisture (Fig. 2). The bacteria’s body enlarges with humidity allowing the textile to change shape. Other examples of biosensors are Organic Primitives (Kan et al., 2017), pH-reactive organic materials used for sensing, actuation, and interaction, (Fig. 3) or the use of bioluminescent organisms for performing light-emitting behaviors.



Figure 2. BioLogic by MIT Media Lab (Lining Yao), 2015 (photo by Rob Chron).

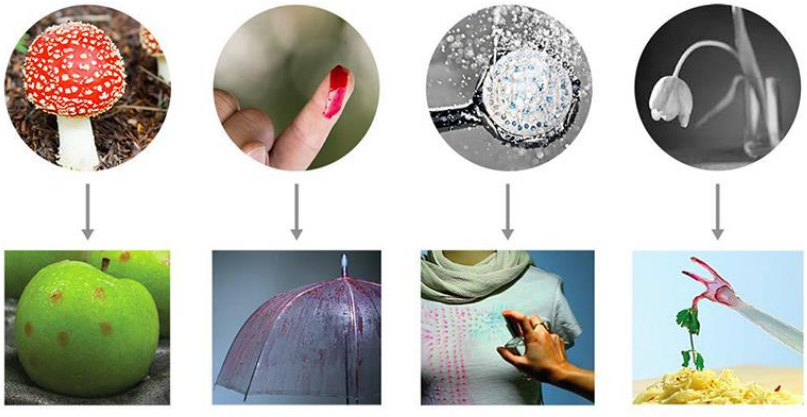

Figure 3. Organic Primitives by MIT Mediated Matter Lab (Viirj Kan).

Researchers and designers are exploring the smart behaviors of traditional materials supported by digital manufacturing and parametric design, such as organic pulp-based surfaces and fibers reacting to moisture. Programmable knitting (Scott, 2018) tested the shape-shifting moisture-responding anisotropic behavior of pulp-based fibers woven into

textiles to determine the geometry related to each deformation and integrate it in the design process by using parametric design (Fig. 4).



Figure 4. Programmable Knitting, by Jane Scott, 2018. On the left: growing medium profile. On the right: Shear, after actuation (photo by Cristina Schek).

This newer generation of hybrid and post-digital materials also shows the reactive properties of the natural world. However, the post-digital and bio-mimetic materials show authentic properties connected intrinsically to the material. The combination or description of new properties via micro-scale digital or procedural components is perceived as an embedded "intrinsic" property and as inherent to the respective material. The properties of the living are conveyed even more strongly in these materials, since the material apparently reacts automatically to its environment. The hidden individual components lead to the suggestion of existing formal and functional properties in the material itself. These are per se not present in the actual material or artifact, but rather result from the hidden current and operating properties.

The traditional nomenclature of design and its semantics is at this point undermined. The encoded and rewritten material can no longer be decoded with a classical sign function or described with questions about "material authenticity". The product language, which acts out of its symbolic or symbolic nature, can therefore no longer be used as an unrestrictedly effective means. Instead, the object is "intuitively" or even "not" accessible. Our existing, object-like environment is able to communicate, but no longer communicates this to us - in the sense of a classic sign function - as it used to.

3. Case Study: Transformative Paper

A case study of post-digital interactive material developed was developed by one of the authors as a result of a student's project and is presented in this section. Similar to Programmable Knitted by Jane Scott (2018), the authors' case study is a cellulose-based interactive interface in which the material itself works as a sensor and an actuator. It is a shape-changing multi-layered surface made of paper combined with a plastic layer and cut in

small bio-inspired segments reacting to short-term environmental conditions, as a combination of the properties of the material and the designed shape. Depending on the air humidity, the paper structure morphing without electronically based sensors into various states (Holzbach, 2015b).

The project Transformative Paper (Fig. 5) was developed in a collaboration between the Institute for Materialdesign at the Offenbach University of Art and Design and the company BMW. A whole series of different concepts of responding surfaces was created under the guiding theme "Intuitive Brain." These surfaces were developed by students by using different interpretations and perspectives around the theme, which convey the “intuitive” meaning in different ways.

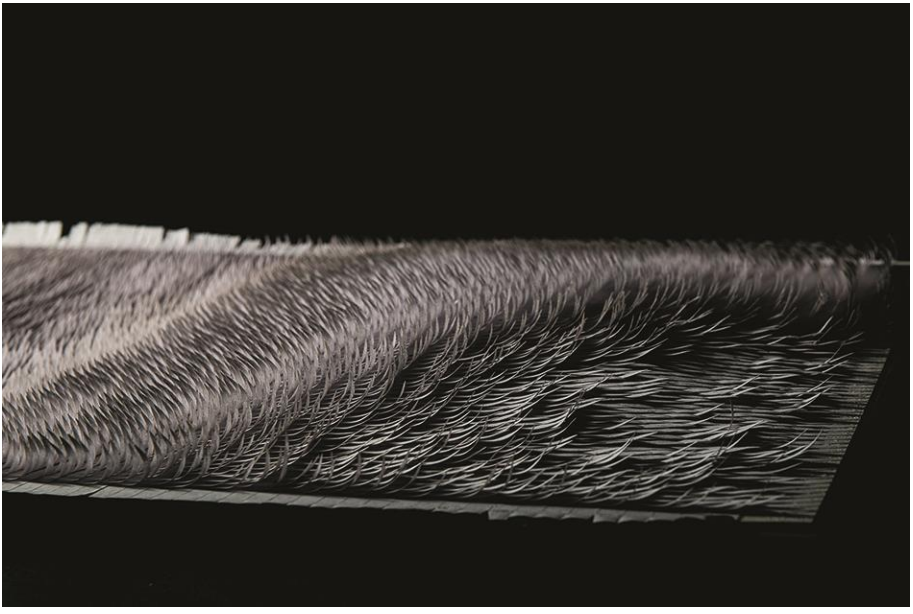

Figure 5. Transformative Paper by Florian Hundt, a result of the cooperation "Intuitive brain" between Prof. Dr.-Ing. Markus Holzbach, Institute for Materialdesign IMD, HfG Offenbach and BMW AG, 2015. The interactive surface uses the anisotropic condition of papers, in combination with a plastic film, to perform a dynamic behavior when triggered by moisture.

In this particular case, the responding capability of the project is based on the notion of anisotropy: a condition in which specific material properties can vary depending on the direction. This also applies to wood and especially wood veneer with its fiber-based structure. In the first conceptual, preliminary stage, the interaction of the veneer wood and its anisotropy with the macrostructure consisting of different fractals has already been

established. Depending on the moisture distribution to the used wood species, and according to the orientation of the veneer wood, different forms can be realized. For instance, a one-sided moisture supply leads to corresponding swelling processes in the wood. This leads to tensions and deformations in the wood.

This behavior is reversible, and the process is reversed with increasing drying. The material and thus also the structure resume their original form. Controlled by the alignment of the veneer modules, "intelligent" structures become conceivable, which react to both the absolute humidity and the distribution of moisture in the room and which can fulfill specific practical and aesthetic functions through their three-dimensional deformation. The reactive surface serves as both a sensor and an actuator (Fig. 6).

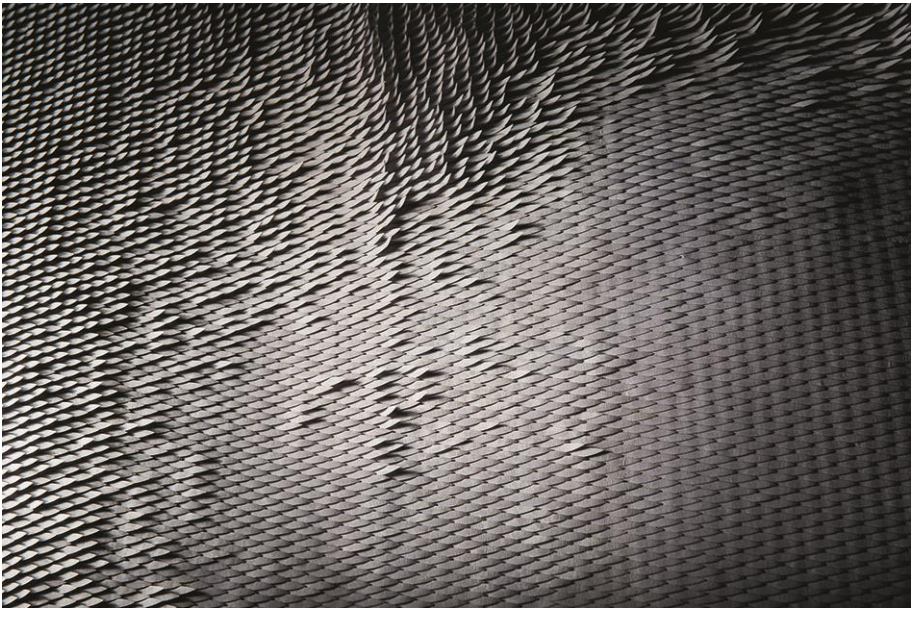

Figure 6. Transformative Paper by Florian Hundt, a result of the cooperation "Intuitive brain" between Prof. Dr.-Ing. Markus Holzbach, Institute for Materialdesign IMD, HfG Offenbach and BMW AG, 2015. A detail of the interactive surface.

Basing on this logic, the behavior of anisotropy should be exploited in further development. Up to now, wood has been the most commonly used raw material in paper processing. Since paper is made directly from the wood, it has the same swelling behavior and also the anisotropic properties of wood. Conventionally, these effects, which result from the anisotropy of the starting material, are undesirable, especially with machine-made paper and in a wide range of areas of application. On the contrary, isotropic properties are desired, i.e., materials whose property profiles are the same in different directions and thus

homogeneous. However, In the development of the project, a series of tests were performed in order to investigate and verify the anisotropic behavior of wood. For example, according to the type of wood, growth conditions, and other variables, different properties are obtained in different growth directions. Strengths, swelling behavior, and deformation behavior can be predicted quite precisely. In particular, in the scope of the work presented here, the effects resulting from anisotropy are of particular advantage.

After all, in a post-digital scenario, the adaptive and interactive qualities of materials are expected to be developed from an authentic and inherit – "intuitive" – material intelligence and without the addition of a digital component. Thus, specific deformation properties can be introduced into desired areas of reactive surfaces in a very targeted manner. The individual fractals are integrated into the overall surface and positioned individually, quasi tailor-made.

The main goal of the presented work "Transformative Paper" was formulated as the independent response of an interactive automotive skin to the influence of the weather and especially to the interaction with rain. The developed reactive skin reacts automatically and is intuitively able to adapt to the weather. If one makes use of the anisotropic properties of the paper and combines the paper with other materials, new areas of application and contexts can be opened up. In this case study, the paper layer was constructively combined with another plastic film in a multilayer construction. The resulting multilayer construction reacts continuously to environmental influences. Depending on the humidity, the paper structure is transformed into different states. This results in a gesture that can appear so subtle when humidity is low that the transformation is not evident at first glance. The transformation takes place more evident when the surface is exposed to moderate moisture and heavy rain. If the structure is dried, the individual segments will stand up. When wet, the structure closes entirely automatically and without digital control or regulation (Holzbach, 2015a).

4. Exploratory workshop on users' perception

A challenge for design research is identifying meaningful ways to design with and for materials like this. They imply complex and novel experiences that designers need to comprehend and implement to foster people's appreciation and acceptance (Parisi & Shetty, 2020).

An exploratory workshop on this novel typology of material interface involving a limited number of selected participants was carried out by one of the authors and is here described addressing the critical issues of users' perception and appreciation, and to overcome the missing understanding of the experiences enabled and implied by this interface. In particular, the object of the study is Transformative Paper, by the collaboration between the Institute for Materialdesign at the Offenbach University of Art and Design and the company BMW AG, the one broadly presented in the previous section of the paper. The study was

organized in the format of a workshop with users, aiming at unfolding qualitative patterns (Petrelli et al., 2016), using the lens of Materials Experience (Karana et al., 2015; Giaccardi & Karana, 2015). The setup, methodology, and results of the study are thoroughly described in this section.

4.1. Methodology

The activity was organized in the format of a small workshop of 1 hour and 30 minutes. The activity was performed at the School of Design of the Politecnico di Milano. The study involved 20 participants, including design students (13), practitioners, (4) and scholars (3), from 4 different countries, i.e., Italy (13), Portugal (5), Brasil (1), Perù (1).

The methodology of the activity is based on quantitative and qualitative data collection through a questionnaire made of scale questions and open-ended questions, plus direct observation by one of the authors and discussions with the participants. The activity was divided in four subsequent phases:

- exploration and analysis of the static form and expression of the material;
- exploration and analysis of the dynamic form and expression of the material;
- comparison with other dynamic materials, i.e., thermochromic painting, electroluminescent ink, shape-memory alloy spring, and oxidizing copper;
- participant's background, previous knowledge and final remark.

The lens used to observe and analyze the item is the one of Materials Experience. Each of the moment was introduced by small presentations by the author, with the support of projected slides, including the introduction of grounding theoretical notions with examples and showcasing of the samples. A coded envelope and four papers containing questions and scales related to each of the four phases, namely part A, part B, part C, and part D, were distributed during the execution of the activity to each participant as a compass to the activity and to collect data. After each moment, before explaining the following part and distributing the related paper, the author encourages a moment of discussion with the participant in order to unfold key issues in the scope of the research. The language use for the questionnaire, the execution of the activity, and the discussion was English. Participants were asked to fill the questionnaire and express their opinion in the discussion in English or in their mother language if that made them more comfortable. This was appreciated when allowed to provide more accurate and complex description of feelings and recalls in the participant's memory.

The questionnaire was set as follow:

Part A: the sample is shown in its static expression. A sensorial evaluation scale (Karana, 2009) was provided to support the evaluation of the samples.

- How would you describe the material?
- Which are the main sensorial qualities?

- Which emotions, feelings and memories does the material elicit in you? Why?
- Which adjectives/meanings would you use to describe the material? Why?
- How would you approach and interact with the material?
- How would you think it would change in time?

Part B: the sample is shown in its dynamic expression.

- How would you describe the behaviour of the material? What are the inputs? What are the outputs? What are the qualities of the behaviour?
- Which emotions, feeling and memories does the behaviour elicit in you? Why?
- Which adjective/meanings would you use to describe the behaviour? Why?
- Look at the previous paper (paper A): is the experience elicited by the material changed? What in particular? Think about the sensorial qualities, emotions, meanings, way of interacting or approaching the materials. Would you change the nickname of the material?

Part C: other materials showcasing dynamic behaviors are shown and compared.

- Describe the different experiences resulting from the materials and related behaviours. Use the questions in the previous page (paper B) as a guide for the description.
- Put the different experiences in order of preferences and explain why?

Part D: questions for demographic data (age, nationality, job), previous knowledge on the topic (Transformative Paper, Materials Experience, Smart and Interactive Materials), and optional comments are contained.

Paper questionnaires and audio recording of the activity were digitalized and transcribed by the author in tables. Comments and answers in mother language were translated by the author. Once transcribed, data were analyzed by the author in order to extract patterns, contradictions, and key considerations.

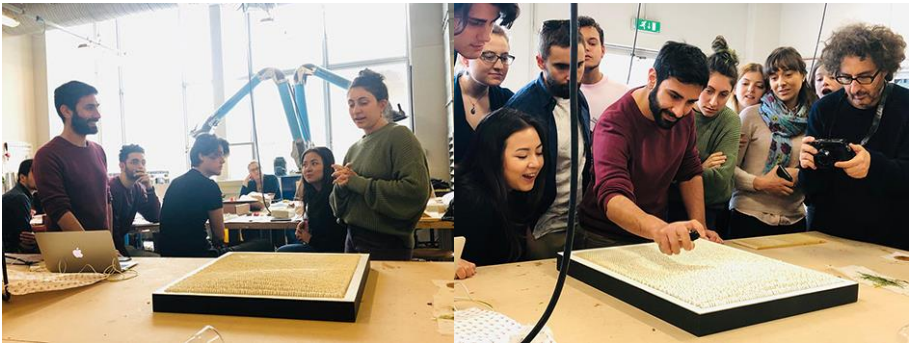

Figure 7. Two phases of the exploratory workshop, carried out by Stefano Parisi, Polimi, 2019.

4.2 Results and discussion

Among the results, prominent findings unfold the relationship between temporal and static expressions. For instance, slow bio-inspired responses and the principle of accordance between shape, material, and behavior evoke positive connections.

In particular, the behavior and dynamic expression influence the experience (Rognoli, 2015), modifying all the layers of experience. Some people had a positive reception to the materials, mainly related to the feeling of surprise and wonder, while to other the behavior itself was considered as aggressive. Slow behaviors are considered more evocative and emotional. Diffusely, the behavior was considered as natural and assimilated to vegetal elements. Thanks to the behavior the materials was considered as “alive.” This was considered positively. Some participants underline the fact that the material, in the static dimension, suggested how the material would move, by reminding a field of grass. This accordance appears to be key.

Biomimicry arises as an approach to transfer the feeling of nature and to create more intuitive interaction. Most of the participants are encouraged to interact with the material when static, while when reacting at first preferred to observe instead of touching.

In this case, the input (water) not only trigger the behavior (shape-changing), but changes the qualities of the material itself, making the materials wet and softer, which is perceived by participants as more fragile or comfortable. The natural transformation of the substrate with time (e.g. ageing) may interact with the reversible behavior.

Limitation of the activity is related to the diversity of samples provided, in terms of shape, applications, and details. In fact, while the main object of the study was considered by the participant as a designed material system with a high artistic value, the other samples used for the comparison – namely, thermochromic painting, electroluminescent ink, shape-memory alloy spring, and oxidizing copper – didn’t have the same complexity and were considered as material samples. Plus, among these material samples, some of them were designed for a specific application. In general, the items didn’t have common characteristics that would make the comparison more objective, i.e. size, thickness, colors, surface qualities such as texture, performance qualities such as flexibility. While Transformative Paper had a proper showcasing divided in two moments leading the participants to explore thoroughly its static and dynamic dimensions, the other samples used for the comparison didn’t have the same space for presentation and showcase. Another limit is represented by the small sample of participants involved and by their robust relation with the area of design and materials. Following studies may involve unskilled participant, unfamiliar to the topic.

5. Conclusions

Concluding, the paper presents the emerging scenario of hybrid interactive systems and paved the way for post-digital interactive materials. In particular the authors used a speculative approach to propose organic material interactive interfaces as a potential alternative to digital and electronic-based ones. Supported by the theoretical background and related works, the authors demonstrated the potential of this novel area of advanced materials, in particular the ones related to intuitiveness and authenticity of the interaction and communication between the users and material interfaces. Secondly, the challenge of sustainability is promoted by the use of organic and natural interactive components, instead of digital, chemical, and artificial ones. A case study developed by one of the authors is presented: a cellulose-based interactive interface where the material itself works as a sensor and an actuator. An exploratory workshop based on the notion of Materials Experience on this novel typology of material interface carried out by the authors validated the hypothesis of the beneficial impact of such materials in enhancing meaningful and positive experiences for the users. Not only, it triggers complex interplays between the behavior, the shape, and the material qualities opening up to original ways of designing and experiencing the artifact.

Although the exploratory workshop is conducted with a narrow, insular, and small number of participant and to date has not been repeated yet, it presents some interesting and promising insights to use as a base knowledge for further research actions. The methodology of the exploratory workshop can be considered as a pilot or prototype for a more in-depth user study.

The authors underline that the case study is analogic and does not use embedded technology and smart components to react. However, it is key to the study as an example of dynamic materials, in order to retrieve information to use not only for the development of post-digital interactive materials, but to extend to smart materials with embedded electronics, in order to reiterate positive experiences. Indeed, data obtained from the studies are intended to be applied to the design of hybrid material systems as part of a broader methodology.

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Acknowledgements: we thank all the people who participated to the exploratory workshop, first of all our students and colleagues. Markus Holzbach personally addresses his special thanks to BMW AG for the cooperation with the IMD Institute for Materialdesign at the University of Art and Design Offenbach and for their valuable support in the research project “Intuitive Brain.” Special thanks also go to Florian Hundt, who participated in the “Intuitive Brain” project as a student and made his work “Transformative Paper” available for this paper.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The flow of emotions in co-creation

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Abstract | Co-creation is a broadly used practise among service designers, as a workshop is an effective way to build new solutions or improvements together. The focus of this article is on the emotions arising before and during the co-creation workshop and a reflection on what influences them. The first purpose of this article is to deepen the understanding of emotions that emerge in the co-creation workshops that are commonly encountered by the different participants. The second purpose is to determine if there are other factors that influence the experience of co-creation. In this article, emotions are considered a human response—consciously or unconsciously—that connects human beings with their surroundings. This connection has an impact on people's emotions and determines their experience, attitude, behaviours and interactions in the workshop environment.

KEYWORDS | EMOTIONS, CO-CREATION, COMMUNITY, INTERACTION, HUMAN SURROUNDINGS

1. Introduction

Service design is a rapidly evolving field, both in research and in practice. One of its most common practices, co-creation, is also constantly evolving. According to Sanders and Stappers (2008), co-creation starts with two approaches: the first considering the user as an informant or expert of their own experience, and the second considering the user as a fundamental part of the creation process, that is, a partner. Over the years, both approaches have co-existed and matured. Indeed, a service design process is generally participative, and the methods and tools used often enhance collaboration (Sangiorgi & Prendiville, 2017). Nonetheless, human-centred approaches, prevalent both in design and in Western worldviews, have been criticised for their anthropocentricity (Acosta & Romeva, 2010), neglecting all other elements we (humans) interact with, although we are only one part of a larger ecosystem.

Surprisingly, although highly human-related, the emotional components of co-creative practices are often overlooked (Soto et al., 2020a) and even unacknowledged as essential elements to consider in these collaborative settings (Miettinen & Sarantou, 2019). Emotions have a significant impact on people's decisions, their perceptions and their relationship with their environment. The complexity of the projects could be addressed by designers, starting with the consideration of the people involved (Miettinen & Sarantou, 2019) and their ecosystems. A new way to understand emotions in the interaction between humans and non-humans environments could contribute to the development of better environments for co-creation and enhance participative experiences. Hence, this article asks the following question: What elements can influence the emotions experienced by participants in a co-creation workshop? This paper has a practical perspective that is based on the findings from data collected between 2018 and 2020 as part of a doctoral dissertation on the emotional skills of service designers in co-creation practices (Soto, 2021). First, data were collected in a Master level course in service design taught in Finland (NN:9 students). Second, data were collected during three service design sprints organised in Sweden, Finland and Estonia (NN:44), and finally, an online open-ended questionnaire was administered to service design facilitators (NN:6).

The findings presented in this article suggest that it is necessary to know and consider all the factors that can influence the emotions in a co-creation workshop. In addition, those factors go beyond the workshop; for example, everyday personal and professional situations, interactions between people and between people and their environment. This article proposes a vision of a *co-creation community* in which it is essential to increase the knowledge of emotions and their connection and interaction within the community in order to enhance the awareness of how all participants build the experience of a workshop (Soto, 2021) and the need and desire to increase connectedness with all life forms (Kahn, 1997; Keller & Wilson, 1993).

2. Conceptual Background

The concept of emotions goes far beyond a single definition developed by specific disciplines. Nonetheless, these perspectives can contribute in constructing a definition and common understanding and in this case can serve as a bountiful meaning for design. The psychologist Fridja (1986) describes emotions as phenomena in which behaviour, physiological response and subjective experience have an encounter. In psychology, there are different definitions related to the intensity of emotions and their combinations. This paper follows the perspective of evolutionary psychology, which distinguishes between basic or primary and complementary emotions (Desmet, 2002). Different authors use different definitions of basic emotions (Bloch, 2008; Ekman, 1971; Frijda, 1986, 1988; Izard, 2009). This study utilises Bloch's (2008) six basic emotions—joy, anger, tender love, erotic love, sadness and fear—and all the possible combinations between them. These are claimed to be universal (the same for any culture), and they manifest with moderate intensity. *Complementary emotions* are combinations of the six basic emotions. They combine two or more basic emotions with different intensities, and the outcome depends on those combinations.

In the field of design, the works of designer Pieter Desmet and engineer Donald Norman are relevant references. Desmet's (2002) approach focuses on how designers can develop new ways to create emotional connections between products and their users. Meanwhile, Norman's (2004) work is connected to the human response and its relationship with technology. Both are related to the emotions humans experience when they interact with products as well as the emotions that can be triggered in the interaction with other people about a product. According to Desmet (2002), emotions can arise from a direct or indirect relationship with a product. By connecting his work with the co-creation approach, the way in which interactions affect and influence emotions becomes much clearer.

Moreover, this paper finds inspiration in the *community-centred design* approach (Cantù, Corubolo & Simeone, 2012) as a way to conceptualise co-creation environments as creative communities and also to broadly understand a community as something in which not only humans are involved. The holistic understanding of what constitutes a 'community' in this article is connected with the ecosystem approach, whereby a community (or ecosystem) could be described as 'a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit' (Convention on Biological Diversity, 2006, Article 2. Use of terms section). In this sense, co-creative environments in service design practices can be seen as dynamic ecosystems in which the participating humans interact with and affect each other (and their emotional states) alongside a multitude of other non-human elements, which also influence the overall process, experience and generated outcomes.

The discourse on service design has widely evolved, moving from an original focus on the discipline, such as interactions and interfaces, to investigating the deeper relation between theory and practice to better understand the complexity of the interactions, relations and

experiences involved (Sangiorgi & Prendiville, 2017). Co-creation is a combination of tangible and intangible outputs (Horvath & Carpenter, 2020), where the interaction of the participants allows the merging of their perspectives, opinions and experience, contributing to a participatory practice where emotions arise spontaneously. Given that participatory design is here viewed as a collective creative practice in which facilitators and participants shape the process (Sanders & Stappers, 2008), emotions can be triggered both by the service designers facilitating the process and by the collaborating participants. Accordingly, service designers must be flexible to deal with the constant flux of situations that emerge during co-creative practices (e.g. during workshops or design sprints). This flexibility and adaptation requires specific skills to conduct the design practice since adjusting to the emotions involved can be a challenge. Social, communication and empathy skills are essential for succeeding in co-creative processes (Miettinen, Rontti & Jeminen, 2014).

Co-creation workshops typically involve individuals who have their own personalities, professional and cultural backgrounds, personal goals and expectations and respective lives outside of the workshop setting. Therefore, the facilitators' and participants' emotions can be affected by the many co-existing factors that are present in such collective creation processes. Indeed, emotions are also driven by the personal situations and previous experiences of people, which lead to predispositions in their interactions. The visceral level is the most primitive part of the brain, and it reacts positively or negatively to environment stimuli, such as temperature, lights, colours, smells or shapes (Norman, 2004). The complexity of emotions in an interactive environment is affected by a set of factors related to the present perceptions and judgements of the participants based on their previous experiences. Although present and prior experiences may sound very ambiguous, the purpose of describing it in this way is to indicate that the variables that influence people's emotions are not only an automatic response in the face of particular stimuli. This makes it harder to recognise the emotions related to the service design process and to be open to the emotional state of others during the workshop. By improving their awareness of the participants' emotions during a workshop, service designers could more successfully adapt the flow of the workshop to create the optimal experience for successful participation and collaboration.

3. Research Methods

This paper considers data collected in two case studies. The first (CS 1) was an advanced service design course in Finland. The second case study (CS 2) consisted of three design sprints (workshops) carried out in Gothenburg (Sweden), Tallinn (Estonia) and Rovaniemi (Finland). Part of this material was previously published, focusing on similar themes discussed in this article (see Soto et al., 2020a and Soto et al., 2020b). Finally, this article uses material collected through a short online open-ended questionnaire, seeking to collect views from co-creation facilitators on the external factors that could impact the emotions of both participants and facilitators.

For both cases studies, the use of a specific matrix is essential to understand some critical aspects related to emotional perception. The focus of the matrix "Emotional Map" developed for CS 1 was on the emotions of students when they play a role as facilitators of a workshop. The focus of the matrix "Emotional Record" developed in CS 2 was specifically on the participants' emotions. In both cases, service design in healthcare was the main topic of the workshop. The purpose of the research strategy in CS 1 and CS 2 was to better understand the dynamics in a single setting (Eisenhardt, 1989) and to identify multiple levels of the information and proceed with the analysis (Yin, 1984). The additional questionnaire was aimed at asking facilitators their opinions about the other factors based on their experience to further develop the claims brought forward by the authors in this article. The tools used for CS 1 and CS 2 were as follows:

Emotional map: A visualisation of emotions according to their pleasurable or unpleasant characteristics (Van Gorp & Adams, 2012) (see Figure 1).

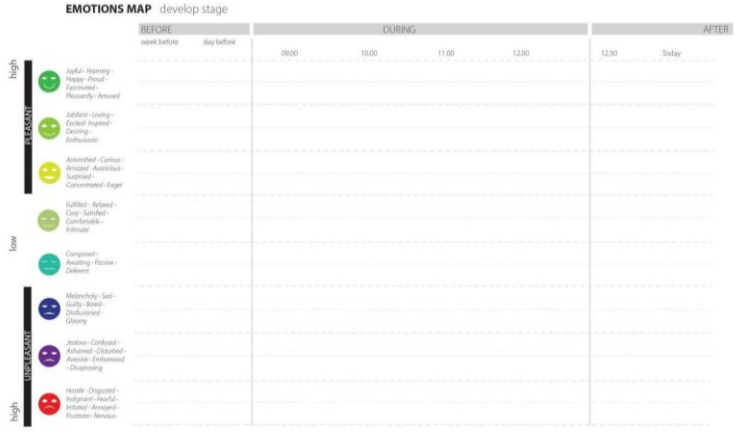

Figure 1. Emotional Map tool

Emotional record: A brief survey to identify the emotions experienced every day during the workshop (see Figure 2). The nine emotions displayed in the survey are a combination of the six basic emotions (Bloch, 2008) and the most common emotions identified in the “Emotional map” tool.



Figure 2. Emojis used for the emotional record matrix

4. Findings

This section shows the results from the data analysis and the corresponding reflections. The findings are organised in two sections: (1) *Variation of emotional perception,* where the data illustrate the fluctuation of perceived emotions according to the stage of the workshop; and (2) *Invisible factors that influence emotions,* where the respondents identified factors regarding their own practical experience and opinions that can influence emotions. Both sections merge results from CS 1 and CS 2 and the online questionnaire.

4.1 Variation of emotional perception

The emotions experienced as a facilitator are diverse and depend primarily on the practical experience that one possesses. Personal skills are an essential role in the facilitator's performance, yet they are not part of traditional service design training: 'The facilitator's personality is essential in her or his role, but none has received specific training to handle emotions' (comment from a facilitator, CS 1). In both case studies, some differences can be observed, mainly depending on the experience of the facilitator.

The facilitators' emotions during the workshop are intense and fluctuate depending on their practical experience; for example, the workshops they conducted previously gave them the knowledge to handle different types of situations with flexibility and wider understanding this define their emotional perception, more or less pleasure, during the process. However, in CS 1, even for those who felt unpleasant emotions during the workshop after a few days, they remembered just the good emotions related to *satisfaction* and having achieved something. Meanwhile, CS 2 showed less fluctuation of emotions. In general, *joy, satisfaction* and *astonishment* were the most common emotions.

The Emotional Map tool used in CS 1 shows the perception changes during the workshop and around one week after the workshop (see Figure 3), when students reconstructed the emotions experienced according to their memories. The visualisation of this representation shows the fluctuation of emotions before and during the workshop, moving from pleasant to unpleasant emotions, although the display of emotions after the workshop shows less variation, with more neutral and pleasant emotions.



Figure 3. Emotional map responses by the three groups

Before the workshop, the emotions of the students who would act as facilitators were diverse, and many of them were related with the expectations and challenges of being the

host or leader of the activity. Therefore, the respondents added some extra emotions or emotional comments to the matrix list, such as: *we know what to do, enthusiastic & nervous, awaiting*, *concentrate*, *indifferent*, *sad*, *guilty*, *confused*, *fearful*, *excited*, *worried* and *nervous.* According to their answers and comments shown in the matrix, the emotions identified before the workshop extended until just before the workshop began. After the first intense part, the emotions were more related with a 'relief state', when all was running as expected, while the emotions in the last part were divided into boredom and happiness. As an example of the emotions before the workshop, one of the answers from the online questionnaire explained the combination of pleasant and unpleasant emotions: 'I love to meet and interact with people, but there are several technical (not only technological) issues that I need to be sure of'.

Comparing both case studies and the online questionnaire shows that the facilitators' emotions were quite similar independent of the type of workshop. Although this might seem obvious, when consulting the facilitators about the emotions they experienced, they stated that it was an aspect that they had not previously reflected upon.

4.2 Invisible factors that influence emotions

The process of recognising the emotions experienced during the co-creation practice is complicated because people in general do not have accurate knowledge to define a precise emotion in a specific situation. Here, most of the answers focused on facilitators' experiences during a workshop, assuming that the emotions were triggered by the ongoing interactions. One of the most challenging aspects was determining which factors influenced the identified emotions, and even the process of distinguishing those emotions might have been affected by factors external to the specific interactions that occurred during the workshop. According to the facilitators of CS 2, they considered all the structural aspects of the space (e.g. light, walls to place papers, place linked with the project) to be important, making some connections between emotions and the environment, but just as a functional part of the activity.

People's emotions are a complex set of elements. Emotions are the reflection of the history of their interactions with different communities (e.g. family, friends, work, gym), the various situations they have faced and the way they have solved or reacted to each of them and their experiences and the growth they have enabled. People are influenced by their surroundings and the communities in which they interact; this can be seen in their lifestyle decisions and behaviours (Tolosa, 2013).

In the online questionnaire, the respondents were asked about their opinions about other or external factors that influence emotions in co-creative environments. The purpose of the questionnaire was to explore factors beyond the planning, structure or any other activity that they commonly regarded as essential to running a workshop. According to their answers, *prior* to a workshop, the external factors could be elements such as the tensions inside the organisation (between participants if they know each other), the stress related to

the thought of meeting new people, the level of clarity regarding the purpose of the workshop or the language being used in the international workshops. The answers regarding the factors *during* the workshop were more extensive and detailed and thus likely easier for the respondents to identify. These answers have been organised into four topics: the atmosphere, the facilitator's skills, the workshop structure and the participant's life outside the workshop.

Table 1. *The factors related to the definition of the emotions in a workshop environment*

Topics	Examples
The atmosphere *All the characteristics of the room and workshop dynamics.*	Lights, temperature, smell, the environmental conditions, the infrastructure and the participants' freedom to express their emotions.
The facilitator's skills *The experience and proper attitude to guide the workshop and handle possible situations.*	'The way the group is being approached by the facilitators and how he/she/they are focusing to that workshops activities' (a questionnaire respondent) and 'how well it's facilitated' (a questionnaire respondent)
The workshop structure *The workshop design and the decisions behind it.*	All the decisions about the methods used, timing, dynamics, tools, materials, the topic or the purpose of the workshop. Nowadays, the workshop characteristics, such as face to face, online or hybrid.
The participant's life outside the workshop *Every person's history and reality shape his or her personality and daily attitude.*	'The group of people that is present in the workshop, e.g. if someone is having a bad day, that affects others as well' (a questionnaire respondent); 'For example, if one participant gets a message from dentist during the workshops that her appointment for afternoon is unfortunately cancelled. This person had a fear of dentist and now immediately feels more relaxed' (a questionnaire respondent).

There were some clear needs and a desire to affiliate with life or lifelike processes. This is reflected in human–nature interaction, which defines the cognitive and emotional characteristics of humanity. There is also an intentional human–nature emotional bond, and as a consequence of this bonding, the protection of nature is a natural reaction to this connectedness (Lumber, Richardson & Sheffield, 2017). The interactions in a workshop seek to achieve such connection, and although there is always a highly personal component, the facilitator can contribute to guiding that feeling of belonging. The facilitator is a guide in this process, as described by one of the questionnaire respondents:

> I have noticed that it is important to the participants to know that even if they are working independently, the facilitator is there to help if there are questions or problems, it is important to be present during workshops.

The case studies provided an overview of the emotional experience in a co-creation workshop, the knowledge of case studies respondents about emotions and the lack of precision in its identification. The answers to the online questionnaire added more detail about the factors that influenced the facilitators' emotional perception. The three methods used provide a visualisation of the emotional perceptions of the facilitators and participants. Although the identified factors could be examined in more depth in future research, this article shows that there are also many unexplored areas related to the emotional flow of collective creation and what defines it.

5. Conclusions

The data collected from CS 1 and CS 2 and the questionnaire give specific information about emotions but also raise new questions. The results and reflections in this article suggest that understanding emotions within a community requires consideration not only of the visible part of the interactions but also what happens with each person. There are numerous factors that affect the attitudes, decisions and behaviours of the participants, that is, the 'world' behind each participant, and life does not stop while people are in a workshop. All of these factors, with more or less intensity, contribute to building a specific atmosphere for the co-creation experience.

The article highlights that emotions are part of a complex group of factors, which depend on the participants themselves, other situations related to them and the conditions around them. The way in which participants process all these experiences depends on the individual and the specific situation. Therefore, emotions are not only a direct consequence of a person's momentary experience; rather, they are a sum of elements, including the recent transportation experience, smells, music, colours, temperature, family issues, health problems or work-related situations. In this sense, facilitators must develop the ability to forecast situations and nurture collective creation environments, considering all the factors that influence the participant's experience.

The real challenge is to generate an emotional climate that supports a stimulating co-creative environment. It is crucial to consider all of the participants in the space, not only people (e.g. users and stakeholders) but also the specific conditions of the space and the environment (e.g. non-human living beings, climate, culture). The opportunity for the facilitator is to increase his or her awareness of everything that constitutes the situation, fostering empathy as a natural response when interacting with others and making the participants feel like part of the definition of the workshop's atmosphere.

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Acknowledgements: Special thanks to Mira Alhonsuo for her support and kind collaboration in both case studies. Thanks to the Co-Designing Healthcare project, funded by Nordplus Horizontal 2018, as well as the National Fund for Cultural Development and the Arts in the Becas Chile Crea 2019 funding modality (Project No. #515401).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The *Food Futures Teaching Cluster*. Food Culture, Visual Communication Design, and Collaboration.

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Abstract | This paper describes the planning and implementation of the *Food Futures Teaching Cluster*, a collaborative project that brings together faculty and students from the design arts and humanities to explore and engage with current conversations promoting local and sustainable food practices. This teaching cluster involves two concurrently taught courses taught by two of the authors: American Food Cultures (a comparative studies seminar) and Photo-Graphic Design (Introduction to Visual Communication Design). With the assistance of the third author (Department of English), who participated in curriculum design and met with students as a consultant with expertise in visual rhetoric, students in both classes collaborated to address the topic of food futures in discussion, research, writing, and design. This teaching cluster structure draws upon evidence-based teaching practices commonly acknowledged in teaching and learning research. It presents students with an opportunity to engage in collaborative, experiential learning with a long-term project that results in real-world impact for actual audiences. Over the term, the authors observed, documented, and analyzed how students developed a range of written and visual compositions presenting stories, facts, viewpoints, and emotions related to the *Food Futures* theme. This paper highlights students' reflections on the topic of food sustainability practices and the iterative, collaborative teaching process. Students additionally tie these thoughts to greater insights about their impact as human beings on nature. This study concludes with a faculty reflection and plans for future work, arguing for this approach's capacity to improve relationships among ourselves, our environment, and our technologies.

KEYWORDS | FOOD CULTURE, SUSTAINABILITY, COMPARATIVE STUDIES, VISUAL COMMUNICATION DESIGN, TEACHING, COLLABORATION

1. Introduction

Collaborative models of instruction in design education have become increasingly commonplace. Whether that takes the form of an apprenticeship model (e.g., having students work with professionals in the field), a mentoring model (e.g., having freshmen work with juniors or senior students), or—in this case—an interdisciplinary parallel course model, introducing design students to different ways of thinking, different approaches to problem solving or critique, can be an effective way to foster creative thought and output from our students. In fact, interdisciplinary design has been a professional paradigm for decades. As Tony Golsby-Smith argues, "Epistemic modes …are being broken apart today as we address the large tasks of our time–sustainability, globalization, diversity, … Interdisciplinary approaches are needed for the practical application of disciplined understandings to the existing world" (Golsby-Smith, 2013). Bringing this model into the classroom presents students with a valuable opportunity to experience this professional collaborative mindset in an educational context.

This paper describes the planning and implementation of the *Food Futures Teaching Cluster*, a collaborative project that brings together faculty and students from the design arts and humanities to explore and engage with current conversations promoting local and sustainable food practices. This collaboration is part of a larger multidisciplinary program at the authors' shared institution called *Livable Futures*, a project created to explore effective ways of combining artistic, scientific, and humanistic methodologies in order to address near-horizon challenges that affect both planetary and human conditions. Individual projects within this collaborative consist of media-enhanced dance performances, artists' talks, software design, and innovative teaching collaborations. In that spirit, the authors bring visual communication design and humanistic inquiry together in a teaching cluster focusing on a topic that involves wide-ranging elements of genetics, environmental science, geopolitics, economics, ethics, and art: in short, the future of food.

Over the semester, the authors observed, documented, and analyzed how students developed a range of written and visual compositions presenting stories, facts, statements, viewpoints, and emotions related to the *Food Futures* theme. This paper highlights students' own reflections on the topic of food sustainability practices, as well as their experience of the iterative, collaborative teaching process. Students additionally tie these thoughts to greater insights about their impact as human beings on nature.

The theoretical rationale for the *Food Futures Teaching Cluster* draws upon a body of research—situated both within design education as well as the scholarship of teaching and learning—that offers a pedagogical framework for structuring the assignments and interactions that the students experienced during the term. Privileging both robust collaboration and wide interdisciplinarity that reaches beyond traditional classroom spaces, the true value of this teaching cluster structure lies in its attempt to ground student work in real world issues meant for authentic audiences, in order to design purposeful, meaningful interventions.

2. Context

Food Futures is situated at The Ohio State University (OSU), a large public research university situated in the mid-western United States. Specifically, *Food Future*s is a project sponsored by *Livable Futures*, "a grassroots network of artists, scholars and activists seeking to share resources and foster creative solutions to survival under planetary conditions of unpredictability and crisis" (*Livable Futures*, n.d.). *Livable Futures* is one of several similar large projects that, together, are known as Discovery Themes. The Discovery Themes Initiative, begun by OSU in 2012, is a ten-year, multi-million-dollar project designed to address global issues or problems, such as Infectious Diseases, Chronic Brain Injury, or Sustainable and Resilient Economy, among others (The Ohio State University, 2012). *Livable Futures* is funded under the "Humanities and the Arts" Discovery Theme, established to increase student engagement, faculty collaboration, and national recognition in the humanities and the arts (Noyes et al., 2016).

Directed by Norah Zuniga Shaw (Professor, ACCAD/Dance), the *Livable Futures* collaborative consists of faculty members and students from various departments, centers, and units within the Arts and Humanities. The physical "hub" of the collaborative is the Advanced Computing Center for the Arts and Design (ACCAD), an interdisciplinary center made up of designers and engineers, animators, artists, and others working within a collaborative research facility featuring open, reconfigurable classroom, studio, and performance spaces. The group includes people from Design, Theater, Computer Science and Engineering, and English, among others. Additionally, the project involves internationally recognized visiting artists, designers, activists and scholars. Among the activities sponsored or supported by the collaborative are media-enhanced dance performances, artists' talks, scholarly lectures, software design, community gardening, a remote "field school" located in coastal Louisiana, and several interdisciplinary teaching collaborations.[i]

In addition to the shared mission and support structure of *Livable Futures* collaborative, other notable university-wide activities were conveniently unfolding during the course of the *Food Futures* that helped establish the exigency of the theme. For one, OSU officially launched its Sustainability Institute during the spring of 2019, a multidisciplinary center created to promote research, teaching, and community partnerships aimed at supporting sustainable practices (Sustainability Institute, n.d.). Among the projects undertaken by the institute—and a main source of context for the teaching cluster—is The OSU Panel on Food Sustainability. To help address issues ranging from food insecurity, dietary health, economic stability, and environmental impact, this panel established a goal to "increase production and purchase of local and sustainably sourced food to 40 percent by 2025" (The Ohio State University Panel..., 2018). As the authors continued planning before the term, we identified opportunities to engage students in the larger conversations surrounding food on campus and in the community, such as relevant events to attend, guest speakers, and venues to present student work, detailed in the following section.

The central goal of this initial planning stage was to build a collaborative framework incorporating elements that would successfully enhance the students' learning outcomes. Many of the ideas we implemented have been explored in the context of other courses, but we anticipated that they might transition effectively into our teaching cluster. More generally, researchers in the scholarship of teaching and learning have long published on the advantages of interdisciplinary collaborative teaching (Ebert, 1999; Shibley, 2010; Bryant, et al. 2014). Those advantages include widening your sphere of pedagogical and subject-matter expertise, exposing students to a wider audience, and modeling the kind of collaborative learning/working community often seen in professional settings, among others. In the world of design education specifically, there is a growing body of literature that speaks to the need to develop effective, replicable frameworks for collaboration (Poggenpohl, 2009; Davis, 2013; Lane and Tegtmeyer, 2020). Despite the institutional norms that often hinder cross-disciplinary collaborations (e.g., difficulty scheduling, departmental budgets, differences in tenure requirements), advocates that believe in the benefit of the approach advise faculty to recognize the challenges to anticipate ways of working around them (Davis, 2013). Sharon Helman Poggenpohl (2009) argues for the need to develop stronger theories and models of collaborative education in design based on the "recognition that innovation is often the result of collaborative work" (137). Lane and Tegtmeyer's *Collaboration in Design Education* (2020) identifies the various types of collaborative relationships in design education contexts, from working with peers and design faculty, to interacting with students and faculty outside of design, working in conjunction with partners from industry and academia, and even members of the community at large. In order to foster stronger critical thinking and creative production, *Food Futures* sought from the outset to implement this wide range of collaborative relationships throughout the term, which we describe in greater detail below.

3. Course Descriptions, Outcomes, and Collaborative Structure

Contemplating the issues associated with how we cultivate, process, and distribute food is an integral part of envisioning what shape our livable futures might take. This teaching cluster involves two specific courses, taught during the same term at approximately the same time by two of the authors: Photo-Graphic Design and American Food Cultures. With the assistance of the third author (Department of English), who participated in curriculum design and met with students as a consultant with expertise in visual rhetoric, students in both classes collaborated to address the topic of food futures in discussion, research, writing, and design.

Central to the planning process from the outset was the guiding question: could we create a productive teaching collaboration, one that brings these two separate classes into conversation with one another in order to explore a deeply relevant topic from two very different disciplinary vantage points? This teaching cluster structure draws upon evidence-based teaching practices commonly acknowledged in teaching and learning research. It

presents students with an opportunity to engage in collaborative, experiential learning with a long-term project that results in real-world impact for actual audiences.

Working in small teams, students developed a variety of design projects (e.g., design journals, food landscape photo-essays, posters, visual narrative book, etc.) as part of a larger campaign to help raise awareness of sustainable food practices in general. More specifically, these projects align with a goal established by the university's Panel on Food Sustainability, which is to have the university purchase 40% of its food from local and/or sustainable sources by the year 2025. These project deliverables were displayed and distributed to reach students, staff, faculty, and other relevant audiences within the greater community.

3.1 Course 1 – Introduction to Visual Communication Design, Photo-Graphic

Photo-Graphic Design is a studio course where students explore form in photographic, typographic, and graphic elements to create various levels of integration and juxtaposition. Sophomores from visual communication design major are taken through a step-by-step process that encourages exploration using traditional and digital applications for creating type and photographic compositions. Students apply design principles and visual strategies of word and image to convey connotative and denotative meanings. Throughout the 15-week semester, the course consists of design lectures, topical research, reading discussions, presentations, and critiques. In this particular section, students developed a series of three design projects (e.g., design journals, graphic posters, and visual narrative accordion book) as part of a larger campaign to help raise awareness of sustainable food practices in general.



Figure 1. Food Diary, a type and image composition sketchbook, including images of sample student sketchbooks as well as students presenting work to one another.

The first project required the students to document their encounters of food from different occasions within a week that would require them to draw upon all sorts of emotions, intellectual ideas, and aesthetic expressions. Inspired by these sources, each student created a design diary in a sketchbook format to visually and verbally present his or her own stories, statements, facts, viewpoints, and emotions related to the food topic (Fig. 1). To compose their type and image elements the students applied various design considerations involving complex visual relationships of scale and space concerning form and counter-form relationships and the overall visual syntax and semantics representation of letters, words,

sentences, and paragraphs. Students were encouraged to use graphic support elements to provide additional structures and visual guides.

The second project built upon the food diary that was created in the previous exercise. Each student was guided to develop a distinctive story based on the food experiences presented in the sketchbook. The students continued their type and image composition explorations with a focus on expressing and conveying the meaning and message of their selected food story in a poster design application format. Students formed smaller teams to help each other to identify unique visual themes for their poster concepts. They discussed and applied various communication and persuasion principles of rhetoric based on their required reading materials: v*isual simile*, m*etaphor, personification, metonymy, synecdoche, visual and verbal pun, hyperbole, antithesis, irony,* and *allegory* (Meggs, 1992) to strategically assemble the different forms of photo-graphic elements and create a larger visual impact. Each student produced two food story posters and applied a different design composition for each one that was based on one of four approaches to type and images interaction: *Separation* (when the type and image operate independently), *Fusion* (when the type and image blend to form a unity), *Fragmentation* (when the type and image disturb or disrupt each other), and *Inversion* (when the type and image trade place) (Skolos & Wedell, 2006).

Moving away from letterforms, the students continued to explore the dynamics of form and counter-form within photographs, as well as the interaction between type and image for their final project. This exercise involved designing a progression of pages in book form, using an accordion fold structure (Fig. 2). The range of compositions throughout the book required the students to incorporate type and photographic images that flow in a rhythmic theme. Their studies should consider form progression, juxtaposition of image and type, and visual connection and comparison. The visual and narrative progression must grow from the texture of a body of type to the inner forms of photographs. The aim for this exercise is to reveal photographic forms, not simply to display pictures (Grear, 2006). The visual rhythmic sequence is open for interpretation. The turning of each page and spread should offer surprises while still create a consistent mood throughout the book.

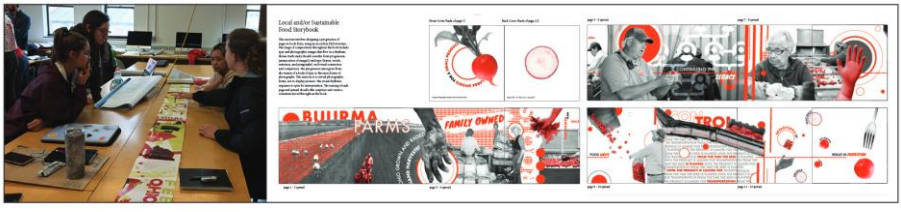

Figure 2. Form & rhythmic progression accordion book overview, including image of students sharing their projects, as well as a sample completed student book.

Each student began this exercise by using the visual and written narrative developed from the previous food diary sketchbook and poster projects. Their design composition

explorations progressed by adding new images, text, and support graphic elements to expand on the photo-graphic form and narrative sequence. At this stage of their practice, the students were more mindful of design considerations regarding graphic space, image cropping and sizing, type and image relationship, tone and texture, motion and implied motion, repetition and rhythm, field of tension, and visual unity (Cullen, 2006; Meggs, 1992).

3.2 Course 2 - American Food Cultures (Comparative Studies Seminar)

American Food Cultures is a course that explores the various ways that culture has shaped our nation's attitudes and practices surrounding food production and consumption. Drawing upon the emerging field of food studies, this course takes a historical perspective on the development of the food system in America, as well as the discourses and visual cultures associated with "American" food. Throughout the term, students contend with topics such as how the distinctive iconographies of Southern hospitality and "ethnic" cuisines have coopted and distorted experiences of colonialism, slavery, and immigration. Students also explore more recent cultural movements such as the rise of "rational" and "scientific" constructions of dietary requirements. Connecting these discourses to contemporary concerns about industrial food and the American diet, a central goal of this course is to raise questions about the cultural politics of efforts to transform the food system in pursuit of more sustainable and equitable ends.

Students in this course read from a number of texts that included Abigail Carroll's *Three Squares: The Invention of the American Meal*, Michael Pollan's, *The Omnivore's Dilemma*, and Carlo Petrini's *Slow Food Nation*, among others. In addition to regular readings and discussions, students also wrote several analytical papers and—most relevant to the teaching cluster—completed an assignment called "Mapping Our Foodscape." This assignment had students create a visual display, as either a poster or by using the online presentation tool Prezi, of their depictions of the foodscape as they experience it (i.e, the physical locations, cultural spaces, institutional settings, and discourses that shape our food environments). These displays were required to include:

- Representations of the spaces and places where students regularly "gather meaning" from food
- 4-5 images (photos, sketches, clipart) illustrating key meanings in/of those places
- 3-4 quotations (or concept/terms) from the readings explaining important distinctions

Ideally, "Mapping Our Foodscape" is an assignment designed to encourage students to interrogate how their university campus organizes or influences their relationship with food.

3.3 Collaborative Structure

The faculty team met prior to the term to create the kind of learning experience that, ideally, would create valuable collaborative moments bridging the two courses in order to promote knowledge exchange as well as a sense of community and a "real life" audience. In creating

this anticipated collaborative structure, we consciously drew upon evidence-based teaching practices commonly acknowledged in teaching and learning research (Harvard Initiative, 2020). Such practices included: creating experiential or authentic learning objectives, offering students sustained or "process-through" feedback on major assignments, and providing peer-to-peer learning opportunities. For example, at several points during the first main assignment for each class (the food diary sketchbook and the foodscape project), both classes interacted in several ways, including attending the same lectures, helping one another brainstorm, sharing drafts of projects and soliciting feedback, and showcasing their finished products. Ultimately, our goal was to present students with an opportunity to engage in a collaborative learning experience centered around a long-term project that results in real-world impact for actual audiences (Fig. 3).



Figure 3. Collage depicting several collaborative moments throughout the term.

We also realized that as the term unfolded, a big component of our approach was emergent and improvisational, as conditions on the ground led to us to revise our plans along the way. To an extent, we anticipated that we would invite potential guest speakers with specific expertise in our topic. The more we planned, the more we saw opportunities to connect the work of these classes to the events and organizations within the broader university community. For one, there was the previously mentioned Panel on Food Sustainability, which suggested for us an opportunity to promote and raise awareness about that initiative. In a related vein, OSU would soon be launching its new Sustainability Institute later that term. We also identified local groups such as Best Food Forward and Slow Food Columbus that could help deepen our understanding of the broader context of food advocacy and activism. Also, the dancer/choreographer/performance artist Ann Carlson was scheduled to perform her orchestral movement piece, *The Symphonic Body/Food,* later in the term. This event in particular allowed the design students a real-life venue for displaying their posters (and also an opportunity for one of the authors, Rick Livingston, to actually take part in the

performance. In part a result of the posters being well received, there was a follow-up request by coordinators from the Methodist Theological School in Ohio to have the posters on display during their conference “On Food and Faith: Ministry in the Time of Climate Change.” Conference attendees included religious leaders, scholars, scientists, farmers, activists, and (perhaps most notably) former Vice President Al Gore (Fig. 4).



Figure 4. Food poster overview, including poster presentations at The Symphonic Body/Food performance event as well as "On Food and Faith” conference.

4. Student Reflections

To better understand the impact of the teaching cluster experience on students, the instructors drew upon a variety of reflective instruments for analysis. This included student feedback produced and collected during the semester—design statements, discursive evaluations, and end-of-term feedback—in addition to reflective questionnaires sent out to a subset of students from the design course. While detailing the entirety of this feedback is beyond the scope of this short paper, we can say that, generally, students found the collaborative structure and thematic focus to be valuable enhancements to the course. We eventually intend to collect additional student data and feedback to produce a more detailed analysis of these findings in a future project. Below, however, we highlight design student responses gathered after the term had ended, which were based on prompts asking about changing mindsets and behaviors, attitudes about the collaborative structure, and its effect on the design process.

1) How did your thinking about food change over the course of this semester?

- AMBER: Through the course of the semester, my idea of food expanded greatly. Through this project I realized that food was a topic that covered more than the

act of simply eating it. Before the project I had strong views on animal rights dealing with food, which I highlighted in my work. Yet through my research and through seeing the research of my peers, as well as all of the lectures and lessons we learned in the course, I learned that food deals with sustainability, culture, racial injustice, obesity and starvation, economics, way of life, mental health, and so much more. After the project, I became more aware of how food affects my own life, and what I can do to make a better impact through food.

- CHRISTINE: Starting the semester off I was kinda of skeptical about completing an entire design course just about food. But as the semester went on, I realized there was more to food than just eating. […] Over the course of this semester, I was able to grow as a designer as well as an individual. I had the opportunity to learn about the importance of local and sustainable food. Food that is produced locally and sustainably is not only healthier but has less harmful effects on our environment.

2) Reflect on the collaboration—how would you describe the experience of working in tandem with the other class?

- AMBER: Working in collaboration with the other class causes me to see how designing for a mission such as food could be done with other non-creatives. The things I learned from the other course's class members and professor touched more on the idea of how food affects people as a whole. The other course gave me insight that I didn't consider, and caused me to dive deeper into my research. It also caused me to be conscious about the way my poster/design items were worded, as that too could make all the difference.
- ETHAN: Collaborating with other students was exciting. I often find that my design work improves when I get feedback from other designers and non-designers alike. I also think that there are opportunities to make this collaboration more successful in future years. There were instances where both classes could have benefitted from more instruction and guidance, because sometimes we did not know what we should be talking about with each other. As a design student, I was able to develop my work based off of what the other students said when they looked at my work, but I did not know how to give them feedback on their work because it was more difficult for them to explain or show the kind of work they did, given the medium and nature of their work.

3) Have you engaged in any additional actions based on exploring this topic of local and sustainable food? For example, have you changed your eating habits, joined or volunteered for a food-based organization, or engaged in similar activities?

- LILY: I have changed my diet since this semester, and I have cut dairy and meat out of my diet for the most part. Though I've not yet stuck to a strict type of diet (vegan, vegetarian, etc.), I've become a lot more conscious of what I feed myself, as well as how the dairy and meat industries are incredibly harmful to the

environment. Though switching over completely to purchasing dairy and meat alternatives is pricier, I want to continue to explore food options and support food production that is healthier for the environment.

- AMBER: From the course and my personal research I became more aware of animal rights in the food industry, and now choose to buy pasture-raised eggs despite the fact that they are $4.59 a carton, because I am essentially paying for the animal to know happiness. […] After the course, I realized that one day I want to own my own chicken coop so that I don't have to be a part of the cruelty that is going on, and plan to have my own chickens after college.
- SARAH: I have become much more aware of what I eat and where it comes from. Because I physically saw where lots of produce in Ohio is grown and collected, I sometimes find myself reflecting on that experience and my accordion book project when shopping for produce at my local Kroger/Giant Eagle. I also find myself going to restaurants that I know have locally sourced food.

4) How has this experience changed your understanding of concepts like "natural," "biological," or "human"?

- ETHAN: I've learned that words like "natural," "organic," and "healthy" can be extremely misleading and require a lot more inquiry when making shopping decisions. […] I think that this project opened my eyes to how multi-dimensional food is and how much emotion is behind it. There are as many experiences with food as there are people in this world. In the research I conducted on the dairy industry for my design project, I found such complexity behind every aspect of the process. I had approached the project initially with a strong stance about the treatment of dairy cows, but through my research, I learned to treat this issue with nuance.
- AMBER: After the course I became more aware of the idea that companies like to hide behind vague words like natural, fresh, and organic. The course made me realize that the only way to know for sure what is going on behind the scenes is to do my own research. The course caused me to realize that the idea of "natural" is what we define it as. […] The greatest thing that the course did for me was that it caused me to be more aware of food, from the act of cooking it, to all of the elements it touches. Essentially, I realized that to eat is "human." We all need it, and that need can be greater than we know, therefore it is up to us to find a solution to feed the people without harming our planet.

5. Conclusion

Reflecting on this experience and how it aligns with the values of the larger *Livable Futures* collaborative, the three authors approached this teaching cluster as an exercise in stepping outside of our intellectual comfort zones by engaging with individuals from other academic

disciplines, each of us bringing our own training, knowledge, and skills to the conversation. Our goal was to create a visual communication design mindset (as well as ourselves) that embraces values of understanding, empathy, and compassion in design thinking and practice in order to address complex issues that affect both humans and nature. By exploring these new approaches to teaching design, we ultimately seek to create the kind of spaces, connections, and underlying ethics that lead to more responsible relationships with one another, our environment, and our technologies. Particularly during a period of worldwide pandemic, we remain mindful of the advice of Lane and Tegtmeyer to explore these new and ever-shifting collaborative pathways. They write:

> "Design faculty are tasked with teaching in an ever-changing world — with advancements in technology our tools are changing as well as access to an abundance of information. This shifts the expectations of what designers need to know on a continuous basis and challenges educators to stay ahead of the curve. In addition to technological changes, the types of problems that designers should/could solve are shifting and becoming more global. Designers have valuable contributions to make not only in business and commerce, but in healthcare, politics, sustainability, diversity, etc. This requires a new type of collaboration, one that is more than passing down of skills and tools and different than experimental community learning spaces, but a way to communicate and work with others outside of their discipline and unlike themselves." (Lane and Tegtmeyer, 2020)

Food Futures is part of an ongoing collaboration between the authors. This multidisciplinary approach to design education is one that we—in slightly different formulations—have successfully repeated for other sections of the Photo-Graphic Design course. In addition to the thematic focus on sustainable food cultures, a version of the course focusing on the concept of water wellness was conducted the previous year, and a course centered around the idea of tree futures is currently underway at the time of this writing. Additionally, one author (Chan) has successfully utilized a version of this approach as a guest instructor in design schools in China and Germany. Whatever the content, the students largely tend to respond positively and enthusiastically to the general approach, the shared sense of mission and purpose, and the opportunity to situate their design work in a context that has real-world impact. With that in mind, we plan to continue refining this approach, adapting it to timely and relevant contexts along the way.

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Acknowledgements: The authors wish to thank the Ohio State University *Livable Futures* collaborative, under the direction of Norah Zuniga Shaw, for its intellectual and financial support of this teaching collaboration.

i. The Livable Futures collaborative grew out of a similar project titled Humane Technologies, which shared much of the same structure and key membership, and also helped incubate similar types of projects. To get a more complete sense of the collaborative context, the authors recommend "The Humane Technologies collaborative: An overview of the 'provocation, making, reflection' process" (Chan & McCorkle, 2018).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The river and the revered: Tracing the impermanence of the land, the people and the embroidered

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Abstract | These The paper aims to ascertain the connection between the intensely embroidered expressions of Shershabadi women and their environmental landscape in the Indo-Gangetic plain, tracing the impermanence of their cultural footprint dux e to geopolitical crisis induced migration. The constantly changing topography of the region, the flood rich plains and displacement from their lands impact the formations of individuality and expressions of culture, questioning the notion of identity as a community. We argue that the river is both the cause and causality of Shershabadi expression, deeply rooting the community to their land and shaping their aesthetics. Through anthropological frameworks we analyse the primary and secondary research data, presenting a multiscalar, multistressor assessment of vulnerability at rural community level. Integrating migration mapping with culturally inclusive research, our objective is to establish the unique evolution of this community, their culture and embroidered expressions known as “Kheta”, worthy of getting a geographic indicator status.

KEYWORDS | CULTURAL FOOTPRINT, MIGRATION MAPPING, #KHETAKISHANGANJ, INDO-GANGETIC FLOOD PLAINS, GEOGRAPHICAL INDICATION

1. Introduction

The paper aims to highlight the connection between **land** – Ganga-Brahmaputra delta region, India-Bangladesh – its **people** – Shershabadi community living along the banks of major rivers in this region – and their **expression** of embroidered textiles (Kheta). This delta region, crisscrossed by rivers, has witnessed a unique play of land and water without any permanent line of divide between the two. Hence the intention here is to trace these rivers as the lines of life that have shaped the migrations and expressions of Shershabadi community along these life-lines from present day Bangladesh into the neighboring states of India. A multidimensional social phenomenon; migration is yet to be conclusively understood by scholars, cutting across different disciplines. Through our research following the cultural footprint of Shershabadi community, we have attempted to understand the cause and causalities of migration at a community level triggered by shifting of river courses, the ensuing catastrophe, and their impact on human environment as well as material culture. Persecuted by the Mughals and later by the British East India Company (Hoque, 2015), historically claimed to be the direct descendants of Emperor Sher Shah Suri's soldiers, the Shershabadi or Sher-Shah-abadi – Hindi word for population – community's deep connection can be traced back to the Ganga-Brahmaputra delta region.

Initially settled in the land given by Emperor Sher Shah Suri – who ruled from 1486 to 1545 A.D – in Malda district of Bangladesh, the Shershabadi community has constantly moved westwards along various rivers in search of better life opportunities since 1548 A.D and have settled in the Kishanganj and neighboring districts of Bihar in India (Author, 2018).

The rich delta of Ganges and Brahmaputra, silted by nearly 700 rivers (*refer to Figure 1*), makes the dynamics of water and land unique to this part of Indian subcontinent. The constant flood induced emergence and erosion of riverbanks, the political persecution as well as the social marginalization of Shershabadi community gradually led to their psyche marked by a lot of informality and impermanence of life and living, shaping their aesthetics, and impacting the evolution of their unique craft of quilted textiles called "Kheta". Even though the Shershabadis have endured waves of migration across generations, it has only resulted in evolving and strengthening their community identity; their embroidered textile, Kheta, has been instrumental in keeping this identity distinct.

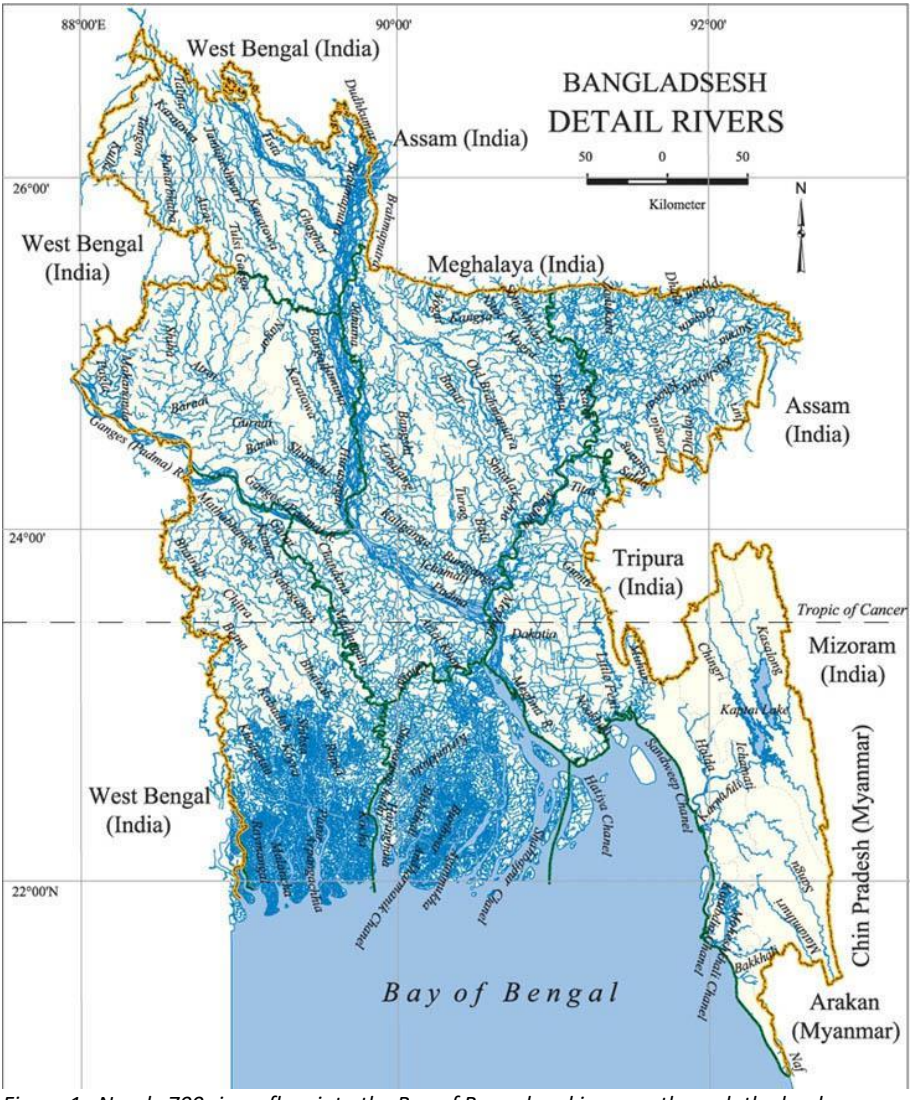

Figure 1. Nearly 700 rivers flow into the Bay of Bengal making way through the land between Bangladesh and Eastern part of India, creating a dense network of waterbodies.

2. Literature Review

In the paper, titled “Sher Shah Abadi community: A study from historical perspectives”, Md. Akramul Haque provides information on the community in general, their Afghan lineage and described them to be the soldiers turned land owners around Malda district in undivided Bengal. He describes in detail the continued persecution of the community first in the hands of the Mughals and later the British rulers of Indian sub-continent. In the recently published dissertation, Mr. Keshar Kumar focus on the informal nature of employment within the Shershabadi community in Kishanganj district of Bihar. His qualitative research for Tata Institute of Social Sciences, focuses on the involvement of Shershabadi women in the informal, hazardous yet skill oriented cottage industry of bidi (indigenous cigarette) rolling. This helps us in substantiating our understanding of impermanence in the daily life of the community and the evolving nature of their expression.

However, in the absence of extensive published literature on the migration, material culture and embroidery expressions of the Shershabadi community, a considerable amount of our secondary research has been dedicated to the writings on movement by anthropologist Tim Ingold and sociologist Richard Sennett. Referencing “Life of Lines” by Tim Ingold and “The Craftsman” by Richard Sennett, we have tried to deepen our understanding of community, their role as a craftsman, the deep rooted connection between life, climate, land, river, walking, imagination and spirit of creation as well as what it means to be “human”. Informed by the writings of Tim Ingold, we based our hypothesis on the fact that the primary tactile contact with our environment is through the feet rather than the skilled hands and hence the material culture and embroidery practice of Shershabadi women is an expression of the migratory path that they have walked on for generations in their vulnerable state. In a series of essays compiled as, “Being Alive: Essays on Movement, Knowledge and Description", Tim Ingold explained the vitality of materials, what it means to make things, the perception and formation of the footprint, the identity of community.

Further, we developed our understanding about the challenges of living along the river banks through the works of conservation architect Marina Tabassum, who attributed the informality and impermanence in the lives of Shershabadi women to the lack of distinct line of divide between water and land in the Ganga-Brahmaputra delta region. We referred to the book, Sui Dhaga published by Wisdom Tree in our research and subsequent claim to get Geographical Indication for the embroidery of “Kheta”. Building our argument on the facts shared by Ms. Niaz Zaman and Ms. Charusmita Gupta in chapter 4 (The representations of feminine in kantha) and chapter 6 (Sujni: the fine needle work of Bihar), we formulated our comparative research methodology and research questions.

3. Objectives of the Paper

The paper has the following objectives:

- To map the migration of Shershabadi community along the rivers in Ganga-Brahmaputra delta.
- To establish the impact of migration on the community, its material culture and expressions, especially on the embroidered textile Kheta.
- To make a compelling argument favoring the grant of geographic indicator status or Kheta.

4. Methodology Followed

Drawing inferences from the extensive primary research conducted in Kishanganj published in our previous paper (Author, 2018) and through ethnographic data driven analysis, we have attempted to understand the relation between the Shershabadi community, their migration over the generations and the evolution of their material culture. The multiscalar, multistressor assessment of vulnerability at rural community level was based on the migration mapping from Bangladesh to the state of Bihar in India. The hypothesis stated in the paper is based on the socio-anthropological approach to understand Shershabadi women artisans at a human level drawing a relation between their skilled hands and their footprints on the river banks in Ganga-Brahmaputra delta. In order to establish the uniqueness of Kheta embroidery, a comparative primary research was conducted through skill mapping and skill development workshops in the villages of Arrabari, Chandpur, Shafaqatnagar, Kharkhari and Kamarmuni. With a sample size of 100 Shershabadi women artisans, three workshops spanning 3 to 7 days were organized in August/ November 2017 and October 2020. A total of 5 new design patterns were discovered in addition to the 8 existing ones (Author, 2018). The authors also conducted first hand interviews with experts Ms. Jasleen Dhamija (veteran Indian textile art historian, craft expert and former UN worker), Ms. Archana Shastri (Textile expert and author), Ms. Sudha Dhingra (Associate Professor, NIFT), Ms. Swati Kalsi (textile designer) and Mr. Shahid Hussain Shamim (CEO, Paribartan, Bangladesh, textile expert and author) to trace the journey of the community and their expression. Through a combination of these ongoing skill development workshops in Kishanganj, interviews with experts in India & Bangladesh and demographic information (Census of India 2011), a set of data was collected in the first stage. The data was analyzed to understand the socio–economic and geo– political evolution of this migrant marginalized community providing vital clues to their unique cultural expression making a case for the Geographical Indicator status.

5. Limitations of Present Research

The connection between the land and the patterns of Kheta was established and elaborated upon by actual samples, documented and researched by the authors across the three workshops held in seven villages of Kishanganj. A total of three academic papers have been authored so far. The first paper, based on the primary research experience in the workshops, details the discovery of the community, their expressions and the design patterns. The second paper tries to establish the uniqueness of the embroidered expressions making a case for Geographical Indication. The present paper (third) traces the origin of the embroidered expressions and correlates the interdependency between the land, people, their migration, and cultural expression through a theoretical framework. Since the last census of India was organized in 2011 and the next one is due in 2021, the data on the present number of Shershabadi women is not conclusive. Today the community is spread across two countries i.e. India and Bangladesh, and it is still a long way to conclusively establish the extent of migration that has already taken place as well as connection with other craft practices that may have impacted its unique evolution to the present form of Kheta (Author, 2018). Hence there is a need for field testing the hypothesis of impermanence across India and Bangladesh, which we have tried to establish in this research paper.

6. To Migrate

Tim Ingold writes, “The things about things, however, is that they *occur* - that is, they carry on along their lines. This is to admit them into the world not as nouns but as verbs, as going ons. This is to bring them to life” (Ingold, et al, 2015, p.16). This quote builds the premise for Kheta to be seen as an *act* of embroidering, filling up complete surfaces with continuous patterns.

> “The river gives and the river takes away; in the face of nature, we are powerless”
> (Shershabadi farmer displaced by flooding of agricultural land)

Kishanganj is home to densely populated villages with smaller cluster of Shershabadi houses called “tolas”. Constructed out of mud, thatched roof and impermanent bamboo structures, these are cramped wall to wall living conditions for families with 10 to 15 members each, providing a sense of security and community identity to these people. The land along the rivers makes the soil extremely fertile due to heavy siltation. The villages here are lined with bamboo forests and vast watery floodplain with intermittent stretches of jute and paddy fields that are lush, green and flat. It takes only little imagination to think of a future scenario, when the Shershabadi population will likely have doubled, and a good chunk of the current agricultural land that they own, will permanently be underwater due to seasonal floods causing the rivers to change courses. Such a scenario could mean that a majority of this community along the river banks would be displaced, forcing them to crowd even closer

together in their villages or else once again migrate from Kishanganj district as geo-political refugees.

Such a catastrophe, even though imaginary now, fits right in with the community's crisis-driven story line. The entire Ganga-Brahmaputra delta across India and Bangladesh, has been witness to multiple woes since the first recorded communal riot around 1671 A.D. due to Mughal emperor Aurangzeb's intolerant religious policies (Lal, 1992). The partition of Indian subcontinent into India, East and West Pakistan in 1946 led to the Noakhali riot in present day Bangladesh in which approx. 5000 people perished and more than 50000 people were uprooted from their land (TIME, 1946); many of these displaced people including Shershabadis, migrated along the crisscrossing network of rivers moving towards India. The 1971 India-Pakistan war leading to creation of Bangladesh as an independent country witnessed further persecution of the Shershabadi community by the retreating army causing mass exodus across international border into Indian states of Bengal, Bihar and Orissa. Poor literacy levels, famine, epidemics, killer cyclones, massive floods, military coups, communal riots, political assassinations, and pitiable rates of poverty and deprivation led this community to survive as migrant refugees in their own lands.

7. To Negotiate, To Survive

As it has been pointed out by conservation architect, Marina Tabassum, "Migrations like these lead to possibility of negotiation, appropriation and optimization." To what extent, has this migration affected the textile expression of Shershabadis is a question worth asking and is one of the primary objectives of this research paper. The clues to the answer remain in the way this community has adapted time and again to the ever changing ways of living along the fertile river banks of Ganga-Brahmaputra delta.

The village lifestyle of the Shershabadi community still continues indigenous practices like building their mud houses, constructing the mud granaries, making of Khatia / Charpoy (cot), hand grinding of spices, making of sun dried pickles, oil pressing, basketry, and catching fish with indigenous tools and techniques. Since the native Surjapuri community are the major land owners, Shershabadi people mostly end up cultivating maze, paddy and jute in the low lying lands that are flooded by rivers during the monsoon causing extensive damage to their standing crops (Author, 2018).

Many of them are *char* dwellers, who inhabit the constantly changing islands (locally known as chars) on the floodplains of region's major rivers—the Ganga, Padma, Jamuna, Meghna and Brahmaputra. These islands, many covering less than a square mile, appear and vanish constantly, rising and falling with the tide, the season, the phase of the moon, the rainfall, and the flow of rivers upstream. Making a life on the *chars*—growing crops, building a home, raising a family—is an extreme example in adaptation that may have evolved them into one of the most resilient communities in India.

The many adaptations across generations can be seen in the way the visual references and practices of making Kheta have evolved. Each pattern in Kheta follows a stitched guideline and is carefully embroidered with precise intuitive calculation, leading to an extremely sophisticated design vocabulary that can be directly traced to the tricks of living on a char. For example, most of the bamboo and mud houses are built in sections that can be dismantled, moved, and reassembled in a matter of a few hours. The houses are built on a raised platform of earth using panels of thatch for the roof. In most of the households, the large granaries built out of mud, serves the purpose of stocking grains as well as quilted textiles (Kheta) that are seen as prized possession in case of flash floods, displaying an immensely practical sustainable and circular way of dealing with their environment.

The real secret of this community's survival is the fact that they seldom ponder over their vulnerable state of living. They have always been under pressure, and since ages their survival depended on their ability to move from place to place keeping the river as the only constant; their line of life. They farm their piece of land (char) for as long as they can, and then the river washes it away. No matter how much they worry, the ending has always been the same. There's no arguing with the soaring river. And yet they make the most of what is available and adapt until the bitter end, and then, when things become impossible, adapt a little more. It's a matter of community psyche — a fierce instinct for survival combined with a willingness to put up against incredible odds — . This can also be seen in the way the Shershabadi women layer their used saris, quilt every inch of it using simple tools like (only) needle and thread giving a new life and purpose to the otherwise worn out fabrics. Their feet that have walked the migratory miles along the river banks, pass on the instincts to their subconscious, drawing on the sense of constant movement across generations; their survival in anonymity erases any individual expression of motifs and their vulnerable selves get captured in the layers that are quilted together providing them warmth against the bitter cold of the landscape.

The designs of footprints are not ready made, nor are they imposed from above upon a hard surface. They are made, as human beings or other animals walk or run along, in a surface that is soft, pliable or absorbent. Thus whereas the stamp connotes immobility and omnipresence, footprints register emplaced movement. For from staking a claim, the indigenous inhabitant leaves footprints in the ground as clues to his whereabouts and expectations, and for others to follow. While a trained eye and touch can read much from a single footprint, even more can be read from a series of prints. Such a series, observed in sequence, comprises a track. If the same track is trodden often enough, the many individual prints merge into a continuous path. One cannot, then, read individual movements from a path, but only those commonly or collectively made. Footprints are individual; paths are social (Ingold, et al, 2015, p.63).

8. To Move, To Connect

> "There can be earth without human beings but can there be humans without earth? And if earth is necessary for human existence, then could we not equally say that human beings are the earth's most general instrument, since they provide the means by which its bounty is recovered? Do people produce upon the earth, or do they assist, like midwives at birth, in harvesting what the earth has produced?...yet the ground still appears as a *substratum* for such activity, an interface between the mental and the material where the sheer physicality of the world comes hard up against the creativity of human behaviour." (Ingold et al., 2015, p.63)

Moving from the approach of looking at textile as "man and his expression" in our earlier research papers, the narrative has changed to appreciating Kheta as an *act* of the land, by the land and for the land. It is not an embroidery anymore but the act of it. It has nothing to do with being an outcome like a textile product, however, everything to do with being the witness to the lives of Shershabadi women.



Figure 2. The intensity and richness of the land gets translated into the lives of Shershabadi community

8.1 To Stay Connected with Land

To appreciate the connection between Kheta and the land it belongs to, let us look at the textile up-close. Traditionally the base material is worn out sari or dhoti that are collected over the years with the intention to breath in new life. For a community of people who own

very little and are constantly moving from the state of permanency to impermanence, the idea of continuity and recycling becomes inherent to their existence. A closer look at the embroidery process reveals an initiation act of removing the edges (selvedge) of the fabric to loosen up the warp and weft so that they can be aligned and moulded to the linear patterns of the embroidery. This act is akin to the process of loosening up the soil before the seeds are sown. Similarly the act of picking the layers by the needle can be compared to the transplanting of paddy saplings which is the main cultivated crop in the region. One can attribute these underlying connections between handling of the textiles to the agricultural wisdom gathered over the ages.

8.2 To Connect with Feet

During the process of quilting in Kheta, once the base fabric is folded into layers over each other, the women squat together to secure the same with stay stitches and practically move over the fabric tracing their footsteps along the stitched guidelines (Author, 2018). The contact of their feet with the textile resonates with anthropologist Tim Ingold's idea of bare feet revealing the ground to be composite and heterogeneous, not so much as isotropic platform for life. The intensity of the primary tactile contact is much higher as the textile is experienced both through the feet and the hands. Assuming that most of the Shershabadi migrations have been through walking along the river banks, does the migration on feet has anything to do with the richness of the textures created by the migrant community?



Figure 3. The intensity and richness of the land gets translated into the intensity and richness of colors and textures in their quilted textile of Kheta

8.3 To Meditate

The act of this embroidery, with equal floats on either sides of the surface making it completely reversible, is a consistent movement of the needle and threads. Groups of Shershabadi women seated on the floor, under the mango tree in their courtyards, participate in this rhythmic act like many monks in meditation. “Far from being merely habitual or ‘done without thinking’ such rhythmic activity calls for intense concentration. This concentration, however, is that of a consciousness that is not confined within the head of the practitioner but reaches out into the environment along with multiple pathways of sensory participation.” (Ingold, et al, 2011, p.18)

8.4 To Weave

> “In both carpentry and textiles, the form of a thing does not stand over it or lie behind it but emerges from mutual shaping within a gathering of forces, both tensile and frictional, established through the engagement of the practitioner with materials that have their own inclination and vitality.” (Ingold, et al, 2015, p.24)

Similarly in the act of Kheta quilting, the way threads are taken from one edge to the other and left as fringes on both the sides, self-finishing the textile, is drawing from the act of basket weaving which is a common practice for constructing houses as well as objects of daily use

8.5 To Remember

> “This surface, for Kant, lies at the very foundation of human experience; it is the stage on which the play of our skills proceeds (and) the ground on which our knowledge is acquired and applied.” (Ingold, et al., 2015, p.37)

The movement of Shershabadi community along the rivers not only took with them the memory of the land but also the contact with the earth, the ground, the surface, the wind and the sky. This is where the community made contact with these elements. On one hand, in those layers of saris is the collective memory of the single footprint, the series of prints, tracks that the prints made and over a period of time, the continuous path that they merged to make. It also has the memory that the thread makes when it comes in with the fabric that has become soft and supple with repeated use. The act of embroidery is the promise to make new memories with renewal of life. The fresh intense colors pulled in to the recycled saris/lungis by the threads are reminders of life being fluid, cyclical and circular, yet not repeating ever.

9. Conclusion – To Revere

> "We should resist the temptation to equate holism with finality or completion. The meeting of minds weaves a whole rope but so long as life goes on, there must always be loose ends." (Ingold, et al., 2015, p.12)

The river is the life line of this land. However, the only permanency in this fluid reality of Shershabadi community is not the land but the presence of the river alongside. The river meanders her way through this land and in some areas is as wide as 12 kms making it revered. The first stay stitch that the Shershabadi woman embroiders in her Kheta, is the walk that she does on one side of the river bank trying to gauge the life on the other side. The thread which is the carrier of her memory in the act of making these quilts, has no beginning or end like the river, allowing a continuity to be embedded within those layers.

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Saumya Pande With 25 years of experience as a designer and educator, Saumya Pande has advocated slow conscious living and conservation of indigenous cultures in her classroom, at global conferences and as a TEDx speaker too. As the founding course leader of Fashion department at IIAD, she is committed to creating an inclusive, rich learning environment with diverse viewpoints, talents and experiences. An alumna of NIFT (Delhi) and NTU (UK), she has the unique experience of setting up design departments of NIFT Chennai, Pearl Academy Noida and IIAD Delhi. Strongly influenced by Indian identity rooted in traditional skills, her creative practice spans across fashion, textile, craft practices, illustration and dance, constantly pushing the limits of body and space. In 2014, her textile installation titled, 'The New Body', was showcased in Florence, Italy. As the co-founder of Zameen Astar Foundation (ZAF) she is creating livelihood for Shershabadi community and conserving their craft of quilted textiles called Kheta. She is currently involved in setting up a unique online museum of brooms in India. A trained dancer, Saumya loves to collect seeds and pods from all over the world.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Shape of Drugs: a matter of Human-Centred Design.

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Abstract | The importance of drugs in our daily activities is evident. And yet design thinking suffers from relative *inertia* about viewing medications as objects of use and consumption. Conventionally intended as industrial pharmaceutical products obtained based on scientific principles, drugs are both medicinal forms saturated with meaning and technical objects—for the latter, we mean the product's tangible characteristics with which the user has to cope. Therefore, it can be assumed that any medication's efficacy depends on its scientific principles as well as on the sophisticated, hyper-technological or—conversely—prosaic techniques of intake or delivery. An approach to drugs from a human-centred design perspective may thus be aimed at verifying possible correlations between medication shapes and the inefficiency that, as a designed artefact, the medication may produce in terms of identity, understanding, and usability.

KEYWORDS | HUMAN-CENTRED DESIGN, PHARMACEUTICALS, PRODUCT DESIGN, USER BEHAVIOUR, AFFORDANCE

1. Introduction

An object's statutory design is punctuated by different focal points: sometimes these are specific outlooks or points of view; at other times, they are foundational issues that help define the various nuances of that object's essence within the epistemological and phenomenological framework (Molotch, 2005; Bertola & Manzini, 2004).

Technical objects, items, products to be used or consumed, things, tools, apparatus, and gadgets - the focal points around which we centre the facts, experiences and symbolism of objects are all closely linked and yet are also imprecise and fragmentary when used to provide clarity concerning drugs (as solid contingencies), to the extent that their nature as objects, their morphological, typological, experiential and sensorial - even aesthetic - purposes, and their usage, become elusive.

In fact, drugs are part and parcel of our object-driven civilisation, following the same rationale of goods, which is followed by other objects that define the essence of our material culture, including their uses and unhelpful intrusions. As such, they become a constituent part of the physical real-world and the values within which our life experiences unfold.

Specifically, we are referring to experiences that take place as part of self-treatment practices and more specifically to the simultaneously private and political practices and cultures surrounding the body, its wellbeing and health (Foucault, 1985), particularly the forms of daily treatment and drug consumption. When it comes to treatment, there is no maturely developed thought on design for objects or on the subjects' interactions and experiences when they aren't equipped with the necessary training. This can lead to errors, with some having severe consequences.

2. Framing drugs within the system of objects

Considered as objects, drugs and their shapes pose many design challenges:

- As products of the most advanced development stages in the scientific world, drugs pose a challenge for the designer to act as a formal translator that avoids expressing a technical purpose in order to create a shape that generates a better usage experience (Bürdek, 2008; de Seta, 1980; Norman, 2013; van Onck, 1994);
- By incorporating value-based technical-scientific structures, drugs don't solve the problem of "how objects are experienced, what needs other than functional ones they answer, what mental structures are interwoven with—and contradict—their functional structures, or what cultural, intracultural or transcultural system underpins their directly experienced everydayness [...], the processes whereby people relate to them" and what relationships exist between objects and subjects (Baudrillard, 2007, pp. 6-7);

- Cleansed of any symbolism, drugs pose the issues of recognition, understanding, learning through use and making the experience of care accessible;
- Despite emerging as a response to mass production, through medical prescriptions drugs acquire a status of unique exceptionality and their usage becomes exclusive and personal;
- Understood purely as objects that are "tools" for "bestowing" health, the shape of drugs is a design challenge, as we know that even the most marginal, the most banal, or even the most technical object, becomes "aesthetised, culturalised" (Vitta, 2001, p. 312);
- As a precursor to the processes that have dotted the history in which the natural and the artificial - bodies and prosthetic elements - have been hybridised, drugs remain a primitive object, devoid of the design culture that surrounds objects for giving them friendliness and empathy. This is even more applicable, the closer we get to the sphere of bodies and their suffering;
- As objects that feature in everyday life, drugs and treatment procedures lack a discussion about the "strength" of habitual regimes, their *driving habits* (Bourdieu, 2001, p. 178) and the mental habits and their *structuring structures* (Bourdieu, ibid.), which often remain despite changes to the context of use.

2.1 Drug as a daily apparatus

The list of aspects in which a drug-object emerges as deficient can quickly lengthen. This is a sign of its distance from "product design". We would like to dwell on a particular element, whose intrigue lies in the power - beginning with drugs - to broaden design considerations. The problematic broadening, we propose concerns objects - and drugs, when viewed as objects - as an apparatus. In addition to fulfilling a specific function, an apparatus - etymologically speaking - encapsulates the properties of making available and preparing [something], in the sense that it indicates a sequence, but also by "having its own assets" or making something available to someone. It also contains a sense of putting in order, providing a rationale that adheres to criteria. These criteria target a purpose, but also ensure that someone does something, or allows them to do it. Finally, in its "availability", we also find the motivating factor of being inclined or being made to be inclined to do something (Cortellazzo & Zolli, 1999). In an apparatus, the physical tool is therefore accompanied by regulations and a prescriptive "body" (Costa, 2016, p.75) as well as by an exhortative one. Agamben defines apparatus as "something that has […] the ability to capture, orient, determine, intercept, control and safeguard human beings' gestures, conduct, opinions and discourses" (Costa, 2016, ibid.).

Such presuppositions provide a starting point for viewing drugs as apparatus and seeing the treatment system as a whole, combining objects, subjects, relationships between objects and subjects, ordered and pre-ordered actions, prescriptions and provisions that are written,

verbal, formal, codified or constructed in the natural lexicon with which things are made familiar, as imposed or conveyed by an authority (the doctor) or simply self-learned.

As an apparatus, drugs are, in all senses, “social objects”, made up of a concrete “body” (they are material things) and of an invisible corpus consisting of acquired concepts and tacit knowledge, expectations concerning behavior, prescriptions, rules and anything prohibited. They can only “operate” and be effective if the end-user is fully immersed in the cultural dynamics from which those principles are derived (Ferraris, 2005).

Drugs are the meeting point of production interests and a health-related ethic that has been pervaded by economic values. They carry ideologies about recovery and care, and so also about what constitutes an admissible and acceptable therapeutic object. They embody scientific principles, social values, forms of exclusion from or the right to treatment, and conceptions about health policies. As a socio-technical apparatus, they contain forms of hidden power. As a socio-semiotic apparatus, they pave the way for signification processes that follow trajectories back and forth between the society level and individual level, between the level of scientific precision and the level of approximation of daily life, between technical-specialist level and the level of daily incompetence (Landowski & Marrone, 2002).

2.2 Drugs equipment

Drugs are sealed into their pharmaceutical shapes (pill, syrup, suppository, etc.). They are accompanied by concrete and textual objects that are intended to serve as persuaders (aimed at prescribing, laying down sequences of actions, encouraging therapy adherence) and dissuaders (aimed at prohibiting unsuitable or even dangerous actions). This refers to the package insert, the packaging, medical prescriptions, suitable or unsuitable aids to assist with the treatment.

Despite their apparent function as “apparatus”, the language, semantics and practicality of these objects make them unsuitable for this role. Authoritativeness expressed as polished jargon generates refusal; the self-containment of the signs/signals used to order sequences of actions doesn’t possess the required prescriptive strength, the persuasive nature, or sufficient commanding clarity.

Here, we offer an initial exploratory hypothesis that it’s the drugs themselves, in their self-contained formality and functional minimalism, that embody the distinctive element (perhaps because they are dense with ideologies, values, salvific powers) and possess the ability to influence their users’ behavior, at times assuming the role of a miracle object that, being potentially harmful, can instill fear. On account of the values attributed to them, drugs, as objects, seem to embody the same prerogatives as apparatus: moral, ethical and philanthropic discourses, scientific statements, institutionalized medical principles, philosophies of health and social cultures surrounding treatment. The concepts of dependence, addiction and refusal belong to the relations that a subject establishes with the

governing power that certain objects have. However, the abundance of meanings associated with drugs doesn't come with a rich circle of practical-functional instructive signs.

The packaging that contains them and the wealth of information intended to instruct aren't sufficiently strong to orient the experience of using a drug and make it accessible. It seems their design is centred on guaranteeing that the drugs remain uncompromised and are created with rules and regulations in mind (e.g. the linguistic register used on the package insert) than built around users' experience, in line with their physical and cognitive characteristics.

For the power that the scientific world bestows upon them and the social role that drugs assume rhetorically, their prescriptive shapes have not attended to finding an appropriate expression for "generating inclination" or empathy towards treatment regimes. They speak to their author, heedless of the users' cultures or the emotions that accompany illnesses and the restrictions their treatment imposes. They don't offer feedback, which might reassure users that they are taking the correct action. Neither do they contain auxiliary advice for patients, to allow them to frame their pharmacotherapy within the wider picture of their hygiene and nutrition regimes, or that of an ideal lifestyle. This is isolating for an ill or injured person, creating a sense of otherness out of their condition.

3. A drug's meaning as a symbolic object: new paths for investigation

We dwell on a paradox, going only so far as to raise that paradox as a further path of study. It concerns objects and their functional, signifying and symbolic value. The form of objects and their requirements as tools can be reabsorbed into a circle of meaning that lies without or goes beyond their use (Barthes, 1974). This hypertrophy of meaning (Landowski & Marrone, 2002) makes an object's dimensions as a tool-less natural and obvious, through the socio-cultural meanings attributed to it (Baudrillard, 2007).

Objects seduce, becoming iconic and memorable. They amass affective and emotive values. They become an obsession, in the sense that we project our imaginations, fantasies and intimate dreams onto them (Dorfles, 1988; Fusillo, 2011). However, objects also have a mythopoetic strength, when portraying the widespread cultural values that society incorporates into them (Barthes, 1974).

And that is how a drug exists not only within its specific role but also by having amassed a deep symbolic dimension, because, by curing illness, drugs become an impediment to the link between life and death. Our imaginations use specific vocabulary to evoke the sense that the active ingredients contained in drugs defeat illnesses—attack, kill, beat and fight off. Such vocabulary belongs to mythological tropes which we project onto these objects (Barthes, 1974).

3.1 Drugs as communicative objects

Communication intervenes in this construction of functional and metaphorical value, with its graphic and textual *paratexts* (Genette, 1989). We find them on the objects themselves (*peritexts*) in the form of the information on the packaging or on the package insert. But we also find they reappear far away from the objects (*epitexts*), in user comments, in online chatter, in advertising messages, in marketing reviews, in scientific bulletins, etc. For drugs, however, the communicative-identifying component and the informative-prescriptive component, have peculiar rationales. The nature of products, the need they respond to, the users they target, their methods of sale and purchase, and the circumstances under which they are used, all come into play here.

Moreover, drugs are part of a hyper-regulated world where every form of design revision requires a cultural development, experimentation and consultation. All of this collides with policies created above the industry level. This world is struggling; it's far behind in the process of reconverting information into digital records. It's held back by an ageing population - the primary users of pharmaceutical products - reluctant to move away from traditional information sources.

It's within this context that we have been unable to build a peritextual and epitextual information system for communicating the legendary benefits of pharmacotherapy and the epic progress made by research and its findings. Such a system could raise awareness, warn, inform and create a culture of "good usage", warning against the ease of excess, *Do It Yourself* (DIY) regimes, irresponsible usage and "hearsay".

3.2 A drug's peritexts

As for the vast system of information - peritexts - on packaging and package inserts, we find ourselves faced with forms of communication whose arduous task is to explain complex procedures. These explanations suffer issues relating to the translation process (Nergaard, 1995; Osimo, 2015; Baule & Caratti, 2016) and, specifically, to what they are required to explain by way of text descriptions: actions, gestures and procedures, often involving components of tacit knowledge (Polanyi, 1979). These prescriptive forms also suffer the issue of inert denotation (Sennet, 2009), a form of writing in which the language, mode of expression and type of information are only comprehensible and useful to an expert user or one who already has experience with such procedures.

Finally, these texts present a strong imbalance between negative descriptions of the side effects drugs can cause compared to their benefits. The latter is reduced to a few lines. There is no counterbalance to the long lists of side effects that reference data on each drug's effectiveness at reducing or eliminating the symptoms of illness would offer. They don't take care to provide consoling descriptions of the signs that would signal the desired wellbeing.

4. Actions taken into account when designing drug shape and user experience

4.1 Some Problematic Points

Here we propose various questions regarding drugs' nature in relation to certain theories about objects and the rationale behind their relationship with end-users. There are some peculiarities worth noting:

- It's difficult to understand drugs as objects for use and to align them fully with opinions or reflections on drugs (Pizzocaro, 2016). Even with the huge range of medicine shapes, attention to formal aspects and their ability to evoke their required function seems weak. Drugs seem to (provocatively) boast a total absence of formal elements, sensorial activators and indications for use. These are necessary elements for bringing users and objects closer together, through understanding, organisation, gestures, interaction, memory, etc. In the pharmaceutical world, we settle for working with the shapes most like the things we normally consume (e.g. food). This juxtaposition doesn't leave space for attention to be devoted to gained or learned sensorial experiences, cognition, rituals or the gestures that we see with nutrition. That makes the action a truly cultural act, accompanied by training in *techniques of the body* (Mauss, 1936) learned by experience.
- It's difficult to categorise drugs fully as objects for consumption. There is a vast literature behind the dynamics that generate needs and then allow objects to meet those needs. This comes from market research, the psychology and sociology of consumption, human ethology and even psychiatry (Fabris, 1970; Pizzocaro, 2015). Studies on purchasing behaviour, possession and consumption of objects are vast and able to quell desires and align with physical, mental, natural and cultural needs (Fabris, 2003). Yet, even in this category, it's not easy to find a place for drugs. Experience of health and illness comes down to personal experience, but it's also a cultural construction. And even with different sensibilities, we attribute great importance to wellbeing and health only when deprived of them (Borgna, 2005). Only then do drugs enter the needs category: not as a desirable product, but as a remedy, something palliative. Once introduced into daily usage, we are aware they are missing only when we find ourselves without them. It's never the user that chooses the drug but a professional. Here we pose another interesting element in terms of drugs as objects: needing them, choosing them, methods of using them that require technical skills which users ask from expert figures.
- And finally, despite attributing drugs with the typical prerogatives of objects used daily, we observe that anything we consider positive in the behaviour of using drugs in the home becomes a potential source of error when applied to drugs.

4.2 Otherness experienced by users undergoing treatment for chronic pain

A drug is part of a process - of treatment - connected to macro-systems (science, technology, the industry) and micro-individuality (the patient, the familiar context of treatment). This process, especially for chronic conditions, can meet with new feelings of otherness. Now that people live longer, expectations of living independently are falling, leaving a population vulnerable to pain (Scheler, 1916). We feel the effects on body and mind because “pain breaks. It’s the division” (Heidegger 1959). Illness induces a change in the world of life, to the approach towards the other, transformed in terms of its functions and abilities. Drugs leave traces, they mark the body. They act as a form of apparatus, called upon to reinvent a new order of space and time, defined by the procedure-based nature of the treatment, that breaks up individual, familial and domestic space. New objects enter into daily life: drugs, prescriptions, diagnoses and treatment plans find a place along surfaces to which cognitive and aware minds assign positions. Those positions may be functional, they might be symbolic or moral, or perhaps they are dictated by previous experiences.

Tangible and intangible variables (skills, places, objects) insert themselves into the ecosystem of treatment. They can be read only within the framework of their relations. The same medical narrative (Morsello et al. 2017) recognises the value of sensitive reports underlying the ability to narrate and to recompose old and new experiences through reconfiguration processes.

4.3 Adopting a human-centred approach for the experience of using a drug

In developed countries, populations have longer life spans, thanks to better access to treatment opportunities and the use of drugs, but with a significant economic and social cost. What is more, the context of treatment is changing, in terms of its location and physical dimensions (moving from hospitals to homes) as well as in terms of its organisation (greater accountability placed with the end-user). This represents an opportunity to redesign care systems so that they are human-centred and involve the subjects. This means intervening in how objects are presented and communicated, and in changing service, systems, usage contexts and activities.

The elderly has been prioritised as a reference point for design on account of their personalities, physical and cognitive attributes, and linguistic barriers linked to their health literacy. Delegating responsibility for treatment management to such users presupposes their active involvement, an education suitable for the language of the treatment, making it comprehensible and checkable even at the point of dialogue between specialist and patient (Graham & Brookey, 2008) and for their interaction with the products and tools that support treatment. Within the context of “domestic independence”, the latter should be functional, usable and even pleasant to use.

It should be noted that users allow themselves to interpret objects (especially those with no social protocols or where uses are not embedded overtime), sometimes generating more meaningful alternative uses that have a social influence on the intended use (Pizzocaro, 2015). Conversely, the use of drugs is situational and not necessarily permanent. As such, the same users find themselves without defined use strategies: on the one hand, they try to understand and adopt suggestions from the doctor or package insert; on the other hand, they mutate and apply usage models from other product categories (Norman, 1988) that they are used to following.

In the world of drugs, learning by drawing similarities with actions used for other objects - where experience of use cannot distinguish errors - poses an objective risk to user-health. The spurious passage from novice to expert and excess confidence is among the most frequent causes of drug management mistakes. Perhaps the perceived distance between drugs and other product categories is so reduced - due to familiarity, habits or marketing and advertising for products that are consumed on a daily basis - that users are induced to use them without knowledge and erroneously.

Above all, elderly users might be kept safer if they are correctly informed or interact with objects they understand - objects designed not only to treat but also with consideration for the drug management process (Graham & Brookey, 2008), with adequate checks on their actions. Guiding and influencing user behaviour during treatment - by redesigning the drugs and the objects connected to them - is the designer's role. That can happen only with an understanding of the true physical, cognitive and social capacities of the users, by involving them as we perform the design development process for products/services so as to improve the experience of use, as we seek to prevent the errors that have occurred in the design and use of objects for some time.

5. Conclusions: aiming for practices involving drug familiarity

We would like to list some examples of certain characterisations of people's behaviour when undertaking daily tasks, believing that it's useful to lean on these when developing our design considerations for treatment processes.

- Familiarity. We can consider familiarity as a complex cultural system where the following coexist: forms of reciprocal adjustment, lexical constructions and behavioural jargon, shared images of health and illness (Santambrogio, 2006), the learning of techniques and adoption of tacit knowledge, the development of discretion and sentiments about the body and its treatment (Foucault, 1985; Pennac, 2012), the experience of public and private forms of illness, the influence of beliefs (including religious beliefs) and of ideologies concerning space and objects and their uses. Familiarity immerses us in an "experiential realism" where each individual linguistic, lexical and behavioural element has overlapping

emotional and value-based meanings. They can be interpreted as cognitive data and various forms of knowing how to do something (Maher, 2014, pp. 8-9). In the realm of familiarity, we focus on systematic indices of thoughts and actions more or less consciously. Gradually, as correlations between these forms are strengthened, the framework of associated ideas ultimately becomes a way of measuring normality (Kahneman, 2011). Finally, everything that we consider familiar - and therefore normal - is part of a sort of "base-level knowledge", which encourages us to subtract every individual action from the process of conscious reflection. Familiarity legitimises the transfer onto a drug and the treatment it provides of habitual regimes (acquired from using other objects), of the ways in which we interact with them, and of the rationales under which we bring them into the domestic space, etc.

- Habits. These are a constituent part of familiarity, of domesticity. This is the prerogative that, beginning with the concept of habitus (Bourdieu, 2001), injects our actions into "a system of perceptual, ethical or aesthetic ways of thinking and actions acquired over time". They tend to endure even after a change in the conditions that generated them (Bourdieu, ibid.).
- Repetition. Treatment regimes, repeated daily, become habitual, and therefore practical methods, gestures and knowledge are fortified over time. However, they are by and large self-learned. There is a transition from novice to expert when learning to use any product, but with drugs, there is vast scope for error and misunderstanding. Further, an absence of solid knowledge precludes users from exercising their own discretion, interpretation and therefore good sense, as the rationales underlying drugs and their consumption don't belong in that sphere of common sense (Santambrogio, 2006).
- Confidence. This falls under the possible disintegration of what we have called familiar behaviour, lingering in this last case on lax behaviour, ease of distraction, shortcuts to simplify prescriptions, and DIY solutions improvised by users when they believe they have sufficient understanding about how a drug is administered. Generally speaking, this trust in their actions is supported by the positive outcome of actions repeated over time. It can become an obstacle where, even with repetition, one causes the kind of accidents that typically result from "homemade" actions, which are never uniform and always require the problem, context, objective and treatment action to be rethought from scratch each time.
  And it's here that the tangible and intangible essence of apparatus and its prerogatives (as mentioned earlier) to "capture, orient, determine, intercept, control and safeguard human beings' gestures, conduct, opinions [...]" (Costa, 2016, p. 75) could become prime exploratory territory to guide the processes—which increasingly rely on technology—for managing pharmacotherapy.

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Acknowledgements: The thoughts and observations presented in this paper derive from the research conducted within the project *Curati con Cura - Care for Care*, by the research group *Pharma Design Studies*. This project was funded by the Department of Design at Politecnico di Milano. The research group includes Giuseppe Andreoni, Valeria Bucchetti, Elena Caratti, Valeria Iannilli, Antonella Penati, Silvia Pizzocaro, Agnese Rebaglio, Dina Riccò, Carlo Emilio Standoli, and Umberto Tolino

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Wicked Home: Living Space as Ecological Holobiont

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Abstract | This paper discusses a new culture of life through architectural design at a time of ecocide. Establishing the principles of practice for an ecological era by reconfiguring the terms of our engagement with the living realm by de-anthropocentrising the human self and embracing the liveliness of our environments, the way we inhabit spaces is reimagined through the infrastructures that inform the rituals of everyday life. Inspired by the irreducible complexity of the living realm, the Wicked Home research project discusses an approach that increases the liveability of our homes by nurturing many nonhuman "others" without compromising the quality of life for humans. Entangled with an ethics of care, these design principles are exemplified in the *Living Architecture* and *Microbial Urbanism* projects, which discuss how such proposals can be realised in practice.

KEYWORDS | HOME, DE-ANTHROPOCENTRISING, WICKED, CARE, DESIGN

1. Introduction

What would it mean to de-anthropocentrise our concept of home? If we eliminate the metaphors of appropriation, ownership and occupation alongside the so-called Activities of Daily Life of the human, how might we reconfigure our need to communicate with the liveliness of our environments?

“Conversation with a Stone” by the Polish poet and 1996 Nobel Prize winner Wisława Szymborska provides one approach. The poem is frequently read as an epistemological cul-de-sac; the poet wishes to know every detail of the external world, but the stone remains shut, not accessible to human experience and inquiry. The poet’s repeated request to “enter your insides/ have a look round,/ breathe my fill of you” is consistently refused by the stone, whose pronouns are capable of switching mid-sentence from singular to plural in response to external violence, while still speaking with one accord—“I’m shut tight./Even if you break me to pieces,/we’ll all still be closed./You can grind us to sand,/we still won’t let you in.” The stone continually points out the epistemological incommensurability between the poet’s embodied, sensory knowledge and its own material form (“I'm made of stone […]/and must therefore keep a straight face.”). Neither curiosity, imagined palaces nor bathetic appeals to the poet’s mortality grind down the stone’s resolve (“Go away./I don't have the muscles to laugh.") This means that the epistemological terrain from which each speaker addresses the other does not even meet, let alone overlap. If we assume that each even hears the other (although the evidence in the poem for such an optimistic assumption is debateable), there is nothing to suggest that one is speaking from where the other is hearing. The poem therefore presents a hermeneutic dead zone, a space characterised by an absence of dialogue and resonance:

> “You may get to know me, but you'll never know me through.
> My whole surface is turned toward you,
> all my insides turned away." (Szymborska, 1997, p.63)

In the fourth exchange the poet brings all the powers of human persuasion to the task, describing the proposed visit as being only temporary, motivated neither by unhappiness nor homelessness. The poet has a world “worth returning to” and will “enter and exit empty-handed”, recording the entry into the stone only with “words,/which no one will believe”. This provokes the stone’s most scornful response:

> “You shall not enter,” says the stone.
> “You lack the sense of taking part.
> No other sense can make up for your missing sense of taking part.
> Even sight heightened to become all-seeing
> will do you no good without a sense of taking part.
> You shall not enter, you have only a sense of what that sense should be,
> only its seed, imagination.” (Szymborska, 1997, p63)

It is a remarkable inversion of anthropocentricism that the stone should here tell the human "You lack the sense of taking part." Furthermore, "No other sense can make up for your missing sense of taking part." The stone effectively reveals itself to be more empathetic and insightful than the poet. Another 'natural order' exists, it seems, to that we thought we knew.

In the final stanza the stone refuses poetic conceit altogether, bringing thereby the poem to an abrupt end — no 'accommodation' is reached, poet and stone remain implacably 'alien' each to the other:

> I knock at the stone's front door.
>
> "It's only me, let me come in."
>
> "I don't have a door," says the stone. (Szymborska, 1997, p64).

The poet's techniques—reflection, imaginative empathy, inquiry—are ultimately shown to be inadequate to the task. And yet the poem does not mock such attempts to connect. Language itself can be said to constitute a threshold or portal—that poet and stone are able to exchange requests and refusals shows a protocol is possible, one that permits the exchange of perspectives and positions, and this ultimately transforms what could have been a mute meeting between incommunicable subjectivities into an encounter with epistemological humility, empathetic agility and rigour, and the duty to engage actively with that which we study.

This *politics of participation* can be said to inform the thinking behind the current paper, which calls for profound changes in attitudes to the concept and reality of *home* via a domestic ecology in which the human inhabitant exits the stage, and other, nonhuman, agencies are instead invited into the spotlight. What the authors propose is a concept of home as a constructed form of nature—specifically, *a wicked home*. To get there, we must facilitate conversations between things and agencies that are usually either kept apart, or rendered mute under the looming shadow of the human.
In the following we will explain how a wicked home could be constructed and why we believe it should be constructed. Two interconnected tracks run parallel through this paper, shaping our argument. One is the motive—what sets us in motion, what urges a shift. The other evokes the possible new constitution of home—what it is made of, what it lives by. These tracks present us with emerging design challenges—collectively, they represent a *wicked* design challenge, one that architects need to address with some urgency if they are to respond to the demand of architecture students for meaningful change to the damaging impact our present industrial approaches and toolsets are inflicting on the environment (Architecture Education Declares, 2019).

2. Design at a time of ecocide

Wicked

At a time of ecocide, **a *culture of life*** must enter into an age of ecological design, where our toolsets for perceiving, conceptualising, theorising, designing and modelling our world are concordant with the ethos of (re)enlivening. To date, the profession has responded by devising ecologically "kinder", or more "sustainable" versions of existing practices. Such inaction is less cognitive dissonance than a failure of imagination to inhabit different stories about our relationship with nature and culture. Such naturecultures are the very milieu in which we exist (Haraway, 2003). In taking our first steps towards an ecological era, we must develop new types of design, the principles, materials, toolsets and expressions of which may not even be recognised by today's standards.

A first step is acknowledging that the term "ecology" is ontologically problematic. Arising from a utilitarian view of managing nature, the household of god, Enlightenment scientists, proposed an "oikonomics" of the environment (Linnaeus, 1749; Hestmark, 2000) and animal management (Haeckel, 1866). Fundamentally imperial, it was transformed during the 20th century (Anker, 2001), into a mechanistic, land management view of "ecosystems", then a totalising concept of earth as a colossal self-regulating cybernetic system, proposed by the Gaia Hypothesis (Lovelock and Margulis, 1974). By the late 20th century "ecology" was implicated in all interacting "systems", relationships and

Home

IMAGINE a building infrastructure that houses microbes that perform useful domestic work such as cleaning water, making useable amounts of electricity and producing a range of metabolites, which are fed back into the household system or released to enrich the natural environment. Aiming to wean modern homes off their dependency on fossil fuels, it provides microbial strains with ideal environments for flourishing, where they are made to feel "at home" by feeding them regularly and providing them with a safe environment to build microbial settlements. The microbial "brain" that processes the biochemical information and productive fabric, or "flesh" that carries out the complex biochemical transformations, is a bio-electrically active anaerobic biofilm—something like the gelatinous sludge found down the U-bend of your kitchen sink or toilet—which is housed within a ceramic battery casing. Feeding on nutrient streams of domestic waste that pass into its stomach, or anode, a low-pressure stream of water and biomolecules pass through its "gut wall", which take the form of a carbon fibre, or ceramic semi permeable membrane. The waste products of these cyborgian microbial transactions are electrons, or quantum excreta, that self-power the system and are captured by conductive wires, optimised by an artificial intelligence, and visualised through the activity of electronic devices. Other effluents take the form of cleaned water, or "bacterial urine", while a further range of organic substrates pass through the semi-permeable membrane into the cathode, or "bladder", ready for discharge. While much of this domestic work is invisible to humans, electronic sensors convey microbial actions via a digital interface,

non-living structures, including geophysical forces, materials and cities (Harvey, 1996). Ecological thinking's evolving epistemologies have led to increasing debates about the appropriate expression for 'life' within a world in the throes of ecocide. In generating "straightforward environmental images" (Morton, 2007, p150) Timothy Morton uses "ecology" to replace bucolic visions of "nature" with an equally problematic "dark" ecology that depicts an irredeemably contaminated world. Such re-aestheticisation overlooks human responsibility for our damaged ecosystems. The colonialisation of thought that characterises human exceptionalism and frames our anthropocentric worldview, means we cannot fully acknowledge or address the many other agents that co-constitute our world. While inherently problematic, "ecology" also lends itself to new conceptions, which are shaped by the rise of post-humanism in late 20th century and advent of new materialism at the turn of the 3rd millennium. Embracing a *more-than-human perspective*, alternative ecological narratives enable different kinds of power structures, transactions and relationships by elevating the status of all forms of empowered matter—living, biological, agentised, reactive, vital—from their dependency on human relations. Free to produce effects and exist in their own right through a condition of mutual care between actors (Tronto, 1997), they constantly negotiate their position and relevance to the living world.

This ***new culture of life*** re-purposes the familiar tools of modernity and makes visible the other worlds it has ignored and which enables conversations between human and nonhumans to generate a quality of interdependent living that is powered by domestic waste streams. Further incorporation of technologies such as screens and robots that feed on electron flows, comprise a specific *metabolic trading system*, where the overall *housework* performed is meaningful to all participants.

The strange substrates and infrastructures described here are the results of the Horizon 2020 funded project *Living Architecture*, co-developed by the Experimental Architecture Group, who picture a "Home" as a holobiont, a designed form of nature where 'speaking' chemically, physically, biologically, mechanically and even digitally (through electricity) with the nonhuman realm becomes possible, transforming our activities of daily living into world-making actions.

Inhabited through rituals of care and nurturing, Living Architecture provides an apparatus that exemplifies how homes constitute entire 'worlds', or experiences in themselves, presenting alternative paradigms for domestic economies, and the potential to bring about integrated, systemic change in the material impacts of human inhabitation that contribute to planetary enlivening. When we design and inhabit our homes in this way, we become holobionts, being composed of wholly integrated assemblages of different species, microbes, humans and technical agents that form coherent units capable of performing useful work, and which do not discriminate between their matter and excrement. Those living spaces that thrive on entangled relations produce the infrastructures for Wicked Homes. How a home could be constructed from a posthuman household inhabited only by microbes and the digital ghosts of the past, present and future was prefigured in the

damaged. Specifically, it calls modern conceptions of biology into question, which entered into common language at the turn of the 19th century. Increasingly professionalised and specific, the term "biology" was independently introduced by scientists Thomas Beddoes, 1799, Karl Friedrich Burdach, 1800, Gottfried Reinhold Treviranus 1802 and Jean-Baptiste Lamarck, 1802. Referring to a particular quality, or kind of life, "bios", this new field became increasingly specialised and produced further new disciplines like plant and animal physiology. During the second half of the century, the laws of thermodynamics shaped biological narratives, where physiology was underpinned by basic energetic and metabolic exchanges like photosynthesis and respiration. Over the course of the 20th century, these new disciplines sought to understand the mechanisms of life, becoming further componentised into cellular, and molecular biology. Having reached a pinnacle of ultimate control over the very building blocks of nature, the late 20th century witnessed our ability to re-write the book of life through DNA sequencing. Approaching a point where meaningful changes to the way an organism works need to be situated, Andrew Ellington observes "… context matters, the system matters, the background matters. Which is all about how things are going to interact inside of an organism. It's not just an isolated pathway, it's a pathway inside an organism. And so really, we're coming around from pure design to design in the context of the system, which is more systems biology" (Ellington, 2015). Using mechanistic frameworks to conceptualise installation *999 years, 13 sqm (the future belongs to ghosts)*, a collaboration between Cecile B. Evans and Rachel Armstrong, 2019, projecting a way forward through which the transformation towards our emerging ecological era can begin.

While such "lived" systems are discrete worlds, their persistent exchanges may also constitute lively infrastructures capable of spilling out beyond the boundaries of a traditional house interface and leak into other associated realms of care such as the street, the garden or public square. *Microbial Urbanism* (MU) builds upon the "programmable" microbial exchanges underpinning the Living Architecture project and scales them up to an urban scale. Through the first-time convergence of two established microbial platforms—arrays of organic batteries, or Microbial Fuel Cells and root microbiomes that take the form of "functional" wastewater gardens—MU provides an urban infrastructure that *generates carbon-free electricity directly from wastewater*, which is contaminated with human, agricultural, or industrial waste. Sharing the same wastewater and biowaste stream inputs, these combined technologies directly couple organic processes with high tech "smart" solutions, thereby providing sustainable energy from urban biowaste that powers digital services and can be thought of as a "bio-digital" platform. A MU pilot project is proposed for Tallinn, with site evaluations also taking place across different European municipalities. Overall, the project's ambition is to catalyse bio-digital platforms that integrate the resource streams of physical (organic) and virtual systems to reduce consumption streams, as well as bringing about the widespread establishment of culturally diverse bio-digital cities. Collectively and individually, MU's

these "BioBricks" (Tom Knight, 2003) emphasised the difficulties of their re-assembly by synthetic biologists and the processes of life were deemed irreducibly complex—a "wicked" challenge. Evelyn Fox Keller observes the non-innocence of the gaps in our understanding: "Whose law is the law of nature? Where does the idea of a law of nature come from? And what is the function of a law of nature? The law of nature, the concept of a law of nature comes originally from the civic realm" (Keller, 1990). Recognising the missing pieces of life's mechanistic puzzle as "zoe"—or "bare life—Rosi Braidotti calls for concrete gestures that value this animating force through all its manifestations (Braidotti, 2006, p41). A new biopolitics and biopower (Foucault, 2004) challenge existing governance, classification systems and other modes of subjectification, including identity politics. Their impact on unacknowledged nonhuman subjects is devasting and manifests as global ecocide. Recognising the vital couplings that occur between nonhuman bodies, brings forth an *alterbiopolitics* of care, from which a *sympoietic* order of "labour/work, affect/affections, ethics/politics" arises (Puig de la Bellacasa, 2017, p.5). This new politics between human (bios) and nonhuman (zoe) does not take place in the oppressive manner through which Hannah Arendt regarded "bare life" in the public realm, as denying a person the possibility of a political existence (Arendt, 1958, p98), but through Giorgio Agamben's conception, where a new system of power relationships is possible (Agamben 1998, p.13), comprising a "good" quality of existence for all. Freeing lively matter from activities seek new paradigms, concepts, platforms, toolboxes, services, products and experiences, which can be networked to establish foundations for new kinds of community transactions that work towards enlivened, regenerative bio-digital settlements hosting many kinds of Wicked Homes. Through a spectrum of such prototypes, the development of Wicked Homes seeks to establish transferable principles, an ethics of practice that enable an 'ecological' approach to the production of our living spaces, and our first, tentative design steps towards planetary enlivening.

The projects Living Architecture and Microbial Urbanism draw together the concepts of ecology, Zoë, the decentred human and *agentised "household" of nature.* They provide a framework for a radical re-enlivening, a re-conceptualisation of what it means to inhabit a world at a time of ecocide. How this impacts and reconfigures design practices becomes the topic of a recently established Academic Design Office (ADO) at KU Leuven. The Wicked Home ADO takes a radical break from modern architectural practice and considers the character of our homes as irreducibly complex, a variable and contingent synthesis between infrastructures, inhabitants, materiality, context/site, technological interfaces, and the concerns of the architect—in other words, they are "wicked" spaces. Modern architecture, however, prefers to enliven machines using industrial scale energy sources that simplify complex organic resources into electrical power supplies. At the same time, when inhabited, the buildings discard (complex) waste matter into the 'environment', spending as little time as possible within our living spaces before they are discarded through drains, vents and garbage disposal mechanisms. Denied any chance of a meaningful 'living' existence through recycling, re-use or

the obligation to mimic biological systems as the authentic operating systems of life, an expanded view of the living realm can be considered from first principles, namely; materiality, agency, ethics and infrastructures. Fundamentally messy, sticky (clinging to other bodies), irreverent (not obeying conventions) and semi-permeable to their surroundings, these vital agents constantly seek new alliances, and embrace ongoing change by continually responding to their context. Unleashed as all kinds of "unholy" matter, protocells, "living" gels and other monsters defy our understanding of matter, waste, technology, life and body, overturning the recognised order of the world.

"And now the plants can no longer be distinguished from the animals. Polyparies, which have the appearance of sycamores, carry arms on their branches. Antony fancies he can trace a caterpillar between two leaves; it is a butterfly which flits away. He is on the point of walking over some shingle when up springs a grey grasshopper. Insects, like petals of roses, garnish a bush; the remains of ephemera make a bed of snow upon the soil." (Flaubert, 1981, p231)

Recognising these blasphemous assemblages as "contradictions that do not resolve into larger wholes, even dialectically, about the tension of holding incompatible things together because both or all are necessary and true" (Haraway, 1991, p5), Donna Haraway proposes the political myth of "cyborg", which occupies the treacherous realm of fiction and social relations uncoupled from organic reproduction. While Haraway's cyborg

molecular transformation, our effluents become 'waste'. Advancing how our built environments are designed, constructed and inhabited, the Wicked Home engages our own metabolic activities (consuming resources, producing waste matter, moving around) within our living spaces and entangles our daily activities with the natural realm, where the flows of air, water, natural resources and the activities of daily life complicate the notion of what it means to make a 'liveable' habitat.

By critically engaging experimental frameworks and practices, the Wicked Home expands the limits of design practice through inter-, trans- and post-disciplinary explorations, using speculative design, prototyping and critical projections. Grounded both in solid theoretical frameworks (new materialism, post-humanism), as well as transformative practices, these concerted actions fully engage with the design of lively substrates. While expanding the realm of human action and acknowledging the participation of nonhumans, the wicked home remains "homely", inviting the delineation of a domestic ecology (oikology) in which the human inhabitant plays one of many parts. Conceiving the "home" as a coherent world comprised of complex, quasi-living bodies, it offers a counterpoint to modernity's concept of machines that still find favour within the field of architecture. Recognising their inner life of nonhuman things, as well as our interdependencies, the Wicked Home is an experimental platform for drawing together multiple forms of knowing that are not exclusively human. Conferred with the status of 'nascent beings' which symbiotically work alongside us as an immersive, evolving choreography of space and matter, the Wicked Home incorporates a wide spectrum of wicked matter (inanimate, human, vitalised, biotechnological) that is

circles its relation between animal, human, machine, a radical de-anthropocentrisation of its politics extends its influence into our proximate landscapes. Not backdrops for the actions of agentised assemblages, the nonhumans that make up our environment like soils, mycorrhizal networks and bacterial biofilms, form lively associations that configure the selective pressures acting on our bodies and also *become us*. Read through the interconnections and entanglements that shape the relations between all bodies – be they environmental agents, vital materials, technologies, metabolisms, or beings— Charles Darwin's identity dance between organism and niche, becomes a holobiontic state of affairs (Gordon et al., 2013). Navigating such turbulent spaces invites participatory modes of design and an ethics of practice where human and nonhuman are mutually co-constituted, and the notion of what it means to be a body, or living being of any denomination, is radically expanded. Making obsolete any conception of a "pure" human subject at the centre of design, holobiontic subjects (human and nonhuman) take the place of the *anthropos*, compelling us to understand what kinds of other lively agents we live alongside, recognise their diversity and pay attention to how they behave in different settings. No longer separate from the natural world, or our technology, we are co-dependent and entangled with myriad presences, within *a new culture of life* that welcomes unconventional states of existence and modes of design *as integral to its becoming*.

brought into proximity with other agents to forge enlivening interactions and thereby increase our co-responsibilities. Acknowledging these nonhuman presences through the organisation of our rituals and activities of daily life, the design *pursuit of re-enlivening* acquires a new empathy with the material realm and catalyses *a new culture of life* that re-engages with the critical issues of our time. Such an attitude generates a condition of care and attention for nonhuman beings that makes it nonsensical to abuse the spaces we inhabit, since they are part of ourselves. Framing our design interventions through an alter-biopolitics and *alter-oikonomics*, our attitudes to the concept and reality of *home* are transformed.



Figure 1. Protocell installation by Rachel Armstrong, territorialises a dynamic chemical space that forges Turing Bands, which Alan Turing (1952) considered responsible for the "dappling" of animal skins, Synth-ethics group show, BioFiction festival, Vienna Natural History Museum, 2011, photograph courtesy Rachel Armstrong.



Figure 2. Living Architecture "wall" of "living bricks", courtesy of the Living Architecture project 2019



Figure 3. 999 years, 13 sqm (the future belongs to ghosts) by Cecile B. Evans and Rachel Armstrong, photograph courtesy of Rolf Hughes, 2019.

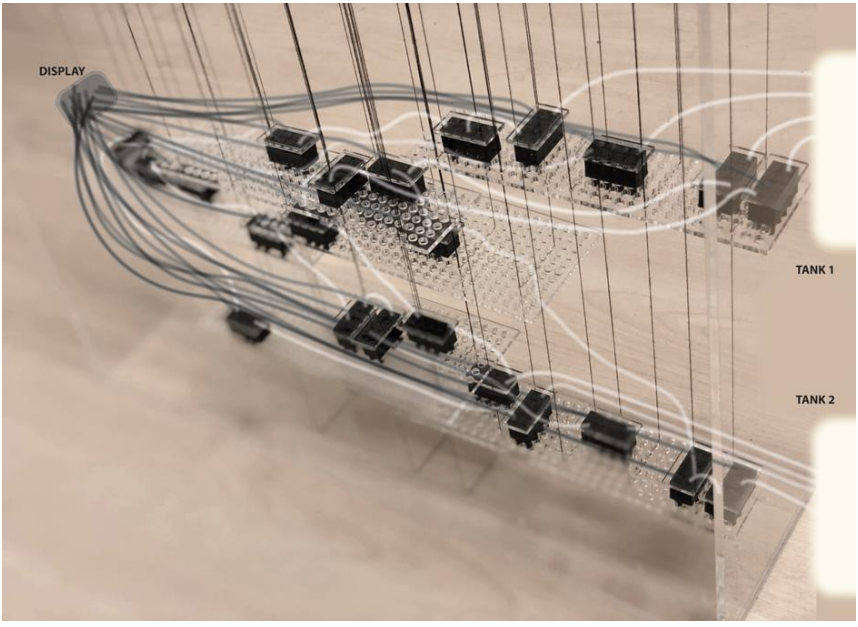

Figure 4. Drawings for the "living" technology and bacterial "homes" that constitute the electricity-generating "guts" of 999 years, 13 sqm (the future belongs to ghosts) by Cecile B. Evans and Rachel Armstrong, which are entangled with digital screens to generate "ghosts", model courtesy of Pierangelo Scravaglieri and Simone Ferracina, 2019.

3. Towards a new culture of life

This paper is intended to outline a potential toolset towards creating a new culture of life. Without an effective precedent signposting the milestones to an era of ecological design, and lacking the appropriate concepts and methods, that enable us to fully participate in planetary enlivening, the way forward is challenging. Just as engineers building the first steel bridges without fully understanding the tensile properties of steel used dovetail joints optimised for wood, we too are caught in a twilight zone of uncertainty, transitional thinking, and incomplete knowledge of the optimum approaches. Only hindsight can tell whether the decisions we make are appropriate for the issues we seek to address. This does not, however, imply that we stumble forwards haphazardly, but instead continually assess our pursuit of (re)enlivening and what it means for design in the context of an emerging ecological era.

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Acknowledgements: ROME Acknowledgements

The *Living Architecture* project ran from April 2016 to April 2019. Funded by the Horizon 2020 Research and Innovation Programme under EU Grant Agreement no. 686585, it brought together experts from the universities of Newcastle, UK; the West of England (UWE Bristol); Trento, Italy; the Spanish National Research Council in Madrid; LIQUIFER Systems Group, Vienna, Austria; and Explora Biotech, Venice, Italy.

The Wicked Home, Architectural Design Office at the Faculty of Architecture, Campus Sint-Lucas Brussels and Ghent, KU Leuven, is a traversal academic project that combines design practice, design education and research is led by Nel Janssens, Annelies De Smet, Jo Liekens, Laurens Luyten, Rachel Armstrong and Rolf Hughes.

The Exper*imental Architecture Group* (EAG) was founded in 2017 at Newcastle University by Rachel Armstrong, Rolf Hughes and Simone Ferracina to bring artistic and design-led experiment into juxtaposition with the technological repertoire of "living technologies". Fundamentally transdisciplinary and collaborative, EAG's outputs have ranged from written texts, to public installations and immersive environments.

The 999 years 13sqm (the future belongs to ghosts) bioengineering team comprises: Ioannis Ieropolous (lead; University of the West of England), Simone Ferracina (University of Edinburgh), Rolf Hughes (Newcastle University), Pierangelo Scravaglieri (Newcastle University), Jiseon You (University of the West of England), Arjuna Mendis (University of the West of England), Tom Hall (University of the West of England), Patrick Brinson (University of the West of England); MFC Bioreactor Brick Installation Design: Pierangelo Scravaglieri, under the guidance of Ioannis Ieropolous. Structure Design: Dominik Arni. Structure Fabrication: Weber Industries. Contributing Writer: Amal Khalaf. Animation: Tom Kemp. Music: Mati Gavriel. Sponsorship from Personal Improvement Ltd. and Living Architecture (EU Grant Agreement no. 686585). In-Kind support provided by Andrew Hesketh; Audioviz (UK FogScreen) and the University of the West of England's, Bristol BioEnergy Centre, at the Bristol Robotics Laboratory.

Microbial Urbanism is an Innovation Action proposal within the EU Horizon 2020 framework by Newcastle University, University of the West of England, KU Leuven, TAMassociati architects, Tallinn Technical University, Organica Water Inc., Institute of Advanced Architecture of Catalonia, Translating Nature, Tallinna Lin, City Faciliators, Metabolic Institute, Valga municipality, Personal Improvement Ltd., Municipality of Sithonia, Municipality of Polygyros, Municipality of Nea Propontida. (Submitted 22nd January 2020).

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Three Dimensional technologies: Digitising Nature

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Abstract | Digital technologies are changing they way in which we take, view and perceive images thus challenging our perception of the image as object, my research investigates how this changes our relationship with the subject object divide. Using emerging imaging technologies, such as multi image photogrammetry, we are now creating three-dimensional objects as opposed to two-dimensional images. This creates new ways in which the viewer can experience the image, more immersive and emotive, that is yet to be fully realised going beyond a visual record of objects. Through aligning critical discourse on perception and nature as well as exploring the creative potential of digital photogrammetry I aim to create multiple embodied experiences that challenge the viewers anthropocentric bias. With the aim of questioning the viewers preconceptions around the subject-object divide and exploring the potential that it can be used to narrow the culture-nature divide.

KEY WORDS | ANTHROPOCENTRIC, CULTURE-NATURE DIVIDE, PERCEPTION, PHOTOGRAMMETRY

1. Introduction

Through a reflexive studio based practice that involves a cyclical process of action/reflection (Praxis) (Adams, 2006), my research investigates the role that three-dimensional technologies, such as photogrammetry, can have in altering our perception of the object. Digital multi image photogrammetry, see Figure 1, is a process that has become affordable thanks to digital cameras. With increasingly powerful computers, a smartphone and open source software is relatively accessible, to non-professional operators. Digitising museum collections is already a well established practice, however this is mostly limited to two-dimensional photography, yet photogrammetry can offer further benefits, offering both scientific advantages as well as novel interactions for the non scientific observer. When a high-resolution digital camera is applied, photogrammetry can produce three-dimensional objects that are sub millimetre accurate as well as generating photorealistic textures. The primary advantage of this process is that it is non-destructive, the same as taking a

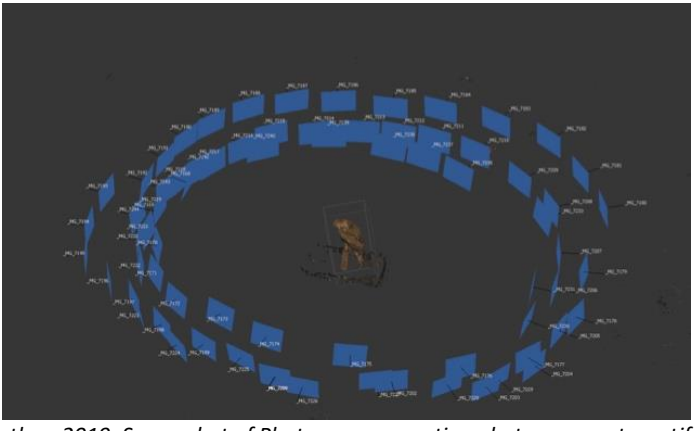

Figure 1. Author, 2019. Screenshot of Photoscan generating photogrammetry artifact.

photograph, but the digital object can be measured and handled, maintaining the integrity of the original artefact, as museum collections get older the original artifacts will become increasingly irreplaceable.

My research privileges the creative possibilities of this technology, over the scientific, and how this technology can be used to engage the viewer/subject in order to re-engage them with the natural world. The practical phase of my research has largely taken place within the storage facilities of the West Australian museum. In *Figure 2* we can see an example of the working environment, which illustrates that this process can be applied to multiple situations. This has provided me with the raw data (photographic images) from which the creative possibilities can be explored, the results of which will be explicated in the constructing a digital nature section.



Figure 2. Author, 2019. W.A. Museum storage facility, example of working environment.

By relating the process employed by natural history museums to the subject they deal with, it has allowed me to further align the research within existing academic debates on the culture-nature divide as well as the subject-object divide. The natural sciences and (western) society have been grounded in the traditional views on the subject and object since the times of Kant and Descartes. We, humans, observe the object and we gain knowledge through what we observe/perceive, whilst modern philosophy has been questioning this relationship between subject and object (Haila, 2000). The continental philosophers from the phenomenologists to the speculative realists have moved away from this Cartesian /anthropocentric point of view, however the traditional views are still persisting (Ben-Zeev, 1989). This research then asks, if the immersive nature of digital technologies can alter the anthropocentric bias that is inherent within the subject-object and culture-nature divides? Through investigating the creative potential of photogrammetry within museum design I aim to allow the viewer/subject to experience their relationship with the object. This practice led research will be supported by a theoretical discussion of the work of Maurice Merleau-Ponty (1945), Timothy Morton (2014) and Graham Harmann (2018).

2. Photogrammetry Intertwining the Real and the Digital

Whilst photogrammetry is not necessarily a new technique, the introduction of digital cameras and accessibility to powerful computers as opened up the possibilities for the applications of photogrammetry. Photogrammetry is the process of making measurements through the analysis of multiple overlapping photographs (McCarthy, 2014), refer back to *Figure 1*, it was originally used as a method to generate maps. They had a three dimensional, stereoscopic; depth to them and technology has made it possible to combine large groups of images rather than pairs. Digital photography has allowed much larger data sets to be used to reconstruct complex 3-dimensional models. As a result of the relative speed, low cost of the digital hardware and software multi-imaging photogrammetry has rapidly been adopted by archaeology and cultural heritage imaging (McCarthy, 2014). In archaeology multi-image photogrammetry is seen as a non-invasive method of measuring and researching the data rather than potentially damaging the original artifact.

One of the earliest applications of linking this technique, in the digital era, was the reconstruction of the Bhuddas of Bamiyan (*Figure 3*). These 40 metre high statues where destroyed by the Taliban, in Afghanistan in 2001, and photographs of the original statues where gathered from the Internet. Once enough images had been gathered from a variety of sources archaeologists where able to generate accurate 3-dimensional models that could be used to reconstruct the Bhuddas of Bamiyan, from the remaining ruins (Grun, 2004). Since then multi-image photogrammetry has become a standard part of the archaeologist's work practice (McCarthy, 2014), and has been integrated into the practice of digitising museum collections. For the most part this digitisation process is largely seen as a way to keep a visual archive of the collections. However constant technological innovations are reshaping the role of museums, changing the ways that they produce and distribute their collections (Bertacchini, 2011). Whilst three-dimensional techniques such as laser scanning are been used, the cost is, for all but the most well funded of institutions, prohibitive. With a reasonable digital camera, appropriate software and minimal lighting rigs, multi-image photogrammetry provides an affordable alternative. With an archive of ever increasingly accurate digital 3-dimmensional objects this opens up potential opportunities for creating interactive online museums and digital artifacts that supplement the original objects. This can also open up economic opportunities that arise from licensing the digital objects, although this is limited at the moment for research and educational purposes (Schweibenz, 2004).

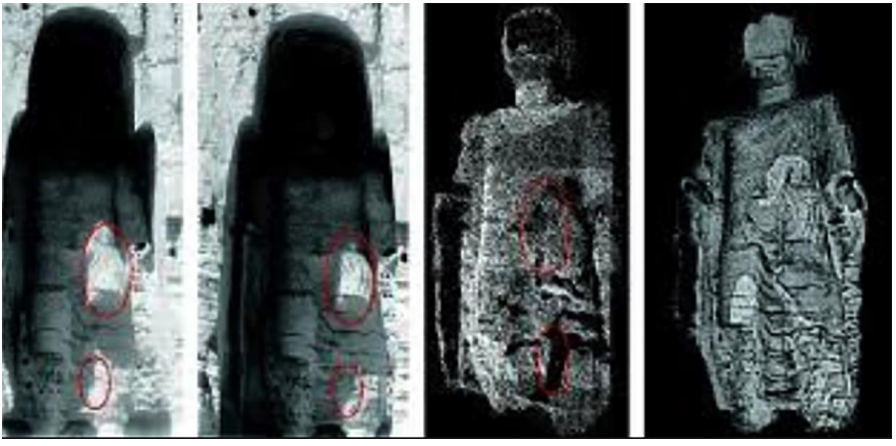

Figure 3. Armin, Gruen. 2004. Photogrammetric re-construction of the Great Bhudda Of Bamiyan, Afghanistan. Photograph and three-dimensional re-construction.

2.1 Museums and Technology: Digitising the Object

Traditionally museums have been seen as institutions that collected and preserved physical objects in order to produce knowledge (Bertacchni, 2011), their primary objective was to preserve and catalogue whatever objects they specialised in. They would then transmit the accrued knowledge to the general public as well as make the objects available for research (Alexander, 1983; Lewis, 2011). Museums in the late 20th century are often criticised for being elitist temples of colonial loot, and even as late as 1996 the historian Gyan Prakash proclaimed that museums themselves have become history (Thomas, 2016). Since then museums have reinvented themselves and continue to thrive, in part due to technological innovations this has reshaped the role of museums as producers of culturally significant content. The digitisation of museum collections, as well as increased capacity for digital storage and accessibility to the Internet, has changed the ways in which we manage and access information (Bertacchini, 2011). Opening up new ways to retrieve, experience and even monetise collections, it the experience of digital collections that I wish to privilege in order to analyse how we can engage with technology as opposed to the "real" world.

This leap from the physical object to the digital one represents a paradigm shift in the way we represent objects as images, even greater than the inventions of photography, cinema and television (Jeffrey, 2015). In order to better understand our relationship with the digital object it is important to acknowledge both the immateriality and the uncanny nature of digital images (see *Figure 4*). These digital reproductions still have similar issues of authenticity as analogue (mechanical) reproductions. "One might subsume the eliminated element in the term "aura" and go onto say: that which withers in the age of mechanical reproduction…" (Benjamin, 1968). The point that Benjamin is making is that reproductive media, such as photography, has a diminished sense of aura or presence compared to the

original object or artwork (Bolter, 2006). For the most part this stands for digital media, as it is still a reproductive medium. Digital reproductions, due to its ephemeral nature, still lacks a physical presence, an aura, perhaps the field of haptics may change this, for now the digital reproduction will still have a sense of the uncanny valley (Jeffrey, 2015). Whilst this creates a sense of separation between the subject and object as the technology improves, this separation will change, already the immersive nature of the technology is regarded as more emotive than traditional imagery and even the real object (Geismar, 2015).



Figure 4. Author. 2019. 3-D model of Hawk.

3. Dualist Dichotomies and the Anthropocentric Bias

To better understand our changing relationship with our perception of images generated by digital technologies it is important to understand some context between the subject-object divide. This section will include an overview of Descartes dualistic approach and the philosophers that consequently eroded this method. Western philosophy and the natural sciences have been shaped by the relationship between the subject and the object. This is largely as a result of Descartes theories between *res cogitas* and *res extensa,* a separation between the mind and body (Descartes, 1644). This separation of the subject and object has resulted in a dualistic approach that has acted as a determinant in how we see the world (Haila, 2000).

This dualistic approach has its limitations; in that it separates the human from the world around them, it does not take into account the fact that humans are a part of the world. One of the first philosophers to address the inadequacy of this Cartesian dualism was the phenomenologist Heidegger (Cerbone, 2006). Phenomenology is a field of philosophy that studies the structure of consciousness as we, the subject, experience the world from the first person point of view (Cerbone, 2006). It was Heidegger who introduced the term *Dasein* in order to explicate our individual human existence, of being in the world, thus exposing the insufficiency of the subject object relationship.

Other phenomenologists, Maurice Merleau-Ponty in particular, argued against Cartesian dualism in that he felt it was inadequate when it came to understanding that which could not be seen. This marks a significant move away from the established philosophies of the time namely the theories of Kant and Descartes whose empirical methods of observation are still embedded into the epistemological approaches of western societies. However for some this does not go far enough, as it does not address the anthropocentric bias inherent in our perception of the world. This is where Speculative realism takes up the current debate around "Object oriented Ontology" (Harmann, 2018). It is a relatively new philosophical movement that aims to end correlationism[1], and anthropocentrism. Whilst it draws comparisons with the environmental discourse of Timothy Morton (2016) it is often seen as anti-phenomenological. Speculative realists, such as Graham Harman (2018), see phenomenology as having a dualistic relationship between [2]Dasein and Being, which therefore still creates an anthropocentric bias. Harman and other speculative realists reject both traditional empirical (Cartesian)[3] philosophies as well as some of the phenomenologists more anthropocentric ideas. They place the same importance on things, matter and real objects, bypassing more traditional viewpoints such as phenomenal experience (Morelle 2012). This would have a fundamental change in the subject/object relationship and arguably a philosophical approach that starts to move away form a strictly anthropocentric view of the world.

The speculative realists argue that we as humans need to stop privileging our perception, our agency, over the natural world. As this has led us to a point where our anthropocentric bias has had a more negative than positive impact on our understanding of the objects that make up our environment. This is a point that has been agreed upon by environmental theorists, such as Timothy Morton, who has aligned himself with Harman's 'object oriented

[1] Correlationism refers to the belief that objects only exist through human minds and language; Morton (2016) refers to this as anthropocentrism in a philosophical form.
[2] The phenomenologist Heidegger uses the term Dasein to describe our individual human existence, excluding traditional assumptions and prejudices of Being thus recognising the indeterminate nature of the subject and object relationship.
[3] The term Cartesian refers to the traditional Western philosophies (primarily of Rene Descartes, 1596-1650) that have dominated the natural sciences. Regarded as being too empirical by most modern philosophical movements.

ontologists' (OOO) (Morton, 2011). If we accept that, as Merleau-Ponty argued, empirical observation can only get us part of the way to understanding the thing that we observe and that our observations are intrinsically limited through our anthropocentric prism. Then it is possible that our perception of the object is fundamentally flawed, a situation that has created the environmental issues that we are facing. Perhaps one way to overcome the issue is to redress the imbalance that we as humans have placed upon the subject-object discourse, by shifting the debate from the perception of the subject to one that is more Object Oriented. I aim to explore our relationship with, perception of, the object and the role that emerging three-dimensional technologies will have in this debate. In particular the changing role of museums from empirical intuitions that categories nature to places that we can experience the natural world, in ways that illicit curiosity and wonder.

4. Intertwining the subject-object and culture-nature divide

The subject-object dichotomy has entered into current environmental discourse, as a way of illustrating the issues (anthropocentric bias) that have led to the culture-nature divide, insofar that the parameters with which humans perceive nature has been defined by humans themselves. The language with which we use to attribute a definition of the natural world can never be neutral. It can be argued that the language that western society uses to frame our perception of nature has been framed within the context of Imperialism and colonial attitudes (Moore, 2017), which can be argued is at the root of the culture-nature divide (Haila, 2000). On the one hand we have early environmentalists, such as Henry David Thoreau (Schama, 1995) creating a romanticised vision, "in wildness is the preservation of the world". Implying that an untouched wilderness will provide an answer to the failings of an industrialised world. This romantic view of nature is in opposition to the more imperialistic/colonial approach to nature in that nature can be controlled through such means as deforestation, to make way for agriculture and industry. This would appear to help create a schizophrenic understanding of the meaning of nature and the natural world, leading in part to the current culture-nature division.

For the purpose of this article I will apply a more contemporary definition of nature in order to clarify the ambiguous definitions of nature. In Bill McKibben's *The End Of Nature* (1989) he argues that Nature (N) no longer exists, what he is referring to is a world where humans have altered every aspect of the natural world. This marks the beginning of the debate at to whether we are still in the Holocene epoch or are we in, as Crutzen (2016) suggests, in the Anthropocene epoch (the age of humans), this definition will be explored in more detail later. However nature (n) refers to a natural world in which humans are intertwined with.

It is argued that our anthropocentric understanding of the natural world has been framed within our own social (western) construction, that we understand nature through our scientific/empirical study of nature. This Cartesian approach can only reach so far; ontologically this has a finite point. A more phenomenological approach to our perception of

nature is required. This can go some way to bridging the subject-object, culture-nature divide that traditional Cartesian methodologies have exacerbated. A non- Cartesian approach to understanding the natural world would be one that is aware of our biological limitations of human perceptions (Synder, 1996).

The meaning of the natural world as Vogel (2015) suggests is ambiguous, this ambiguity has in part led to a human-nature divide and this divide has created a schism between humans in discussions as to whether humankind lives within the natural world or side by side. Current philosophical thought is moving away from traditional western philosophy that has a bias towards prioritising anthropocentric requirements over that of the natural world.

5.Constructing a Digital Nature

Natural history museums are currently in the process of digitising their collections, a vast project, in the case of the Natural History Museum, London (NHMUK) this involves around 80 million specimens (Paterson, 2016). Initially this process started with the lepidopteron (butterfly) collection, 181,545 specimens, and this pilot project is intended to develop an appropriate workflow. The data that is being digitised includes a digital image (2-D photograph), species name, geo-referenced location, collector, collection date, the main purpose is to release data that had not been previously readily available.

The bulk of the digitisation process within museums is currently limited to 2-D digital photography, largely due to the cost, time factor and data storage. However digital imaging techniques are changing rapidly, as are the capacity for digital storage. The logistical benefits of creating a three-dimensional digital record of collections within museum institutions has been discussed above, however my practical research has been exploring the creative potential of photogrammetry. Through the creation of three-dimensional objects from two-dimensional photographs there are many options to use this information in many ways. My creative practice is exploring these options from generating physical object, digital animations and ultimately mixed realities (XR).
One of the creative explorations has been to develop a sculptural installation comprising three-dimensional prints based on photogrammetry models of natural world artefacts. It is influenced by the collection of Albertus Seba (1665-1735). Seba was a pharmacist and zoologist who accumulated one of the largest collections of natural curiosities in his time. These where called *WunderKammer* (Cabinets of Curiosities) and eventually when he passed away were sold off across Europe forming the basis for some of the most prestigious natural history museums in Europe (Musch, 2001). The three-dimensional prints act as a metaphor for the [4]Sixth Mass Extinction. Each of the prints will be coated in a matte black material that

[4] The sixth mass extinction refers to the next time that 75% of the planets Biodiversity becomes extinct, an increasing number of scientists believe that we are at the beginning of such an event.

absorbs 99% of the reflective light, so as to obscure their form, representing the loss of the original both from nature and as artifact. Representing another embodied experience that challenges our perception of the object is a series of digital photo animations. They will still reference the illustrated plates of Seba's collection (see *Figure 5*), loosely collated into taxonomic groups. This is a series of digital three-dimensional images will then serve as a marker as to how digital technologies are changing our relationship with the natural world.



Figure 5. Seba, A. 1735, Illustration from Seba's collection.

6. Conclusion

Technology has changed the ways in which we, the subject, can create, view and ultimately experience images, as these images become increasingly realistic this must ultimately change our perception of the image as object. As technology becomes more immersive then the boundaries between the natural and digital worlds will blur, thus challenging our relationship between subject and object. Through my research I have tried to explore just how we can adapt this change to our advantage. As we go from one climate crises to another it is becoming increasingly clear that our relationship with the natural world is fundamentally flawed, humans are having a detrimental affect on the environment that they require in order to survive. My research has looked at possible ways in which we can potentially alter our perception of the natural world through visual applications of digital

technologies; as it becomes increasingly problematic to experience the natural world, as our very presence causing more problems than solutions.
The natural sciences and institutions such as museums, particularly through western societies, are seen as being strongly connected to the traditional epistemological theories of Kant and Descartes (Grayling, 2019). However contemporary (continental) philosophies have largely disputed this point of view. This questioning of the traditional points of view, of Cartesian dualism, first appears in the theories of the Phenomenologists specifically in the ideas of Maurice Merleau-Ponty (1945). By placing the body (subject) into the experience of perceiving the object this creates what is known as an embodied experience, one narrows the subject-object divide. However this does not go far enough for the Object Oriented Ontologists, such as Harmann, they argue that this still creates an anthropocentric bias through which we perceive the world around us. As long as we view the world from an anthropocentric point of view we will always see the natural world as something "other", something separate from us.
Through the application of these theories into my practice led research my aim is to create non-empirical experiences that will explore new ways to understand our relationship with the natural world around us. As well as to investigate how technology and the digital image can immerse us, the subject, into a world that has up until now largely been viewed or experienced from behind glass. Another purpose of these installations is to question the impact that our anthropocentric bias has had on the natural world, the environment.
Also if it is possible that technology, through creative practice can raise awareness of our bias towards the understanding of our perception of the objects around us.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Towards Neurodesign. The Mental Effort in packaging design

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Abstract | User feedback collection methodologies nowadays also benefit from neuroscience tools and methods. Among the typical indicators of neuroscientific experimentation, there are three commonly accepted ones: Emotional Index, Interest, and Mental Effort. While the first two describe the affective sphere, the last notes the cognitive response. The tools needed for its measurement have become portable, lightweight, and readily available. This allows its use in real contexts, opening up to neuromarketing and neurodesign experiments. On the other hand, the method of interpreting the data is still underdeveloped. The contribution aims to increase knowledge of Mental Effort in the design community, summarize the tools needed for measurement by emphasizing the most accessible ones, apply an interpretation tool and present a possible one. Satisfactory results emerge from the case described, demonstrating that it is possible to use neurophysiological data to identify areas for improvement of the product.

KEYWORDS | NEURODESIGN, NEUROMARKETING, MENTAL EFFORT, USER-CENTERED DESIGN, PACKAGING DESIGN

1. Introduction

The importance of involving the user in the design phases is now well established, as emerged from the first researches of the 1980s and subsequent popular reference publications for user-centered design (Norman, 1988) (Nielsen, 2005). The user provides feedback that supports the designer in the creative process to meet real needs, with effective solutions, to generate successful products. Therefore, it has become crucial to be able to collect user feedback in an increasingly complete and reliable way. On the other hand, it is widely accepted that the human-stimulus interaction process is a holistic phenomenon that cannot be deconstructed into individual components without reducing the possibilities of representing it in its entirety. As Aristotle already stated in Metaphysics, the whole perishes upon division, and the whole is greater than the sum of its parts; assumptions that were then placed at the basis of various theories of perception, including the Gestalt. However, this fragmentation is necessary to analyze the process of human-stimulus interaction in a scientific manner and in its complexity. If we then consider a physical product rather than a virtual product, the complexity grows as the sensory channels involved increase: similarly, the complexity of the message received by the user increases. Just think of the tactile and olfactory stimulation alone to understand the complexity involved. In response to this complexity, scientific research is providing new tools and methods of investigation. A recent frontier is constituted by cognitive neuroscience, now able to outline the user's response through three neurophysiological indices. For a broader understanding of the three indices and their relationship with Design, please refer to a recent publication written by an interdisciplinary research group composed of researchers in neuroscience, psychology, design (Babiloni, Di Lucchio, Montanari, Paoletti, & Perrotta, 2021). Of these three indices, the Emotional Index and Interest measure the affective response, while the Mental Effort index detects the cognitive response. This contribution focuses on Mental Effort and its interpretation from a design point of view. For a case study on the interpretation of the Emotional Index, from a design point of view, see the research by Paoletti and Imbesi (Paoletti & Imbesi, 2021a).

2. Mental Effort and tools to measure it

The Mental Effort Index expresses the cognitive Effort the user applies when exposed to a stimulus. A user who wants to achieve a task through a product needs to understand how to use it to get the desired goal. The more Mental Effort users show, the less the product is easy to be used. In this perception, affordances play a crucial role: introduced in the scientific debate by Gibson (1979) and reworked in the concept of perceived affordances by Norman (1999) specifically for design. Further studies have then expanded the idea of Affordance, including Gielo-Perczak and Karwowski (2003). They have defined a framework to combine the concept of Affordance with those of emotion and intuition.

But how to measure Mental Effort? The latter is an index obtained from the synthesis of the user's brain activity measurements. Measurements can be made with different instruments, the main ones being functional magnetic resonance imaging (fMRI) and electroencephalogram (EEG). FMRI highlights neuronal activities by identifying the change in blood oxygenation and flows resulting from neural activity. In fact, the more active an area of the brain is, the more it uses oxygen. The necessary instrumentation consists of a tunnel in which the user is made to lie down. When the user I immobilized, the brain is scanned. This measurement then detects the regions of the brain that receive the most blood and therefore appear to be active. The limitations of this test are the cost of the machines, the resolution of the times, and the participants' inability to move. In fact, the participants are asked to lie down perfectly still inside the MRI machines during the recording of the images. Consequently, it is impossible to carry out measurements at the exact moment in which the user acts in the real context of use.

Unlike fMRI, electroencephalogram (EEG) can be performed using a portable helmet equipped with electrodes positioned in correspondence with the prefrontal cortex. Specifically for Mental Effort, these electrodes record the variations of the theta waves. The helmets needed for the EEG have, over time, become lighter, more portable, and more accessible. Indicative of the great attention that cognitive neuroscience is receiving from other fields of knowledge is the Open BCI project. Open BCI is an open-source brain-computer interface (BCI) project. From the hardware point of view, it is composed of open-source biosensors compatible with Arduino. It is designed to be low-cost for researchers, manufacturers, hobbyists and allows recording EMG, ECG, and EEG signals. The website (http://openbci.com/) provides the files needed so that the user can easily 3D-print the components at home. Likewise, the software necessary to obtain the data in a raw manner is also provided free of charge. Although the data is raw, it represents an excellent solution to allow most non-professional users to get closer to the EEG tool.

Furthermore, since communities are growing around similar projects, they lower the barriers related to specific knowledge. They provide alternatives to the expensive software needed to filter out the vast amount of data collected by the tools. The limits of the devices that measure EEG activity are the cost of the software, the specific knowledge required (which for a designer means seeking support) of a specialist in both neuroscience, software development, and statistics to reduce the amount of data to the significant ones.

The easy availability of the instruments, and the high portability of the devices that leaves the user free to act and move in a natural context, even from a laboratory, opens up new possibilities.

3. Mental Effort in Neuromarketing and Neurodesign

As seen in the previous paragraph, the tools for measurement have nowadays achieved a very high reduction in costs, dimensions, and weight. That allows measuring brain activity no

longer in the laboratory and assuming static positions, but in an authentic and daily scenario, leaving the user free to perform the desired action. These tools are mainly used in the field of neuromarketing, while in design, they are still a frontier. Neuromarketing applications range from the evaluation of preferences in the automotive area to preferences on the packaging by relating the smells and colors of the products. It's also applied to the assessment of the best combination between the message to be conveyed and the media to choose; case studies are growing and are covering more and more areas of communication and marketing (Monestina, Berdasco, Albiñana, & Royo, 2014; Vecchiato, Cherubino, et al., 2014; Vecchiato, Maglione, et al., 2014). As limiting as it is to define a rapidly expanding field of research, neuromarketing can be seen as: "the application of neuroscientific methods to analyze and understand human behavior in relation to markets and marketing exchanges." (Lee, Broderick, & Chamberlain, 2007, p. 200). It is easy to imagine how these applications can be translated to design if we apply these tools and methods to understanding user behavior while interacting with a service or product (physical or dematerialized). The recent research carried out has given rise to the so-called neurodesign:

> "Neuro design is the use of insights from neuroscience and psychology in creating more effective designs. What can psychology and neuroscience tell us about what is really driving where we look in-store and online, what we choose to click on or pick up, what makes us share an image on a social network, and what image cues help drive a purchase decision? "(Bridger, 2017, pp. 13-14)

While from the point of view of measurements there is a shared scientific basis, the data interpretation remains to the designer's experience. Neuroscience tools can indicate the user's neurophysiological response, but obviously, they cannot directly tell which characteristic of the stimulus-product has elicited that specific response. While the figure of the neuroscience specialist is fundamental in the measurement of the data, the designer's know-how is necessary for its interpretation. At the moment, however, little has been done in this area. Some steps have been taken towards the interpretation of the neurophysiological data from the designer's perspective, both in the creation of the theoretical bases (Paoletti, 2019) and in the construction of operational tools that the designer can use without a specific background in neuroscience (Paoletti & Imbesi, 2021b). Below is a case study of the interpretation of the Mental Effort for packaging design.

4. Interpret Mental Effort, from a design perspective

In order, therefore, to interpret the Mental Effort data from the designer's point of view, in his Ph.D. research Paoletti (Paoletti, 2019) hypothesized a correspondence between the neurophysiological indices, the processing levels of a product that emerged from Norman's research (2004), and the types of interaction defined by Desmet and Hekkert's studies (2007). Following the literature review concerning emotional design, Paoletti proposed the ME index as representative of the level of processing that Norman defined as reflective. This level refers to the users' conscious reaction, in which conscious cognition is involved in deep

and slow reflection. At this level, cognition provides an understanding of the external environment. The reflective level for Norman is the level of design that is based on the cognitive aspects. At this level, users reason about decisions, evaluate alternatives, and compare possible choices, using long-term memory and declarative memory. Norman defines the reflective level and develops it with the seven-stage model of action (Norman, 2013). In analyzing the product experience, in parallel with the ME, Paoletti identifies the ME as the most relevant during that phase of the product experience defined as an instrumental interaction. For instrumental interaction, we refer to Desmet and Hekkert's (2007) research, which describes the product experience as consisting of three types of interaction: instrumental interaction, non-instrumental interaction, non-physical interaction. During the instrumental interaction, the user evaluates how the use of the product must take place. There is a desired task that must be achieved, and there is a cognitive evaluation of how to use the product, which therefore assumes an instrumental role. This type of interaction is mainly based on the functional aspects of the product. Paoletti (2019), therefore, proposes some aspects of the product that the designer should consider when designing for instrumental interaction, which in the user's perspective are identified as the functional sphere. By defining these aspects relating to the functional sphere respectively F1, F2, F3, and F4, they can be used both in the design process that focuses on the functional area and in the inverse process of interpreting the user experience to assign the variations of the ME to the related product's aspects. To define the four aspects relevant to the functional sphere, Paoletti's research was based on the research conducted by Norman on the seven-stage-model-of-action. The four aspects pertinent to the functional sphere are F1 signifiers/affordances, F2 constraints, F3 mappings, F4 feedback.

When the product has correctly designed signifiers, affordances, constraints, mappings, and feedback, the conceptual model is straightforward. For example, the scissor object has two blades connected by a pin, which suggests their rotation; its handle has two holes that indicate where to insert your hand; furthermore, the smaller hole suggests inserting a finger, while the larger is clearly for the rest of the hand. In the example of the scissors, therefore, the signifiers, affordances, constraints, mappings, and feedback are appropriate and thus lead to a clear conceptual model: for this reason, we hypothesize a low ME; the instrumental interaction with the product occurs with a low cognitive load.

5. An example of ME interpretation for design

The principles of interpretation mentioned in the previous paragraph have been transformed into an operational tool in the form of cards, as better described in the publication of Paoletti and Imbesi (2021b). Below are the results of a measurement of the ME index and relative interpretation, applying this tool. The stimulus proposed to users was a packaging belonging to the category of the spout pouch widely spread in the food and beverage sector. The stimulus was selected in two variants, respectively stimulus A and stimulus B, of two different manufacturers but which apparently were very similar. The

stimuli have no significant differences in size, weight, material, geometry. The two apparently similar stimuli elicited similar ME values during the non-instrumental interaction phases but different ME values during the instrumental interactions, particularly during the unscrewing of the cap. The interpretation of the data was made following the card tool mentioned above (Paoletti & Imbesi, 2021b), and it emerged that the area responsible for this change was that spout's area. The data measurement took place during all phases of user-product interaction: initial stages of visual exploration, phases of product use, final steps.

During the initial, non-instrumental stages, in which users explore the product without any specific goal, the product communicates through its geometries. The signifiers are clear: the cap's gripping area is evident thanks to its position and size. The cap's knurling is a clear signifier that suggests where to grab; it also means to rotate to open the package by unscrewing the cap. So the use is explicit, the suggested affordances are clear, and there are no others to confuse the user; furthermore, the physical constraints reduce the possible activities to be performed exclusively to those necessary for the opening. For these reasons, the ME during the non-instrumental phases is similar for the two stimuli. We cannot say whether the ME values are appropriate or not, but they are similar. It would be necessary to build a case history to define a range of ME values acceptable during this specific interaction phase, particularly for this product. As mentioned, the interpretation is strictly case-specific.

Some differences instead emerge in the ME measured during the instrumental interaction. To open the product, users grab the packaging in the only rigid point under the cap and, with the other hand, unscrew it. Observing users while using stimulus A, we observed that this action was performed with a partial overlap of the fingers. While during the non-instrumental interaction, the physical constraints correctly suggested the only rigid point to grasp the packaging. During the instrumental interaction, this area was insufficiently dimensioned. Therefore, we have identified the characteristic of the product that elicits higher ME values in stimulus A than in stimulus B. This interpretation thus becomes the design direction to follow in the re-design of the product. It is evident that the product used as a stimulus has a low impact on the user's life. Applying these tools and methods can have a more significant effect if applied in contexts in which the quality of the user experience can have more significant consequences, such as in the medical field.

6. Conclusions

The crucial role of the user in the design process requires that measurable user-experience data be improved in quantity and quality. Today, cognitive neuroscience offers a new point of view from which to measure these interactions. Much remains to be done from a design point of view because simple measurement does not meet the designer's needs. It is necessary to be able to interpret the variation of the data in a design key. Some recent research has shown how to apply neuroscience to the world of manufacturing, creating

several neuromarketing case-studies. Other research has highlighted the possibilities that arise for neurodesign. Still, little research has provided tools and methods for interpretation. Based on these few and still partial research, we have framed one of the neurophysiological indices in the user experience. We have mentioned the tools necessary for measurement. We have highlighted the scientific contributions that can be adopted for interpretation. We have applied these tools to show an interpretation of the index called Mental Effort. This is only one of the three commonly accepted indices to describe the user's neurophysiological response.

Furthermore, since the perception's process is holistic, an approach that considers its parts separately is reductive. However, this is necessary for a scientific and at least initial study. Accepted this limitation, the results of a specific case study were described, in which the Mental Effort data on two similar products was interpreted. The illustrated case study showed how it is possible to identify areas for product improvement for a subsequent re-design. What could be obtained from neuro-tests is a description of a trend, not specific data. A subsequent one should follow each test to refine the result obtained in terms of the quality of the user experience. Finally, the case study shown is from the area of packaging for food and beverage, in which the quality of the user experience has mainly commercial consequences. But these consequences can be even more incisive if, for example, we consider applying these measurements and interpretations in other sectors such as biomedical.

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Acknowledgements: the neurophysiological measurements referred to in this article were made possible thanks to the instrumental and methodological support of BrainSigns. It is a spin-off company in Sapienza University of Rome, with core expertise in recording and performing high-quality analysis of brain and other biosignals in many different fields such as Neuromarketing, Human Factors, and Clinical Applications

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

“WIT” as a Sustainable Engine Overcoming Mind Fixation in Ideation.

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Abstract | Traditional design brief methods are not properly equipped to deal with the complexities of "the next industrial revolution" which demands smart solutions that will optimize human comfort. 'WIT' is a biomimetic design-thinking tool driven by the ideality design principles (IDP), developed to enhance product designers’ (PDs) idea creation abilities in the design process. The case study was conducted with a unique focus group: Jewish ultra-Orthodox product design students, who have an added layer of [external] blocks due to limited access to information and media that most other design students are exposed to. Applying the WIT tool assisted participants in coping with the design paradoxes, released mind fixation and, as a result, accelerated the creation of various creative and diverse concepts during the ideation stage.

KEYWORDS | DESIGN PARADOX, IDEATION, IDEALITY, WIT

1. Introduction

Nowadays, innovation is strongly connected to the design of smart products with reduced environmental impact, with the aim of moving toward a more sustainable society. Experts envisage that many domains will benefit from the progress made by this "IoT revolution," which will present an unprecedented demand for smarter solutions that will optimize human comfort. Consequently, there is a rush toward realizing and implementing new technological capabilities in smart solutions (Business Insider, 2016). At the same time, the competitive nature of the world of design, which dictates constantly changing rules and modifies the way humans live, has increased.

Ideation in the design process emerges from the 'WHAT' and the 'HOW' stages, and acts as a creative bridge where new ideas are formed (Johnson, 2005). The WHAT identifies potential attributes describing the functions of the solution space, while the HOW describes the method for implementation. Together, these form the design brief.

In the ideation stage, PDs may encounter several mind blocks on their path to developing an "ideal" design brief. For example, a common, known phenomenon is the 'design process paradox,' which is the natural cognitive tendency to comprehend the way things function by adjusting them to functional requirements as determined by the customer, redirecting these to the HOW (Ullman, 2010). Consequently, this limits the space between the WHAT and the HOW until it is almost non-existent. Given that every design decision affects and feeds the next action (Schön, 2017), this paradox can lead to additional mind fixation during the thinking process and, as a result, limit the outcomes of the ideation stage.

Resolving the paradoxes which exist within the design process is the essence of design (Dorst, 2006). In the case of the 'design process paradox', PDs must face their tendency to choose the safe option – that is, grabbing the first concept that occurs to them and executing it as a solution, and by doing so skipping the idea expansion stage (the WHAT) and rushing toward a specific design solution (the HOW).

We can look to Nature to help resolve the paradoxes which exist in the design ideation stage. Nature's principles have always served as a source of inspiration to the man-made world in the realm of problem-solving; its systems operate within restricted sets of conditions, minimizing waste and irreversible damage to the ecosystem and even enriching and sustaining it in an original way (Benyus, 1997). The "biomimetic" approach emulates nature's solutions, processes and strategy from a holistic, sustainable perspective. In design, this approach expands the range of possibilities through observing and searching for similar sustainable patterns of biological systems in nature (Helfman, Reich, & Greenberg, 2014).

IDP stems from the biomimetic approach and assists designers in their aspiration toward an "ideal" design. In ideality, which can be defined as a comparative model of the cost versus benefit ratio, the conception process can assist creators by maximizing positive effects and minimizing negative effects. Thus, the design solution can be executed in a more sustainable

manner (Tischner, 2001). An additional, equivalent sustainable strategy is to "get more with less," by achieving a greater number of benefits with fewer resources.

An ideal solution in today's world does not come solely from one designer's worldview (VanGundy, 1988); this may have been adequate in the past, but is no longer fit-for-purpose. In the IoT era, more sophisticated thinking methods are required; tools that deal with the relationship between the WHAT and the HOW, and focus on the IDP in order to solve new challenges and to encourage creativity that will lead to an ideal design approach (Ackoff, 1978).

2. 'WIT' METHOD

WIT is a bio-inspired design thinking tool, a new WHAT method which incorporates an additional, IDP stage. This structure is designed to shift PDs' mindsets during ideation, and as part of a systemic, logical framework, with the aim of encouraging inventive thinking and the formulation of ideal product design briefs.

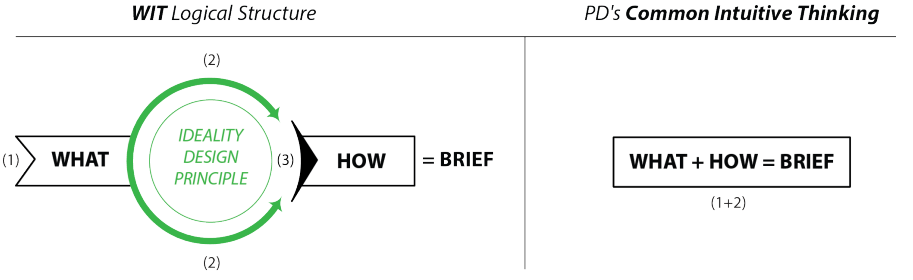

Figure 1. The WIT method's logical structure

Just as nature solves its problems in an ideal approach (Volstad & Boks, 2008), so too does WIT guide the PD's thought process through a series of logical, directed questions with the aim of increasing the level of ideality in the outcomes: increasing the system's advantages with practical functionalities, while minimizing the costs and harmful functions of the system by implementing unique design strategies and principles (A. Weiss et al., 2016).

Table 1. IDP questions employed in the WIT method

Reducing Costs (Resources)	**Increasing Benefits (Optimization)**
1. Defense Strategy – aim: prevent disturbances, malfunctions and system damages. Will be carried out by implementing the design principle of: 1.1 reducing surface area, friction, load, turbulences, etc.	1. Multifunctional Planning Strategy – aim: saving resources. Will be carried out by implementing the design principle of: 1.1. Expanding the functions associated with one structure in the product
2. Opportunistic Strategy – aim: preventing waste of existing resources.	2. Amplifying Strategy – aim: increasing product effectiveness and impact.

Will be carried out by implementing the following design principles: 2.1. Matching structure to function	Will be carried out by implementing the design principle of: 2.1. Creating an amplified effect of the system's components (accentuation, duplication, expansion, collection, etc.), and increasing interaction and synergy with the environment
2.2. Symbiosis – reciprocal interaction between product and environment	
2.3. Utilizing environmental resources	
3. Effective Resource Management Strategy – aim: preventing waste of existing resources. Will be carried out by implementing the following design principles: 3.1. Synchronizing system components	
3.2. Improving and saving energy conductivity, preventing energy waste	
3.3. Relinquishing redundant parts	

The main objective of WIT is to assist PDs in overcoming cognitive obstacles by focusing on the WHAT, while avoiding the tendency to quickly jump to the HOW. The essence of WIT is to enable PDs to think beyond their preliminary solutions by creating methodical, cyclic thinking which breaks free from common linear thinking; to stimulate a broader approach within biomimetics' existing constraints. Applying the tool eliminates PDs' habitual mindset barriers, thus serving as a design platform for the creation of a schematic but creative thought process.

3. CASE STUDY

This case study aimed to examine the effectiveness of WIT with the specific target audience (described below in Section 3.1), analyzing the participants' performance before and after applying the WIT and testing the study hypothesis (see Table 1).

Information was collected using both online and offline methods in order to achieve an extensive range of results, which were examined using an integrated research approach. In this way, the author sought to examine the WIT process as a researcher firsthand and subjectively, through small focus groups divided into control and test groups, in order to evaluate the participants' outcomes. The approach allowed the author to receive an objective and broad view, in a statistical manner, on the tool efficiency.

Gathering of information helped identify the various cognitive phenomena users experience when applying the method, and how this influences their results. The information collection process used a purposive sampling method and the data collection was done during the participants' trial with the WIT.

Table 1. Case Study

Research Question	Does WIT assist in eliminating PD students' fixated thinking patterns during the ideation stage?
Hypothesis	Using the WIT releases fixed design ideas during the ideation stage.
Criteria	Self-growth mindset Creativity Concept diversity / quantity
Research Methods	Integrated quantitative and qualitative methods

3.1 Unique Target Audience

The participants were students of the Mercaz Charedi Institute of Technology in Israel's undergraduate design program. These participants can be described as a complex target audience. Members of the ultra-Orthodox Jewish community in general, and their academic world in particular, are characterized as being closed, going to every length to maintain their strict principles in every aspect of their daily lives. This method of education limits students' access to information, and even censors the little content to which they are exposed, by preventing members from accessing mass media, general information and even blocking the Internet. Thus, this focus group is both unique and extreme as compared with students studying in parallel secular academic programs, who are habitually exposed to media content, which greatly influences their ideation performance.

This case study, therefore, tests whether WIT is effective even when employed by a group with a unique ethnic, personal, and cultural background. More specifically: will students with no practical experience, specifically students without access to influential content, be limited in terms of their ability to implement IDP? Or does the WIT require adjusting based on users' lifestyles and backgrounds? If the experiment is a success, will it be possible to substantiate that the methodologies were verified under extreme experimental conditions?

4. Methodology

The experiment was executed on Google Docs and lasted a total of 120 minutes, with 12 third-year students in working groups of 2-3 participants tackling a single design challenge. Participants' process and outputs in solving this challenge were examined in two stages, pre-exposure (Task A) and post-exposure to the WIT (Task B). The effectiveness of the WIT was measured according to three criteria: self-growth mindset, creativity, and concept diversity/quantity (see Table 1). Proposing concepts was optional, while the last part of the study was a mandatory quantitative questionnaire that also included the participants' feedback on the WIT tool.

Table 2. Research tasks

Task A	Design concepts should be formulated using intuitive ideation approach, demonstrating the diverse range of methods the participants have been exposed to thus far. Participants had to fill in at least one option; proposing additional concepts was optional.
Task B	The WIT was thoroughly explained using a chart. Participants were then asked to explore WIT's "Reducing Costs" and "Increasing Benefits" strategies (as described earlier in Table 1), through the creation of a design concept that would match each separate strategy, according to the following algorithm: "Description of the strategy – aim: Describe the principle's characteristics. Will be executed by the design principle" (A. Weiss, 2015).

4.1 Test Case Description

In both tasks A and B, participants were asked to propose concepts aimed at offering simple, manageable maintenance solutions for homegrown vegetables and herbs.

Background: "Urban family life today is characterized by living in apartments with no green space. Furthermore, the global decrease in meat resources affects the rise in demand for homegrown vegetables for private family consumption. Also noticeable is the ever-growing trend of health, diet and nutrition awareness, which promotes increasing the consumption of fresh vegetables and herbs."

5. Results

Task A lasted 30 minutes. Each team described a maximum of two ideas, providing mostly standard solutions, and some creative interpretations. The participants focused, for the most part, on the functionality of the planter, how they would implement the solution in their workshop, and which materials they would use. Most teams had one or two ideas to present, while a small portion of the teams presented a third idea.

Table 3. Task A: 9 of 13 total concepts presented pre-exposure to WIT

1	Miniature glass greenhouses, to be placed on balconies or in windows, using an artificial light source integrated into the enclosed housing. The system can be hung or placed on walls to minimize space consumption.
2	Vertical gardening device attached to windows.
3	Herb rack sprayed with soda water to repel bugs and an automatic watering system attached to the window.
4	Device hung from the ceiling, which opens up when pressed. Minimizes space consumption.
5	Portable adjustable device that folds up.
6	Kitchen counter planter, placed at a short distance from the faucet in order to reuse water for watering purposes. Connected with a spout at the back of the sink.

7	A smart pot with an automatic water and natural light control, measuring and supplying the amount needed through sensors.
8	A planter located near an organic waste bin.
9	A kit with a special cutter and cleanser of herbs; once the herbs are grown, they are properly cut, and if needed the plant is removed and the soil cleansed.

Task B lasted 90 minutes, during which the participants described approximately one idea for each strategy, producing an average of 4-5 ideas beyond the two ideas that were initially suggested. Most of the ideas written during Task B related to the general concepts described in Task A.

Table 4. Task B: examples of concepts post-exposure to WIT

Increase Benefits	
Multifunctional Planning Strategy	
1	Growth of vegetation on graded levels to reuse water and save space.
2	A pot structure that allows collection of water drops from the air and waters itself.
3	The plant produces pure oxygen, such that a device can be constructed to collect it for human use.
4	A terrarium for fish and plants with vents to allow the entrance of oxygen, and a net that filters air and water, and prevents entry of pests.
5	Vents covered with a net, which only allows oxygen to filter out.
6	A planter located near a water source, with a mechanism that collects grey water and filters it for reuse.
7	Some of the levels can be dedicated to composting by adding a suitable lid.
8	A smart pot structure with air channels for enriching oxygen in the plant's roots.
Amplifying Strategy	
1	Sensors that check and send an update about the vegetables' ripeness.
2	A pot that is able to collect the seeds of fallen fruits and replant them, creating a new plant.
3	A soil maintenance system that allows the soil to remain loose, even after several irrigations. The loose soil could be moved to a different soil receptacle, which allows the roots to continue growing, giving the plant more space to grow.
4	Additional educational information on calories, vitamins, recipes, and a connection to the community to enable sharing and exchange of information.
5	Incorporating fish into the terrarium, thus the water of the fish helps the vegetation grow and also improves visual appearance and ambience.
6	A wall of plants located in the sunniest spot, with a solar system that uses the sun's rays to activate the filtering and watering system.
7	A mechanism that allows the plant to receive its optimal water supply, thus monitoring its growth.
8	A water-filtering mechanism that also acts as a regulator of the water supply.
9	A smart pot with a light control that controls light waves and optimizes the plant's needs.
Reduce Costs	
Defense Strategy	
1	A flexible material structure that adjusts itself to various spaces, and can be easily cleaned and folded for minimal space consumption.

2	Protecting the growth zone by creating a border to avoid contact with pests or children.
3	A designed planter structure that allows the usage of sustainable energy sources, such as watering and fertilization, by locating the planter near a grey water source and a composter.
4	Dripping fluids that emit an odor to repel pests.
5	A smart system that prevents unwanted pests from harming the plant.
6	A smart pot surface that rejects dust.

Opportunistic Strategy	
1	A device placed on air conditioning units to reuse the air conditioner's water for watering purposes.
2	A pot that collects water from the air to accumulate water drops and waters itself (e.g. in nature, the Namibian desert fogstand beetle is able to perform this function).
3	A smart pot with a form and shape that transforms in accordance with weather changes, reflecting environmental symbiosis.
4	Placing the planter near an energy source; for example, as part of the trash bin or hung on the bin, in order to expose the plant to organic fertilization sources.
5	A product that functions using a solar system.
6	A watering tube that is connected to the home water system for optimal use.
7	Filling the terrarium with water by extending the air condition tube into the terrarium, such that filling water is not done manually.
8	Placing the plant directly under the sink, thus allowing maximal use of running water, with a control unit that measures water usage.

Effective Resource Management Strategy	
1	The pot's system informs when vegetables or fruit are ripe for eating and should be picked, or if it's time to trim the herbs.
2	A pot with several compartments for growing different types of plants in one pot, with a control unit that can supply each plant with its appropriate water needs.
3	A plant system that allows the plant to draw water according to its needs. A single water supply can be connected to several plants, as water passes through each one and stops when the plant reaches its ideal moisture point.
4	Filtering system that reuses shower water and expels its chemical soap components.
5	A planter design with a monitoring mechanism that checks the plant's condition in terms of water supply and fertilization, and also announces the ripeness state of the plant.
6	A tube connecting the faucet to the planter or pot, based on the communicating vessels rule, to allow water movement and regulation.
7	A smart pot with a mechanism that can synchronize and control the plant's growth, such as irrigation, fertilization, light control, etc.

5. Discussion

The participants were presented with the research stages, with Task B requiring additional time for explanations on the researcher's part.

In Task A, pre-exposure to the WIT, participants easily launched the first idea, but then quickly fell into a state of fixation and struggled to think of additional ideas. The traditional method provided capabilities of quick, intuitive thinking and creative ideas, yet, at the same

time, also limited the search within the participants' knowledge space. Post-exposure to WIT, participants were able to reach new search spaces by exploring the useful features of the planter, as well as via usage environment: it was evident that this new approach strengthened the group's cognitive abilities and broke barriers.

Table 5. Quantitative research findings

Design Stage	**Task A: Pre-Exposure**	**Task B: Post-Exposure**				
Method	Various traditional methods (Jones, 1970)	WIT				
Design Strategy		Increase Benefits		Reduce Costs		
		Multifunctional design strategy	Amplifying design strategy	Defensive design strategy	Opportunistic design strategy	Effective resource management design strategy
Cases of Concept Expansion	13	9	8	6	8	7
Total	13	38				

Participants collaborated well during team brainstorming and made use of quick sketches of ideas that facilitated communication between team members, helped strengthen their thought processes and develop additional ideas. Additionally, there were instances in which ideas were adapted for multiple strategies and resulted in an in-depth discussion. These ideas could be divided into sub-ideas and assigned to more appropriate strategies. All these created a flow of new connections that led to new ideas, in addition to the high level of creativity due to the elimination of limitations.

The participants' resulting ideas were vast in quantity and highly diverse, with a ratio of 3:1 in favor of the WIT method. In total, an average of 7 ideas were suggested. On average, pre-exposure to WIT, participants were able to produce 1-2 concepts. Post-exposure to WIT, however, participants were able to produce approximately 6-9 concepts, which is a significant increase of approximately 200% in the number of ideas generated. The ideas in Task B required more time; however, they reinforced the thought process beyond the standard processes demonstrated by the students in Task A of the experiment.

Participants presented high quality thinking abilities both pre- and post- exposure to WIT. However, it was only following their exposure to the WIT that the participants' thinking processes were forced to remain in the domains of the new strategies, and their performance showed significant improvement. These improvements were mostly apparent in the fields of thinking flexibility, creativity and innovation. Specifically, the ideality concept forced participants to think beyond normative patterns and remain in each strategy domain

longer than is typical in the intuitive thinking process, resulting in a greater number of concepts.

Likewise, nature's restrictions fall under the principle that "necessity is the mother of invention." Restrictions and limitations within various living conditions are the engines of innovation in nature. Biomimetic solutions within nature's systems are often found in the most challenging environments and extreme conditions, and yet, the resulting solutions improve survival conditions and continued existence. For example, in nature, seed distribution mechanisms of plants implement a wide and creative range of solutions in order to ensure the continuation of the next generation (Barker, 2009). The challenge is finding a way to disperse them without innate movement capabilities. In design, limitations, such as extreme conditions, limited access to information, or conceptual impediments in a trained thinking process, all serve as an engine that can propel students, by way of nature's IDP, beyond the normative limitations of the thinking process, becoming fertile soil for idea expansion. In turn, exposure to several unique concepts allows us to perform a more precise decision-making, by choosing one or combining several, bringing PDs closer to an ideal concept worth further development and investigation in the solution space (Ullman, 2010).

In addition to examining the effectiveness of WIT, the majority of participants (74.2%) voted positively in their questionnaire, which illustrates that use of the WIT aided in examining new and unusual spaces, and overcoming obstacles such as existing mind fixations, at the ideation stage.

The results of this case study show that WIT is suitable for students of a unique ethnic, personal, and cultural background. These results prove promising in substantiating the effectiveness of the WIT method (as the WIT was already shown to be effective with another, more mainstream test group (A. Weiss et al., 2016)), especially since it was unclear whether BA students in general, and students with limited interaction with outside media in particular, would be able to implement ideality design strategies. It is worth continuing to study this question with PD students of different backgrounds to continue optimize WIT's overall effectiveness.

The research analysis emphasizes WIT's ability to aid in shifting from common, traditional and linear thinking patterns, often affected by mind fixations, toward fresh, new thinking patterns. This contribution is mainly evident in the enhancement of students' growth mindset, which occurs in three phases, as well as in the quality of the resulting outcomes. The first phase of the method forms an analytical linear thinking pattern and expands the search time. The second produces a systematic thinking pattern via analogical creative thinking. In the third phase, an intellectual awakening is evident, leading to a focused and intuitive thinking state, thus enriching the synthesis process of the design.

6. CONCLUSION

Applying the WIT within the ideation stage can act as a catalyst for thought, accelerating the flow of creativity, thereby shifting the designer toward newer realms of possibilities.

The tool is effective for PD students, particularly those of a multicultural ethnic group with a unique personal and cultural background. The difference in the achievements post-exposure to the WIT was significant. The students' thought processes were more open, more ready to cope with cognitively challenging mindset modifications, and able to break from a trained mindset acquired during their studies. In this unique focus group, the WIT design process stimulated the participants' creative brainstorming capabilities in the teamwork process, acting as an engine for expanding their thinking and allowing them to dive deep to cope with their own conceptual limitations – as was reflected in the increased quantity of diverse concepts. Necessity is the mother of invention, and the WIT's embedded restrictions and limitations on the different mindset conditions can serve as engines of innovative thinking – assisting in releasing mind fixations in the ideation stage.

The fundamental difference between traditional methods and WIT lies in its perception of time. Whereas traditional approaches examine the design challenge via facts and findings that exist only in current systems, WIT's ideality-based approach widens the realm of possibilities by focusing on finding solutions by looking at possibilities that may exist in futuristic systems. Thus, WIT leads the mind toward an optimistic mindset that reinforces positive functions, and aids in exposing deeper layers of the problem space objectives, resulting in the creation of innovative ideas.

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Acknowledgements: I would like to express my sincere gratitude to Dr. Yael Helfman Cohen, Dr. Gal Ribak, and Dr Yifat Yair, who provided me an opportunity to collaborate on this pilot research, and gave me access to the laboratory and research facilities. Without their precious support, it would not have been possible to conduct this research.

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MAKING

PROCESS
MANUFACTURING
POST-INDUSTRY



TRACK CHAIRS

DESIGN CULTURE (OF) MAKING
PROCESS | MANUFACTURING | POST-INDUSTRY



Mario Buono,
University of Campania “Luigi Vanvitelli”, Italy
“Design culture and “project making” intercept unexpressed needs satisfiable through flexible and adaptive processes in order to configure and create customizable and evolving artefacts.”

Eujin Pei,
Brunel University London, United Kingdom
“This track aims to explore how digital technologies such as Additive Manufacturing (3D Printing) offers designers with benefits, and why we should continue to preserve our understanding of craft making and working with materials.”





Andreas Sicklinger,
University of Bologna, Italy
“In the timeless and spaceless digital world of today, making still distinguishes the homo faber: Design is more and more seen as a process rather than as a result, yet the result is the product we use.”

Oscar Tomico,
ELISAVA Barcelona School of Design and Engineering, Spain
“Digital production technologies have the potential to transform current socio-technical systems of production towards a more sustainable future.”



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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A designed generation: Maker's maturity and social responsibility

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Abstract | The following paper is a first step towards a research path that investigates the role of the craftsman and new craftsmanship in the machine society. The research looks at the post-industrial panorama, the actors on stage and the effects that this revolution has brought, is bringing and can bring to the artisan activity. A context with a strong identity and a culture of know-how that has allowed, together with technological progress, the emergence of figures such as the Maker, the digital craftsman. A figure that is only recently beginning to proclaim itself as such, but still floating in a limbo of identity ambiguity. As uncertain instrument of this new 'productive group', also the technological potential risks failing its role. Craftsmanship and post-craftsmanship perhaps have the opportunity to cooperate in order to achieve a result greater than the sum of the parts.

KEYWORDS | IDENTITY, CRAFTMANSHIP, POST-INDUSTRY, AWARENESS, ECONOMY

1. Introduction

"The territorial and production context is defined by the set of skills and experiences settled over time, productive knowledge consolidated at individual, family and group level and, moreover, by the bonds, which are also consolidated between companies and people."
(Tosi, 2010)

Modern production systems find their foundation in the artisan realities and in the culture of know-how typical of a tradition that is slowly disappearing. A production that, in addition to be a pride in the world, is a central sector of an economy that reflects the mechanisms of society (Follesa, 2017). The building blocks of the development process of the global society, the liberalization of markets, have intervened as devastating factors in small-medium enterprises. Today, as reported by the latest ISTAT trade analyzes, in Italy in 2018 there are a total of 1.7 million of craft activities, reporting a decrease of 3% in the last 3 years.
Faced with a crisis in the planet's resources, the current consumption and production model leads us to redefine and question many practices that have been implemented so far. There are numerous critics and scholars of the current economic system who propose 'lateral' alternatives to development, through the application of concepts such as the necessary degrowth of Serge Latouche (2007) in "La scommessa della decrescita", or the "Crescita felice" by Francesco Morace (2015). The quantitative approach, according to these studies, must move towards a qualitative approach.

2. Crisis design: facing productivity crisis we produce new production tools

European policies announce for 2020 guidelines based on smart, inclusive, sustainable growth by promoting and developing an economy based on knowledge and innovation, more aware and rigorous in terms of resources. An attitude that at the same time favors both social and territorial cohesion through new indicators of well-being which, according to the "Report by the Commission on the Measurement of Economic Performance and Social Progress" by Joseph Stiglitz (2009), seek to outline aspects beyond of merely economic/monetary values, trying to conceive of well-being as the union and balance of social, environmental and economic capital.
From the material consumption point of view, the European Commission is working to standardize the calculation methods for the main environmental certifications in order to make the consumer more aware and responsible in the purchasing phase. High types of traced and tracer labels attempt to integrate social aspects through recognition of human rights and mapping of the entire production chain, including workers. There are collective scenarios such as those put in place by the Commons Collaborativo (Rifkin, 2014) that are becoming increasingly current and feasible. These aspects, through the concept of interdependence in the network, define new consumption models that go beyond mere possession in favor of exchange and services.

2.1 An unpredictable design: distributed productions generate values that the market cannot control without indulging them

The most recent social and economic transformations have shown, both in the context of global development and in the national economy, a crisis of production balances and questioned the development models that have defined and guided local production in the last forty years, reducing progressively the degree of competitiveness of craft businesses. This loss is exacerbated by the constant contamination of culture carried out by globalization and by the massive industry which tends to amalgamate cultures to expand its catchment area. Lyotard defines the end of the great narratives in "The post-modern condition" (1979) as a loss of identity dictated by a single cultural strand composed of the sharing of certain values. The homologation of these paradigms, which aim at a more economic than ethical model, determines the end of this meta-narration of which the philosopher speaks and marks the departure from traditions and cultural values generating radical movements and works of 'rupture'.
The growing amount of innovation that is emerging thanks to radical and widespread movements such as Open Source, which from the first experiments such as the human genome project (HGP) has evolved to the present day, distinguishing itself as a real means of innovation on a global scale (making the term 'open innovation' coined in just 10 years), favored the advent of new thought tools such as the J.S. Brown's *Thinkering*, a portmanteau of 'thinking' and 'tinkering' (Antonelli, 2011). Regarding this revolution, Andrea Branzi (2017) states that the widespread and distributed nature of modern design (referring to design as much as to architecture) makes it difficult to identify a single will, defining it as a militant and fluid link.

"…just think that during the Salone del Mobile there are more than 400 exhibitions at the same time, all projects not intended for the market, but an expression of an idea of reform of the environment, the city, the habitat, to realize that it is a widespread avant-garde form. Less evident, perhaps, but with an anarchist, reformist base and with a surely greater number of employees than we had." (Branzi, 2017)

The result is a series of small unpredictable innovations, as Pasquale Gagliardi (2017) defines them, which clashes with a practical market that tends to favor a *'planned change'*.
Innovations that fall within a programmed scheme or that are easily recognizable within an economy that, although dynamic, must remain predictable (A scenario extremely dissimilar from that structured by the Schumpeterian theories on which many companies base their business model). The issues related to the relationship with local resources and territorial identity are the basis of projects, studies and actions in different sectors of industrial design and especially in the field of design applied to corporate territorial systems.
In Europe, specific directives on development activities push nations and companies to feed internal production in order to support their own development if they do not want to see their production system reduced to what Bauman calls an economy of only transit and exchange of goods and people.

2.2 A design of necessity: digital manufacturing as creative process design tool

In response to these needs there is a fervent return to the local, a new economy from below, sustainable and respectful of the diversity of the territories that could truly outline a strategic vision of the productive future. Just think of the role of the makers and the rapid social responsiveness of rapid manufacturing which has led to the proliferation of communities and places such as Fablab and Co-hub, where the interdisciplinary exchange of skills is in favor of the development of innovative start-ups and cultural growth of the cities in which they operate. The technological update of Industry 4.0 and the adoption of certain production technologies (such as FDM or SLA / DLP) run in aid of an increasingly demanding market attentive to the central role of the final consumer. This rapid expansion has moved the planned obsolescence market above all, which has obviously felt called into question in the face of an instrument that can reset its competitiveness. An interesting program launched by Groupe SEB (which includes industry giants such as Moulinex, Tefal, Rowenta), is the "10-year reparability commitment", a mapping of 'repairers' that offers the possibility of finding 3D printed parts to replace of the components that can break over time in the products. Jan Middendorp of LettError describes the importance of tools for a designer, referring however to artisans as their ancestors. The latter, according to Middendorp, were like disgruntled customers in the 'tools' market and for this reason they have always tried to make their own, to personalize their work environment.

"*They always had the tendency to personalize their tools, to appropriate them by honing them, converting them or expanding them. The more specialized the work, the greater the demand for customized or individually made instruments."* (Middendorp, 2000)

The opportunity offered by some experimental and consolidated technologies, gained thanks also to the Open Source communities and the digital manufacturing machinery industry, to be able to apply these tools and innovations to any production sector and, as well as design has become more evident participated and a fundamental part of the most disparate disciplines, so the role of the designer is redefined under an ethical key for which the design process itself is the fulcrum of the activity and acts as a coordinating element capable of managing the various skills at stake and work and production flows.

"*It is not just about 3D printing technology adoption. Inserting a 3D printing sub-process into traditional stamping will likely require process redesign*" (Brody, EY 2016)

Danish designer Olivier van Herpt launched in 2014 Adaptive Manufacturing, a collaborative project with the help of Sander Wassink. The project starts from the assumption that technological production has replaced the craftsman and therefore removed all traces of human and local influence and how this 'ambiguous' digital manufacturing process can mediate the language between the two realities.

"*At the foundation of every product there is the production process. When we replaced the craftsmen by machines, we lost the translation of local influences into our products. What if*

our machines could become more sensory? What if the machine could sense the local environment and incorporate it into the production process?" (Van Herpt, 2014)

The research of the two designers examines the ways in which it becomes possible to regain that lost connection between the production of objects and the objects themselves. To do this, they decided to design scripts that distil shapes and textures from external phenomena. External information, measured by sensors, is then translated into specific printer behaviors via software. A sensory and sensitive machine that perceives the environment and therefore binds to a specific territorial context, translating the input into a specific movement, position or raw material. Here the designer still plays a fundamental role by defining the degree of sensitivity of the machine and the elements to be considered. These approaches and experiments let think about the role of the digital manufacturer. In addition to demonstrating a willingness to declare themselves through their products, making them unequivocally attributable to their work, they show an exquisitely melancholy taste in their past, artisanal, traditional and local realities. Through the readjustment of past products or the use of traditional materials, the need to combine digital manufacturing with a world in decline seems to emerge until questioning if it is out of a real nostalgia or a secret will to confront the massive industry.

3. The responsibility of design: the centrality of design process given by its complexity

Regarding this, Enzo Mari (2006) speaks of an almost criminal role of design in its being an instrument of proliferation of new goods in a world already submerged by them. In fact, Mari condemns the creative process and the search for innovation by attaching an almost criminal role to the current landscape which is dominated by unnecessary overproduction and a senseless frenzy. These words recognize the traits described by Gagliardi of a revolution that is not guided by a thought or a will capable of evaluating the social impacts that such innovations can have. We live in a period full of 'tools', but with ambiguous ends. According to Mari, the designer must look at human needs outside the market conditions when developing a project. With a severe denunciation of the progressive deterioration of today's design work, the main culprit for this situation is the global market that requires an object to be producible and salable in every part of the world. The role of the designer is thus diminished to a simple 'signature' to be affixed to series of objects in which any construction philosophy is lacking.
The designer should be in a position to respond to this 'ambiguity' by providing a complete and reproducible analysis tool that is able to put a more willing and interested market at the service of technological innovation, aware of its development and potential. A working method that would be able to create products from a synergistic process between technological research and the morphological and social spheres. Enzo Frateili (1969) defines design as the result of the combination of three factors: language, function and meaning as indeed they refer to three specific study areas, morphological, technological and social respectively.
In this sense, the role of the designer acts as director of these categories to favor their synergistic development and offer a result greater than the sum of the parts. However, the

designer is not at the center of the action, but he becomes a multifaceted and dynamic figure that insinuates himself into the individual disciplines and regulates their input and output.

3.1 A complex design: technological development confronts industry with radical changes in production dogmas

A system like that one just introduced perfectly coincides with the description provided by Alberto Gandolfi (1999) of a complex system, which combines the advent of digital, electronic computing, at the moment of true understanding of what really is a complex system and the realization of how this complexity is inherent in everything that surrounds us, from the physical and biological nature of things to the texture of the social fabric, from production systems to political systems. These systems are in fact represented as hierarchical constructs where each level of this scale is regulated by a network of interdependence and continuous circulation of data (input and output) which, thanks to the complexity of the system and of the individual parts that compose it, in order to generate outputs of greater importance than the sum of the inputs.
If, by its definition, design is a process, as such it does not have a single interpretation and result but is a useful tool for understanding a whole series of social, productive and fruitful processes. An interdisciplinary discipline that has now imposed itself in almost all sectors of research and development, as well as production.

"We are not experts in a specific subject ... we are experts in the process that leads a specific subject in bringing innovation" (Kelly, 1999)

Design as discipline has evolved in step with the technologies that have allowed this material to express itself in new forms and, precisely because it is driven by this impetuosity, it has evolved and complex over time to take on so many facets to become an extremely difficult subject to understand. Taking up the words of Bruce M. Tharp, and the study that led him to define the 4 major themes of contemporary design scenario: *"Design is pretty much a mess"* (Tharp, 2009).
Without a convincing, truly taxonomic way of organizing the design activity, the latter risks leading to misunderstood results; the risk, for the designer, becomes that of being scattered and vague.

3.2 Designing awareness and behavior in front of the innovations

It becomes imperative to endorse critical thinking towards a system that develops responsible and empowering policies. In this way of thinking we look at the Responsible Design, which has a relationship with the market, defining itself 'commercially available' and whose primary intent is not a profit maximization but rather to serve the less wealthy (E.g., a public tap that closes itself after a certain period of time). On the other it is possible to talk about an Empowering Design, which has little to do with the market but is closer to a critical intervention towards an attitude to be rectified (E.g., a tap that shows you how much water you are using and gives the user the environmental impact awareness).
In the world of 3D printing, it is not difficult to associate the role of plastics, and it has been,

fortunately, equally easy to find alternative and ecological solutions to the question. Today, various materials are developed directly deriving from industrial plastics that would otherwise risk ending up at the expense of governments or the environment itself. Instead, what is most difficult to see is what has been carried out in productive consumption and waste management. For instance, the waste generated around the food sector and how digital manufacturing has offered an answer. We could be able to produce pseudo meats and edible compounds from food waste, and there is nothing that excludes that one day it will reach our meal consumption. Nonetheless, as per Scionti experiment in 2018, a 3D printed steak, will have to look as a regular steak in order to be recognized as it is. Robert Artigiani (1987) stated that even in front of radical changes, characteristic elements of the previous system must be maintained, in order to achieve a minimum perceptual and existential stability. Just as in 3D printing filament production, we have increasingly sustainable materials (in economic and ecological terms), derived from the recycling of the same bio-plastics, technologically performing and aesthetically appealing but which are produced in a less ecological way (given the limited accessibility of industrial complexes to renewable energies), in an increasingly aggressive and competitive market context and distributed in ABS containers and spools and sealed in common plastics.

4. Towards new products conception

The economic and social crisis, mentioned above, focuses on the need to identify new development models that take into account the deep interdependence now active between the different economies and the potential expressed by the development of communication and data exchange systems. According to the study by Warnier (2014) the development of new small-scale production techniques will allow the transfer of power from the hands of industries and those who regulate the infrastructure to those of the designer and consumer, who today more than ever is identifying himself as the only figure. In fact, Morace redefines the role of the consumer, referring mainly to the Italian context, which is becoming more aware of the production and creative processes and increasingly interested to them so much that he wants to be an integral part of them. From *prosumer* to C*onsumAuthor*, a hybrid figure who directly participates in defining and selecting the prototyping lines of products and services, assuming their identity and involvement (2016).
A concept that is closer to the world of luxury and an almost elitist market, but which in an increasingly social and open context is actually spreading like wildfire on almost all market levels. Since the days of Apple, the concept of branding had been introduced, or no more than just brands. A fluid, inclusive system, in constant transformation and improvement where the consumer, the community, feedback play a fundamental role in the development of the activities themselves.

4.1 A physical design: product circulates on digital platforms, but acquires its value when we can touch it

Therefore, the Research investigates the responsibilities that design has developed with regard to everyday products and in particular with the products to which the new generations especially refer, to which the cultural and social values of the context of belonging should be handed down, who today more than ever are able to define, recreate, hack, reprogram this

context. A first question that arises is how is evolving the concept of product by including those that are being created nowadays. To answer this question, perhaps the question can be circumvented not by looking at the present *ConsumAuthor*, but at those who will come.
The well-known digital divide created with the new generations has become consolidated and we increasingly have free access and understanding of digital systems. Nonetheless, the physical interaction and therefore the contact with matter remains, such as the need for the mind to establish a relationship, an experience that is not only visual or auditory, but above all tactile. Mulgan (2017) clarifies how the artifact, the physical object, in each of its declinations, facilitates large-scale coordination (referring to the interaction created in large connective intelligence systems and collaborative societies). We are used to thinking with things and we struggle to do it in their absence. Large-scale cooperation and coordination generate a schematization and vice versa.

4.2 Digital manufacturers identity: the result of a new product and production conception

At the basis of the reflections set out so far, the research deals with the relationship between design and production and the different ways in which the design discipline must be placed towards a post-industrial production, paying particular attention to the identity, defined by the tools themselves, rather than by geopolitical or cultural characters. It must investigate the identity of objects and the different ways in which this is built in relation with the social context and from there with both material and immaterial resources.
At the basis of this reasoning there is the assumption that there has always been a correspondence between objects and places and that such correspondence has been interrupted (or at least weakened) with the advent of the machine society, the expansion of an economic system always more open and inclusive, and with the substitution of codified knowledge for practical knowledge.

5. Discussion: what future of Maker holds?

In this socio-economic evolution, design plays a primary role.
On one hand because of its being an important discipline in the development of production systems, and therefore central in defining new possible alternative economic scenarios, and its ability over time to have become so multifaceted and interdisciplinary as to play a role in every production system. On the other hand, for the responsibility that is unanimously attributed to it in the development of those consumer dynamics that have accompanied the progress of globalization.
Having outlined the panorama, the context, and the direction that the research wants to take, it becomes necessary to filter from the pool of potential results and sectors to which this research can be applied. We are most likely in the middle of what Gandolfi (1999) calls a 'catastrophic bifurcation'. Micro-oscillations of confusing revolutions (entropy) are about to transport us into a future in which each individual will have full responsibility (enthalpy) for its own work and creation. It can no longer be said that we are at the gates of a revolution and the risk becomes that of letting it get out of hand or worse of using these tools unconsciously. The question emerged at this point becomes: does the designer who 3D

prints, really develop his design by virtue of 3D printing or exploit manufacturing as a tool for creating a design?
We usually think of production systems with two distinct figures: designer and developer, architect and worker, mind and arm. This gap is about to disappear. If we have now witnessed a series of movements that have generated individual verticalized figures on single themes (art, engineering, craftsmanship, gadgets, small and medium productions and so on) now we see hybrid figures capable of operating (not just knowing how to operate) in a more active way on the production scene. Such a change is not only the result of technique or sensitivity, but a way of acting that has been able to generate a result greater than the sum of its parts. Awareness of the tools and design by virtue of these.

6. Conclusion

The intertwining of specific artisan knowledge and the technological updating offered by digital manufacturing systems opens up to growth common, allowing the craftsman to take advantage of an amplified production system, and the activities to demonstrate an increasingly punctual public service.
By offering a critical eye to the good practices of knowing how to do in relation to the important social aspects and the union between those consolidated artisan qualities with the enabling technologies of Industry 4.0, the way will open for the definition of a new product social innovation, modeled on the needs of the citizen, guaranteeing the flexibility of digital manufacturing processes. The skills developed and systematized in this way will be able to generate improvements and implications also within the scientific community which will therefore be aware of the potential inherent in the urban and social fabric. The activities as they have been distributed and described, contribute to the implementation of the specific objectives and the achievement of the expected results described with the aim of directing the results of the Research in favor of those realities, whether they are artisanal SMEs or less mature, who can thus be able to experiment with tools, models and products that are both sustainable and compatible with the levels of complexity, flexibility and efficiency that increasingly characterize the contemporary landscape and that are gradually invalidating the traditional ones. With particular attention to the relationship established between the digital craftsman and his role as producer, the figure of the 'Maker' is placed in a context that no longer sees him as just a customer of an instrument market, but an active part of a production sector which has spread its production potential to everyone. An open, distributed and (still) free scenario, which nevertheless carries with it the weight of the moral, ecological and civil responsibility of a power that has long declared its potential.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Accumulation of empirical investigation into joint structures in wooden furniture design

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Abstract | The aim of this study was to explore the joint structures used in traditional furniture to develop innovative designs and crafts that involve alternative materials or different processing methods while preserving the nail-free, mortise and tenon methods of traditional furniture. A total of 12 craftsmen were recruited using a participatory design approach and were invited to attend a three-month design workshop. Progressive guidance was given in three stages. First, several practical activities were arranged for participants to practice fabricating conventional mortise and tenon joints and to exercise their design awareness. Next, participants were asked to experiment with various wooden components to construct joints using available materials and material processing tools. Finally, participants proposed and implemented their designs based on their practice and exploration in the first two stages. To illustrate the reinterpretation of traditional crafts, three of these products were presented and described that best satisfied the study objectives.

KEYWORDS | JOINERY, CRAFT, FURNITURE DESIGN, TRADITIONAL KNOWLEDGE

1. Introduction

1.1 Craft in modern design

In the era of technology, with the influences of contemporary values, machine-made products, and quality expectation, craftsmanship has become a medium for designers to communicate their ideas (Kermik, 2012). Marcel Wanders, Jurgen Bey, and Jaime Hayon are designers that have aimed to make craft design more accessible. Contemporary art critic Risatti (2007) noted that 'if craft is to survive in the twenty-first century, it must take itself understood as a way of bringing objects into the world that is meaningful in and of itself. The value of the craft is within the capacity of the artisan to manage every step of the process (Sennett,2008). Moreover, traditional craft is more than a source of inspiration; it enables craftsmen to realize their design potential.

1.2 Joinery: material and making

Joinery originated in ancient Egypt and the Hemudu area, and joinery systems developed separately in the West and East (Wang, 2013; Korn, 2003). Among the various types of joining methods, mortise and tenon joints are often deemed essential in furniture making (Wang, 2013).

The function of joints in wooden furniture has evolved from structural to decorative. For example, furniture makers must consider wood grain or colour matching (Seike, 1977; Chen, 1997; Booth & Plunkett, 2014). Studies on structural strength have revealed that the joints of wooden components are the most vulnerable part of a piece of furniture, and thus determine its loading capacity (Nandanwar, Naidu, & Pandey, 2013; Tankut & Tankut, 2011). Numerous factors affect the loading capacity of the structure. For woodworking joinery, the type of wood and type of mortise and tenon joint must be considered.

1.3 Material selection and inspiration

Structural joints are crucial for determining the loading capacity of furniture (Nandanwar, et al. 2013; Tankut & Tankut 2011). Thus, when innovating in joinery woodwork, craftsmen and designers must apply knowledge of traditional joinery and innovate on the basis of these traditions, which involve a philosophy of crafting. Crafting can be viewed as a manifestation of culture; in addition to altering the substance, crafting adds meaning to the product (Tin, 2007). Materials are a crucial part of crafting. The primary materials and their composition and assembly comprise material manipulation (which is also known as crafting). The properties of materials must be considered during the crafting process (Ingold, 2013).

Through interdisciplinary collaboration, and technology and science of other domains, Contemporary craftsman Trish Belford used interdisciplinary collaboration, material integration and contrast, and other technologies to demonstrate the role of craft in the development of new technologies and the reform of aesthetics (Ravetz, Kettle, & Felcey,

2017). Sörensen (2016) reviewed studies on design and materials and listed four complementary material selection methods: deductive reasoning (selecting materials using a material properties database), inductive reasoning (reviewing existing products that can provide new solutions), similarity (searching for alternatives in property configuration documents), and inspiration (randomly reviewing a series of materials or products) (Ashby & Johnson, 2013). Sörensen (2016) also proposed displaying materials in example products to encourage designers to consider the characteristic and meaning of materials when selecting them in the creation process (Karana, Hekkert & Kandachar, 2010). These studies have highlighted a close relationship between material properties and the crafting process as well as a relationship between materials and the function and performance of the product (Lenau, 2002; Karana, Pedgley, & Rognoli, 2013).

Considering the importance of furniture structure and our attempt to bring innovation to traditional crafts and make breakthroughs, this study, which is the beginning of a series of studies into creativity, followed the following principles: 1) the value of design is derived from a craftsmen's exploration of materials and 2) inspiration can be obtained from traditional craftsmanship. The aim of the study was to find feasible alternative structures and forms on the basis of craftsmanship, materials, and structure. This study explored the use of wood materials for furniture innovation by testing creative structural joints of woodworking joinery both theoretically and practically. Wood is chosen to be the material here because it is an organic material that the grain reflects meteorological changes in air, humidity, and sunlight.

2. Method

This study adopted a participatory design approach, and a design workshop was held for drawing, conversations, contemplation, planning and design, project development, and prototype construction (Martin & Hanington, 2012). The four complementary material selection methods proposed by Ashby and Johnson (2013) and the materials selection advice provided by Karana, et al. (2010) were referenced for observing and recording participants' design behaviour and outputs.

The workshop was held during the summer of 2017 in Taiwan through the National Taiwan Craft Research and Development Institute (NTCRI), a government agency in Taiwan that promotes tradition crafting technologies in contemporary design. Two workshop meetings were organised each week for 3 months (16 hours in total). The 12 participants (six novices and six experts) were all Taiwanese and were aged 24 to 53 years; five participants were female and seven were male. Four professional instructors (one experienced designer and three craft technology instructors) assisted the participants in the workshops.

Table 1. Participant Background

Participant code	A	B	C	D	E	F
Gender/age	Female, 47 years	Male, 34 years	Male, 50 years	Male, 31 years	Male, 49 years	Male, 53 years
Participant background	5 years of knitting experience ; woodworking novice	8 years of design experience ; 3 years of woodworking experience	20 years of woodworking experience	5 years of design experience ; woodworking novice	15 years of art experience ; woodworking novice	Woodworking novice
Participant code	G	H	I	J	K	L
Gender/age	Female, 32 years	Male, 37 years	Female, 35 years	Female, 25 years	Female, 24 years	Male, 25 years
Participant background	Woodworking novice	5 years of woodworking experience	8 years of woodworking experience	5 years of design experience ; 3 years of woodworking experience	1 year of art experience ; woodworking novice	3 years of design experience ; 3 years of woodworking experience

2.1 Practical Procedure

The workshop comprised three stages. The first stage comprised preparatory practice and concept introduction. During the second stage, material combinations were tested and selected. The final stage was for idea implementation and prototyping. The research framework and flow are illustrated in Figure 1. Details of the process are described in the following sections.

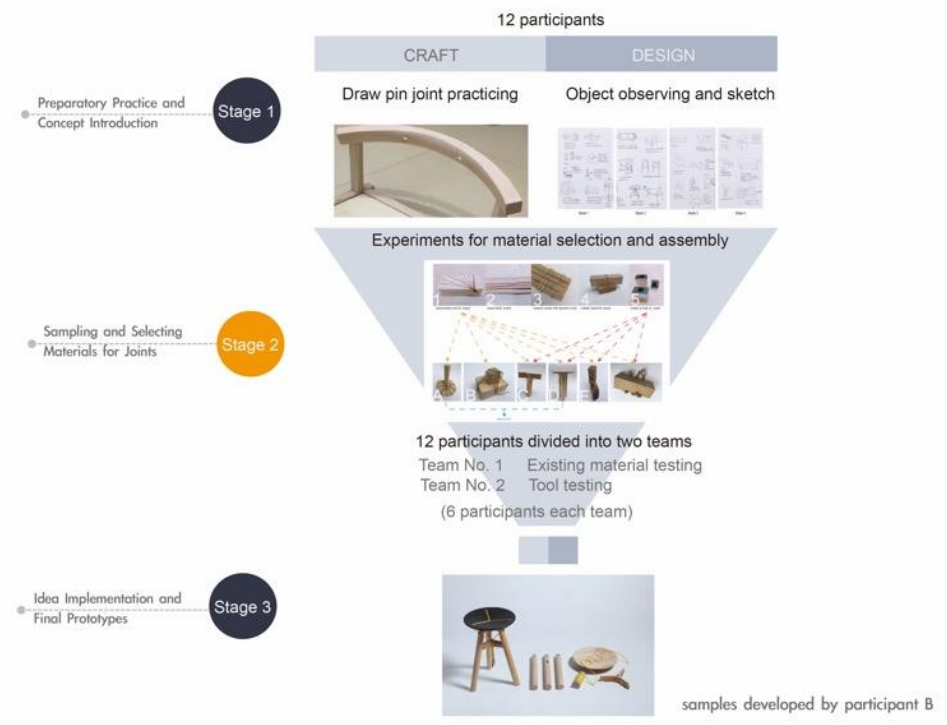

Figure 1. Research framework and flow.

2.2 Stage 1: Preparatory Practice and Concept Introduction

During the first stage, the participants were coached by three craft technology instructors to practice fabricating the cogged scarf joint which was redesignated by the technology instructors to separate the common dovetail tenon in furniture structure. The cogged scarf joint enables simple furniture disassembly and were frequently used in the curved rails of round-back chairs produced during the Ming Dynasty. The introduction of this concept and the hands-on practice prepared the participants for the material selection and design development in the second stage. The design instructors asked the participants to complete a text-and-picture-based perception exercise over a 4-week period. To perform this exercise, the participants first chose a theme (e.g., plants, insects, and pastries) and then completed a sketch and a description of at least five objects each week (Figure 2). The objective of this exercise was to encourage the participants to observe the compositions of objects. Moreover, drawing these objects enhanced participants' observational memory and perception, thereby preparing them for the material selection during the second stage.



Figure 2. Record of the 4-week design perception exercise of Participant B.

2.3 Stage 2: Sampling and Selecting Materials for Joints

The objective of the second stage was to guide participants to consider the properties and limitations of wood as a material and enable them to experiment with different material combinations and wood processing tools to develop structural joints that preserve the essence of joinery and yield a strong structure. The key components of this stage were material selection based on design and crafting knowledge, structure assembly, and crafting process arrangement. Five professional instructors (three technology instructors, one design instructor, and one researcher) provided consultation to participants on material selection, structure assembly testing, and crafting during the 8-week period of Stage 2. Then, the researcher and the design instructor assisted the participants to develop their design concept from the various combinations tested.

First, the researcher and the design instructor explained the concepts of material joints and testing to the participants. Next, the participants were divided into two equally sized groups in accordance with the additional nonwood materials, brought by the participants, and various material processing tools. The researcher also asked the participants to record their material selection and assembly processes in words or in drawings similarly to the perception exercise completed in Stage 1.

The researcher and the design instructor subsequently guided the participants to consider not only the component crafting process for the wood tenon and mortise structure practiced in Stage 1 but also those of other joint structures commonly used in wood furniture. Participants in the first group used materials such as cotton threads, leather strips, and plastic strapping to join wood or combine other materials with wooden components. Participants in the second group used material processing tools to investigate alternative methods for fabricating wooden joints. For example, an ax can be used to split wood at different angles, and a laser cutter (provided by NTCRI) can be used to cut wood and perform a series of wood bending tests.

Finally, the participants chose five joining methods for their design and development based on the material selection and assembly samples. The orange and red dotted lines in Figure 3 indicate the designs that a material assembly sample can be developed into. The orange dotted line denotes the use of thread for tying the materials in designs A to F in assembly sample 1. The red dotted line denotes hole drilling or colouring in designs C to F as in assembly sample 5. In addition to receiving advice from the researcher and design instructor regarding the development of the material assembly samples, participants were assisted by the technology instructors, who predicted the structural strength of the designs based on their experience and offered suggestions on material processing. Group discussions were organised several times to help participants to determine the most feasible structure based on the structural test results of their chosen materials.

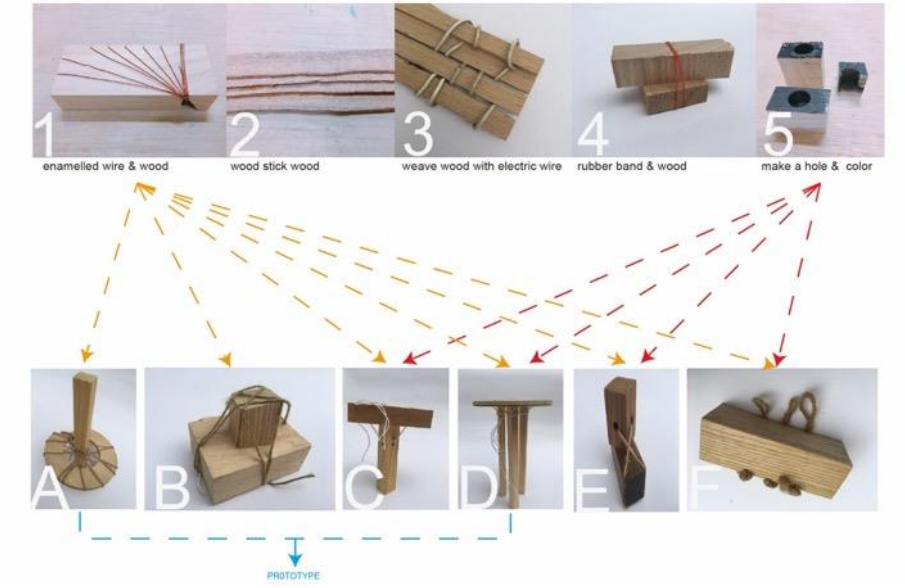

Figure 3. Designs using of the five material combination samples developed by participant B.

2.4 Stage 3: Idea Implementation and Final Prototypes

Participants individually developed a series of assemblies comprising wood and other materials. For example, some participants used various types of thread and weaving and knitting techniques to create a wooden assembly in which structural joints were formed through friction between the materials. One participant used shrink materials to assemble the structure. In total, 12 products were fabricated in the workshop, and the prototypes and primary material assembly approaches are described for each group in Table 2.

Table 2. Prototypes and primary material assembly approaches (participants were coded alphabetically)

Group 1: Existing material assembly testing	Code	A	B	C
	Photo			
	Approach	Hole drilling and knitting	Tying with thread and hole drilling	Tying for fixing
	Code	D	E	F
	Photo			
	Approach	Thermoplastic films	Wax sealing	Fixing by using a corrugated cardboard structure
Group 2: Joint structure tested after using material processing tools	Code	G	H	I
	Photo			
	Approach	Surface baking treatment	Wood splitting using an ax	Surface baking treatment
	Code	J	K	L
	Photo			
	Approach	Surface spraying	Surface processing by using Eastern gouache	Surface laser cutting

The results indicated that participants in Group 1, who used available materials for testing wood joints, were more successful than their counterparts in Group 2 in generating prototypes that met the objective of the experiment. The participants in Group 2, who tested assemblies after using material processing tools, had insufficient time for the convergence of their designs because the materials for assembly testing must first be

processed using tools. Consequently, only Participant L managed to produce a prototype in the time provided. Regarding the prototypes created by Participants G to K, the material processing was applied either partially or fully to the prototype surfaces and the structures of their finished products used the traditional mortise and tenon joints.

3. Illustrations

Prototypes that best satisfied the requirements of this study are illustrated herein. These three cases are from Group 1, and they used binding, knitting, and tying for materials assembly. Records of these prototypes are presented as follows:

3.1 Case 1: Bind

The participant used tying by thread and hole drilling to replace the traditional joint structure. After several discussions with the researcher and the four experts, the participant applied the method to a traditional Taiwanese wooden stool (Figure 4); holes were drilled on the surface of the seat for the legs, which could be easily assembled or disassembled through binding.



Figure 4. Traditional Taiwanese wooden stool (Photo: Author)

This participant applied the binding method to the stool, which reduced the labyrinth of crafting joints with multiple angles (i.e. A, B, and C; Figure 4). To stabilise the structure, the participant retained the traditional cross lap joint structure (D) and the leg joint (B). In addition, the participant used binding to secure the seat and the legs, thus improving the sustainability of the wooden stool by enabling the user to replace worn threads (Figure 5).

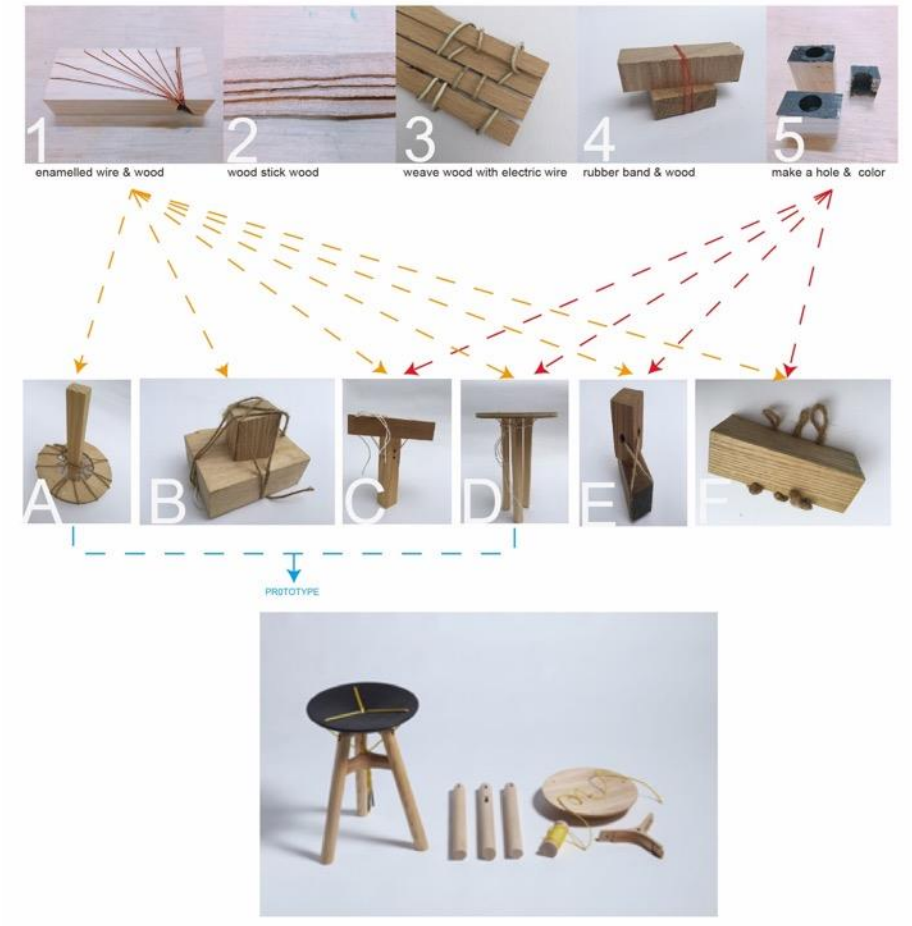

Figure 5. Series of experiments for material selection and combined with ramie and cotton thread and final prototype. Photo: Participant No. B /NTCRI.

3.2 Case 2: Knitting

This participant applied knitting expertise to material assembly samples and tested various threads (e.g., cotton thread, aluminium wire, and wool yarn) and knitting styles to identify the approach that best stabilised the wood joints. Several trials revealed that joints created using knitting with wool yarn or cotton thread yielded the optimal joint stability. This joint comprised continuous intermeshing loops, and wool yarn and cotton thread yielded greater friction than aluminium wire, thus improving the stability of the joint.

After discussions with the researcher and the four experts, the participant decided to implement this approach in wooden panels joined using a dovetail joint (Figure 6). The participant tested the feasibility of the structure using material combination samples 2 and 3 (Figure 6) and proposed a desk design (Figure 7) as the prototype.

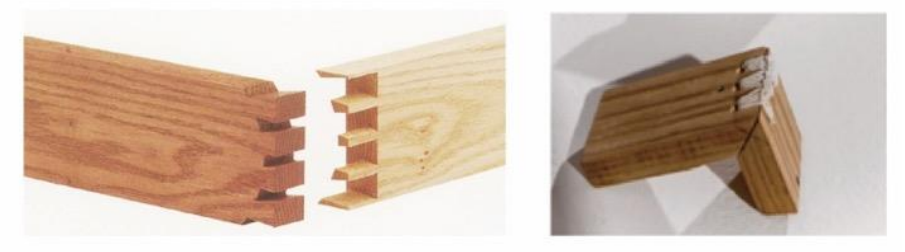

Figure 6. The dovetail joint structure (left) generally applied in making cabinets and tables. Photo: Author.

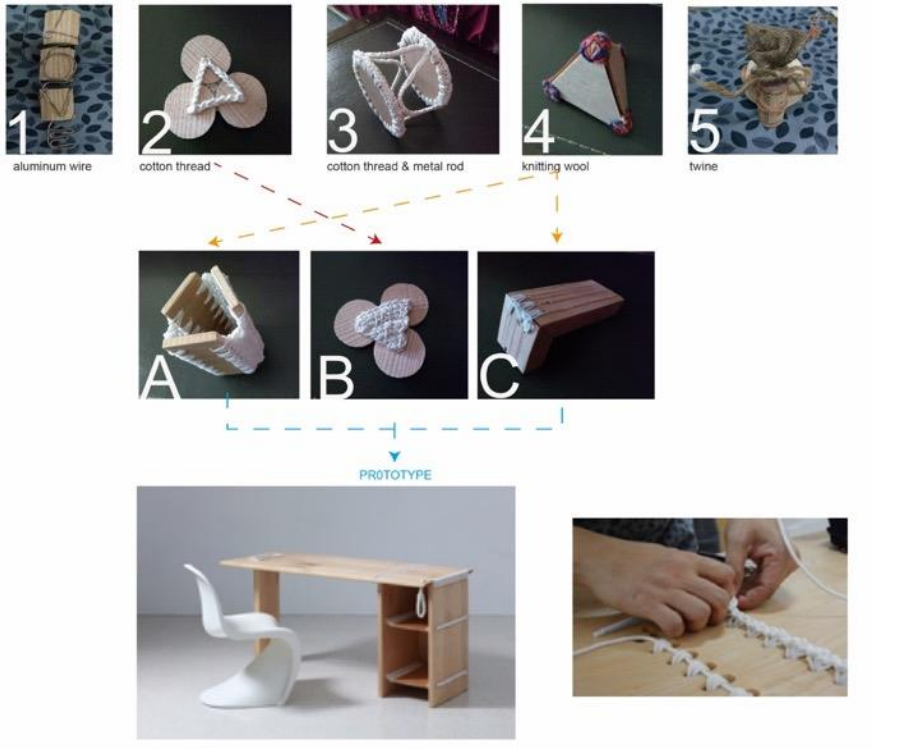

Figure 7. Series of experiments for material selection and knitting connection and final prototype. Photo: Participant No. A / NTCRI.

3.3 Case 3: Tying

This participant's material combination sample contained long strips of materials (e.g., wide paper strips, plastic strapping, and bamboo strips). The participant first drilled holes in the wooden materials and then tied the materials together for testing. After discussions with the researcher and the design instructor, the participant implemented the design in a Taiwanese farmhouse-style bench. Similarly to Case 1, crafting the joints of the bench legs is relatively challenging. Because this participant was an experienced carpenter, the design instructor encouraged the participant use materials other than threads to secure the joints. Following this suggestion, the participant developed a tying method that creates friction between long leather strips and wood. This tying method enables the user to fully disassemble the bench (Figures 8 and 9).

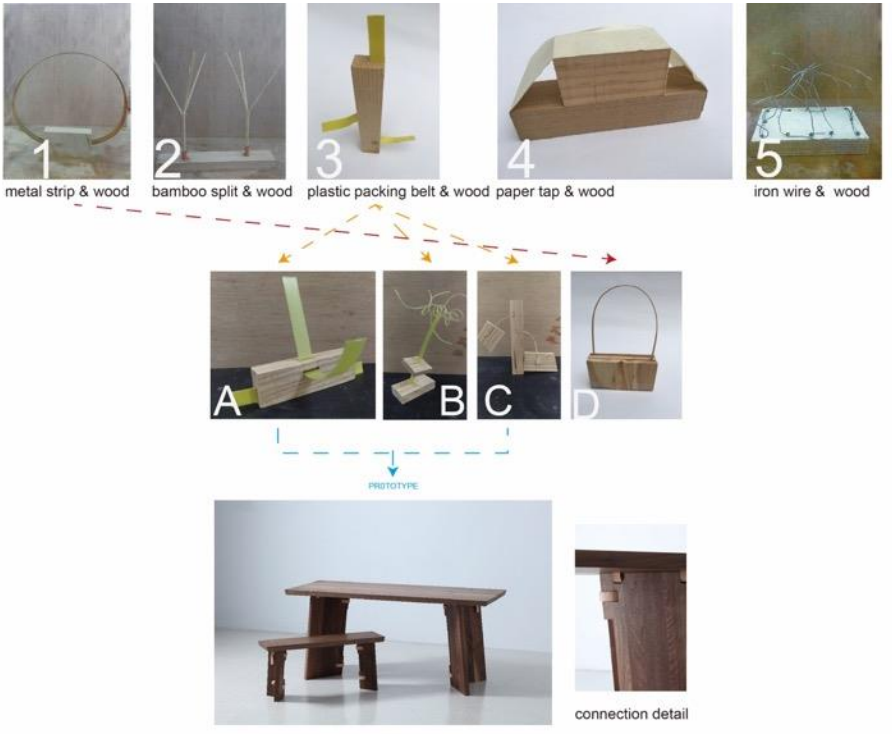

Figure 8. Series of experiments for material selection and wearing ways and final prototype. Photo: Participant No. C / NTCRI.

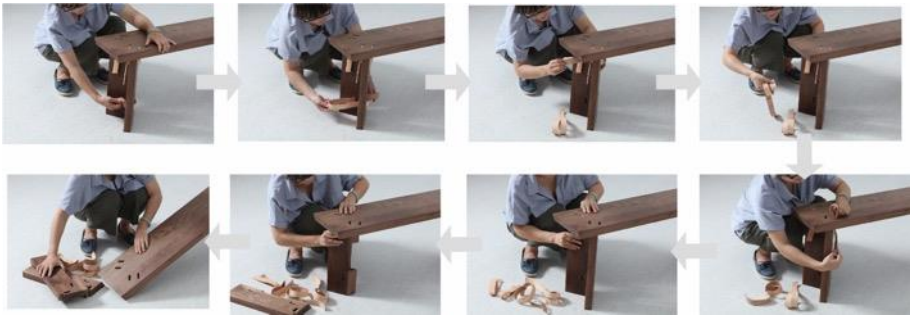

Figure 9. Disassemble and assemble process. Photo: NTCRI.

4. Findings from Implications of design

This was a pilot study exploring alternative materials combinations for traditional furniture joinery. When developing their designs based on trials of material assembly or material processing tools after discussions with the researcher and experts, most of the participants proposed designs associated with traditional furniture structures or designs that incorporated concepts of traditional furniture structure. The three cases presented in this paper were all inspired by the structure and form of a traditional mortise and tenon joint. The use of leather strips and cotton threads to replace the mortise function is one unexpected example.

For participants who were experienced carpenters, processing wood was not a difficult task. By contrast, their challenge was to supersede their existing thinking and training as craftsmen. Participants required knowledge and experience to identify appropriate materials. For example, in Case 1, although the overall assembly should have been secured by thread according to the study requirements, the traditional cross lap joint was retained as the primary supporting structure of the prototype to meet the load-carrying capacity of the wood stool.

Among the participants in the second group, who performed trials of material processing tools, only one (Participant L) successfully completed the task. This participant performed trials using a laser cutter to cut the surface of wood. They then used bendable wood pieces—cut using the laser cutter—to replace the hinge structure of a cabinet cover panel. This idea was inspired by design plans obtained from Pinterest (www.pinterest.com), and the technology instructor approved its feasibility. Although this approach was not novel, it used modern tools and approaches to replace the conventional method, thus providing a new direction for this study. The other participants applied splitting, baking, and Eastern gouache to the surface of wood; because they spent most of their time on material processing, they failed to develop a concept that related to joint structure. These participants completed only one product using their material processing method. Therefore,

the researcher should have clearly instructed the participants on applying the processing tools during the implementation stage.

5. Reflections and future work

The selection of a material combination requires repeated practice, which is crucial in this study considering that the focus was on traditional wood joinery, the physical properties of which render it a relatively challenging material. Conversations between participants and the researcher and design and technology instructors as well as conversations among the participants played a critical role during the implementation stage; these discussions enabled the participants to clarify their concerns regarding the appropriateness of materials combinations. Moreover, participants were able to obtain suggestions from others and perform trials. No participants were experts on all subjects, but they could identify a participant familiar with their chosen materials.

When exploring the material combination, the participant in Case 3 identified methods to exploit material properties such as firmness, friction, and flexibility. In future studies, material properties can be explored and applied to the fabrication of novel wooden joinery structures. In addition, methods for incorporating digital-aided design and digital manufacturing into the crafting process and design brainstorming should be considered to expand the value of traditional crafting technology. The experiences of this design workshop on material combinations and selection will be applied to bamboo, metal, and ceramic crafts. Subsequent studies in this series will explore the ability of craftsmen to apply bentwood and digital crafting to joint structures and to innovate on the forms of these joint structures.

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Acknowledgements: For enthusiastically participating and supporting our study, we would like to heartily thank NTCRI in Taiwan, the craft technology instructors, the design mentor and all participants who take part in the craftsmen training project of NTCRI.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Amorphous Stacks: A Low-Tech Construction Method for Jointless Cast Structures

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Abstract | The project explores an experimental fabrication method to reinvigorate masonry techniques and stereotomy (stone-cutting) construction. It introduces amorphic blocks cast from a pressure-driven scaffold system, stacked into four archetypal structures to examine the method's performance and applicability. The low-tech, self-explanatory, and hand-craft aspect of this construction method contributes to greater accessibility and the potential for widespread application in areas devoid of technology and resources.

KEYWORDS | FORMATION OF FLUID MATTER, AMORPHOUS GEOMETRY, GEOMETRIC STACKING SYSTEM, JOINTLESS STRUCTURE, DIY MASONRY CONSTRUCTION

1. Introduction

This paper explores the creation of a new dry-stacked system of an interlocking family of distinct amorphous units cast in fluid material. The use of a stacking system in constructing structural and ornamental architectural features with discrete and modulated units is evident throughout the history of stonemasonry. From the Roman concrete arches stacked with mortar to the dry-stacked Inca stone walls and the extensively used mass-producible brick constructions of modern architecture, the art and science of stacking systems in masonry have evolved both structurally and aesthetically, reflecting the increasing needs of high efficiency and new aesthetics in the culture of building.

The current practice of stone masonry construction is divided into two broad categories according to the fabrication method: stone-cutting and solid-casting. Both categories have adopted innovative materials and construction techniques through research and practice while presenting different architectural applications. In the case of stone-cutting in masonry construction, many practices combine traditional craftsmanship with digital fabrication technology and structural analysis. *Cyclopean Cannibalism*, a research project led by Brandon Clifford and Wes McGee (2018), successfully translated the ancient construction methodology of Cyclopean masonry into a contemporary digital procedure with high accuracy and efficiency through the use of a six-axis robotic arm to carve each stone unit of a Cyclopean masonry wall. Other contemporary research on stereotomy has integrated digital computation in the design process. The *Sean Collier Memorial*, designed by Höweler + Yoon (2015), combined new digital fabrication methods, including computational graphic statics and robotic machine milling, to build a five-way vault geometry with traditional stonemasonry techniques.

Similarly, solid-casting construction has evolved with digital modeling and fabrication tools yet has strayed from a holistic approach by limiting the material's structural capability. Current experimental practice and forefront research in solid-casting tend to focus on developing computational techniques to produce complex geometries and visual aesthetics while overlooking the potential to accentuate the nature of the material and materiality. The application of cast stone continues to be used primarily for cultured stone and ornaments to mimic prehistoric aesthetics. Innovations in cast concrete are mostly limited to the cladding system, focusing on visual appearance rather than the construction process and structural integration. The *Broad Museum* in Los Angeles, designed by Diller Scofidio + Renfro, is characteristic of its parametric precast concrete façade composed of glass-fiber-reinforced concrete (GFRC) panels that were cast in digitally fabricated molds, showcasing a versatile and rapid prototyping workflow. While it combines the precast technique with complex geometry, the method requires a substantial supporting structure to hold up the cladding system. However, the current trajectory undertaken by architectural designers and researchers calls for more attention to exploring the materiality of fluid materials for casting. As Pier Luigi Nervi stated, although the casting of fluid material (i.e., reinforced concrete) has been used in architecture for over a hundred years, "few of its properties and potentialities

have been fully exploited" (West, 2017, pp.4). While the geometry of stereotomy (cutting) is limited to ruled surfaces since the generative surface follows the trajectory of the cutting blade, the plasticity of the casting material allows an extraordinary variety of forms with non-developable surface geometries with the introduction of flexible formworks. With the exploration of stacking units' surface geometry, there is the possibility of a new construction method that supports itself (without mortar). The accessibility of fluid materials around the world also suggests its great potential to be popularized by larger user groups, specifically those in remote regions that have limited construction resources and technology.

Another challenge of contemporary masonry construction, as well as in other material constructions, arises from the perishing value of craftsmanship in the culture of making. As the stereotomic problem has become creating "a whole that must be made of various parts" (Sanabria, 1989, pp. 266), the fabrication system has gradually transformed into a standardized mass production process that produces uniform building units, such as bricks, resulting in maximal productivity and economic benefits. However, these two trajectories of mass production and technology-oriented development have rarely reflected the inherent value of traditional masonry that resides in its technical virtuosity. Mass production and advanced digital technology not only remove the marks of the builders' hands from the artifacts but their required high level of expertise and background knowledge further hinder the popularization of the techniques and constrain access to only specific user groups with status and resources (Eglash et al., 2004); people from remote or isolated areas with limited resources have restricted opportunities to use these new techniques. This phenomenon reveals the social challenge of the contemporary construction paradigm and the need to address the broader socio-economic problems and propose sustainable solutions.

How can modern architecture reinvigorate tradition without losing the value of craftsmanship? What are the opportunities in fabrication to challenge accessible means of construction? In exploring of an approach alternative to those centered on technologies, this study addresses the challenges of the lost value of making and the urgent social need for accessible construction techniques in underdeveloped places. This paper reconsiders the casting technique in masonry construction and reexamines the materiality of fluid materials to offer new possibilities in expressing the intrinsic qualities of the material. Through prototyping and speculative design, it reflects on a new understanding of an integrated and reciprocal relationship between material and human experience in the course of making.

This paper presents three primary objectives on the subject matter after an introduction to the fabrication methodology. Firstly, it examines the applicability of the new construction method by prototype testing four archetypal structures. Secondly, it discusses the potential and limitations of the method based on the results drawn from the first section, followed by reflections on future exploration and development. Finally, it proposes a possible application of the technique to solving real-life architectural problems. By drawing results from physical models, this investigation aims to contribute to the diversity of possible research approaches to masonry construction methods.

2. New Masonry Construction Method

2.1 Casting From Flexible Formwork

This study adopted plaster casting as the primary fabrication technique to engage the thinking of matter as a participant in generating form. There are several advantages to casting as a fabrication method. It is a relatively simple construction method that requires very little technological support, offering the possibility of construction in situ. Common materials for casting, such as concrete and plaster, are highly accessible and can be executed. The plasticity of the fluid materials also facilitates the subject of this study. The casting materials' transitional phase between liquid and solid states allows the manipulation of their form. Their fluid nature implies a self-activated form-finding process that responds to their surroundings. As the mold mostly constrains the casting outcome, the utilization of a flexible mold (fabric and inflatable materials) is crucial in the sense that it implements the materials' intrinsic qualities instead of discounting and overpowering them. Paired with the use of the flexible mold (in this case, the latex balloon), the materials "actively seek the shape of their own stability in the gravitational field" (West, 2017, p.6). As Mark West noted in his explorative research on the use of fabric formworks in concrete casting, the materials in play are "alive": they arrive at the final geometry in a kinetic way, engaging in "a kind of formal self-invention in real-time" (West, 2017, p.6). Plaster was adopted as the material for casting prototypes due to its similarity with concrete and soil, yet with a shorter curing time.

The study uses the surface geometry of stacking units manipulated by a flexible scaffold system (Figure 1) to create an interlocking system without the use of mortar. Under the same method, architectural applicability was tested using the construction of three phasing prototypes: the fabrication of a column structure, an inclined column and wall structure, and a conical wall structure. The geometry of the latex balloons filled with liquid plaster was manipulated by external pressure generated by a cubic scaffold system to create organic forms with concave and convex surfaces (Figure 2). The formwork also utilized temporary fabric support in place of possible wooden falsework. Between the amorphous blocks, the seamless fitting of concave and convex surfaces behaved as joinery that interlocked the masses. During the casting process, each unique block became a part of the scaffolding system for the succeeding one, providing sufficient friction for structural stability. The realized form reflected the means of its construction from the geometric properties of each individual and mutually-responsive unit. This simple construction method would allow users to build it themselves with minimal equipment. Embracing the characteristic of irregularity in material crafts, no specific patterns of the arrangement were employed intentionally during the fabrication process. This flexibility in making opposes the strict uniformity required by mass production and the high precision prescribed by technology, offering greater freedom of creation and accessibility.

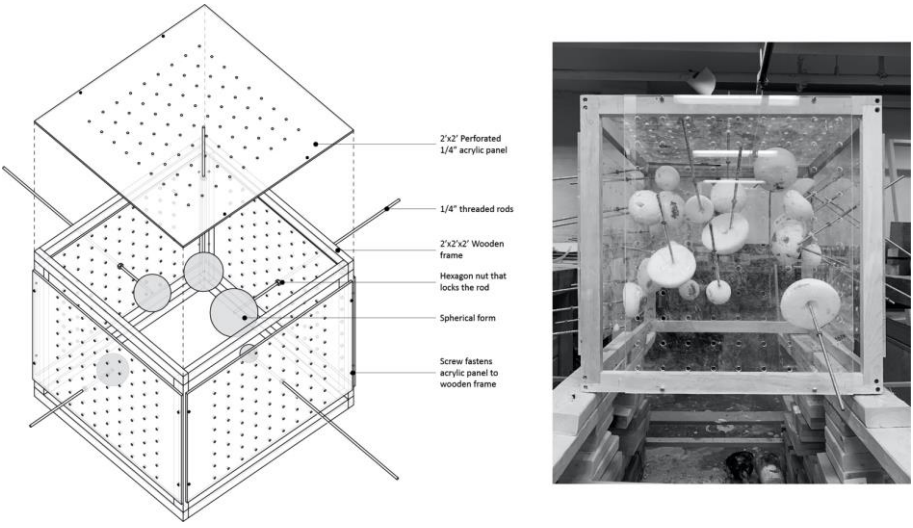

Figure 1. Pressure-driven scaffold system.

2.2 Pressure-Driven Scaffold System

A customizable pressure-driven scaffold system was designed to fabricate the stacking structure (Figure 1). Builders were able to construct the entire structure solely by this system without additional tools and machines. In addition, it was composed of simple components that could be disassembled and reassembled easily, providing an advantage of mobility. As a type of force, pressure can take various forms and effectively transform the shape of soft matter. In this study, spheres of different radii were used as the pressure impetus. The perforated panels of the formwork enabled the spherical force to enter the cubic scaffold system from the exterior in axial directions in order to apply force onto the plaster volume, while the grid pattern established a customizable and controllable system for axial pressure in multiple configurations. This scaffold system also included a sheet of heavy-duty fabric, which was placed and secured around the wooden frame. The fabric sheet helped to offer temporary support for the structure, creating a flexible platform for manipulation. The plaster volume confined in the balloon was left to cure after it found its own shape of static equilibrium through the back-and-forth adjustments of pressurizing and depressurizing. Thus, the geometric outcome of the stacking units was subjected to both the imposed pressure and the surrounding context (gravitational force). The combination of the prescribed parameters and the open-ended factor implies a more holistic construction method than an entirely prescriptive one.

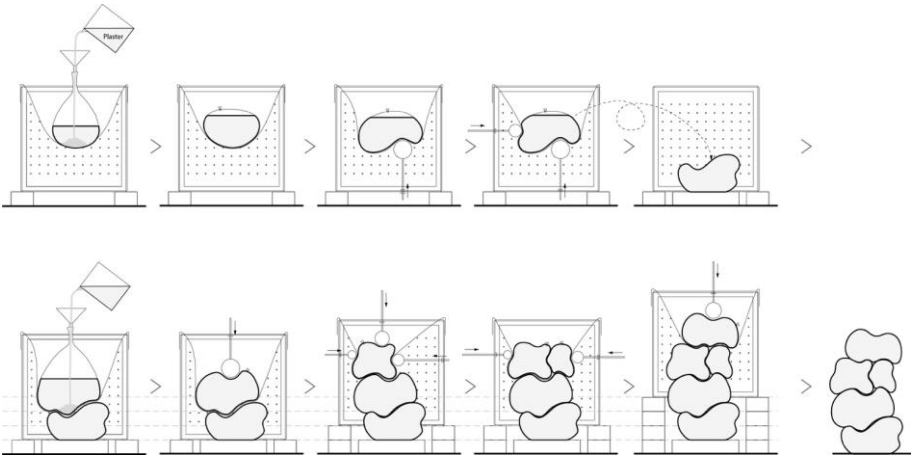

Figure 2 Fabrication sequence of stacking blocks.

2.3 Surface Geometry as Joinery

The connection between each block was achieved by its surface geometry without the use of mortar cement. After casting one block, the next block was cast on top of the previous one, which became part of the scaffold for the succeeding block. Thus, a concave surface on the previous block would form a convex surface on the latter one, and vice versa (Figure 1). The seamless fitting of concave and convex surfaces increased the contact surface area between the two blocks and provided greater friction for structural stability. The concave and convex geometry also behaved as the joinery system that interlocked the two blocks by eliminating the rotational movement. The greater the depth of the concave and convex surfaces, the stronger the anchoring function they perform. Moreover, a larger distance between the centers of gravity of the two blocks would not only require a greater surface curvature, but also the weight of the upper unit to stabilize the structure (Figure 3). This connection system shares similar principles with those of Inca masonry techniques; Inca stonemasons utilized the friction between precisely-cut matching faces of neighboring stones as a connecting mechanism. However, the surface geometry's behavior as joinery in this study differs from the Inca prismatic ones in its amorphous geometry, contributing new aesthetics to the conventional masonry practice.

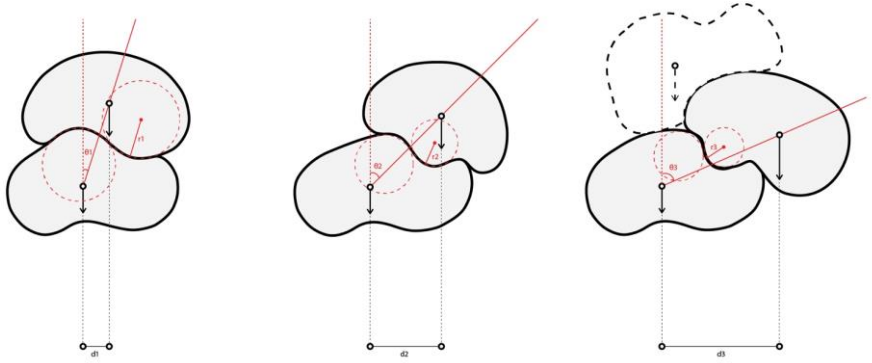

Figure 3. A larger distance requires a larger degree of surface curvature and the weight of an upper stone for structure stability. (r1>r2>r3, d1<d2<d3, Θ1<Θ2<Θ3).

3. Structure Prototypes

3.1 Column Structure

The architectural applicability of this construction method was tested through three major studies that included four archetypal structures: a vertical column, inclined columns, an inclined wall, and finally, an inclined conical wall. The first study investigated a 6-feet vertical column structure constructed by a 2'X2'X2' cubic scaffold to examine the applicability of the new method (Figure 4). The vertical column was composed of 10 unique plaster blocks with an average size of 1'X1'X1'. This size of the stacking block allowed an approximately 20 minutes for the workable form before it was left to cure, which would take up to 24 hours. The structure eventually attained its global static equilibrium when the final keystone was set in place. With this fabrication method, the stacking structure achieves static stability only after completing the assembly process.

The process of finding the global equilibrium was one of trial and error, a course that was more intuitive than computational or systematic. This constructive process is a concern that resides in most handcraft traditions, which has been solved mainly by the accumulation of experience. Recent research has integrated computational modeling and solver-based simulation to test and revise the structural performance before fabrication, establishing a more efficient design workflow that ensures a successful outcome. Examples include the use of the *Grasshopper* component to calculate the center of gravity in the *Quarra Cairn*

research project completed through a collaborative effort between the Massachusetts Institute of Technology and the University of Michigan (Clifford et al., 2017). This limitation of the innovative construction technique appeals for further explorations and research on designing a solver-based computational program that can simulate the optimal positions for each stacking unit in advance.

The paradoxically stabilizing function of the keystone in the amorphous stack recalls the argument stated by Charles Perrault in the 17th century and mentioned in Richard Etlin's introduction to *Stereotomy: Modern Stone Architecture and Its Historical Legacy.* Perrault described stereotomy as being based on the paradox that the practice employed "the weight of the stone against itself by making it hover in space through the very weight that should make it fall down" (Fallacara & Stigliano, 2012). Stonemasons in different eras have addressed this problem from different approaches according to the available contemporary technology and knowledge. Inca stonemasons confronted the problem by solely using the weight of stones to achieve stability (Protzen, 1985), whereas Roman builders avoided this problem by using temporary wooden formwork and thick mortar joints (Sanabria, 1989). A majority of recent research on stereotomy has centered on integrating technology that relies on auxiliary support and joinery systems, as in Roman architecture. This study, however, takes an approach aligned with that of the Inca builders, where the form solves the problem of physics with its mass and geometric characteristics, resulting in a direct and responsive relationship between form and structure. This approach considers the matter's resistance to weight as a virtue rather than as an obstruction to be overcome (West, 2017).



Figure 5. Detail views of the 6 feet column structure.



Figure 4. Prototype of a 6 feet column structure.

3.2 Inclined Column and Wall Structure

The second study continued to develop the fabrication method to resolve the static equilibrium of inclined columns and wall structure by adding two fixed planes to the formwork. As each amorphic block offsets the others in a linear fashion, it will form a leaning structure with an angled central axis. Two fixed planes were added to the top and bottom of the scaffold to prevent the structure from collapsing. A key knob was attached to each panel, acting as a pin joint to prevent blocks from sliding and rotating. A piece of fabric, which was later removed, was secured to the two panels at a certain angle, functioning as temporary support for the inclined structure during the fabrication process. Besides the adjustment of the scaffold system, other fabrication processes remained the same, including the use of latex balloons and casting in plaster. As the last unit was cast in place, the inclining structure reached its static equilibrium and no longer needed the fabric support.

This study examined one-foot tall column structures at two different inclining angles: one at 20 degrees (Figure 6) and the other at 45 degrees (Figure 8). Both structures maintained a static equilibrium after all blocks were cast and the fabric was removed. The success of the two prototypes suggests the wider potential of this technique's application in architectural construction. After two inclined column prototypes, this study proceeded to explore the possibility of applying the technique to construct an inclining surface structure by examining a half-foot tall inclining wall structure at 30 degrees (Figure 11). In this wall structure, the relationship between the amorphic blocks was no longer a one-to-one dialogue but multi-directional and dynamic. Each amorphic block not only related to its vertical neighbors but also to the horizontally adjacent ones. This network interrelation with multiple directionalities added extra structural stability to the wall section.

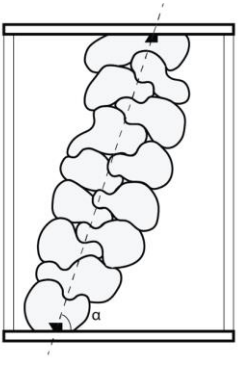



Figure 6. One-foot tall inclined column structure at 20°.

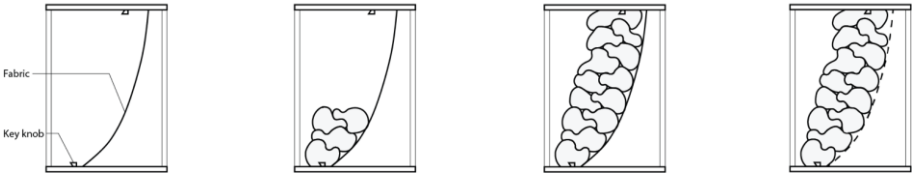

Figure 7. Sequence of prototyping the inclined column structure at 20º.



Figure 8. One-foot tall inclined column structure at 45º.

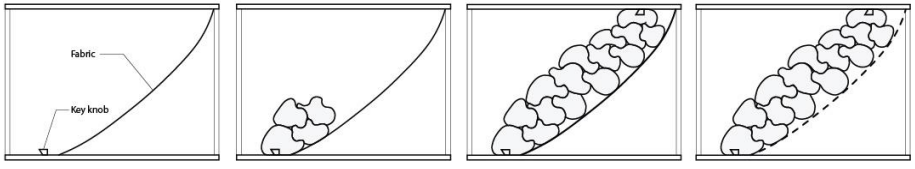

Figure 10. Sequence of prototyping the inclined column structure at 45º.



Figure 11. Prototype of the half-foot tall inclined wall structure at 30º.

3.3 Inclined Complex Wall Structure

The third study proceeded to fabricate a larger-scale prototype with highly complex geometry to further examine the potential of the construction technique. The increase of scale led to a strengthening of the scaffold's structural capabilities to face the challenge of large scale constructions. An inverted conical surface was chosen to introduce geometric complexity (Figure 12). The entire structure was constructed by a 3'X1.5'x3' scaffold and consisted of 104 stacking units of 1/2'X1/4'X1/4' plaster blocks, with 20 degrees of inclination. The structure successfully held itself up; however, it failed after removing the supporting fabric due to the deformation of the fabric caused by overweight. Another leading reason was the disproportional relation between the scale of each stacking block and the entire structure. The scale of each stacking block was demonstrated to be too small for the scale of the overall structure, which resulted in a much larger number of the units that led to a higher probability of collapsing in this dried-stack structure without mortar. In conclusion, this complex prototype proves the potential of this construction method in building organic forms and dynamic structure. The result of this prototype also suggests that a complex geometric structure and larger scale constructions in question require more thoughtful planning of scale and material usage than a column structure in order to be free from collapsing.

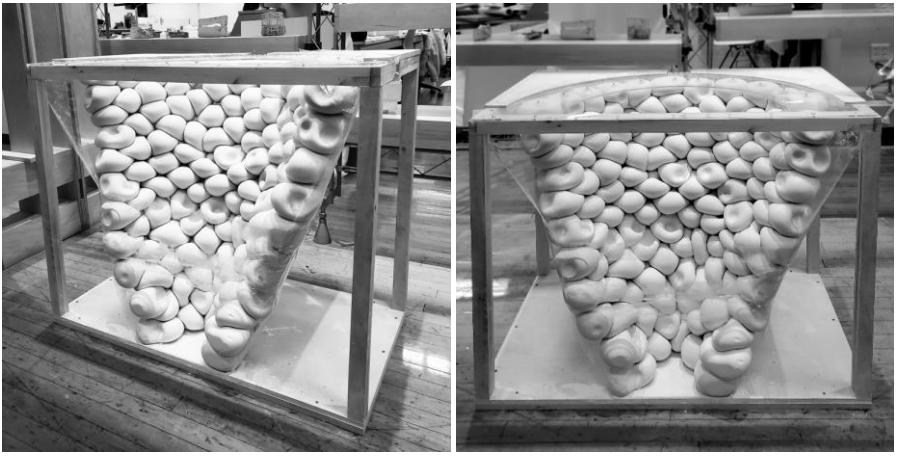

Figure 12. Prototype of the 3'X1.5'X3' inclined conical wall structure.

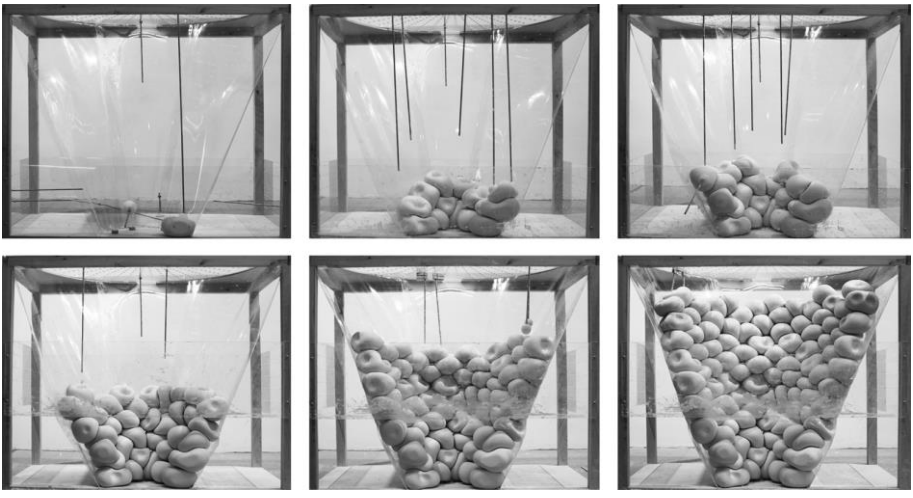

Figure 13. Sequence of prototyping the 3'X1.5'X3'inclined conical wall structure.



Figure 14. Detail view of the inclined conical wall structure.

4. Discussion and Conclusion

The prototype testing results of the four archetypal structures prove the validity and applicability of this innovative fabrication technique and suggest its potential in constructing a structure of greater complexity. During the prototyping process, several variables emerge to be crucial for the effectiveness of the construction: the surface curvatures of the concave and the convex, the inclination degree, the relationship between the total number of units within each self-standing structure, and the structural capacity of the scaffold system when facing the challenge of large scale construction. A conjecture can be drawn from the testing result of the four archetypal structures that there is a right domain of ratio between the structure's total volume and its unit count for the practicability of the construction method.

Utilizing the fluid property of liquid casting, this construction method reflects the relationship between form and physics in the fabrication process. The use of the surface geometry of each block as the joinery system eliminates the need for additional adhesion or mechanical joints, which establishes a direct and responsive relationship between form and structure. Although the interlocking system improves structural stability, the center of gravity must be monitored to achieve a global equilibrium. The intuitive aspect of the search for global equilibrium during the fabrication process presents an opportunity to incorporate a new computational program. This combination of craftsmanship and digital computing could potentially yield a hybrid model in which technology and human hands are codependent.

The design and the prototype examination of this fluid-cast and pressure-driven fabrication method rethink the potential of liquid-casting materials and the curing process in constructing organic forms and structures. Its low-tech and crafts-based attributes inform itself of a non-standardized and self-explanatory construction method that could be adopted in areas of limited resources, technology, and skilled-builders. The widely accessible casting materials, including concrete and plaster, allow users to build structures in places with difficulties in transportation, such as high mountains or remote islands. The DIY aspect of this technique blurred the boundary between users and builders by lowering the prerequisites and skill demands. With the support of computational parametricism and algorithms, the hand-built approach gradually abolishes in favor of robotic arms. By utilizing the virtue of the fluid material, this fabrication method's flexibility and plasticity challenge the standardization of mass production and the prescriptive design, offering greater freedom of creation and accessibility. This exploration presents an alternative approach to masonry construction, inheriting the legacy of past knowledge to imbue the making tradition with greater accessibility.

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An Exploratory Study about Communicating 4D Printing between Product Designers and Manufacturing Engineers

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Abstract | 4D Printing is an emerging technology that combines Additive Manufacturing and stimuli-responsive shape memory materials to produce freeform parts that can evolve over time. In this paper, we suggest that using conventional sketches to communicate 4D Printing does not fully convey the design intent. This paper provides evidence of poor communication between Product Designers and Manufacturing Engineers when describing 4D Printed parts. Literature review highlighted that very little studies have been carried out to investigate the communication of the shape transformation process. The study found that the marks made on paper were spontaneous and unpredictable. For example, participants used random colours, arrows and shading. Time was indicated by using 'symbols' and splitting this into two separate sketches to define the differences in speed. The main study involving fourteen pairs of Product Designers and Manufacturing Engineers aimed to capture the participants' gaze and behavioural activity during sketching using OBS Studio Software and with a Wacom Bamboo Tablet. To track the Product Designers' and Manufacturing Engineers' sketching process, the participants were asked to view an animation that showed the shape change behaviour. Next, they were asked to make annotations to specify the geometric relations using symbols, dimensions, angle, alignment and symmetry on the sketch to communicate the shape change behaviour of the 4D Printed parts. In summary, this study has found that a framework could be further developed as a guideline to communicate the shape changing behaviour of the 4D Printing process. The main contribution to knowledge is to enable Product Designers and Manufacturing Designers to communicate the use of 4D Printing during the idea generation phase.

KEYWORDS | 4D PRINTING, COMMUNICATION, SYMBOLS, PRODUCT DESIGNER, MANUFACTURING ENGINEER

1. Introduction

The fourth dimension of 4D Printing refers to the element of 'time' where parts can transform or reshape (Tibbits et al., 2014; Pei et al., 2017). 4D Printing uses materials that can remember and recover to a programmed deformation when parts are exposed to an external stimuli (Ge et al., 2014). During the early stages of the design process, sketches or drawings are often used as a visual communication tool (Eitz et al., 2012). In this context, the medium for communication is important because poor representations could potentially lead to confusion (Alcaide-Marzal et al., 2013). Sketches are often the most effective way for Product Designers and Manufacturing Engineers to capture their thoughts and ideas about a design solution. According to Baronio et al. (2016), sketching and dimensioning is required as requirement for designers and engineers before they proceed to use Computer Aided Design (CAD) to create two-dimensional (2D) drawings or three-dimensional (3D) models. Figure 1 shows an example in the use of symbols referring to a technical drawing that shows information about a hydraulic circuit system. We can identify the moving parts of the system such as the motor and the pump unit by means of arrows and other associated symbols.

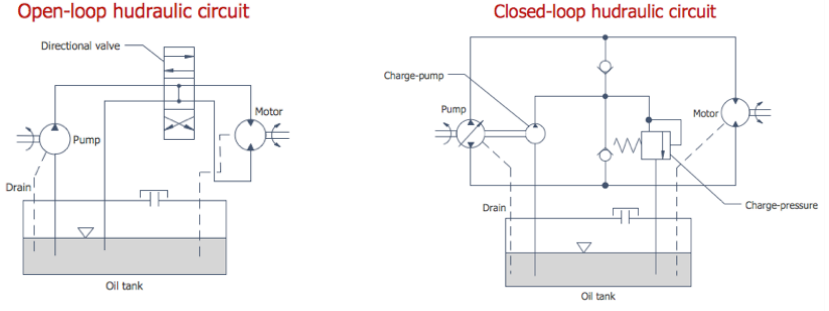


Figure 1. Example of symbols used in hydraulic circuits.

Our earlier work identified existing challenges for 4D Printing to be communicated during the early stages of the design process. We found that participants made random marks on paper and there were no recognised or established symbols available to explain or represent 4D Printing, especially for shape transformations. For this study, the use of symbols was chosen so that visual communication of the core message could be easily conveyed. This paper describes the study in which the main objective was to evaluate whether the use of established symbols could be effectively used to communicate the shape change effect of 4D Printed parts.

1.1 Shape Changing Behaviour in 4D Printing

Nam and Pei (2019) classified 4D Printing shape-change behaviours into three categories, namely basic shape change, complex shape change, and a combination of shape change. In

this research we focus on eleven different shape-change behaviours, including folding, bending, rolling, helixing, twisting, waving, curling, curving, topographical change, buckling and expansion. According to Nam and Pei (ibid), a fold is a sharp curvature caused by deformation along a crease. As shown in Figure 2, it is different from a bend which is a more evenly distributed deformation of a material along the deflected area that creates the curvature. Rolling is a different behaviour, in which the shape moves by turning over and over on its own axis. On the other hand, twisting is dominated by in-plane stretching. A helix is a type of smooth deformation in which a curve occurs in a three-dimensional space. Buckling is characterized by a sudden sideways failure of a structural member subjected to high compressive stress or force. Curving is the amount by which the surface of a geometric object deviates from a flat plane. Topographical change results in a distorted shape that resembles the physical features of a ground terrain. Expansion and contraction shape-changing behaviours are based on a shape-memory cycle. The waving behaviour results in a shape that has undulating features or a wavy up-and-down form. Lastly, curling produces a similar resultant effect as curved creases along a continuous surface. There are also notable differences in the degree of shape change (Nam & Pei, 2019). Curving, twisting and helixing shape-change behaviours have deformation angles occurring in the hinge area; while bending, topographical and twisting shape-change behaviours have a deformation that results in less than 360°. If this is more than 360°, the deformation is classed as rolling, buckling or curling.

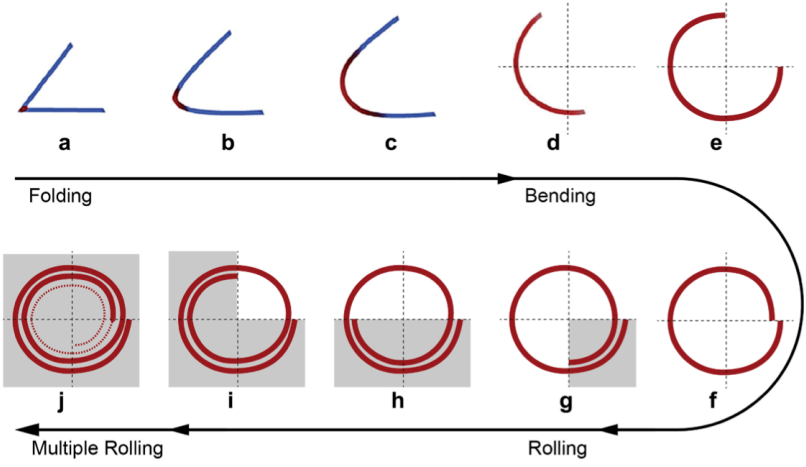


Figure 2. The differences between folding, bending, rolling and multiple rolling (Nam & Pei, 2019).

1.2 Symbols and Icons

The word ‘icon’ is derived from the Greek word ‘eikon’ which refers to ‘the image’ (Yan,

2011). Empirical studies about iconography and symbols can be regarded as a subgroup of visually descriptive or figurative language (Wagner, 2015). Both icons and symbols are used to represent pictographs which are graphs that encode words through the medium of representation (Bottero, 2004). Icons usually represent only visible things, whereas symbols represent the idea. Icons are defined as clear graphical representations with little need for translation. On the other hand, one has to learn what a symbol stands for, as it is not similar to what it represents (Rogers, 1989). Icons are also restricted to the graphical representation of objects and one can easily understand what they refer to.

2. Empirical Research

The main objective of this study is to evaluate whether the use of symbols could be effectively used to communicate the shape change effect of 4D Printed parts. A set of 33 symbols representing the shape-change effect of 4D Printing was first created. An initial study involved one post-doctorate designer and one post-doctorate engineer. This was created to ascertain the total duration of the task that would be required, as well as to clarify the sequence of activities. We found that the pilot study took an average of one hour to complete. For the main study, we recruited fourteen designers and engineers from the Department of Design, College of Engineering, Design and Physical Sciences at Brunel University London in the United Kingdom and also from the Faculty of Engineering, Universiti Teknikal Malaysia Melaka, Malaysia. In this focus group study, the participants needed to have a background in either design or engineering. In terms of the limitations of this study, our main concern was that the number of participants who took part in the focus group was small (n=14), and it was also difficult to recruit participants who had a good knowledge of 4D Printing.

The focus group consisted of three main tasks, involving a (1) 'Classification Test', (2) 'Visual Test' and (3) 'Development Test'. For the 'classification test', the participants had to match the text that described the shape-change behaviour with three symbols that were provided. This task introduces the eleven 4D Printing shape-changes, so as to enable the participants to understand the 4D Printing deformations (Figure 3). The participants were asked to match each symbol with their corresponding shape-change behaviour for this first task and the correct matching and error rates were collected. For the 'visual test', the participants had to rate each of the three symbols according to good, average and poor. For this second task, we wanted to find out which symbols had the best preference. Lastly in the 'development test', the participants were asked to further suggest two other alternative symbols for each of the 4D Printing Shape-Change behaviours. The purpose of this task was to allow participants to create alternative designs of the symbols.

Before starting the task, the participants were briefed about the purpose and the procedure of the study. They were asked to read an information sheet before completing a consent form to participate in this study, in line with the university's ethical process. The participants

were not timed and they were given sufficient time to complete all the tasks. The average time required to complete the focus group was approximately an hour (Figure 4).

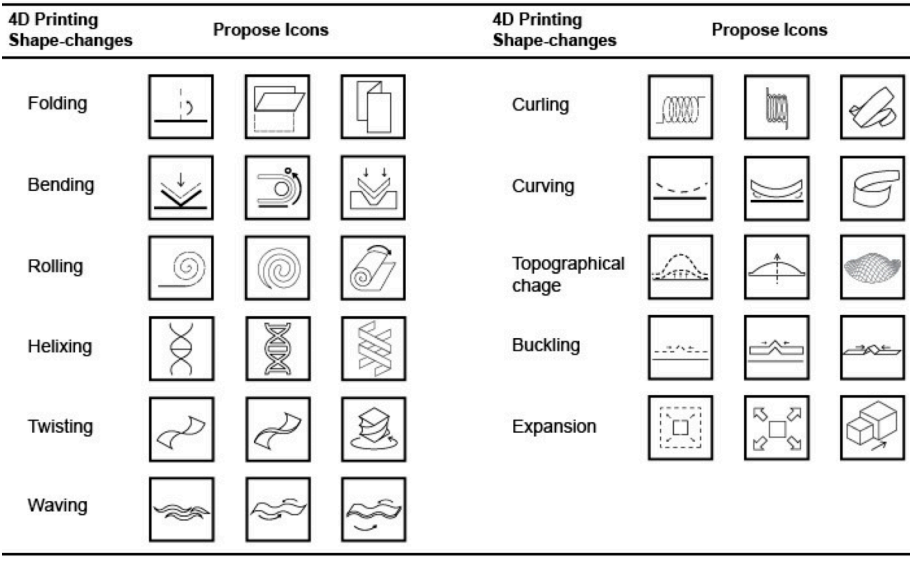


Figure 3. Symbols designed for the 'classification test'.



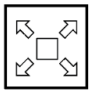
Figure 4. Participants undertaking the experiments.

3. Analysis and Results

The results of Task 1 'Classification Test' are presented in Table 1. The first column showed the representative symbols of the shape-changes symbols for folding, bending, rolling, helixing, twisting, waving, curling, curving, topographical change, buckling and expansion or contraction. The second column showed the correct answer that the participant should answer. And the third column showed the total of participant that choose the correct answers. The table refers to the Participant number. It was found that 8 out of 14 participants received correct answers in Task 1. The 8 participants matched correctly all of the symbols with 4D Printing shape-change behaviours. In addition, we also found that folding, rolling and helixing were correctly matched by all participants. Conversely, 'topographical change' was the symbol that was the worst matched which 4 out of 14 participants answered it wrongly. Next, 'curving' received 3 out of 14 participants who matched incorrectly and they were confused with the 'topographical change' symbol.

Table 1. Task 1 required participant to match the set of symbols with the corresponding 4D Printing shape-change behaviour.

Proposed 4D Printing Shapeshift Symbols			Answers	Total Correct
			E Folding	14/14
			H (Bending)	12/14
			K (Rolling)	14/14
			G (Helixing)	14/14
			J (Twisting)	13/14
			A (Waving)	13/14

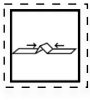
			I (Curling)	12/14
			B (Curving)	11/14
			C (Topographical change)	10/14
			D (Buckling)	12/14
			F (Expansion)	12/14

From this task, it was found that folding, rolling and helixing had the highest score (14 participants who matched the icons correctly). Twisting, waving and expansion had the next highest score (13 participants who matched the icons correctly). Bending, curling and buckling had 12 participants who matched the icons correctly. Curving had 11 participants who matched the icons correctly, and Topographical Change had 10 participants who matched the icons correctly, giving this icon the poorest score.

For Task 2 'Visual Test' there were 3 symbols for them to choose, as shown in Table 2. The participants had to rate their most preferred symbols, with the '1' rating referred to good, '2' rating referred to average, and '3' rating referred to poor. From this task, the most agreed symbols for all 4D Printing shape-changes behaviour were found. Among them, the folding shape-change behaviour received the best results with 14 of the participants agree with the middle symbol as shown in Table 2 being their most preferred and easiest to understand representation. However, the first symbols received only 5 agreements. Similarly, in the second column referring to the bending shape-change behaviour, 10 participants rated the middle symbol as their most preferred representation. From this exercise in Task 2, a summary of their preferred choice of symbols is shown in Table 2.

Table 2. The results of the most preferred symbols selected by the participants to represent the 4D Printing shape-change behaviour.

4D Printing Shape-changes	Agreed Symbols	Total Correct

E Folding				n=14
H (Bending)				n=10
K (Rolling)				n=12
G (Helixing)				n=11
J (Twisting)				n=11
A (Waving)				n=13
I (Curling)				n=12
B (Curving)				n=12
C (Topographical change)				n=13
D (Buckling)				n=13
F (Expansion)				n=13

For Task 3 ‘Development Test’, the participants were asked to create two symbols with their own idea to represent the 4D Printing shape-changing behaviour. With 14 participants participating in the study, generating 22 symbols per participant, a total of 308 icons were created. For this task, there was no restriction on the number of strokes, orientation or sketching style used to represent the 4D Printing shape-changing behaviour. However, the

symbols had to be drawn in black and white and had to be sketched within the boxes that were provided. This ensured consistency across all participants and the space given within the box ensured that the icons created could be seen when shown within a tight constraint. The results indicated that there were significant similarities among engineering participants where they usually included a known symbol that represented the angle, or force, etc. Conversely, most designers only used arrows and shading to define the features, especially in the 'topographical change' shape-changing behaviour. In order to completely analyze the 308 symbols generated, we observed and scrutinized every single symbol, and made 3 distinct observations for each symbol as summarized in Table 3.

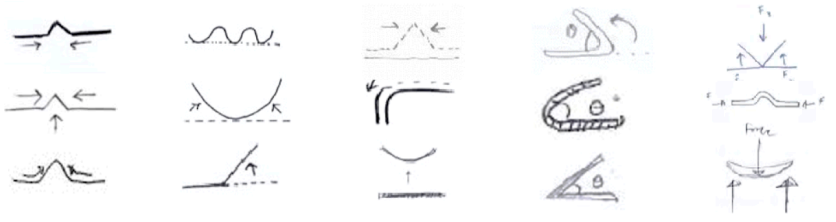
Table 3. Task 3 required participant to create two icons based on their own idea.

4D Printing Shape-change behaviour	Observations
Folding	1. Arrow to indicate direction and folding sequence.
	2. Symbol for view angle.
	3. Dash line to indicate axis of folding.
	4. Preferred 1D or 2D shape to indicate folding symbol.
Bending	1. Symbol 'F' to indicate force.
	2. 'G' indicate as Gear in bending machine.
	3. More than one arrow to indicate direction
Rolling	1. Curve arrows to indicate roll direction
	2. 3D shape to represent rolling shape.
	3. Rolling dash line.
Helixing	1. Used double line to indicate helix shape.
	2. Cross line and dash line.
	3. Curve arrows to indicate movement.
Twisting	1. Arrows circle around symbol to indicate twist
	2. 3D shape to represent twisting.
	3. Curve up and down arrows to indicate twist movement.
Waving	1. Wiggly line represent wave shape.
	2. Shadings to differentiate changes shape.

	3. Arrows to indicate wave movement.
Curling	1. Single curling line.
	2. Thick curl line represent 3D curl shape.
	3. Arrows to indicate curling movement.
Curving	1. Show two views represent shape changes.
	2. Dash semi curve line above straight line to indicate curving shape.
	3. Semi curve 3D shape.
Topographical change	1. Some of participant indicate differentiate movement with colour.
	2. Shading differentiate different surface
	3. Dash line differentiate different surface and movement.
Buckling	1. Two arrows facing each other to indicate force.
	2. 'F' symbol to indicate force.
	3. Sharp edge to indicate high compressive stress.
Expansions	1. Four or more arrows in every corner.
	2. Two different size of box to indicate expansion.
	3. Different size of circle to indicate changes of size.

3.1 Discussion of observations

From the observation of task 3 and task 2, there is some mismatch found between participant's sketches and rated symbols proposed by the researcher indicating shape-change behaviours. For example, most participants used arrows, angles, and sequences of folding either in 1D or 2D shape to indicate folding symbol as presented in Table 3. However, in task 2, the highest agreement received for the agreeable symbol was in 2D shape and did not show any angles and arrows, as shown in Table2. Therefore, from this observation, the researcher can conclude that it is easier for the participants understanding a 2D shape symbol including arrows and angles to represent a shape-change behaviour of 4D Printing.



Task 2 - The highest agreements received for any symbol which was in 3D shape and did not show any angles and arrows.

Task 3 - Most participants used arrows, angle and line either in 1D or 2D shape to indicate 4DP Shapeshift behaviour.

Figure 5. Some of symbols proposed by researcher indicating 4D Printing Shape-changes behaviour..

From the observation of task 3 and task 2, there is some mismatch found between participant's sketches and rated symbols proposed by the researcher indicating shape-change behaviours. For example, most participants used arrows, angles, and sequences of folding either in 1D or 2D shape to indicate folding symbol as presented in Table 3. However, in task 2, the highest agreement received for the agreeable symbol was in 2D shape and did not show any angles and arrows, as shown in Table2. Therefore, from this observation, the researcher can conclude that it is easier for the participants understanding a 2D shape symbol including arrows and angles to represent a shape-change behaviour of 4D Printing.

4. Conclusions and Future Work

Sketching facilitates the communication of ideas in the early stages of the design process. There are very few established methods available to communicate the shape-changing behaviour of 4D Printing. Our study has found that the use of icons to represent 4D Printing shape-changing behaviours could potentially help product designers and manufacturing engineers apply proper representations to communicate with each other during the design stage. For future work, we will develop a more thorough framework by applying the symbols in Table2 into the actual design process and observe the communication when designing 4D Printed parts.

5. Appendix. Responses from Task 3

PARTICIPANTS	SHAPE - CHANGES BEHAVIOR										
	Folding	Bending	Rolling	Helixing	Twisting	Waving	Curling	Curving	Topographical change	Buckling	Expansion
P1											
P2											
P3											
P4											
P5											
P6											
P7											

PARTICIPANTS	SHAPE - CHANGES BEHAVIOR										
	Folding	Bending	Rolling	Helixing	Twisting	Waving	Curling	Curving	Topographical change	Buckling	Expansion
P8											
P9											
P10											
P11											
P12											
P13											
P14											

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Biotextiles applied to everyday objects.

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Abstract | Our daily life is surrounded by materials, but we are not necessarily aware of them. However, their importance in human society is undeniable at many levels. This paper views materials as objects of dialogue which can move us towards a sustainable consumer culture and evaluates present alternatives based on the fourth industrial revolution. The paper focuses on practice-led research by a transdisciplinary group of designers and engineers, using agroindustry waste to bio-fabricate prototypes of everyday life objects. Several mechanical characterization methods have been applied to test permeability, flexibility, strength and absorption. The results have revealed both functional and aesthetic possibilities. Lastly, the paper concludes with a road map that analyses bio fabrication and circular economy alternatives in South America, to illustrate my vision that through plausible collective actions and policy change scenarios we can design new consumer choices.

KEYWORDS | WASTE REMEDIATION, BIOMATERIALS, CIRCULAR ECONOMY, EVERYDAY OBJECTS, BIOTEXTILES

1. Introduction

Materials are a fundamental part of our culture, but we are often disconnected and ignorant as to where they come from and how they are manufactured. Materials are part of a continuous, often disposable, behaviour network: we allow ourselves to buy, use and discard them. Materials are political, as their production and manufacture at low cost allows citizens to buy more and discard easily. This behaviour is not compatible with the actual earth we live in. There is an urgent need to develop sustainable strategies, rethink mass consumption, and plan according to real future scenarios throughout the entire supply chain. It's necessary to talk about materials' political agenda to support sustainable innovations and embrace brands to commit to move towards zero discharge of toxic chemicals in various industries. We are focused on addressing the fast fashion industry, as its one of the major polluting agents due to its vast overproduction of fashion items, the use of synthetic fibers, agricultural pollution, massive freshwater and ocean water pollution and soil degradation. This is a heated topic of discussion regarding global warming goals, even though there hasn't been any real action towards harder policies that lower industries' emissions within its full supply chain. These policies could include the creation of incentives to support new alternatives at a large scale to reduce petroleum as a main resource, or alternatives to cotton to decrease water consumption and electricity. Using natural dyes would reduce water pollution, acting local would decrease transportation. The consumer is also responsible for this impact and there is no sign that we want to change our consumption habits. Therefore, it's important to create competitive consumer choices by designing systems that economically support sustainable brands. The One of 17 SDG goals set in 2015 by the United Nations under the 'sustainable consumption and production patterns' goals, is to educate consumers on sustainable consumption and lifestyles, providing them with adequate information through standards and labels and engaging in sustainable public procurement, among others (UN, 2015). After 5 years trying to reach this goal, it doesn't seem like they will hit their mark by 2030.

On the other hand, sustainable material alternatives are increasingly being explored. We are living in the fourth industrial revolution. The first and second industrial revolutions harnessed water, steam, and electric power, challenging the traditional system of craft-based production. The third industrial revolution harnessed information technology and data analysis, giving birth to the fast fashion movement. The fourth industrial revolution is based on innovations across the physical, digital, and biological worlds, driving a new wave of change across the economy (Abnett, 2016).

Communities of makers, biohackers, designers, engineers, biologists, architects, and artists have risen up working collaboratively, with raw materials, observing nature and taking inspiration from ancestral wisdom and new technologies. Today, we can control the growth of microorganisms, fractionate matter, or purify ultra-cellular structures that by themselves have very interesting physiochemical characteristics (Carvajal, 2011). Furthermore, the textile industry innovation such as "Functional Fashion, E-Textiles, Smart Fabric, Smart

Clothing – is slated to be worth $3 billion by 2018 or $9 billion by 2024" (Suikkanen, 2019, p. 2). Moreover, initiatives to reduce the environmental impact of fabric manufacturing will likely increase those numbers even further. These practices also have a huge potential in fields such as packaging, fashion, architecture, and medicine, among others.

> "Although many of these new textile innovations are still at the early development stage, the sportswear and fashion industry is embracing the use of bio-based textiles and designers are beginning to challenge themselves to create entirely bio-based products" (Prahl, 2018).

As a result, a lot of research is being devoted into dyeing and chemical processing of biopolymers of value as textiles. Although not every biomaterial is able to become a fiber, there is plenty of research on plausible applications for the future. Thus, these techniques do not yet seek industrialization but alternative applications based on raw materials.

> "Brands are expected to announce partnerships with businesses that have figured out ways to make leather without cows, silk without worms, fur without animals and fabrics from recycled waste. Salvatore Ferragamo has been selling scarves made of orange fibers while Stella McCartney produced outfits made with vegan spider inspired silk for Adidas since 2017." (Wendlandt, 2017)

A more unusual waste stream is cow manure, as explored by Dutch designer and entrepreneur Jalila Essaïdi through her start-up Mestic. They developed technology to deconstruct manure and convert the cellulose into biomaterials including bioplastic, biopaper and bio textiles; "demonstrating that the most disgusting matter is inherently beautiful" (Essaïdi, 2017).

> "In addition to creating a fully biodegradable textile, this process helps reduce the production of harmful methane gas and can prevent the contamination of soil and water caused by intensive farming"(Prahl, 2018).

Although scaling these new innovations for industrial applications is a possibility, most of these initiatives have not come from big companies but from artists, architects, designers with limited capital, driven by material innovation in a holistic way. These initiatives have triggered a material revolution demonstrating how bio fabrication plays an important role in shaping the future. Neri Oxman, Associate Professor of Media Arts and Sciences at the MIT Media Lab, focuses her research on "the relationship between the built, natural, and biological environments" (MIT, 2019). She employs design principles inspired and engineered by nature, such as the famous Silk Pavilion installation in 2013, built at an architectural scale through biological fabrication. Another example is the Pavilion grown from mycelium made entirely from bio-based materials as a pop-up performance space at Dutch Design Week 2019 by designer and artist Pascal Leboucq in collaboration with Erik Klarenbeek's studio Krown Design. Mycelium has the potential to compete with plastics. They are naturally fire-retardant without need of using any chemicals, naturally hydrophobic and resist higher melting temperatures than plastics. Moreover, mycelium is compostable. (Lee, 2019)

In our process, we focus on local available materials as starting point to reimagine possible futures where new users and assemblages emerge. We ask ourselves, what if materials are engineered by citizens at home? What if these designs are made for communities living in remote areas? What if textiles are grown locally? How can bio-design contribute to a circular economy? How can we create alternatives that respond to future environmental threats? These questions trigger our designs, situating ourselves in different environmental conditions in the present and reimagining human-nature interaction.

2. Materials and Methods

The present work has been carried out by an interdisciplinary team comprised of designers and chemical, and materials engineering, using local agroindustry waste to create starch - based bio textiles. Our making process began by scaling up biomaterial Petri dish samples to a large-scale frame of one by one meter. Through practice-led research methods, we iterate through prototyping to apply functional and aesthetic solutions to materials. We focus on properties such as elasticity, permeability, flexibility, and most importantly, biodegradability - to produce creative design solutions applied to everyday objects. Moreover, workshops and conferences have been held to engage the community with the importance of rethinking material alternatives outside the laboratory.

2.1 The raw materials used in the process:

Table 1. Quantities used from cassava starch-based formula

Component	Working composition
Cassava Starch	5% w/v
Glycerin	2% w/v
Poly vinyl alcohol (PVA)	5% w/v

To prepare the base material, the compositions specified in Table 1 were used. Cassava starch was suspended in distilled water, and gelatinized at 80oC for 1h, under constant stirring. At the same time, PVA was dissolved in distilled water at 60oC. Both solutions, along with the glycerin, were mixed in an industrial blender and casted onto 1x1m molds, to me later dried in an industrial oven at 50oC.

We made physical and chemical material characterisation tests to determine its properties. We analysed its water absorption capacities with swelling tests in water. Its p morphology was assessed through Scanning Electron Microscopy (SEM). Its absorption was tested through measuring the contact angle of the biomaterial. The analysis of its mechanical properties was done through tensile strength tests and elongation at breakage.

2.2 Applying prototyping techniques to the biomaterial

The bioplastic based on cassava starch, PVA and glycerine formulation has been tested through practice-led research prototypes using techniques to form it in different ways such as sewing machine, laser cutting and thermoforming.

When sewing, a thickness between 1 to 2mm is best. When the material is less than 1mm, it becomes too thin and sticks to itself, behaving more like a plastic film. When the material is over 2mm, it becomes too thick and is difficult to manage, even with an industrial sewing machine.

When using the laser cutting machine cutting at thicknesses between 0.1mm to 2mm were successful. An aspect to consider with this fabrication method is that if there is too much detail on the design, the bioplastic tends to burn during the cut. Another aspect to consider is that if there is too much detail to cut, the bioplastic loses its stability. Its joints are assembled by joinery, defining connections between part edges in the assembly designed for laser cut. Other assembly biomaterial options are to glue pieces with water, or by a sewing machine.

Thermoforming works best with homogeneous materials. As not all these films are 100% homogeneous, when thermoforming some areas break more easily than others. While working with mostly homogeneous biomaterial with 1mm or more of thickness, the material thermoforms at 167°C with positive results.



Figure 1. Sewing prototyping technique.



Figure 2. First prototypes using laser cutting technique.



Figure 3. Material glued with water prototyping technique.



Figure 4. Thermoforming prototyping technique.

2.3 Workshops

One way in which we are rethinking material alternatives is through holding events such as workshops, talks and conferences. It allows professionals, academia and other practitioners from many fields to hold a joint dialogue about how materials and objects are managed in the present, and the need to be co-create new alternatives. Creating the spaces of conversation engages the community with material matters, even if some are in a still distant future or very hypothetical scenarios. Most of all, it opens up spaces for this work to take place outside laboratories, giving people confidence to engage hands-on with biomaterials, and understanding how to produce their own resources with waste.



Figure 5. Open workshop to learn bio fabrication from local raw materials.

3. Results

The process of reimagining plausible future scenarios through bio-materials raises more questions than answers. The agency of materials sets new interaction possibilities with waste and the way we buy and consume 'stuff'. The prototypes we create are not inspired by dystopian scenarios but by possible interactions within an uncertain future. Some examples are 100% biodegradable edible objects, garments that deliver data or work as probiotics for our body. They include garments that double as 'seed carriers' in case of nomadic emergencies, and materials that are entirely engineered and composted at home. These are only a few of the possibilities in reimagining material processes, manufacturing, use and adaptation to natural surroundings and potential future environmental threats.

3.1 Characterization methods

The results from characterization methods showed a high level of swelling the first 30 minutes, but then it loses its stability. As for its water absorption, the result shows little hydrophobic capacity. On the other side, its elongation test showed the bio plastic is able to expand to twice its original size. Furthermore, the film shows different breakage stress values due to its non-homogeneous result. Finally, it is shown through its degree of swelling

and absorption that the film is not as stable in an aqueous medium, thus natural fibres can be added to the formulation to improve this characteristic.

3.2 First tests

At first, we carried out research tests with different foods from which starch could be extracted such as sweet potato and cassava. After selecting the best Petri Dish samples, we tried to scale them to 33x25cm trays. After a few iterations varying the mixtures and the starch extraction base, we were successful with cassava starch. We began to perform more tests only with cassava but varying percentages of glycerine, starch and PVA. After a few tests we could obtain bioplastic variations. The tests showed the resulting material can be as flexible as a plastic bag, others more resistant as semi-rigid packaging, and in other cases have a more leather-like appearance. Furthermore, we tried shaking the mix before drying, obtaining a foamy appearance on the film. We also started to test with natural dyes. We used cochineal dye found in Andean local communities, where a very small quantity adds strong colours to the film. We mixed the cochineal dye with cream of tartar and water, adjusting the amounts to test colour intensity and water variations.

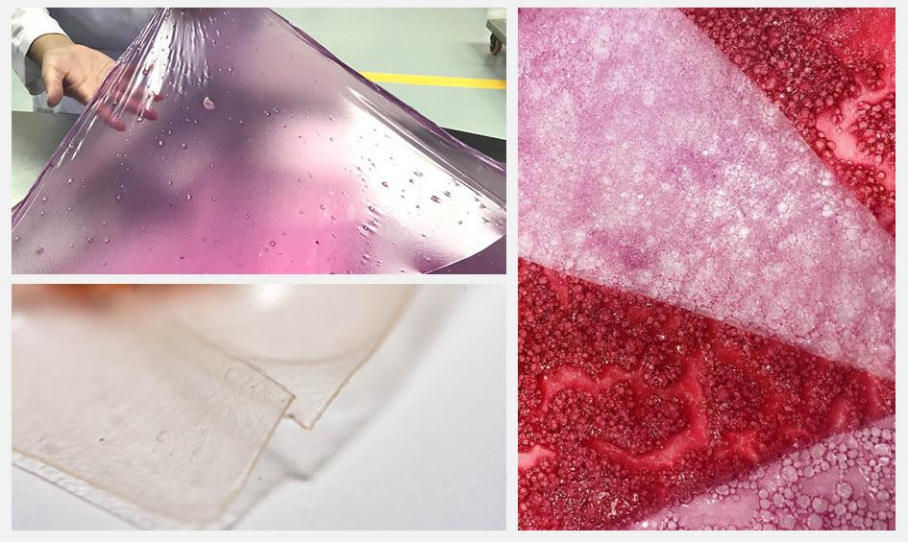

Figure 6. Cassava starch tests showed the resulting material can be flexible as a plastic bag (a); if using more amount of material have a more leather-like appearance (b); or if shaking the mix before drying a foamy appearance is obtained (c).



Figure 7. Color tests using cochineal dye found in Andean local communities.

Once we had a homogeneous result on the 33x25cm trays, we were able to scale the formula to a cassava starch film of 1x1 meter. The scaled films still present some degree of inhomogeneity but they have been improved through iteration that allowed us to start making real-scale prototypes. We went through an experimental process adding different dyes such as *juglans neotropica*, moringa, rose stem, and others. Also, we applied different densities to the trays to try various thicknesses.

Meanwhile, we also started carrying out tests with orange peels by extracting pectin. These materials haven't been characterised nor have mechanical tests been done, but we are continuing research through prototyping to understand its potential applications.



Figure 8. First test on 1x1 meter cassava starch film.

3.3 Bio materials applied to everyday objects

Biodegradable packaging is one of the potential applications for bioplastics, as we continue to phase out single-use plastic and paper bags from our lives. Our culture is moving slowly but contagiously into a conscious mindset that 'things' do not go away after throwing them away. Technologically we are already there on bio-based alternatives such as starch, wheat, banana, mycelium, or chitin; but our culture needs to catch up to demand competitive changes in the industry. This biopolymer based disposable packaging made from waste can also be produced and disposed of in environmentally sustainable ways. "They represent a possible shift away from plastics that can help detach humans from our reliance on fossil fuels" (Kandelin, 2019).

What if biomaterials are able to preserve food fresh longer, change color according to food freshness, be eaten, planted, composted or even add flavour to food?



Figure 9. Cassava starch bag.



Figure 10. Cassava starch film.



Figure 11. Pectin based fruit packaging.



Figure 12. Cassava starch popcorn packaging



Figure 13. Cassava starch hotdog packaging.



Figure 14. Cassava starch French fries based on McDonald's packaging.

The fashion industry is slowly changing but mass consumption still needs to catch up. “An estimated 50 million tons of clothing are discarded every year, and most of it will not biodegrade in a landfill” (Farra, 2019). What relationships should be built with consumers and clothes in order to add sustainable values to what we wear? These prototypes are inspired by this question: garments that give us data about our environment, edible clothes with added vitamins, multifunctional dresses, and ‘seed carrier’ garments. All of these prototypes reimagine the way we make our clothes: grown locally, made from agro-waste, or fabricated in local centers with open source designs that can be downloaded anywhere, and finally, eaten or composted at home.



Figure 15. This cassava starch swimsuit represents plastic garbage islands in the sea. The data represents 2018 patch between Central America and Europe (Law, 2019).



Figure 16. Cassava starch gloves offering sking benefits such as hydration, removes scars and spots.



Figure 17. Cassava starch with native seeds, serving as a seed carrier textile in case of emergencies were communities have to move more nomadically in a plausible future.

Each year, “more than 640,000 tonnes of nets, lines, pots and traps used in commercial fishing are dumped and discarded in the sea every year” (Laville, 2019). No matter how deep scuba divers search, fishing nets are found in the sea all over the South American coasts. These prototypes are based on objects that are able to be discarded and biodegrade gradually. For this reason, pectin-based bio textiles have been used for fishing nets, which resist water longer. Other accessories such as a hammock suggest crafted objects to be used while travelling, made from waste.



Figure 18. Pectin-based fishing net.

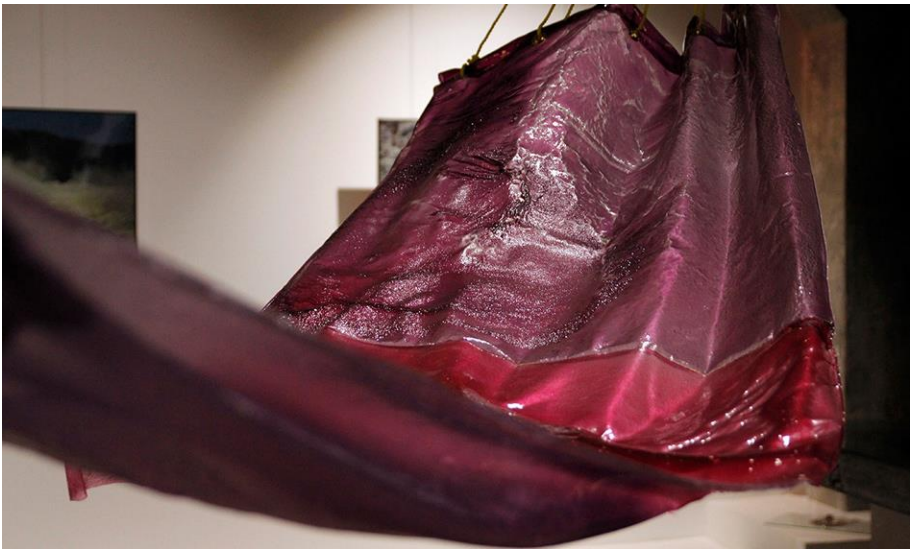

Figure 19. Cassava starch hammock.

4. Conclusion

Bioplastics formulations presented in this paper show their exciting potential to be applied to everyday objects. However, it is necessary for our society to better understand the potential of these nature-based technologies, and to change behaviors and practices prioritising renewable life, standardized new systems and healthier interactions between us and our planet. The system that we live in today is not sustainable for the earth. We need to create models where humans imitate nature, changing our urban metabolism into circular relations with materials and energy within healthier cities.

> "The ways in which goods, water, commuters, or food move through the urban ecosystem determines a city's health and sustainability within larger regional and global natural systems". (Eberlein, 2018)

Thus, the materials revolution can contribute to a more circular economy "based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems" (Macarthur, 2017).

The collaboration between academia and business will accelerate research to be applied to mass production. While our practice-led research inside academia is to create plausible applications, the industry can invest according to its interests, migrating its supply chain into sustainable solutions. According to CGS studies, "more that 50% of generation Z are willing

to pay more for a sustainable product" (CGS, 2019). It will not only be about market incentives for greener products but also that consumers finally demand it worldwide.

Collaboration between disciplines is essential to develop a design and science-based approach, able to embrace complex systems and simplify them through fresh perspectives and navigating ambiguity. It allows the problem to speak through interdisciplinarity, facilitating understanding and making information more digestible. Furthermore, research through design facilitates spaces of dialogue that provide agency to materials through diverse scenarios. When the public can visualize a potential reality, they are more able to embrace innovation and engage with conversations that cross science, art, politics, geography and biology. While all these disciplines seek sustainable futures, design uniquely contributes to research through product, services and experiences that imagine sustainable concepts for multiple audiences.

So, where is all this going? After analysing increasing alternatives within bio fabrication, I created a future road map based on this materials revolution. The aim of the roadmap is to describe the path from the present state towards a future vision providing a summary of various factors on different levels at a glance (Itälä et al, 2015). Throughout this roadmap, I analyse the present of bio fabrication and circular fashion alternatives in South America. Then I draw my vision based on plausible collective actions and policy change scenarios that design a version of new consumer choices.

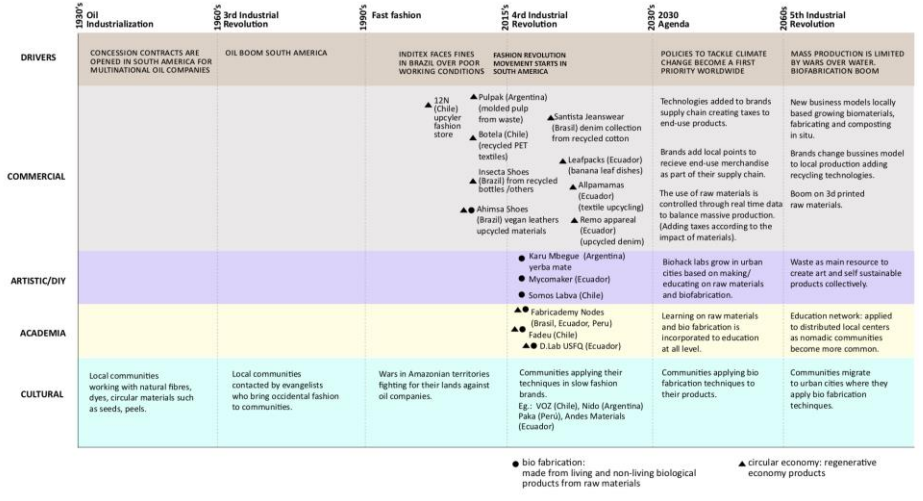

Figure 20. Road Map.

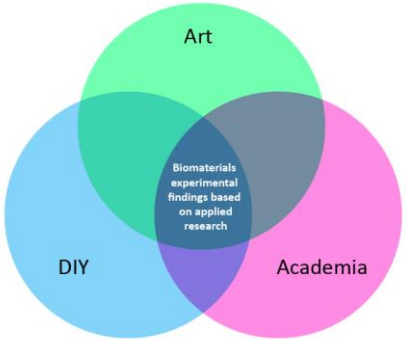

Figure 21. Experimental findings are seen through an interdisciplinary approach. Biohacker spaces, Fab Labs or bio laboratories are DIY labs usually collaborating with different fields of academia. Some are oriented to product development and use art as a medium to present plausible applications; others use biomaterials as a medium to make art.

The zeitgeist from the present is uncertainty about the future. Today's generations feel responsibility to act game changers due to world's climate change. Technology might solve climate emergencies, but there is an urgent need to awake from comfort, to act with awareness as individuals and mostly, to act collectively for a social transformation that drive positive changes forward.

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Acknowledgements: Thanks to Universidad San Francisco de Quito for its constant support to interdisciplinary and applied research. Thanks to Anastasia Pistofidou for sharing her knowledge widely.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Claudio Alcorso and Post-war Textile Culture

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Abstract | This investigation of textile entrepreneur Claudio Alcorso (1913-2000) provides new insights into the agency of the Italian design diaspora on global connections in the textile industry of the late twentieth century. The Alcorso family's Jewish ancestry triggered the expropriation of their textile businesses in Rome by the Fascist regime in 1939. Desiring a move far from imminent war, they established Silk & Textile Printers Ltd (STP) in Sydney, producing silk and rayon fabrics using the then cutting-edge technology of screen printing. The business expanded, establishing networks with global textile producers, eventually becoming the largest textile printing operation in the southern hemisphere. The Alcorso's business networks included Carrington & Dewhurst, Courtaulds and Sekers' in Britain, Cohn-Hall-Marx (Cohama) in the USA and Toray and Teijin in Japan. Global connections enabled diffusion of innovative strategies that facilitated development of differentiated products to stimulate consumer demand in the face of increased competition.

KEYWORDS | DESIGN, CULTURE, MANUFACTURING, TEXTILES, GLOBALISATION

1. Introduction

The influence of the European diaspora on art, design and culture in the post-war era has been examined in fields ranging from photography to architecture. However, these investigations have yet to uncover the true extent to which Italian émigrés influenced the global diffusion and democratization of dress and textiles. This paper argues the importance of Italian-born Claudio Alcorso (1913-2000) in the manufacture of artist-designed textiles for fashion and furnishing for Australian and international markets, from 1945 to 1970.

2. The Piperno-Alcorso family in Italy

The Piperno family was well known in Italian textile circles, owning two departments stores and a factory in Rome (Italian Jewish Goods Commission, 2001). Patriarch Amilcare Piperno (1886-1961) served as government comptroller of woollens during World War I, receiving the Knight Commander of the Royal Order of the Crown of Italy in recognition for his service (Draper of Australasia, 1961). Amilcare later diversified his business into fancy silks, opening 'Amilcare Piperno Al Corso' at 172 Corso Umberto I in 1929 (Lupano & Vaccari, 2009). The store specialised in printed silk fabrics, catering to the sartorial needs of the Italian aristocracy, as well as fashionable patricians who had their clothing made to measure. A second store opened at 53 Piazza Fiume in 1937. It was a testament to modernity after extensive renovations by modernist architect Melchiorre Bega (1898-1976), who designed a sinuous interior staircase mimicking the swathes of fabric in the store windows (Università Roma, 2017; Behance Gallery n.d.). The interior featured Bega's sleek, modern timber and glass cabinetry, used to display bolts of fabrics and all the trimmings required to produce the latest fashions for the stores' clients (Villani, 1938).

A catalogue celebrating the second store's opening was designed by another modernist, Futurist artist and aviator Olga Biglieri Scurto (1913-2002), who worked under the pseudonym 'Barbara' (Ministero Per I Bene e Le Attivita Culturali, 2011). The cover showed a map of Rome from the air, marking the locations of Piperno Al Corso as an integral part of the eternal city, alongside historic sites including Hadrian's Column, the Colosseum and the Victor Emmanuel Monument (Piperno Alcorso, 1937). Costume designer and fashion authority Mario Vigolo (n.d.) was retailed to design illustrations interpreting the latest Paris fashions in fabrications sold by the store (Lupano & Vacari, 2009). The business eventually came to define the family, who changed their family name to 'Alcorso' in the 1920s.

Apart from the stores and factory at 24 Via de Campo Marzio, Amilcare had interests in several Roman properties (Camerano, 2004). He held shares in the De Angeli Frua silk mill, and had financial connections to Abraham, Brauchbar et Cie, a Swiss textile business that owned a printing factory in Lyon (National Archives of Australia, 1940-1954). Amilcare's sons Claudio and Orlando had known Vittorio and Bruno Mussolini, the sons of the Italian dictator, since high school. Orlando attended classes with Vittorio, while Claudio had completed his compulsory national service in the Italian air force with Bruno (National Archives of Australia, 1940-1954). It was the Mussolini family that warned the Alcorsos of

their denouncement as Jewish descendants, and the imminent confiscation of their businesses (Alcorso C., 2016). The Alcorsos quickly began liquidating whatever assets they could to raise funds for their escape from Italy.

It was one of Amilcare's contacts, a manager at Abraham & Brauchbar in Zurich who introduced him to Alfred Gugenheim of St Gall, a provedore who smuggled the equivalent of £60,000 across the border into Switzerland in his fruit trucks (National Archives of Australia, 1940-1954). Claudio had driven to London earlier with his father's assistant Paolo Sonnino, ostensibly to take a course at the London School of Economics. Orlando, who was studying languages in Switzerland, was soon joined by his parents, who brought other valuables that they soon liquidated, lodging their escape funds in a Swiss bank account (National Archives of Australia, 1940-1954). After fleeing from Italy, the family's business interests were overseen by a Mr Storoni, a possible member of "Society Tacoel", a consortium of former employees, who bought the businesses after their expropriation buy the Fascists (National Archives of Australia, 1940-1954; Italian Jewish Goods Commission, 2001).

The Alcorso family reunited in London, and began investigating options to establish a business as far away as possible from the coming European conflict. After researching opportunities in several countries, they decided on Australia. Their research revealed that it had the highest per-capita consumption of printed fabrics and few textile printing factories. The family decided that it would be the perfect location for a screen-printing factory producing silk and rayon dress materials (Alcorso C., The Wind You Say, 1993).

3. Silk & Textile Printers (STP) Australia

Arriving in Sydney in early 1939, Claudio, Orlando and Paolo Sonnino established a textile agency they called FISMA (France, Italian, Swiss, Manufacturers, Australia) using sample swatches they had brought from European print houses. Australian department stores, draperies and fashion manufacturers welcomed the Italians, who brought sophisticated designs that added variety to the ranges of more conventional prints that they bought through their British suppliers (Alcorso C., The Wind You Say, 1993).

Gilkes Brothers & Hoskins Ltd were the only Sydney-based producer of screen-printed fabrics at the time (Lech, 2005). The market depended on imported prints, mostly from Britain. Cheaper prints came from Japan, and were relatively inexpensive due to a low exchange rate (The Textile Journal of Australia, 1934). The indent orders brokered through FISMA helped the family to establish client relationships and assess local taste and buying patterns whilst they built their printing factory. By early 1940, Silk & Textile Printers Ltd (STP) was operational, staffed by technicians and designers trained at East Sydney Technical College, who were ready to develop original textile designs along similar lines to FISMA's European best-sellers (Alcorso C., The Wind You Say, 1993).

However, World War II interrupted the Alcorso's plans. Claudio and Orlando's friendship with the Mussolinis became known first to the Australian press and then to the military authorities, who arrested and interned them and Paolo Sonnino as enemy aliens in early 1940 (Alcorso C., The Wind You Say, 1993). Amilcare Alcorso and his wife Delia had by then

embarked on a ship bound for New York. Their Australian re-entry visas were revoked, and despite lobbying the Australian government, they found themselves stranded in New York. Amilcare set up an office in the Rockefeller Center, managing his Australian business through correspondence with Eric Hearnshaw, an accountant employed at STP (National Archives of Australia, 1940-1954).

Production at STP was co-opted by the Australian military authorities to print camouflage fabrics for the war effort, but there was some printing of fashion and furnishing fabrics on a restricted range of base cloths. Three young women artists employed in the design studio – Avis Higgs (1918-2016), Mary Curtis (n.d.) and Betty Skowronski (n.d.), managed the design of fashion fabrics, producing a series of monotone prints that sold quickly to retailers and manufacturers eager to obtain any stock due to wartime shortages. Higgs, Curtis and Skowronski engaged with the local artistic community, taking lessons from Hungarian émigré artist Desiderius Orban (1884-1986). Higgs joined the NSW Society of Artists, led by publisher and artist Sydney Ure Smith, exhibiting in their annual exhibitions. Hearnshaw saw the positive impact of Orban's art lessons on STP's output, agreeing that he could provide art lessons for the entire design team (Lloyd-Jenkins, 2000).

Herbert Read's *Art and Industry* was a major influence on manufacturing at the time. Read's position was that artists were well placed to provide integrated design solutions for industrial purposes, rather than applying pattern to utilitarian products as an afterthought (Read, 1966). His ideas were readily adopted at STP, who launched their collections from 1943 to 1946 under the title 'Art in Industry'. Fabrics were exhibited next to the original artwork for each design, at major hotels and art galleries in Sydney and Melbourne. Product launches attracted glowing editorials in newspapers and women's magazines, often illustrated with photographs of the attractive Higgs, Curtis and Skowronski standing next to their designs (Lloyd-Jenkins, 2000).

Claudio and Paolo Sonnino were finally released from internment when Italy surrendered to the Allies in 1943. Paolo immediately joined the Air Force, whilst Claudio took some time to recover from his internment with Nazis and Fascists whose politics he abhorred. Orlando, whose friendship with the Mussolinis was closer, was not released until sometime later. Hearnshaw continued to operate STP on a day to day basis, reporting frequently to Amilcare in New York. He also acted as Amilcare's agent, brokering the purchase of textiles by Australian wholesalers on behalf of the General Overseas Corporation (Textile Division), the American company with which Amilcare was now affiliated (National Archives of Australia, 1940-1954).

4. Modernage

By 1944 Claudio Alcorso was back at STP as Managing Director, and business was brisk. He endorsed the design direction initiated by his designers and the art lessons delivered by Orban. The Australian government had released stocks of Italian rayon fabrics impounded at the beginning of the war, providing badly needed materials for fashion prints. STP developed a new shrink-resistant, fine wool fabric that they called "Peau d'Ange" (Angel's Skin), with a

view to establishing an export market for printed Australian woollens (Lloyd-Jenkins 2001). The designers created striking prints illustrating the potential of the new cloth to buyers in the USA, South Africa and India (National Archives of Australia, 1940-1954).

The family received good news in May 1945 from Mr Storoni in Italy, advising that ownership of Piperno Al Corso had been restored (National Archives of Australia, 1940-1954). Though little evidence remains about their post-war operations, it is likely that the stores remained under family control. Both were still trading under the Piperno Al Corso name during the Autumn-Winter 1949-50 season, and Amilcare and other members of the Alcorso family travelled often to Italy after the war (Piperno Alcorso, 1949; The Mercury, 1952). Meanwhile, Claudio and Orlando continued to manage STP with support from Paolo Sonnino and Eric Hearnshaw.

In the early post-war period a number of textile producers including Ascher in London and Wesley Simpson in the USA began producing collections of textile prints designed by prominent visual artists (Rayner et al, 2012). In March 1946 costume designer Matilda Etches (1898-1974) brought a collection of Ascher textile prints by artists including Cecil Beaton (1904-1980), Feliks Topolski (1907-1989) and Henry Moore (1898-1986) to Australia to great public acclaim. This direct manifestation of Read's thesis on the importance of art in industry inspired Alcorso to commission his first collection of prints designed by prominent Australian painters.

Alcorso approached Sydney Ure Smith to provide introductions to the members of the NSW Society of Artists. Many eagerly agreed to provide designs. Alcorso provided no design brief, preferring that artists draw from their own artistic idiom – original designs could easily be adapted into repeats by STP's technical staff. Rather than buying the designs outright as was the norm, Alcorso offered a royalty of 2 shillings for every yard sold, a potential future revenue stream that proved attractive. STP tested a limited number of the artist's designs in their 1946 'Art in Industry' collection. Designs by Russell Drysdale (1912-1981), William Dobell (1899-1970), Margaret Preston (1875-1963), James Gleeson (1915-2008) and Donald Friend (1915-1989) were shown to an enthusiastic trade and public audience at exhibitions opening at the Hotel Australia in Sydney and the Sedon Galleries in Melbourne in September 1946 (Museum of Applied Arts & Sciences, 2000).



Figure 1: Russell Drysdale for STP, "Stone and Wood" 1947, screen-printed cotton. Approx. 99 x 95cm, Author's Photograph, National Gallery of Victoria, Melbourne, December 2018.

Department store David Jones, owned by Charles Lloyd-Jones, an amateur painter and member of the NSW Society of Artists, bought heavily from the collection, which was expanded in 1947 and given the title 'Modernage'. Modernage comprised of 46 prints by Australian artists and the design team at STP. As part of a desire to create a national design style, some artists misguidedly translated Aboriginal motifs for their designs, ignorant of their symbolism and of the distress that their cultural appropriation caused to First Nation artists. At the time, Aboriginal people did not hold citizenship, and were regarded as 'protected species', not unlike Australia's distinctive flora and fauna – a resource to be exploited for commercial gain.

Modernage was heavily promoted in women's magazines and the metropolitan and regional press. In June 1947 the Australian Trade Commission launched a textile exhibition including Modernage at the Australian Trade Display Centre in the Rockefeller Center, New York. "Peau d'Ange" woollens were well received, with the fashion writer of the New York Herald Tribune devoting half her column to praise for the sheer, woollen fabric (The Textile Journal of Australia, 1948). Modernage was also used to promote modern Australian design on ocean liners travelling between Britain and Australia. The RMS Orcades and RMS Orontes, built by the Orient Line in 1947 and 1948 respectively, incorporated several Modernage

designs in decorating schemes designed by New Zealand architect Brian O'Rorke. One of these was "Pearl Divers", (Figure 2) designed by Donald Friend (The Textile Journal of Australia, 1949).



Figure 2: Donald Friend for STP, "Pearl Divers", 1947, Screen-printed cotton. Approx. 96 x 89cm. Author's photograph, National Gallery of Victoria, Melbourne, September 2012.

Alcorso positioned Modernage at the top end of the market. A premium price was charged in line with its association with fine art, and high consumer demand due to post-war textile shortages (The Draper of Australasia, 1947). 36-inch-wide cottons were priced at 17/4 shillings per yard, whilst competitor's fabrics were priced at 13/8 per yard for 48-inch width (The Australian Home Beautiful, 1947). Whilst the collection was supported by glowing editorial and advertising, sales were only moderate, and there were few repeat orders. Alcorso believed that the modernist designs may have been too visually challenging for most Australian consumers (Alcorso C., The Wind You Say, 1993). The best-selling design was "Foliage" by Adrian Feint (Figure 3), a traditional design that presaged STP's subsequent return to more commercial floral prints. It was felt that the majority of Australians were not culturally equipped to comprehend modernist design. As Bourdieu (1999) observed, art appreciation and perception involves a "deciphering operation" that is dependent on the viewer's own understanding of aesthetics. This deciphering may not result in appreciation when…"one unconsciously applies the code which is good….for the deciphering of familiar objects to works in a foreign tradition". A mainstream consumer with little aesthetic training or exposure to modernist design might find designs like Drysdale's "Stone and Wood" (Figure 1) somewhat more challenging than a conventional floral. However, it is clear that overly optimistic expectations, combined with high prices and a limited range of narrow

width base-cloths also had a negative impact on sales.



Figure 3: Adrian Feint for STP, "Foliage" 1947, screen-printed cotton, approx. 52 x 90cm. Author's Photograph, National Gallery of Victoria, Melbourne, September 2012.

A positive outcome of Modernage was that it demonstrated STP's capability as textile printers. The factory was soon unable to keep up with orders, and new locations were sought to expand their production base. STP were offered a newly built, former munitions factory in Derwent Park, Tasmania, together with loans, concessions and incentives to relocate their business. Over the next two years STP relocated their entire printing operations from Sydney to Hobart. During the move, all of the screens and artwork for the Modernage collection were lost (Alcorso C., The Wind You Say, 1993).

5. The Leroy-Alcorso Signature Print textile competition

By 1951, STP had diversified into spinning and weaving in addition to printing around four million yards of textile piece-goods annually (The Textile Journal of Australia, 1951). New investments were made in technology, and the company enjoyed nearly a decade of continuous profits. Alcorso secured a loyal workforce from the suburbs surrounding Derwent Park, as well as skilled migrants arriving from the United Kingdom and Italy. He commissioned Australian architect Roy Grounds (1905-1981) to design purpose-built, three bedroom houses at the "Alcorso Village" at Moonah for sale to STP's workers through subsidised loans. These incentives, combined with excellent working conditions ensured that sick-days and accidents were minimised, supporting efficient production continuity (Edwards, 1958).

Alcorso had not forgotten the importance of a Australian artists in developing original prints. In 1953, he partnered with a major client, Melbourne fashion manufacturer The House of Leroy in the Leroy-Alcorso Signature Print Textile Design Competition. He hoped the competition would bring international recognition to Australian artists, as winning designs would not only be printed by STP for Australasia, but also licensed by the Cohn-Hall-Mark Company (Cohama) in the United States and the Berne Silk Manufacturing Company in Great Britain. Designers would be paid 2d commission on each yard sold, with a further prize of £100 awarded to the designer of the best-selling design the following year (The Australian Home Beautiful, 1954). Once again, this royalty-based model provided a cost effective way to commission artist-designed textiles without excessive risk to Leroy or STP, also providing artists with a suitable incentive.

Entries were received from over 750 amateur, student and professional artists, including many artists that had designed for Modernage. Douglas Annand (1903-1976), a Modernage veteran, won first prize of £300 for his design of torn pieces of monotone spotted paper set against a brightly coloured background (The Mercury, 1954, p. 5). The Leroy-Alcorso Signature Print competition ran for a second time in 1955. That year, there were two joint winners each receiving £150, both of whom were amateur artists. The reasons behind the competition's demise remain unclear. It may have been the victim of a changed relationship between STP and Leroy, or complexities associated with paying royalties to artists. Changes occurring in international textile markets may also have been a factor. Japan's textile industry was printing high-quality cotton fabrics at prices that could not be matched in Australia. Other Asian nations were also producing printed textiles that were cheaper than Australian equivalents, despite punitive import tariffs imposed by customs (Owen, 2010). In response to this increased competition, STP strengthened its' networks with producers overseas, and concentrated on their strengths – printing silks, rayons and the new, easy care synthetic fabrics that were then then taking the international fashion industry by storm.

6. International networks

Alcorso began a close business relationship with Sekers Silk, the Australian branch of Sir Nicholas ('Miki') Sekers' West Cumberland Silk Mills, founded in Britain in 1938. The Australian branch was managed by Sekers' friends, fellow Hungarian émigrés Andrew and Vera Kaldor, who arrived in Australia in 1952. Sekers' European ranges had found their way into the Paris collections of Christian Dior, Elsa Schiaparelli, the House of Worth and Jean Patou during the early 1950s. He was regarded as a textile innovator, producing synthetic dress textiles as early as 1945, and 48-inch-wide fabrics for fashion when the norm was 36-inches (Coulam, 1953).

Like Alcorso, Sekers recognised the value of artist-designed prints (Sekers Silk, 1959). In 1960 he accompanied a collection of prints designed by Cecil Beaton, Graham Sutherland (1903-1980) and Oliver Messel (1904-1978) that were exhibited in major department stores around Australia (Draper of Australasia, 1960). Miki Sekers also recognised that it was more efficient for an Australian production facility to print fabrics for his customers in the Far East,

Australasia and South Africa, instead of shipping finished cloth from the UK. STP was well equipped to take on contract printing for Sekers and other European and American textile houses. In August 1961, STP and Sekers cemented their alliance with an agreement appointing Sekers as exclusive distributors of printed and plain silk fabrics produced by STP (Clothing News, 1961).

Alcorso developed direct sourcing strategies to ensure the ongoing supply of base-cloths that could not be produced viably by STP. He visited Communist China regularly from 1957, years before diplomatic relations were restored with western nations, securing a direct supply of supply of silk base-cloths for dyeing and printing (Alcorso C., The Wind You Say, 1993). This ensured that Sekers led the market for printed silks in the southern hemisphere. STP's design team produced original designs, which were supplemented by designs bought by Alcorso from the Paris studio of designer Georges Delhomme, and designs from Sekers' UK collections, which were re-coloured for the Australasian market by STP's design team under the direction of Vera Kaldor. Best-selling prints from the southern hemisphere also found their way back into Sekers European collections (Clothing News, 1962).

Andrew and Vera Kaldor's son John began working at STP in 1957 as Alcorso's assistant, after a textile design course under Bauhaus teacher Johannes Itten in Switzerland, followed by an internship with his godfather Miki Sekers. By 1960, John Kaldor was back working at Sekers as a textile stylist (Graham & Kaldor, 2008). In 1962, he created "Sekers' Australian Artists Originals", a collection paying direct homage to Alcorso's Modernage. Designs for cotton furnishing textiles were commissioned from Australian artists including Modernage alumni Drysdale, Gleeson and Friend and other prominent painters including Cedric Flower (1920-2000), Elaine Haxton (1909-1999), Judy Cassab (1920-2015), John Olsen (1928-), John Coburn (1925-2006), Ian Van Wieringen (1943-) and sculptor Clement Meadmore (1929-2005) (Cochrane, 1992). The collection was launched in February 1963 in an exhibition titled "Art in Décor", at Sydney's Dominion Galleries and the Museum of Modern Art (Heide) in Melbourne (Clothing News, 1963). However, the fabrics were printed by Kanebo in Japan rather than by STP in Hobart, highlighting the high quality and low cost of Japanese printed cottons that was making Australian production increasingly unviable (The Australian Home Beautiful, 1963).

Alcorso stepped up STP's export programs in response. In his memoir, he recalled how proud his father Amilcare would have been, had he known that STP sold 200 rolls of printed silks to Galtrucco in Milan, which he regarded as the best fabric shop in Italy (Alcorso C., The Wind You Say, 1993). In 1964, STP participated in the Australian Trade Commission's floating exhibition on the trade ship 'Centaur', which travelled through Asia carrying displays, public relations staff and fashion models, staging events and meetings with buyers at each port of call (Clothing News, 1964). STP's exports to England, Europe, Hong Kong and New Zealand increased from £98,000 in 1961 to £170,000 by the end of the 1963-64 financial year (STP Holdings Ltd, 1964). Alcorso's successful export performance was recognised by the Australian Trade Commission with a number of special export awards (Clothing News, 1964). By 1967, STP had merged with Sekers Australia and their main competitor, Tennyson Textiles of Sydney, forming Universal Textiles (Australia) Ltd (UTA). The merger consolidated and

rationalised production operations, creating a more efficient, integrated supply chain (Universal Textiles (Australia) Ltd, 1967). UTA diversified their products, producing new fabrics for niche markets. 'Contender' sail-cloth was produced for the marine market; special, hard wearing synthetic blends were produced for school uniforms and furnishing products such as readymade curtains were manufactured and pre-packaged for direct sale to retailers (Universal Textiles (Australia) Ltd, 1968).

The company invested in new technologies including sublistatic (heat-transfer) and rotary screen-printing, providing increased production flexibility (Universal Textiles (Australia) Ltd, 1968). The business attracted interest from overseas and a number of prominent international textile companies held significant shareholdings in UTA. Lancashire firm Carrington & Dewhurst held 420,000 shares, as did James Nelson (Australia) Pty Ltd, a wholly owned subsidiary of Courtaulds in the UK. Both the Toyo Rayon Company Ltd (Toray) and Teijin in Japan held 300,000 shares each; Sekers (UK) held approximately 167,000, whilst Bruck Mills (Australia) Ltd, the local subsidiary of the Canadian-based producer held nearly 62,000 shares (Universal Textiles (Australia) Ltd, 1967).

Throughout the 1960s Alcorso continued his patronage of the arts through UTA, together with his like-minded colleague John Kaldor, who now managed design direction and marketing for the company. In 1966 they established the 'Alcorso Sekers Travelling Scholarship Award for Sculpture', providing £1,000 annually to fund overseas travel for an artist (The Sydney Morning Herald, 1965). The competition ran until 1969, receiving many entries from the crème of Australia's sculptors, including Col Jordan (1935-), Michael Kitching (1940-), Robert Parr (1923-), Ken Reinhard (1936-) and George Baldessin (1939-1978) (Art Gallery of NSW, 1967). However, in 1969, its final year, the travelling scholarship was somewhat overshadowed by another of Kaldor's art initiatives.

When it was completed in 1969, 'Wrapped Coast', the installation by Christo and Jeanne-Claude at Little Bay, Sydney, was the largest single artwork in the world. More than one hundred workers, including professional mountain climbers, art teachers and students contributed to the realisation of the artist's vision to package the landscape in textiles. UTA donated the fabric used by Christo to wrap the coastline - it was another of their new specialized products - a durable agricultural grade textile designed to suppress weed growth (Safe, 2013).

7. Sheridan

In 1967 UTA launched printed bed-linen under their existing "Sheridan" brand (Sheridan UK). Based on an international trend exemplified by Cannon and Fieldcrest in the United States, Sheridan produced sheets primarily in bright printed florals. Advertising agency Ogilvy and Mather developed a promotional campaign using endorsement from high-profile Australians including fashion designer Merivale Hemmes, explicitly targeting an emerging market of young fashion followers (Sheridan, 1970). The advertising was sometimes controversial, earning Sheridan and Ogilvy & Mather notoriety as well as publicity. Liberal Party Minister for the Army Andrew Peacock offered to resign his position over the appearance of his

fashionable wife Susan in advertising for Sheridan in late 1970. Susan Peacock had donated her $100 fee to charity, but her endorsement still caused a scandal. Sanity eventually prevailed and Peacock's resignation was rejected (The Canberra Times, 1970).

UTA soon became a prime target for a corporate takeover. It had attracted the interest of Dunlop (Australia) Ltd, who saw an opportunity to add the newly rationalised business to its local textile and apparel operations. The Alcorso family, still major shareholders and directors of UTA, did not oppose the offer – thought that it would be good for the industry and their workers. The takeover was completed in June 1969. Claudio and Paolo Sonnino joined the board of Dunlop, whilst Orlando left the business to pursue other interests (Alcorso C., The Wind You Say, 1993).

It was soon obvious that the Board of Dunlop had little time for art patronage, or any social concerns that characterised Alcorso's management style. They questioned the donation of fabric to Christo. They made it clear that they wanted immediate results from all product lines, and were unsympathetic about the performance of the Sheridan, still a fledgling brand. Alcorso became increasingly disillusioned with the Dunlop's lack of vision, resigning from the Board in 1970 (Alcorso C., The Wind You Say, 1993). He was soon followed by John Kaldor, who set up his eponymous business 'John Kaldor Fabricmaker', shortly thereafter (Safe, 2013).

In the 1980s Sheridan developed an iconic collection of artist-designed bed-linen that finally enabled Alcorso's vision for homes furnished with textiles designed by Australian artists to become a reality. From 1984 Sheridan produced a series of quilt cover sets designed by artists including Jenny Kee (1947-) and Ken Done (1940-). At the time there was international interest in the 'Australiana Pop' aesthetic - kitsch interpretations of Aboriginalia and Australia's unique flora, fauna and tourist attractions including the Sydney Harbour Bridge and Luna Park, incorporated into colourful and often comical graphics. The comparatively lower cost and durability of Sheridan's Australiana bed-linen, with its ability to change a room instantaneously, was an attractive option for mainstream consumers, compared with the limited appeal of Modernage fabrics twenty years earlier.

Sheridan opened a flagship store on Madison Avenue, New York City. Macy's and the Federation Group also stocked the brand, together with major retailers in Asia including Daimaru in Japan. At one time, the company was making bedlinen in 110 different sizes to comply with sizes in multiple overseas markets (Sheridan, 2012). Sheridan continued to honour their founder's goal to unite art with industry. In 2014 they launched the 'Modern Art Series' of artist-designed quilt cover sets with a catalogue including Alcorso's biography (Sheridan, Summer 2014). In 2017, the company revived an internationally successful collaboration with Australian artist Ken Done, who produced a new collection of quilt cover sets similar to those he produced for Sheridan in 1985 (Figure 4).



Figure 4: Printed bedlinen designed by Ken Done for Sheridan 2017. Author's photograph, Westfield Bondi Junction, Sydney, August 2017.

8. Alcorso after Textiles

Claudio Alcorso is not only remembered for his work in textiles, but also for other significant contributions to Australian culture. He helped re-establish wine production in Tasmania by founding the 'Moorilla' winery at his home in Berriedale in 1958, now the site of the Museum of Old and New Art, "MONA" (Alcorso, 1993). From 1970 to 1974, he led the Australian Opera to autonomy (Talia, 2000). As chairman of the Tasmanian Arts Advisory Board, he ensured that heritage buildings at Salamanca in Hobart were saved from demolition. He later initiated a grand vision to restore Hobart's former 'IXL' factory buildings, repurposing them as an international boutique hotel and an arts centre, now part of the University of Tasmania (Alcorso C., The Wind You Say, 1993).

Claudio Alcorso was a champion of Tasmania's pristine environment, writing extensively on the high quality foods, craft furniture and leather goods produced there by artisanal makers. As a prominent member of the Tasmanian environmental movement, he campaigned to prevent the damming of the Gordon Below Franklin River, a landmark victory of the Australian conservation movement. As a migrant, he was a strong supporter of a multicultural Australia, and an advocate of equality for Australia's First Peoples, speaking

often at Aboriginal Land Rights rallies (Alcorso, 1993). He was also an outspoken proponent of the Australian Republican movement, up to his death in 2000.

9. Conclusion

This investigation of the life and business activities of Claudio Alcorso provides new insights into the agency of the Italian design diaspora on global interconnectedness in the textile industry. It demonstrates how migration facilitated the diffusion of innovative business strategies that enabled the development of new, differentiated products to stimulate consumer demand in the face of increased globalization. It has enabled new connections to be made between the production of art, design, culture and textile manufacturing, against the backdrop of late twentieth century globalisation.

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Acknowledgements: This paper is based on doctoral research conducted by the author at the University of Technology Sydney from 2011 to 2019. The author wishes to acknowledge Distinguished Professor Peter McNeil, Dr Alexandra Fowler and her colleagues in the Imagining Fashion Futures Laboratory, Faculty of Design, Architecture and Building for their support of this research project.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Collaborative Capabilities: aural encounters in digital/analogue co-creative making

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Abstract | Contemporary arts and design practitioners are mobile, diverse and interdisciplinary. Often operating as micro-businesses or solo practitioners, they need new and innovative approaches that promote collaborative knowledge exchange and transdisciplinary experimentation. This ongoing practice-based research covers the developing co-creative relationships that arise through integrating digital making and data-driven processes as inspiration within collaborative distributed networks of design and making. The authors developed an analogue/digital transformation process for sound-inspired pattern creation, initially explored in the context of textile pattern design with a cohort of practitioners geographically distributed across Scotland, and now expanding out across other craft/design disciplines. Through a participatory design approach (Bannon & Ehn 2012), the project developed a series of collaborative workshops where the practitioners worked together with the researchers to develop new processes for inventing and generating transdisciplinary designs using non-traditional approaches, with designs taking inspiration from the "heard" rather than "seen" environment. It uses the robust multi-sensory process to promote alternative environmental attunement to place and landscape, whilst experimenting within a collaborative digital platform. Through these different lines of work, we explore what it means to be a practitioner in the twenty-first century in Scotland and beyond, including challenging the arts/crafts and craft/design divide through collaborative interdisciplinary participation.

KEYWORDS | COLLABORATIVE MAKING, DATA-DRIVEN DESIGN, DISTRIBUTED COLLECTIVES

1. Introduction

In the arts and crafts the notion of the lone genius creator is a common trope. Even in co-located arts collectives, collaboration tends to be limited to teaching, administrative or financial situations to share in the burden of these issues, rather than collaborating in an extended fashion on creative endeavours (Montouri & Purser 1995, Sennett 2009). Yet, this image of the lone creator is a limiting concept for the modern practitioner, particularly in an age when technologies permit collaboration at distance and where even remote geographies are digitally accessible. Modern arts/crafts practitioners are mobile, diverse and interdisciplinary; they expect to access information, skills and knowledge digitally; and they need to compete more and more with larger commercial/industrial enterprises across the same digital and analogue platforms (Bennett 2018). The need for new techniques and acknowledgement of cooperative approaches to design and creation, whether between groups of designer-creators or co-creating designs with other stakeholders are needed and mechanisms that support these new interactions are required.

This article explores the ongoing work and insights of the Royal Society of Edinburgh (RSE)-funded project *Distributed Capacities,* a creative network of contemporary Scottish art and design practitioners through a distributed and disruptive manner of collaboration. It uses a developing and robust digital/analogue multi-sensory process that promotes alternative environmental attunement to place. It does so through the consolidation of a small cohort of textile designer/makers into conversation and practice with a new collective of non-textile practitioners. In doing so, the project aims to explore what it means to be a practitioner in twenty-first century Scotland, including challenging the arts/crafts divide through collaborative interdisciplinary participation. Furthermore, this project questions existing ways of making and collaborating using digital/analogue avenues that augment, but do not replace the influence of the practitioner on the design process. It asks two key questions:

- How can multi-sensory digital/analogue processes influence contemporary Scottish maker/designer relationships?
- In what ways can these relationships develop a different attunement to the contemporary landscape and response to this?

This article will discuss the ongoing reflection, insights and challenges of this aural driven project. It will first provide a brief theoretical context in the provenance of the project alongside three key theoretical ideas of sound attunement, making and co-creation. This is followed by description and analysis of the first two research gatherings alongside participant reflections between those gatherings. Furthermore, we add a short component of ongoing work from the third digital gathering just before the onset of the pandemic. We finish with a developing critique of the work and a set of next steps for this project, which opens up dialogues of participatory design, collaborative making and a newly found perspective in sensory and place promoted within a twenty-first century Scottish context and through encouraging conversations between practitioners from different disciplines.

2. Context

This project builds upon the existing body of research and practice that took place with textile practitioners during a year-long research project called Aural Textiles, which explored the inputs of non-visual stimuli into textile production (Authors 2019). The bespoke sound-to-pattern process, developed through the project, involved listening and recording landscape sounds and transforming those sounds into textile patterns and designs. We evidenced that a novel set of contemporary textile patterns, across a range of textile disciplines, can be generated in response to the aural environment. Three key insights came out of that initial project:

1. Data-driven processes augmented but did not replace the role of the designer/maker. Each practitioner exerted control over the output that was generated that was dependent on (a) their pre-existing skill set and (b) engagement with the other project participants.
2. A digital/analogue approach to working enabled practitioners to experiment with their process and technique, and the novelty of a data-driven design approach enabled them to be creative in new ways.
3. The use of digital platforms and ease of open source ways of processing and moving information allowed for the practitioners to share sounds between each other, as well as ask and answer questions or provide reflections on their own working practice within a private forum.

Therefore, the impact has been not only new entanglements between practitioner and their landscape and with each other, but an overall democratisation of the design and creation process. It is these new entanglements that this *Distributed Capabilities* project builds upon through a proposed design collective that promotes distributed and disruptive collaboration, including and extending beyond the original cohort of textile practitioners. Before moving towards the gathering, we briefly explore the three key theories that ground our research.

Sound Attunement

The sense of hearing is a key component of living things. In humans, the sense of hearing comes from the interaction between small air vibrations received within our ears and transmitted to auditory areas of the brain. This ‘sonorous presence’ (Nancy 2007) is always around, present in the landscapes and places humans inhabit. Listening or sound attunement ‘makes us re-think our relation to power and in deep listening a deeper dialogue is understood’ (Back 2003: 274). This is further emphasized in the way that sound is ‘tendentially methexic’ (Nancy 2007:10) meaning that sound and the act of listening has a sense of sharing and participation, beyond what is viewed and seen (Johnson 2016). On the other hand, listening also becomes a ‘decentred, receptive state’ (Williams 2019: 648) allowing for a multiplicity of sounds to inform how we understand the world around us. Listening, therefore, is more than just one type of state and thus should be a nuanced practice engaging the maker of sound (e.g. human, animal, or a thing, like the siren sound, or

the low hum of electricity) and the practice of receiving that sound, allowing time to move beyond immediate interpretation. Attuning to the sonorous landscape is important not only to challenge our visual bias, but to open new inspirational cues in creative practice.
The sound-to-pattern process (Mennie & Jaramillo 2018) used in this project promotes this sound attunement by allowing participants the ability to not only pay attention to the sounds around them, but to use and manipulate them into a malleable intermediate and give physical form to the concept of sounds, enabling tangible interactions with them (Figure 1). These intermediates began as spectrograms but have, in the course of this project, taken the shape of a variety of emotional or haptic interpretations of sounds.

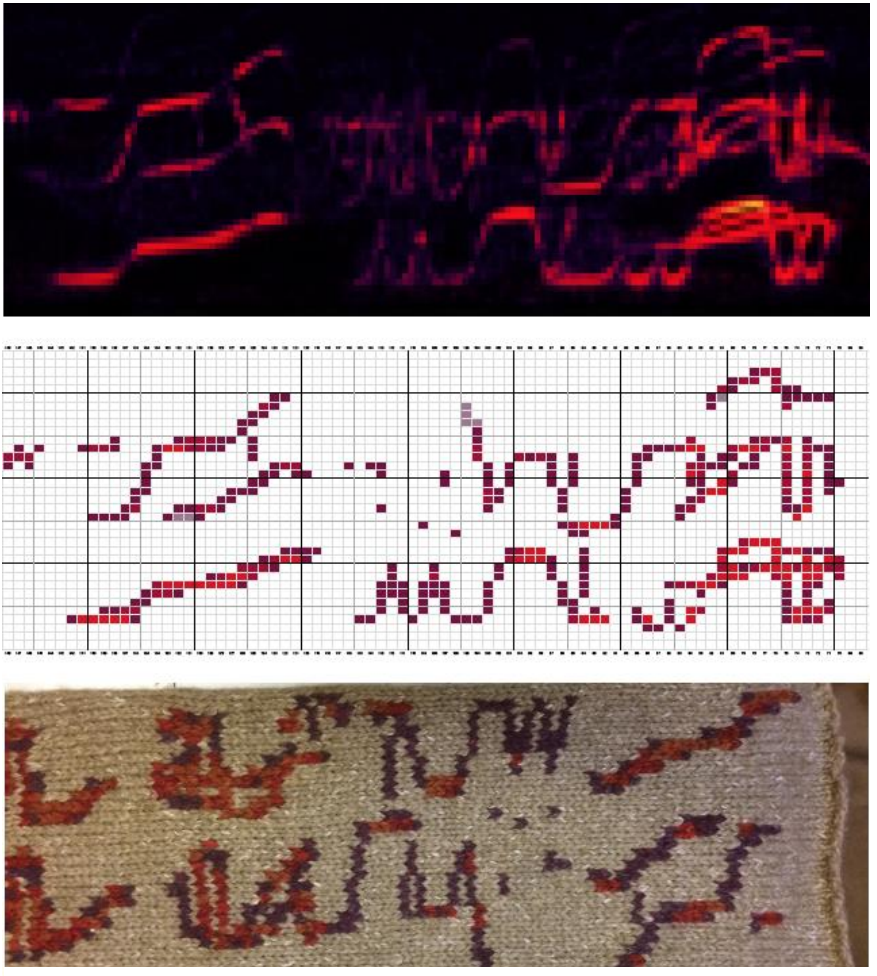

Figure 1: The initial process showing the phases of capturing, transforming and visualising the lapwing bird sound into pattern and test weave/knit. (Source: Authors 2018)

Hybrid ways of making

The requirements for new approaches of making continue to grow as our design and product understanding evolve beyond industrial processes. These industrial processes can be seen as the instigators of the division and separation of the fine arts and applied arts. Digital practices are beginning to show that these divisions need not be made and that links between artistry, designing and creating are possible through what is termed a hybrid way of making (O'Donovan et. al 2017). In our existing work this analogue-digital-analogue iteration allows for an experimental and easily prototyped approach to making. This idea parallels work of Andrew & Diamond (2018) that sees a broadening acceptance of digital tools into textile craft. In this sense, the collaboration happens not just between people but between people and the digital process thereby mutually augmenting each other. It is this mutual augmentation that we will explore in our network, extending into disciplines beyond textiles by inviting each textile practitioner to pair up with a practitioner from another discipline in order to disseminate and further explore the process of data-driven design.

Co-creation

The idea of building and designing together traditionally involved sharing skills, responsibilities and forms. As industrial procedures forced the separation of design from production and from consumption the notion of creating things together was relinquished to the designer and maker. Yet, from the 1950s onward the idea that people, user, participants, or stakeholders all could have a say into the design and decision-making processes was exemplified through participatory design (Sanders and Stappers 2008), user-centred design and the notion of co-creation. Co-creation describes a process of producing items of mutual value, allowing design and production to sit between multiple stakeholders and creator (Prahalad and Ramaswamy 2004). This, however, only answers a part of the evolving idea of co-creation where it is seen mainly as a connection between a creator and a group of users or consumers. The work of Ramaswamy and Ozcan (2018) further this discussion towards an interagencial socio-material assemblage of co-creation. Their value-in-interactional creation supports the agency between multiple actors within a collective of making. For the purpose of this project, we support the notion of co-creation 'as a creative process that taps into the collective potential of groups to generate insights and innovation' (Rill & Hämäläinen 2018: 24). This allows an understanding of thinking that is not only inclusive of the value making approach but also incorporating the multiple agencies inherent in this collaborative project. In the end, these three components of hybrid making, co-creation and sound attunement form the foundations of the ongoing research enabling a rich and strong area from which to develop the work.

3. Process

The six previous Aural Textiles participants, whose practices encompassed weaving, knitting and screen printing, enrolled in the Distributed Capabilities project. Six new creative practitioners were recruited to take part in the project, with disciplines spanning fashion, jewellery, ceramics and woodworking. The project was planned to take place over three phases spanning the course of 18 months: exploration, iteration, and curation. Each phase would allow the participants' time to work with each other at a relatively longer pace, punctuated with three weekend gatherings, and culminating in a public exhibition. The gatherings use a participatory and design innovation methodology (Bannon & Ehn 2012; Dixon & Murphy 2017) that addresses complex challenges through new design practices and bespoke participant engagement. Through our creative and participatory design labs we collaborate with practitioners, addressing the research through creative approaches to co-create preferable futures. We brought this expertise to ensure an interactive session leading to positive and productive outcomes. Key areas for exploration included: engagement, partnerships, governance structures, as well as evidencing value and impact. In-between these gatherings, a digital platform enables continued support, knowledge exchange and reflection, maintaining momentum and presence whilst in a distributed manner.



Figure 2: The first gathering showing the collective group of participants (Source: Sambo 2019)

Gathering 1: Huntly

The first gathering in April 2019 allowed project participants to meet each other and share details of their respective practices. It also allowed researchers to share an overview of the sound-to-pattern process as a starting point for more detailed explorations between pairs of practitioners, as well as, allowing researcher to partake as participant (Chapman 2018). By the end of this gathering, the participants formed pairs comprising one member of the previous Aural Textiles group and one of the new practitioners, with some participants entering into more than one pairing. The intention for such pairings was to understand how insights gained by participants in the previous Aural Textiles project would be shared with the new group members (Figure 2). In the four months after this first gathering, each pair met in person and virtually a number of times to further explore their ideas and processes for sound-inspired collaborative creation of objects across their respective disciplines.

The gatherings were documented in our online blog and Instagram page as a way for all participants to share progress and thoughts with each other. Recorded interviews were conducted with all participants in order to establish each practitioner's prior experience of data- or sound-inspired design and collaborative working; current working models (i.e. distribution of commercial work (retail, wholesale), research & development, residencies, exhibitions, teaching, other sources of income) and anticipated impacts of the project on their practice. Opportunities for future commercialisation were also discussed. The majority of participants indicated that they wanted the project to provide them an opportunity for creative exploration without a commercial focus, to "foster their artistry" (Wilckens 2019) but were interested to explore how outputs might be commercialised in the future. There was also a consensus among the practitioners that they wanted to challenge some of the expectations around "craft" – what it is; how we can use it to communicate and challenge ideas around identity in present-day Scotland; and how we value "making" (as individuals, groups, society).

After the initial meeting, the original members and the new participants paired up and agreed to meet for a six-month exploration phase, which they documented in reflective blog posts and on their business Instagram accounts. During this period, the pairs (and evolving trios) explored the connections between their distinctive disciplines, including between jewellery making and weaving and the connections of ceramics and surface printing. One collaboration in particular began to push the boundaries of sound exploration. As expressed in a blog post:

> "One theme that we plan to develop is the idea of silence. Standing on the open moorland, Lewis stretches out as low rolling hills. Beyond that is a huge open expanse of sea and horizon. Apart from the roaring wind in your ears, the island is both visually and aurally quite quiet. Even the wind seems to turn to white noise after a while. This idea of silence relates back to the spectrograms – we'll be looking at the negative space in the spectrograms – the background noise or silence as inspiration." (Stevens 2019)



Figure 3: A screenprinting skills sharing session experimenting with the use of plastic knit pattern sheets showcasing the final output (Source: Sambo 2019)

This brief description of a collaborative weekend between two of the practitioners evidences a new way of perceiving the wind. Rather than the sonorous presence it is the 'sonorous absence' or the negative capabilities of sound become the inspiration for further investigation. The gaps in-between the sounds form a new type of attunement to what is active in the landscape. These types of encounters carry on towards the second gathering in September 2019.

Gathering 2: Helmsdale

At the second gathering, participants brought materials and tools for hands-on sharing and creative experimentation; as well as samples of work created during the exploration phase. A group reflection on sound-inspired design and collaborative working practices also took place, as well as individual interviews with each participant. Participants were tasked to share with the rest of the group a particular component of their practice. This was done to support creative exchanges but also to consider how public engagement activities could be created and worked out. This developed into a series of ad hoc creative encounters (Figures 3 & 4), with practitioners all learning and experimenting from different creative practices and understanding the processes of each practitioners' way of making: when handing tools and objects from one practice over to an individual from another, the participants were less constrained by technical boundaries or commercial viability. This certainly fed the experimentation in the room and delivered some practice-led surprises. "I had never

thought to do it that way before" was a common remark. (Prosser 2019). It also laid the foundation for our next gathering looking at how we can best enable people to share with each other this sound-to-making process.



Figure 4: Outputs from the tile making session . (Source: Sambo 2019)

Interestingly, some of the practitioners are starting to move away from the data-visualisation elements of sound inspiration and have started exploring their emotional and graphic responses directly to the sounds; while others have started to introduce additional datasets into their designs. Both approaches point to a more in-depth and multi-layered engagement by the practitioners with the soundscape. At the end of the gathering, there was further discussion around potential routes/opportunities to commercialise outcomes from this project. At this stage, it was felt that this distracted from the main aims of the project and negatively impacted the participants' experiences of the project, and the researchers decided not to pursue this further with the group until after the project was completed. Also emerging from this gathering was a clear sense that many participants desire greater input into the direction of the project in terms of defining the research questions and devising ways to address these, suggesting that over the extended period of this project the practitioners have shifted their perceptions of themselves from "practitioners" to "practitioner researchers".

Gathering Three: Digital Gathering

The plans for a third gathering in March 2020 had initially been planned for a public engagement weekend at the UNESCO World Heritage site of New Lanark in south-central Scotland. Participants would have shared and critiqued their ideas of collaborative work and finalised their plans for creating objects for what was then an exhibition in autumn 2020. This, however, was not to be the case. The COVID-19 pandemic caused a massive halt to everyone's lives and with it the project. This gathering though marked a period of rethinking and reworking and a point to pause upon the work up to the beginning of the lockdown. One of the collaborative pairs began to express their work not through the sound but rather



Figure 5: Initial collaborative output between weaver and jewelry maker (Source: Booker & Stewart 2020)

through their own technical process (Figure 5). Through their online and in-person discussions they chose to find 'a common vocabulary to make together, where our practices can meet—that had to come first' (Prosser 2020). Another collaborative pair has shown a developing connecting between knitting and ceramics. Inspired by aspects of memory, dance and movement the knitting incorporates dropped-stitches and other 'imperfections' to attune to ideas of dementia and memory loss. These knitted fabrics are then used to make impressions into clay and fired. This creates two unique interactions, the first is the loss of the fabric, and the second the permanence of the stiches embedded into the finished glazed piece (Figure 6). This has brought about what one of the participants states as 'playing at the edge of what the materials can do conceptually' (Prosser 2020). The fusion of knitted fabric and vitreous nature of ceramics create a new and exciting hybrid connection.



Figure 6: The experimental artefacts between the knitted fabric and the clay imprints (Source: Hopcroft and Sinclair 2020)

As with any type of research involving people, inter and intra-personal challenges arise within the collective. In particular as the collective has grown the necessity for ongoing reinforcement is needed from the researchers. The use of various social platforms allows the necessity for collective sharing, though does not maintain a strong level of connection if it is not continuously used or updated. This and other challenges are ongoing and will require further investigation and review towards the end of the project. Alongside these developing insights are ongoing reflections by the practitioners whose developing understanding of sound attunement has expanded form the initial research space. One participant states, regarding her exploration of call and response to dances and songs, 'I'm fascinated by the

idea that sound doesn't just originate from the performer, and that an active audience contribution becomes a vital element in the overall musical experience' (Hopcroft 2020). This notion that sound is decentralized from the soundmaker reflects back upon the earlier aspects of listening, taking into account that sound making and listening require multiple way of interacting and interpreting.

4. Next Steps

This article has explored the varying stages of an ongoing design research project. It focuses on the collaborative developments of cross-disciplinary and sound-inspired making between a group of practitioners across a distributed network in Scotland. Since March 2019, this collective has encountered new approaches to aurally engaging place as well as working through a growing collective. Its needs and challenges have provided much needed discussion around the tools used, and the needs and desires of the making community.

It has also provided a small window into the developing work to a point at which the COVID pandemic would impact the wider creative community. The next stages of this project will look towards consolidating the collective work, working through pandemic related issues of collaboration, and moving towards curation of the co-created objects in the Spring 2021 for a final exhibition. It is hoped that we will deliver public workshops on sound-inspired design/making as a way to develop the understanding of and storytelling around sound-inspired making and objects. In the end, this project has undergone a series of key transformations from small collaborative network focused around textiles to an evolving assemblage of practitioners. It has opened up dialogues between making and listening, providing the practitioners with new tools not only for their own practice but new ways of working (together).

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Acknowledgements: This work would not be possible without the ongoing and active participation of Cally Booker, Laura Lightbody, Carol Sinclair, Beth Farmer, Dwynwen Hopcroft, Marie Melnyczuk, Isabelle Moore, Olive Pearson, Netty Sopata, Orla Stevens, and Jen Stewart. We thank Zöe Prosser, Lina Wilckens, and Daniele Sambo for assistance with documenting and analysing the gatherings.

This work was funded by a Network Grant from the Royal Society of Edinburgh to Dr. George S. Jaramillo and Dr. Lynne J. Hocking-Mennie.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Collaborative ontology design for Open Hardware and Open Design

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Abstract | The integration of ICT, open source software and practices, digital fabrication and online marketplaces has enabled designers, engineers, and makers to independently design, distribute and manufacture the physical replication of tangible Open Hardware and Open Design artifacts. Orchestrating these distributed chains, actors and technologies requires comprehensive documentation of elements and across multiple domains and applications. The goal of this paper is to explore how an ontology of Open Hardware and Open Design artifacts could be collaboratively designed and what could be its main elements. In this paper, we present the results from a workshop that explored the prioritisation of domain concepts through a game of card sorting/generation to classify the elements of an ontology. Furthermore, we elaborate insights and Research through Design strategies towards integrating the design of ontologies with the participation of users and their communities, bringing Community-Centred Design to ontology engineering as both Meta-Design and Ontological Design.

KEYWORDS | OPEN DESIGN, OPEN HARDWARE, ONTOLOGY, DOCUMENTATION, META-DESIGN

1. Introduction

The integration of ICT, open source software and practices, digital fabrication and online marketplaces has enabled designers, engineers and makers to independently design, distribute and manufacture the physical replication of tangible artifacts. This possibility has been reinforced with the increasing ease of organising both local and global supply chains connecting local manufacturers, manufacturers in China and the distributed network of makerspaces. These elements constitute the Open Hardware (Ackerman, 2009; Gibb, 2014) and Open Design phenomenon (Abel et al., 2011; Bakırlıoğlu & Kohtala, 2019; Cruickshank, 2014). This generates innumerable possibilities for design in practice, education, research, entrepreneurship and social innovation. Orchestrating these chains, actors and technologies can be a complex task, since its distributed nature renders even the discoverability of such documentation a critical issue. Distributing and sharing design projects over ad-hoc value chains requires a comprehensive documentation of elements beyond the mere tangibility of artifacts (processes, software, electronic design, …) spanning across multiple domains and applications.

There is a gap in practice and research regarding how such documentation can be generated and managed, given its complexity in terms of elements (CAD files, video, images, code, schematics, bill of materials, ...) and technical and application-specific information (authorship, copyright, information architecture, code, patentability, function, application, ...) adopting different documentation formats and practices (Lena-Acebo & García-Ruiz, 2018; Menichinelli, 2018; Milara et al., 2019). The goal of this research is to fill this gap by exploring how an ontology of Open Hardware and Open Design could be collaboratively designed. In information and computer science, an ontology is the semantic level of abstraction of data models in a database: a formal representation that model a domain of knowledge or discourse designed as a digital artifact with specific purposes; it informs data structures and interfaces in digital environments, tools and platforms (Gruber, 1995, 2009). Therefore, in the context of this article we focus on ontologies as formal description of data formats for documenting Open Hardware and Open Design projects. Here the ontology by itself is not a complete system ready to be used, but a first prototype of a set of metadata that enables developers to build and integrate systems on top of it, in order to aggregate data from multiple platforms and sources that would be thus standardised and easily catalogued and discovered by users.

The main research question of this paper is: What could be the main entities of an ontology that describes Open Hardware and Open Design projects? The topic was assessed through a card sorting game workshop in which participants classified and prioritised the elements of an ontology, considering its domain concepts. This paper elaborates such experience by proposing some contributions about how the design of an ontology can be co-created, and ultimately also on how the design of design ontologies can be reconfigured as both Meta-Design and Ontological Design. By reflecting upon the results and limitations of the workshop, three Research through Design strategies are developed for three platforms in

order to integrate the practice and research of the design of ontologies with users and their communities' participation towards a Community-Centred Design to ontology engineering.

The paper is organised in the following structure: this introduction (1) sets the context, goals, research questions and methods of the article. The next section (2) clarifies the relationships between the design of ontologies, ontologies of design and Ontological Design. The workshop and its results are then documented (3), and insights from them are discussed (4). The last section (5) summarises the main results and suggests approaches for overcoming the limitations of this research.

2. Ontologies and Design

The representation of artifacts and the processes for creating them has always been a central element of the design activity (Diaz-Kommonen, 2002); this is even more important with open projects, that are shared, collaboratively edited and enacted in a distributed way. Sharing the documentation necessary for the design and creation of artifacts is a key element: for this reason, the concept of access to the (open) source of a design has become the most popular approach to designing with and for open and peer-to-peer distributed systems (Menichinelli, 2016). This paper focuses on one specific foundational element of design representations: ontologies. The development of ontologies is a key aspect in developing the organisation of the information describing design artifacts and processes (Menichinelli, 2018; Svenonius, 2000).

Ontologies, however, cannot be considered only as the structure of the data for design artifacts and processes: the connections between design and ontologies are more profound. The concept of ontology has here a duality: "In philosophy, ontology is the study of the nature of reality and the categories of things that exist. In information science, an ontology is a formal representation of the universe of things that exist in a specific domain. What these two approaches to ontology share in common is that they both articulate a universe of entities and relationships between entities" (Pomerantz, 2015, pp. 46–47). Following this, the connections between design and ontology take place on at least three directions: 1) design of ontologies (ontology as a design material); 2) ontologies of design (design artifacts and processes described by an ontology); 3) Ontological Design (ontology as a worldview which is designed and which designs) (Menichinelli, 2020).

In design of ontologies (1), the adopted meaning of ontology is the one from information science and computer science. The role of ontologies is to enable the sharing, reuse and analysis of common understanding of the structure of information among people or software agents (Noy & McGuinness, 2001). Ontologies are also designed with a purpose: "formal ontologies are designed artifacts, formulated for specific purposes and evaluated against objective design criteria" (Gruber, 1995, p. 907). They are shared among agents and sustain their agency: "an ontology is a description (like a formal specification of a program) of the concepts and relationships that can exist for an agent or a community of agents" and

"a specification used for making ontological commitments" (Gruber, 1992) by defining "the vocabulary with which queries and assertions are exchanged among agents" (Gruber, 1995, p. 909). In a database, an ontology is the semantic level of abstraction of data models, and enables the integration of heterogeneous data sources, enabling interoperability and specifying interfaces (Gruber, 2009).

Design practice and artifacts can be considered and therefore documented in several different ways (Menichinelli, 2018): design as (a) a process ("i.e. step by step instructions"); (b) as an organisation ("i.e. networks of interactions, work organisation"); (c) a documentation ("i.e. blueprints"); (d) as a production ("i.e. files ready for direct fabrication"); (e) as an artifact ("the artifact and its description"). In the direction of ontologies of design (2), designers adopt a Meta-Design perspective self-reflexively elaborating ontologies that describe all these aspects of the design practice, from processes (Green et al., 2014; Menichinelli, 2018) to design engineering activities (Sim & Duffy, 2003). For example, practitioners and researchers have proposed ontologies of open projects in Fab Labs (Määttä & Troxler, 2011; Troxler & Zijp, 2013). Other researchers proposed that, more generally, the role of designers in Open Design is to become meta-designers by being database and interface designers that create multidimensional design spaces based on a database ontology in order to enable users to become co-designers (de Mul, 2016).

Designing an ontology is a way of characterising the world and its entities through language by creating a classification system and vocabulary that provides the conditions for collaborative activities to emerge (Diaz-Kommonen, 2002; Svenonius, 2000). This leads to the third direction: in Ontological Design (3) the adopted meaning is from philosophy and about the human condition. Ontological Design "stems from a seemingly simple observation: that in designing tools (objects, structures, policies, expert systems, discourses, even narratives) we are creating ways of being. that we design our world, and our world designs us back— in short, design designs." (Escobar, 2018, p. 4). Designing is fundamental to being human, and in turn we are designed by our designing, and in this aspect Ontological Design mainly works on the philosophical level of Meta-Design. And more broadly, with a conscious Ontological Designing we design not just artifacts but rather a new way of being, since they embed culturally specific intentions (functions) and therefore participate in agency. As a practice, Ontological Design can bring social change because by showing the possibility of multiple and complex worldviews not just for the design of artifacts, but also of material and immaterial infrastructure (management systems, communication systems, …) and systems of thought (Willis, 2006).

3. A workshop for collaboratively designing an Open Hardware and Design ontology

3.1. Goals and structure of the workshop

The inherent openness of Open Hardware and Open Design projects and the often DIY and empowering nature of the practices and principles of the Maker Movement give place to the centrality of how users interpret project documentation. The access to the documentation, infrastructure, and tools that enable potentially anybody to edit projects, also increase the amount of modifications, forking, duplicates and so on. If not well structured, project documentation can easily give way to misinterpretations and deviations from the intentions posed by the original or previous authors, creating the danger of an increasing degree of redundancy. This complicates the management of project documentation and therefore the development of the ontologies and tools it requires.

The flexibility and openness of such projects therefore require custom and proper ontologies so that their documentation can enable the participation of different actors and relevancy for different applications within coherent systems. In order to address this gap, the authors either organised or participated in a workshop in May 2019 that explored how makers could collaboratively develop an ontology for artifacts based on the analysis of the existing different types of documentation required for its replication. The "Ontology of the Open for Open Hardware" workshop took place on Friday 10th of May 2019 within the Creative Commons Global Summit 2019 in Lisbon, Portugal[1]. The goal of the workshop was two-fold: 1) to evaluate the ontological integrity within the documentation of an artifact through the metadata present in its documentation, and 2) to collaboratively prioritise elements that help to unequivocally identify a single entity, that is, to draw a line between what can be considered a single artifact and its reproductions. Therefore, the workshop consisted of two main activities: 1) a group discussion where participants identified definitions described in open hardware documentation (Figure 1), and 2) a closed card sorting activity to determine the level of priority of all these elements (Figure 2). A two-fold set of definitions expressed in the documentation are being considered for defining elements (Svenonius, 2000):

- Conceptual definitions (which express the intentionality of the author towards the artifact). In this regard, conceptual factors refer to the purpose for which the artifact was created and documented. These factors may differ even for similar technological applications, for example, when two Arduino projects developed with similar technical requirements are used for different purposes.
- Operational definitions (in relation to the description of the artifact). Operational factors are related to the steps required for reproducing the artifacts. A change

[1] https://ccglobalsummit2019lisbonportugal.sched.com/event/MiXg/ontology-of-the-open-for-open-hardware

in materials, dimensions or electrical components, for example, will define the manner in which the artifact will be assembled.

For the first activity of the workshop, participants were given the following items:

- A list of 25 metadata cards previously defined from examples of open hardware documentation.
- Open hardware project documentation examples for participants to discuss.

Organised in three groups, participants engaged in the discussion and evaluation of metadata elements that could be identified as more or less relevant for project documentation and were encouraged to write down missing fields that they considered important. Participants were able to quickly familiarise themselves with the documentation and the list of metadata, as well as how authors express some of these elements within the documentation of projects (Figure 1).

For the second activity of the workshop, participants took part in a card sorting game, where cards representing metadata elements were sorted by level of importance for the overall definition of an ontology while trying to avoid duplicate entities (Figure 2).

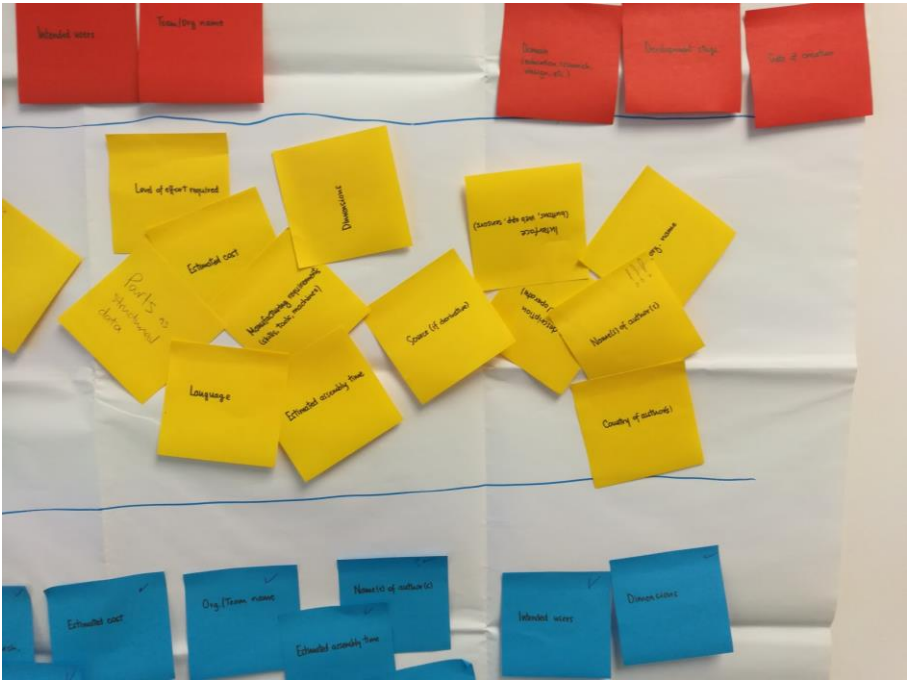

Figure 1. First activity of the workshop.



Figure 2. Second activity of the workshop.

3.2. Results

As results of the workshops, participants elaborated a list of metadata elements that were ranked in terms of their relevance (Table 1). In a total of 28 elements, 17 are operational ones and 11 are conceptual ones: in terms of architecture, an ontology of Open Hardware mainly describes it as a technical effort through the elements, procedures and actors that enable its design, distribution and manufacturing. In terms of ranking, however, the perspective of the participants changes this approach: conceptual elements are generally considered more relevant: the average ranking is 12.9, and for conceptual elements it is 11.3 and for operational elements is 14.0. This disparity might point to a contradiction between the practice and ideals of Open Hardware, or an emerging change in them that it is not tracked yet. The main tension highlighted is between how artifacts are valued by users not only for their physical characteristics but for their intended purposes versus the type of technology, materials and procedures for developing them.

Table 1. Ranking of metadata elements elaborated in the workshop.

Metadata element	Added by participants	Group 1 rank	Group 2 rank	Group 3 rank	Median rank	Definition
Project name		1	3	2	2	Conceptual
Keywords		5	2	4	4	Conceptual
Problem that the artifact solves		7	4	1	4	Conceptual
URI		4	6	3	4	Conceptual
Description		2	5	6	5	Operational
Project type		8	8	13	8	Operational
Date of publication	Yes		9		9	Conceptual
Domain		10	7	21	10	Operational
Manufacturing requirements		9	20	10	10	Operational
Level of effort required			16	5	10.5	Operational
Certifications	Yes		11		11	Conceptual
Estimated cost		12	17	8	12	Operational
Stage of development		3	12	24	12	Conceptual
Estimated assembly time		14	21	9	14	Operational
Interface		11	24	14	14	Operational
Parts list/Build materials	Yes		18	11	14.5	Operational
License		6	15	15	15	Operational
Usage description			25	7	16	Conceptual
Intended users		17	1	18	17	Operational
Version number			13	22	17.5	Operational
Language			19	16	17.5	Operational

Source (if derivative)		23	12	17.5	Operational
Date of creation		10	26	18	Operational
Dimensions	18	22	17	18	Operational
Organization or team	13	26	19	19	Conceptual
Project status		14	25	19.5	Operational
Name(s) of author(s)	15	27	20	20	Conceptual
Country	16	28	23	23	Conceptual

4. Discussion

4.1 Community-Centred Design of ontologies between practice and research, communities and meta-designers

The workshop described above was prepared by identifying the most common metadata elements of a selection of existing Open Hardware projects, then formatted as cards to be sorted. The aggregation/sorting exercise was done through a set of criteria proposed by the facilitator (for example: level of effort required, estimated costs, assembly time, manufacturing requirements, skills, tools, …) with three possible levels of priority. The idea of designing ontologies collaboratively and the specific methodology proposed was well received by the participants: it provided a good starting point for organizing, prioritising a collection of existing entities and for the discussion and addition of new ones to an ontology of Open Hardware projects.

More precisely, for the specific the audience of the workshop, the emerging ontology shows how Open Hardware is considered as a utility-oriented medium for designing and working, with a strong focus on problem solving, manufacturing and usage of the artifacts it describes. The ontology was designed by participants as the results of their thinking about how they would produce and use the artifacts. This utilitarian and problem-solving perspective can be considered as the result of cultural values of the Open Hardware movement or at least of the participants in the workshop, who thought about the ontology with their practice as a starting point.

A workshop like the one organised is, however not yet representative of a community: participants of the global Open Hardware and Maker Movement communities attended it, but more than a community of practice was a small sample of a community of interest in the Creative Commons licenses and their application. Their practice informed their view of the

ontology, the centrality of community-based organizations in such movements cannot be addressed and appreciated in such a context that was limited in time and space. We therefore propose that a collaborative approach can benefit the design the creation ontologies of open projects, with the active participation of the communities that will develop and adopt them so that their worldview can inform and support their practice and vice versa.

The discussions with the participants brought up how the definition of an ontology emerges from local practices. At the same time, we should also note the role of the facilitator, that by selecting entities and designing the cards and the dynamics of the workshops acted not just as a facilitatory but already as a meta-designer of the ontology, bringing design activities in the facilitation. From these two aspects we propose to consider that both practice and research, community and meta-designers should element of Community-Centred Design of ontologies.

Furthermore, we propose that the main results from the workshop are not a specific ontology tied to a limited audience and with a limited approach to design, but how the reflection on that experience could pave the way for more deep and complex design of ontologies together with communities. We then elaborate strategies for extending the experience, tools and methodology of the workshop to different communities, to be explored and researched in their practice. Given the importance of both design and research, and their ability to redefine ontologies, we suggest adopting Redström's approach for building Research through Design frameworks (2017). Moving from the generic results of the workshop to concrete cases, the next section explores how the insights here elaborated GROUU[2], Make Works[3] and Appropedia[4] design and implement ontology with communities through its digital platform as an artifact towards meta-design. These three cases represent different approaches for addressing the issues of documentation and replicability of Open Hardware and Design projects in the Maker Movement: from a single project (GROUU) to a repository of projects (Appropedia) to a network of manufacturers of projects (Make Works). In all these three cases Community-Centred Ontology Design could be implemented especially in the product, project, program and practice.

4.2 GROUU

GROUU is a current doctoral research with a Research through Design approach, revolving around a set of networked sensors and actuation devices (IoT - Internet of Things) for precision agriculture to be used in diverse agricultural contexts. GROUU aims to democratise precision agriculture sensor networks and automation, addressing the effectiveness of knowledge transfer once tests and community implementations are valid and working. By

[2] https://github.com/steam228/GROUU - https://wikifactory.com/+grouu
[3] https://make.works/
[4] https://www.appropedia.org/Welcome_to_Appropedia

aiming to digitise Tacit Knowledge and transfer it between users, GROUU is also exploring the possibility of having IoT as a digitisation and knowledge transfer media. The goal is to extend the implicit knowledge conversion through the socialisation model proposed by Nonaka and Takeuchi (1995) to a digitally mediated data sharing and usage ecosystem. The design of standardised ontologies can achieve this for the Internet of Things, maintained through documentation and versioning protocols.

The Research through Design strategy (Figure 3) sees GROUU at the product level, consisting of multiple open hardware, software and design sources developed within a doctoral research (program) revolving around the redefinition of criteria for Open-Hardware-mediated knowledge transfer design and evaluation (project). These are connected with the practice of the doctoral candidate and experienced farmers involved in teaching each other best practices in farming. Finally, the paradigm connects all of these with the main trends of Pervasive Computing, Embodied Cognition and Tacit Knowledge conversion: this strategy would connect knowledge transfer to media digitisation; the research of new roles for existing technologies could democratize its access.

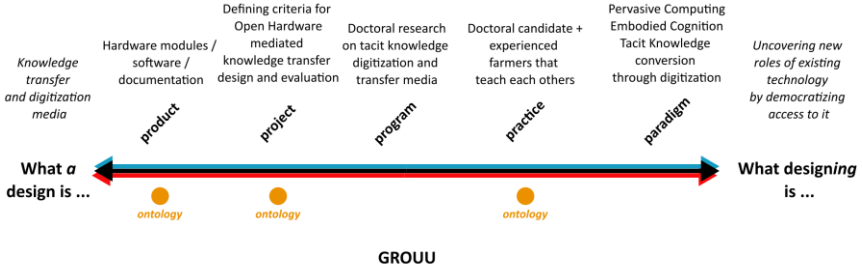

Figure 3. A Research through Design strategy for ontologies in GROUU.

4.3 Make Works

Make Works is an open source online directory for manufacturers, makers, material suppliers, and workshops to make local manufacturing openly accessible to anybody. The digital platform allows designers and makers to find manufacturers, material suppliers and workshop facilities in their local area to produce their artifacts in a distributed manner. Make Works operate in six regions: Scotland, Birmingham, Derby & Derbyshire, UAE, Sweden, Catalonia. Ontologies in Make Works describe specific regions and their manufacturers in terms of industries, materials, processes and machines.

The Make Works team's goal and, therefore of its Research through Design strategy is to explore with Action Research how to develop the platform by considering diversity,

inclusivity, and accessibility. The aim is to avoid reinforcing one single point of view to all the regions, enabling each community voice to be heard and agency with an approach inspired by Fraser's social justice framework of representation, distribution and recognition (1998).

In its Research through Design strategy (Figure 4), the digital platform is the product part of a project made up of several platforms for connecting makerspaces, designers and manufacturers (who constitute the practice). The bottom-up factory listing process is guided by a specific Make Works Handbook that defines the program since it bridges practice and research and informs their workflows. The Handbook describes the starting, co-designing, operating and running of new regions with context-based contributions and suggestions. Finally, Social Justice, Distributed Design and Manufacturing represent the overall paradigm informing all of these. This strategy would then connect locally produced artifacts with designing networks of distributed design and production.

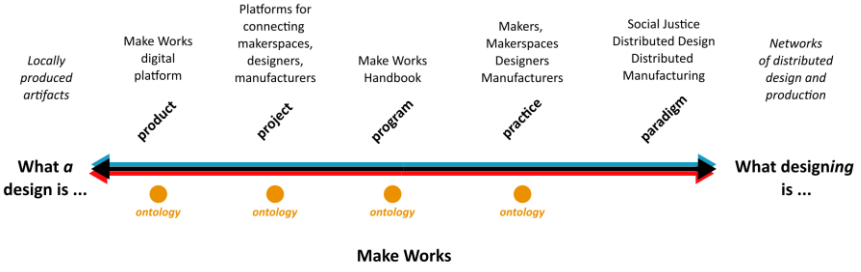

Figure 4. A Research through Design strategy for ontologies in Make Works.

4.4 Appropedia

Funded in 2006, Appropedia is one of the main wikis dedicated to sustainability and international development. Its community focuses on the documentation of open source appropriate technology (Pearce, 2012), and currently hosts hundreds of appropriate technology designs developed by its community. Ontologies in Appropedia comprise these categories: a) a description by the author of artifacts and tutorials, b) contextual applications of technologies in different conditions and through design decisions, and c) impact validation by users in terms of the Sustainable Development Goals or other domain-oriented impact frameworks. Appropedia aims to align its ontologies with the Open Know-How[5] standard to reflect manufacturing capabilities and contextual aspects related to replication and impact to the ontologies.

In its Research through Design strategy (Figure 5), the platform's documentation functionalities are the product to be developed, while the platform is the project. Open

[5] http://openknowhow.org/

research of appropriate technology is the program connected to and informing the work of design students, researchers, designers, makers and non-profits. Finally, Open Source, Open Design and Hardware and Appropriate Technologies represent the overall paradigm informing all of these. This strategy would then connect the documentation of the design and manufacturing of open artifacts with researching open source appropriate technologies.

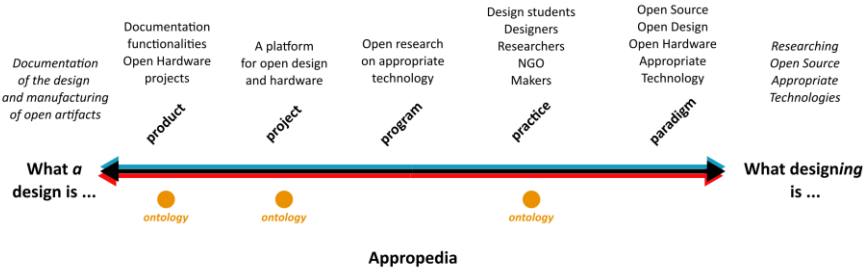

Figure 5. A Research through Design strategy for ontologies in Appropedia.

5. Conclusions

The lack of standardised guidelines and ontologies for Open Design and Hardware create communication barriers and pose a problem for discovering these artifacts through machine-readable search engines and, therefore, ultimately to services and platforms for designers. This paper argues that a collaborative approach to the definition of ontologies could provide an exciting direction for creating documentation tools for developing and managing Open Hardware and Open Design projects and processes. Furthermore, exploring this direction could also improve our understanding of how a design approach could work with ontologies and digital technologies while enabling designers to reflect upon the nature of their practice and its impact on stakeholders' cultures. Overall, this research points out how engaging communities in developing their technological infrastructure has far broader implications about design and its role in supporting collaboration and its practice, research and culture. This paper also contributes to the emerging approach of Community-Centred Design (Meroni & Manzini, 2014; Villari, 2013) by expanding its focus towards data ontologies and local worldviews. Through a focus on the community dimension, Community-Centred Design has extended the scale and complexity of the engagement of users in design processes and projects further beyond Participatory Design and Co-Design (through their engagement as individuals), User-Centred Design (through analyses of their needs) and User-Experience Design (through analyses of their experiences). This approach further adds a focus on the analysis of the communities' worldview of how design processes and projects are structured (ontology as a worldview) by linking it directly to the development of digital tools and platforms that would support their engagement (ontology as a data format)

(Menichinelli, 2020). This approach enables designers to develop digital tools directly linked to how communities perceive and consider intangible entities such as design processes.

In this paper, we present the results from a workshop that explored the prioritisation of domain concepts through a game of card sorting/generation to classify the elements of an ontology. Furthermore, we elaborate insights and Research through Design strategies towards integrating the design of ontologies with the participation of users and their communities, bringing Community-Centred Design to ontology engineering as both Meta-Design and Ontological Design. The approach was well received by the workshop participants and provided content for the elaboration of several insights. However, such contents and insights are constrained by the limited context of the workshop. Further research should expand them by working directly with communities with an Action Research and Research through Design approach to give them an active role. For these reasons, the paper contains three Research through Design strategies for co-designing ontologies in three different examples of Open Hardware and Design projects within the Maker Movement: from a single project (GROUU) to a repository of projects (Appropedia) to a network of manufacturers of projects (Make Works). Thus, further research is important for improving the workshop structure and methods, extending to more elaborated methods and testing and implementing the Research through Design strategies in real life.

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Acknowledgements: The authors would like to thank the participants of the "Ontology of the Open for Open Hardware" workshop, which took place on Friday 10th of May 2019 at the Creative Commons Global Summit 2019 in Lisbon. Likewise, they would like to thank the organisers of the Creative Commons Global Summit 2019 for hosting the workshop. Emilio Velis would like to thank Creative Commons for the scholarship support for attending the Creative Commons Global Summit 2019. André Rocha and Alessandra Schmidt received support from the Distributed Design Market Platform (591699-CREA-3-2019-1-ES-CULT-PLAT) Creative Europe project.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Contemporary Spaces of Apparel Design: Embracing both Digital and Physical Environments

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Abstract | The juxtaposition of digital technology with the physical environment has changed the way humanity moves through life, contributing to complex relationships with our surroundings. Spaces are no longer limited to the tangible as computer screens become portals to auxiliary environments, altering perceptions of distance and time. The relationship between the hand and material object has changed as the work of design blends virtual and physical spaces requiring agile design thinking. This article examines these digital and physical spaces through the lens of a reflective creative apparel design practice, specifically investigating the use of the digital textile printer alongside traditional garment-development methods. Craft and technology discourse provide a framework for using these spaces by analysing them as tools in the making arsenal. Here, by acknowledging the contemporary design environment and embracing the juxtaposed digital and physical spaces for design, an innovative workflow is established that encourages improved design and making systems.

KEYWORDS | DESIGN ENVIRONMENT, APPAREL DESIGN, DESIGN THINKING, TEXTILES, TEXTILE PRINTING

1. Introduction

The juxtaposition of digital processing devices with the tactile, physical environment has changed the way humans move through life, contributing to a more complex relationship with time and place. The time required to accomplish tasks, communicate overseas, or move across the globe has been shortened, and immediacy of results is celebrated. Life's activities are now nearer each other in time, making the places these events occur nearer in thought, if not nearer physically. Because digital technology is a driving force behind this shift, product designers must consider how this affects the making process, the product being produced, and how the product will be used. Much design work is now conducted digitally, in a space where new hand and machine relationships are established. Working through a screen instead of manipulating physical objects allows for experimentation in design with the ability to "undo" actions or test multiple versions without committing to irreversible manipulation of materials. Design iterations are interconnected and virtually side by side for evaluation. This article looks at the digital design environment through the lens of a reflective creative design practice, uncovering how this environment operates as a space for innovative design thinking. Specifically, it investigates the use of the digital textile printer alongside traditional garment-development methods to seek out innovative processes through the development of a body of work using "making as a way of generating design knowledge." (Loh, et al., 2016) It focuses on how both physical and digital design environments work as complementary tools that work in tandem rather than focusing on pre-programmed tool or computer program purposes; for as the more focused these purposes become, their range of creative use is limited. (Albers, 1971) Theoretical craft approaches to making provide a framework for using these digital and physical places by analyzing them as tools in the making arsenal; when these tools are combined with creative play, risk-taking, and design thinking established processes are challenged and pushed towards innovation.

Digital tools and processes are introducing significant changes to the way the apparel design industry operates, including the way clothes are produced. Traditionally, a skilled patternmaker using draped muslin and paper patterns would develop sewn samples that would allow direct evaluation of aesthetics, functionality, and material choice. Modification to the sample required additional versions, and unless a complete re-make is developed the original is lost. With the development of digital platforms, programs such as Adobe's Illustrator and Photoshop, Optitex, Gerber, Browzwear, and CLO 3d provide both 2D and 3D spaces for apparel design and development. Within these constantly evolving technologies, the designer can save multiple versions, experiment with aesthetics and construction, and plan order of operations in the digital space before consuming physical materials for sampling. However, a design on a screen can only understand the nuances of physical material qualities as well as a person programming or using the machine understands them. (Albers, 1971; Edwards, 2000-2001; McCullough, 1996) This suggests that a relationship between processes would be more efficient and innovative.

To develop this relationship, the physical and digital design spaces can be organized and understood as tools. Through this lens we examine how designers might work to problem-solve by combining process and material knowledge the with use of the most appropriate tools. The impact of this designation of tools could be approached from several points of entry, but as it involves the work of designing itself a practice-based approach is taken here. Within this research framework, the development of a capsule collection of garments incorporating both digital and physical tools is evaluated. Current fashion design processes are often problematic, and instead of solutions that are merely "modifications of these undesirable practices and the status quo," (Fletcher, 2014) this approach to the design process encourages the designer to experiment with new methods. In this work, using a practice-based methodology generated information from a maker perspective, supporting research of the design process; while this kind of research remains context-specific, it enables design research to operate as an "open system, one that is networked, responsive, and expanding." (Vaughan, 2019)

2. Contextual Review

This research seeks to describe a progressive relationship between the digital and physical spaces of design by analyzing the design process, and it draws from previous research on design, making, and apparel design, with both long-standing sources as well as contemporary articles valuable knowledge contributors. Because using available resources as tools to manipulate materials frames this work, craft-based discourse is highly relevant; additionally, while today's fashion and apparel field is a global, corporate industry the process of designing and assembling clothing has roots in craft as well. (Lou Taylor, 2004) Important to include here is the use of the terms "garment" or "clothing" instead of "fashion" in this article; Yuniwa Kawamura explains that "items of clothing must go through the process of transformation to be labeled as fashion" (2005), and here we will not be concerned with the sociological and semiotic transformation of the clothing object. Instead, we will focus on the designing and making process. Fiber artist Annie Albers's text *On Designing* describes the dance between functional and aesthetic concerns, and how this affects the maker's use of tools and materials; David Pye also writes about tools and the making process in *The Nature and Art of Workmanship* and *The Nature of Design*, providing a basis for making sense of balancing knowledge and skill with taking the risks needed to innovate. Bringing this into the contemporary lens, an article by Loh, Burry, and Wagenfeld is an example of how Pye's theory on the complex relationship between tools forms a repertoire, one that includes both the digital and physical. Additionally, these sources are examples of how knowledge can be gained through the kind of practice-based design research executed here.

Sources affirming the validity of digital technology for creative use within craft and apparel applications is helpful for both theoretical and methodological purposes. David Pye and Annie Albers contribute perspective on the relationship between hand-crafted methods and

contemporary technology, while Malcolm McCullough describes how computers and software are virtual tools for developing and making. McCullough expounds on both of these concepts in *Abstracting Craft*. Taking this further, Dreyfus and Dreyfus explain the importance of human intuition and expert skill in the use of these tools in *Mind Over Machine*. While this text focuses on robotics and spends time addressing fears around the development of artificial intelligence, the debate between the power of computers versus the experience-led wisdom and intuitive understanding of a human mind provides a useful model to follow when balancing logistics and innovation. The 2001 *Manus-Machina* exhibition catalogue by Andrew Bolton showcases the use of digital technology in apparel design and is important to reference for perspective on using digital tools to make clothing. Because this work involved developing original textiles, sources such as *Digital Textile Design* and "Design Thinking for Textiles: Let's Make it Meaningful" provided theoretical and methodological guidance.

3. Theoretical Framework

Textiles have long been used by humans to make garments that cover, adorn, and protect, and the garment manufacturing process has progressed along with advancements in better tools and new technologies such as the sewing machine. Additionally, social changes such as the industrial revolution and the rise of fashion houses at the turn of the century has led to the development of a complex, fast-paced industry that relies on digital design and communication to maintain. Before the current disruption from the coronavirus pandemic, this fashion system left little opportunity for the designer to think or work outside established systems of making clothes. The more regimented each step in the development and making process becomes, the less creativity or skill is necessary (Edwards, 2000-2001; McCullough, 1995); with regard to tools, the more focused they become, their range of creative use is limited (Albers). The fashion industry focuses on economies of time and money, and these processes settle at the most efficient balance of these with "best" ways of manufacturing generally evaluated in terms of their cheapness rather than ethical or environmental concerns. (Fletcher, 2016; Pye, 1964) Coping with the pandemic's effects on supply-chain logistics and changing consumer buying habits is requiring a new perspective on these priorities, such as a re-connection of time between seasons and collections. (McAlpine, 2020) To help guide us towards the sustainable systems changes often called for in current fashion discourse (Bowles & Isaac, 2012; Fletcher, 2014; Gwilt, et al., 2011) as well as those demanded by the effects of the pandemic, we can look at theoretical models for working creatively outside previously established systems. This idea is supported in Pye's (1968) theories on making, which acknowledge the safety in working within proven methods but also recognizes that taking risks is the only way to innovate, requiring a designer's intuition and dexterity.

The digital environment of design, encompassing both 2D and 3D computer CAD programs, is itself a contemporary design and making tool allowing "Concepts [to] become things. We

can't touch them yet, but we can look at them, point at them, and work on them as though with hand-held tools." (McCullough, 1996) While this opens opportunities for innovation it also enables the simplification of complicated process and the automation of physical tasks – a capability that contributes to mental de-skilling as well. (Edwards, 2000-2001; McCullough, 1996) This defeats the exciting possibilities for creative risk-taking and innovation, converting the digital design environment into "a means to an end." (Loh, et al., 2016) Dreyfuss and Dreyfuss explain that a computer is a logic machine that is an "ideal beginner," and an expert is needed to use the tool in an innovative manner; with expertise and intuitive decision-making the user can challenge pre-programmed uses. McCullough supports this, stating that "masters respond to context, even when doing so means breaking the rules;" this also encompasses the "…exploration, improvisation, and, to use the simplest word, play." (1996) When we simply collect processes to repeat, we do not construct new knowledge. (Albers, 1971)

The theoretical framework for this research is based on a craft approach to making, and by understanding the relationship between designer/maker, tools, materials, and end product we find a framework that encourages educated, creative, and methodical risks to open opportunities for innovative discovery. As Pye stated, "Tools of themselves make nothing," (1964) and are limited to what they are used to accomplish. Without design thinking, or the "creative input and designing workflow from the practitioner… such toolsets remain outside the practice." (Loh, et al., 2016) A designer with expertise in managing both digital and physical spaces of design in a symbiotic manner is needed to navigate the ever-evolving technologies that affect materials and tools. (Bye and Sohn, 2010; Carden, 2016; McCullough, 1996)

4. Process

The collection of garments completed for this work initially began as two separate tracks of design experimentation: one using traditional draping, patternmaking, and sewing methods, the other experimental prototyping using the digital design space. (Figure 1) Both directions sought to uncover design and making processes that would maximize the designer's creativity, reduce material waste, improve emotional durability, and serve functional and aesthetic user needs. Open-ended experimentation and design "play" (Flanagan, 2009; McCullough, 1996) within these spaces soon merged, as intersections between processes began to surface and the capabilities of each environment benefited one another. The result was a larger body of creative design research exploring this relationship, primarily incorporating patternmaking and sewing skills with the use of Adobe Photoshop and Illustrator to develop original textile designs. The researcher's twenty-plus years of patternmaking and sewing experience provided expertise in using textile materials and contributed an intuitive ability to manipulate shape and silhouette to minimize fabric waste. This was combined with dedicated research on the proper operation and capabilities of the digital textile printer. Use of textile printers began as early as the 1960s, and with

improvements in quality, speed, and accessibility these tools have contributed to connecting garment and textile design. (Bowles and Isaac, 2016) With these printers, designers can develop and design conceptually and aesthetically in a digital environment before committing to using actual resources. (Bowles and Isaac, 2016; Carden, 2016; McCullough, 1996) Furthermore, the digital printing process consumes far less water and energy, minimizing environmental impact. (Bowles and Isaac, 2016) In this way, the textile printer enables development and execution of creative, innovative, and less-wasteful garments; for these reasons, use of this particular technology became the fabrication tool spanning the digital and physical space.



Figure 1. The body of work completed in this practice-based research. The look in the far right uses the textured textile made from the motif components in the jacket.

The process of designing and constructing the garments integrated digital and physical spaces from the beginning. Garment patterns were physically developed using draping, flat patternmaking, and muslin sampling; simultaneously, textile print designs were developed digitally in Adobe photoshop. A snapshot of the *Castilla coccinea* wildflower provided the base motifs of the print; these were modified to adjust scale, contrast, and tone. By working in both spaces simultaneously, the textile and garment designs were developed in a complementary manner; volume and proportion created interest as well as highlighted the print designs. After developing the physical paper garment patterns and printing several successful 8”x 8” textile samples, the garment patterns were digitized and placed in photoshop to be joined with the textile print. Here, via the screen, the logistics and aesthetics of the project could be evaluated before moving forward. Several design problems presented themselves. First, the garment pattern pieces did not efficiently nest

within the printing area, leaving significant waste material. Second, the print scale was not appropriate for all applications on the garments. Additionally, the engineered prints and stripes did not match the intended pattern pieces perfectly.

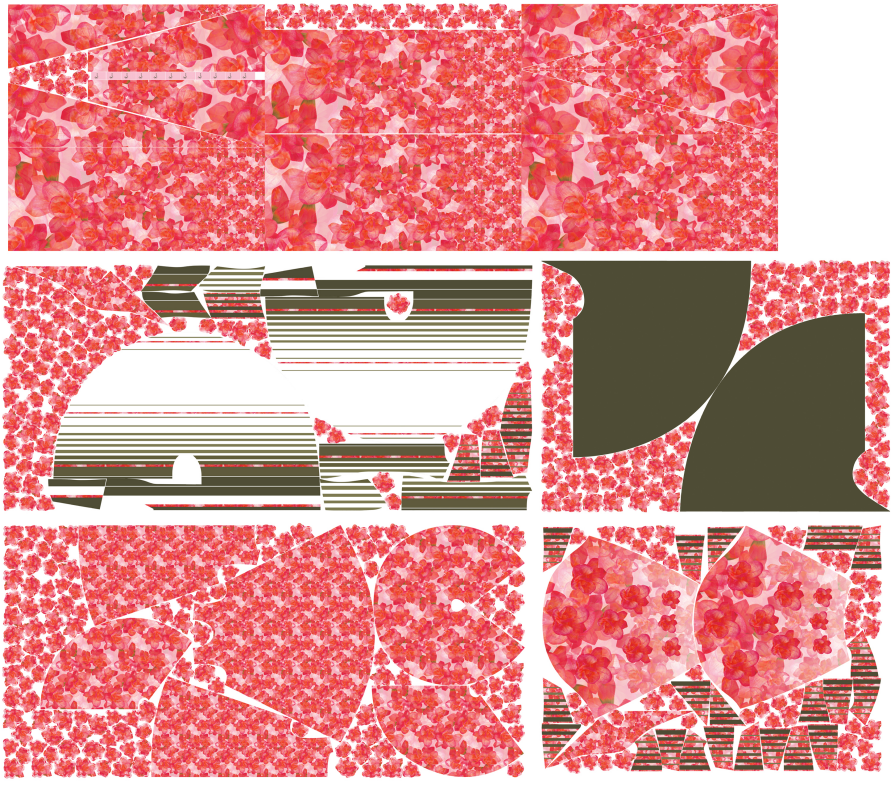

Figure 2. The print layouts were completed in three- to five-yard increments. Tight nesting of the pieces was considered; filling in empty spaces are the smaller motif pieces.

To resolve these design problems, knowledge of the advantages of both digital and virtual places of design was employed concurrently; as a result, the plan for the printing process shifted from producing repeat print yardage to engineered printing. (Figure 2) This allowed the prints to be placed directly on the garment piece in the proper location, and the pieces from various garments could now be intermixed on the blank yardage to enable better nesting and create less waste. Correcting the textile print scale was easily done by digitally developing several versions to compare in relationship to the garment silhouette and body shape. Despite these modifications and a meticulous print layout, the printing process still left a significant amount of textile waste. Smaller pieces were needed to fit within the spaces of the layout, leading to the development of an additional garment that could utilize small,

repeatable components. Using the individual print motifs as component pieces, these were placed in every crevasse of the print layout, allowing significantly more of the raw textile to be used. (Figure 2) The yardage was printed, and the larger garments pieces were cut and sewn while the motif areas were arranged and placed in the laser-cutter to create hundreds of individual shapes. These were then attached to a base textile to create an entirely new textured fabric. (Figure 1) The resulting body of work represented a workflow incorporating physical and digital spaces as symbiotic tools enabling both resources and creativity to be maximized.

5. Analysis

Digital printing allows for flexibility in surface design through color, scale, and placement, and the juxtaposition of the physical and digital places of design using traditional knowledge alongside emerging technology created avenues for developing on-demand customization, accessible creative branding, and forward-thinking methods of making clothing. The open-minded view of incorporating these resources during the process is key, encouraging treating materials as a direct source of knowledge through direct material handling (Marr & Hoyes, 2016) and allowing the maker to respond intuitively when working in both physical and digital spaces. With this approach, they are used strategically as symbiotic tools and the space and time between tools is narrowed allowing design problems to be recognized quickly and resolved digitally. Logistics within the digital environment presented solution options, while knowledge of how the physical material would be sewn, constructed, and draped in the final printed textile material guided the final design solution. This illustrates how an agile, flexible, and resource-led attitude towards tools and materials enables the designer to understand and execute solutions. Risks were managed or worked out digitally before commitment to physical goods, and intuitive experience challenged the digital solutions to their fullest potential.

The designer is more capable of experimenting with methods that lie outside established systems and can develop ways of working that resolve problems such as those within the apparel industry. The challenges facing the industry include adjusting to significant changes in how products are produced, marketed, and purchased – an issue highlighted by the coronavirus pandemic – while resource-depletion, pollution, and ethical manufacturing remain problematic. A new perspective on the processes of design, including a holistic, resourceful view of materials and tools enables the designer to have greater impact through design thinking and incorporating solutions within the design, for “Change only begins to occur once practitioners come to understand the potential of new technology and are comfortable with it.” (Bowles & Isaac, 2012)

6. Conclusion

How we value and nurture the relationship between digital and physical spaces of design is critical to future innovation. Through applied design research and consequent reflection on that practice, a new workflow that shrinks the distance between the digital and physical environments emerged. Because this design research focuses on the tools and materials within each space, by framing these disparate design environments as tools or "toolchests," the focus moves from an isolated or independent approach to an integrated one that allows the practitioner to use creativity and intuition to design a better workflow. (Loh, et al., 2016) This relationship between digital and physical tools assists the removal of limiting processes and tools for their intended purpose only, for "the more we learn how to do, the less we know what to do." (McCullough, 1996) Guided by design thinking, the work of designing becomes an intentional, problem-solving activity as a result, and a more circular or responsive way of using materials and planning production occurs. Specifically related to this practice-based research we also see that "Design thinking is not a commodity, therefore the act of making textiles is more than a series of steps on the road to new product development and innovation." (Valentine, et al., 2017) The work of designing using traditional garment-making methods alongside the digital textile development provides an example of how we can approach design in a contemporary manner.

A re-thinking of the apparel industry as a whole is often called for in discourse addressing concerns about resource sustainability, ethical manufacturing, and pollution (Fletcher, 2014; Gwilt, et al., 2011), yet recommended solutions are limited to modifying specific parts of the larger system or discussing larger theoretical approaches. However, these parts are interconnected, and focus on an isolated area limits effectiveness; furthermore, consumers expect both aesthetics and functionality, and both must be addressed. When either is highlighted, the designed object is limited, and this segmentation "arrive[s] at separate instead of at a single, all-inclusive form that embodies the whole of our needs." (Albers, 1971) The designer is at the heart of this complex system, and "From the centralized position the designer can influence and impart new (sustainable) information that aids in the design and production of 'better' garments." (Gwilt, et al., 2011) This places responsibility on the designer as a driver of systems change; with a contemporary perspective and understanding of the tools at their disposal they are better equipped and empowered to effect change. The industry is undergoing a seismic shift, and the various technologies being introduced are yet to be fully understood. But if we organize our perspective by considering the positive impact of condensing the space between these tools through physical and digital capabilities, the possibilities for developing innovative solutions to many of the challenges facing the fashion industry are reachable.

This suggests that we not simply look at what each place of design offers individually, and that we look beyond designing in a linear manner. This particular body of work began as disparate exploratory tracks, yet the contemporary design atmosphere requires collaborations of resources, including tools. The models of design and business planning are

undergoing an accelerated transformation requiring agility and progressive thinking. This requires organization of methods and tools, or the designing of a path to begin "mastering your means to the point they no longer interfere with attaining your ends." (McCullough, 1996); brands and designers who embrace intentional, thoughtful incorporation of digitization within the entire the design development process will be equipped to survive the coronavirus pandemic and become part of a more sustainable, evolving new workflow. Considering environments or spaces of design as tools provides that organization, and by educating current and future designers, product developers, and makers how to harness the physical and digital places of design as tools in the making arsenal, they will be better equipped to balance the value of human understanding, empathy, and intuition with logistical, algorithmic, digital technologies to thrive in an increasingly virtual and data-driven world.

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Design Cultures of Making: Fashion thinking as creative process and pedagogy

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Abstract |This paper shares research being developed through an Art and Humanities Research Council, Creative Industries Cluster funded 5-year project, the aim of which is to transform the competitiveness, agility and creative output of the UK's fashion industry. Its focus is to develop innovative , multidisciplinary STEAM+D based fashion designers, industry facing training , and education for post graduates fashion students, breaking down traditional fashion and technology silos.Through their work a group of researchers at the Royal College of Art attached to the Future Fashion Factory Project (FFF) propose fashion thinking as a new rational for fashion education that has three distinct strands – fashion thinking for social-change, fashion thinking for applied specialisation and fashion thinking through advanced manufacturing. Fashion thinking through advanced manufacturing is discussed here highlighting Discourse, a tool developed to enable investigation into current pedagogic models, and revealing the importance of developing new language competencies for fashion.

KEYWORDS | FASHION THINKING, DESIGN THINKING, INDUSTRY 4.0, DESIGN ANTHROPOLOGY, PRACTICE BASED, PRACTICE LED, STEAM+D.

1. Introduction. The Creative Industries and Manufacturing Landscape in the UK.

In the Executive Summary 2020 ,Manufacturing the Future Workforce, The High Value Manufacturing Catapult recognised that the overall contribution manufacturing made to the UK economy was in decline but the government wanted to make the UK more competitive in this field. The counter narrative developed through the Creative Industries Federation, the independent body which claims to represents, champion and support the UK's creative industries, stated that the creative industries were growing at more than twice the rate of the UK economy. However, there was a recognition that UK creative industries were under-capitalised, suffered from skills shortages and were hampered by a lack of diversity and unequal access to opportunities. Agility, new skill sets and a younger workforce were seen as imperatives to greater success . The Creative Industries Manifesto (Creative Industries Federation Report 2020) proposed equipping the next generation of the workforce through returning creative education to the heart of the curriculum. Countering this, the Longitudinal Education Outcomes data (LEO,2019) suggested studying for an arts and humanities degree did not enable graduates to earn significant salaries by age 29 when compared to economics or science graduates , with a sub narrative that undergraduate courses in art and design do not contribute significantly to GDP. The Creative Industries Manifesto suggested that metrics beyond salary were urgently needed to capture the true value of creative education. Wider measures such as social value, creative achievements, and civic contribution must be recognised they claimed.

A complex narrative and counter narrative are still developing in UK politics involving the creative industries, manufacturing and higher education. Post the UK leaving the European Union many policies will be rewritten and new strategies developed that will impact all 3 sectors and their relationship to each other. Recently published reports commissioned by the UK Government suggest a confusing picture of claim and counter claim focusing on the value of an arts and humanities education and its contribution to the UK economy. These include a new industrial strategy document and the Ten Point Plan for a Green Industrial Revolution Building back better, supporting green jobs, and accelerating our path to net zero (2020). The tide may even be turning, back in favour of the creative industries due to the devastation caused it in the UK by the pandemic. It is within this fraught landscape that UK art and design schools are being challenged for their relevance and may need redesigning for a more agile future.

2. Creative Industries Clusters Programme. Future Fashion Factory.

In 2018 the Creative Industries Clusters Programme funded by the Arts and Humanities Research Council invested £80m in eight new creative research & development partnerships

bringing together the UK's creative industries with the university sector. This programme was proposed as a catalyst to further grow the creative economy unlocking emerging fields and adapting new technologies. Part of the UK Government's Industrial Strategy Challenge Fund, the programme proposes to drive economic growth through the development of new products and services to address some of the problems of skill shortage, an aging workforce, lack of agility and so on.

The 5 year project funded through this programme and jointly held by RCA, the University of Huddersfield and the University of Leeds focuses on industry-led challenges in which designers are at the fore front of the creative process, applying, co- developing and implementing new textile and industrial digital technologies in collaboration with supply chain manufacturers and other technology experts, in the high value luxury textile and fashion sectors. Developing a new skillset for designers is central to the project as the research focuses on developing two key themes: Digitally Connected and Sustainable Processes and Digital Communication Systems. The RCA is tasked with developing research from both themes to address the identified skills gap in the industry where multidisciplinary designers trained in a unique combination of art, design, science and technology competencies linked to the STEAM+D agenda might answer the need for a newly skilled workforce.

Through FFF the RCA is working with multiple industry partners assessing, from a designer's perspective, how new technologies might be configured and implemented as they are developed. The disruptive influence on the way that business in fashion design is done is being explored by RCA researchers who have received additional funding through the AHRC to be trained in design anthropology and ethnographic methods. Design Anthropology takes the future oriented nature of design and marries it to participant observation as a key component of anthropology, setting itself the challenge of developing tools and practices for collaborative future making. Design Anthropology integrates anthropology's rich tradition of contextualisation and interpretation into the tasks of design, emphasising the generative role of theory in developing design concepts and critically examining existing, often implicit conceptual frameworks. (Ton, Otto and Smith 2013). This approach , married to an examination of Design Thinking and Textile Thinking, an engagement with Transition Design theory, Theory of Change protocols, practise based and practice led research methods will be developed over the course of 2021 and shared through a book sprint and podcast.

3. Fashion Education: Old & New Models of Pedagogy

Traditionally focused on training students in conceptualising, designing and making of their own collections, most undergraduate and postgraduate fashion courses in the UK have not significantly evolved over the past 25 years. They appear to be increasingly unsuccessful in training students to enter a world of advanced manufacturing, relying on machinery and manufacturing processes that have not changed significantly in over 100 years. Design

students are not trained to work with digital tools, leading manufacturing systems or engineering technologies or in the development of new models of entrepreneurship or circular economic models that now make up the fashion industry landscape. Nor are the students being equipped to address societal and environmental concerns in the rigorously informed way demanded by both industry and consumers.

Reports from Fashion Industry Journal Business of Fashion (State of the Industry Report *McKinsey & Company/ Business of Fashion* 2016) showed that students entering the jobs market were lacking knowledge specific to new technologies resulting in impaired ability to challenge current practice or develop new design-led roles. The future of the UK Fashion Design School may depend on these new insights. Multi-disciplinary universities in the UK have already understood *design thinking, speculative design, and critical design methods (Rogers and Bremner 2019. p.5)* as useful approaches to innovation and are leading the way in research for new economic models of values led entrepreneurialism and the design of 'volume to value' business models that are profitable without growth. As Rogers and Bremner (2019 p 4-5) suggest any repositioning of design education 'must first acknowledge that it has been complicit in creating a world that nobody wants any more'. They recognise a shift in UK Design School approaches in a journey from an emphasis on design, to a desire to 'gain academic legitimacy' establishing dialogues with history and scientific and philosophical theory, then a 'search for legitimacy through design science' and finally a push towards interdisciplinarity 'in an allegiance with technology'.

4. STEAM+D

STEAM as a new industry facing pedagogic model originated from Rhode Island School of Design (RISD). Researched over the course of 4 years from 2011, and driven by an understanding that design education fosters critical thinking and comfort with risk taking , RISD's ambition was "to reach consensus among disciplines on the requirements of the 21st Century workforce" (Allina, 2019.pp 32). In the United States the understanding of the value of design to advanced manufacture is well established, where RSDI considers design to be a literacy, a capability and a specialism. The Design Council Report *Designing a Future Economy- Developing Skills for Productivity and Innovation 2018* suggests that design skills are the fusion of creativity with technical ability and interpersonal competencies. They highlight moving from STEM to STEAM+D - that is, Science, Technology, Engineering, Art and Maths, to include D, the Design element, to ensure a resilient economy in the longer term. The report encourages policy makers and education providers to consider how they will develop the complex problem solving, critical and creative thinking abilities that are essential to innovation (Design Council 2018).

In their *Leading Business by Design: High Value Manufacturing* report the Design Council (2015) the policy recommendation was that young people at all stages of education require exposure to the multidisciplinary mix of science, technology, arts, humanities and enterprise

that should underpin both creative and manufacturing success in the UK. They go on to say that government should provide incentives to universities to deliver an increased range of multidisciplinary design courses in partnership with expert bodies to enable engagement with *the fourth industrial revolution*. The RCA introduced the STEAM approach to its programme delivery in 2016 as part of its strategic plan announced in the Vice Chancellor's report 2016/17. The report stated that developing new models of postgraduate, research-led design education are key to the delivery of a distinctive STEAM education at the RCA. The evolving pedagogical model adds research-driven enquiry, applied through knowledge exchange with industry and through dynamic and 'live' curriculum developments. This research is frequently inter- or multidisciplinary in character, the RCA being the UK's most research-intensive art and design university.

The RCA's 2016–21 Strategic Plan outlines the roadmap for the development of the university's taught programmes. Over the planning period, it is developing new programmes to ensure that it remains at the forefront of art and design education. The RCA is supporting design development through an interface with three core scientific disciplines: computer science, materials science and robotics. Around 11% of the students hold a first degree in fields beyond art and design, for example medicine, finance, law or engineering. These students bring knowledge and expertise from previous careers, and find new, creative applications and solutions through studying at the RCA. The LEO data (2019) supports the proposition that it is through a mixed and interdisciplinary training, particularly an undergraduate degree in science and engineering, married to a post graduate design degree that enables graduate earnings to substantially increase. The Fashion Programme at RCA has seen many more students apply with first degrees in maths, biological sciences, architecture, and computing.

The basic principal of Industry 4.0 is that by connecting machines, work practices and systems, businesses are creating intelligent networks along the entire value chain that can control each other autonomously. UK fashion students have been trained to become micro businesses and then Small to Medium size Enterprises (SME's) and UK Government research funding has targeted small-scale enterprises through research with UK universities like the Creative Clusters Programme. This strategy looks as if it may pay significant dividends in the new post pandemic business environment . *McKinsey & Company/ Business of Fashion* (2019) recognised a new role for small players where they might support R &D for larger brands in in-house labs, or attached to universities as Learning Factories designed as a simulation to enable experiential learning as happens in European technical universities. It is proposed this is where the RCA could lead the way, embracing new technical, economic and sustainable challenges. The linking of small designer business to offshored volume producers had been developing at speed through designers' bench and desktop factory technologies - pattern cutting tools that enable digital development of pattern files that can be sent anywhere in the world via digital networks. An example of how fashion designers are needed to engage with these new industry paradigms can be demonstrated by the fact that these tools do not currently serve the industry well. They do not provide accurate enough fit, that

is, how the pattern fits together and then fits on the body. The systems have been designed by engineers, excluding fashion designers from the initial design process, and in the workplace, where the technology needs to be operated by a skilled technician. The systems serve lowest common denominator manufacturers where speed and cost over pattern accuracy had become the dominant metric over design and fit. This had led, it is argued, to the huge problem of too cheap, undervalued clothing ending up in land fill. Challenging a mindset that proposes "just about accurate" as good enough is where the designer/ researcher's value lies.

5. Fashion Thinking – A New Model

Initial FFF/ RCA research reveals the necessity for training a new type of multidisciplinary fashion student/researcher/designer who can rise above existing "siloed" training structures and who has the intellectual capacity to question, hold to account, and design within, emerging and evolving new industrial models. RCA Future Fashion Factory researchers have proposed and are developing three new directions which can be viewed as distinct, but also linked and coupled, to co generate knowledge and form new propositions for designer led research and practice. Beyond Skov and Melchior's (2010) identification of an object based /culture based /practice based and production-based approach this research supports the following positions:

Fashion thinking for social change proposes following a humanities trajectory, looking at systems for sustainability and bio design as well as user experience, informed by psychology and new economic models. The future of meaningful work, infrastructure change and workers' rights fall within this remit. Neo colonialist perspectives are challenged.

Fashion thinking for applied speculation develops criticality, assessing movements within the industry to test fields of application contextualised by new textile and digital technologies, aesthetics, philosophy and science. Circular economic models, their 'complex web of logistics' and scalability problems (BoF 2020) are explored for long term solutions. The ethics of new technologies are also challenged within this paradigm.

Fashion thinking for advanced manufacturing encourages work that radically reimagines making processes, machines and systems from a designer led perspective within the context of Industry 4.0. Degrowth and just in time economic models, agility in manufacturing, scalability and adaptability, R technologies (Stahel 2017) and reverse logistics are developed here.

A series of 'platforms' designed to support engagement with these new perspectives were introduced by Zowie Broach, Head of the Fashion Programme at RCA in 2016. The platforms, Bio Design, Sports, Digital and Future Systems were developed and led by Helen Steiner Graeme Raeburn, Kath McGee, and myself and supported by scientists, engineers, and digital technologists during students' first year at the RCA. The agile structuring of the

platforms has evolved year on year and the content is developed to be future facing and provocative. The groups are taught in parallel with an understanding that there are shared rationales, areas of interest and synergies. Collaborations across Platforms are encouraged. This work is supported by a lecture series and a Work in Progress show.

Each of the platforms has proved to be positioned in exactly the right place to respond to the Covid crisis. According to BoF-McKinsey State of Fashion 2021 Survey (2020), the most fertile ground for new opportunities will be in the areas of digital technologies and sustainability. The casualisation trend that was already in motion before the pandemic is likely to emerge as a ' dominant force' in fashion in 2021. By October 2020, sportswear company stocks had exceeded their pre-crisis-levels by 7 percent according to BoF, while the non-sportswear clothing was down 18 percent and designers are experimenting with a pre-order selling and zero stock models.

Strand 3, Fashion Thinking through Advanced Manufacturing is being further developed in the context of the FFF research investigating the potential for reshoring UK manufacturing in Industry 4.0. In order to equip masters' students with research skills for them to explore and critically examine Industry 4.0 it is proposed they will need both hard and soft skills. Skills that include an understanding of technologies, digital tools and engineering, married to critical thinking, collaboration and interdisciplinary working.

Vaughan (2017) claims that underpinning practitioner research is the understanding that the practitioner–researcher has the skills and expertise in the actions of the field to be able to undertake research within it. Citing Schon, Vaughan points to the transition from designer-practitioner to designer-practitioner–researcher in the course of academic study, as a shift from being able to understand and articulate the value or challenges of technical acts, to being able to place these in broader socio-cultural, technical and economic contexts.

Beyond Nixon and Blakely's notion of Fashion Thinking as "adding meaning and value to the functional and experiential spheres of products and services," (Nixon and Blakely 2012) that hints at the commercialisation of Fashion Thinking for use in business, just as criticism of Design Thinking proposed it as a branding exercise for a set of concepts (Curdale 2013, p 14) RCA research builds on the idea of Fashion Thinking as a "paradigm of critical thought and creative agency". However, rather than proposing Fashion Thinking as a methodology to be incorporated by organizations beyond fashion, its first function as a mixed methods approach to designer led research can be to serve a new generation of leaders *within* the fashion industry. Fashion Thinking as a methodology draws from perspectives developed in *Design Thinking*, Textile Thinking and STEAM +D approaches in its collaborative methods and iterative prototyping . However, RCA FFF researchers propose that through training at Masters level students can take on the complexity of the wicked problems the fashion industry has generated. This also aligns fashion thinking with parts of Transition Design. The *fashion thinker* will be better able to critically appraise complex situations and propose new approaches, systems and economic models through design. Led by, and in combination with, a newly developing confidence in practice based and practice led research, and inclusive of a

more traditional and well- established humanities/consumption focused research , I propose engagement with, and designing of, new technological advances can lead to a more environmentally conscious fashion and textiles industry. The possibility to foster this change is through joint industry/academic/ engineering engagement that is more investigative, critical and reflexive on both sides.

6. Discourse as provocation

Discourse: A Tool to Debate the Future of Fashion AS Design , designed by RCA Fashion graduate and Future Fashion Factory Research Associate Chelsea Franklin in 2018, was a card-based tool aimed at encouraging debate among fashion students on wider developments in education and industry and the scope of their responsibility. Franklin developed the tool over the course of two years with the support of Zowie Broach, the Future Systems Platform and the wider fashion team at RCA in response to her observation that the type of engagement seen in other design disciplines had not been fully represented in fashion education. Her background was as a designer for an international brand. *Student* engagement should, she proposed, include research around bottle necks in commercial opportunities ,an in-depth understanding of material choices, understanding global context, competition, and collaboration in industry 4.0. Her design research included investigating design tools and games such as those produced by IDEO. The aim of the initial prototype was a means for Franklin to illustrate her place and intention amongst the fashion cohort.

Discourse was created in response to a perceived disconnect between the value systems within fashion education and industry. Franklin suggested that the fashion system struggles to produce value. Responsible for both fuelling and exploiting a growing consumer demand for a faster and cheaper product, she believed the fashion industry had educated consumers to understand that fashion had very little value. The workshop developed through *Discourse* began with the objective of generating dialogue and supporting debate on aspects of the fashion system. This was tested by Franklin with her graduating cohort and at her degree show and then as an FFF researcher in two key settings. The first was the International Association of Societies of Design Research conference(IASDR 2019) in Manchester titled Design Revolutions. The workshops were premised on the idea that other design disciplines have much to teach fashion through open dialogue around shared problem spaces. It was observed that participants were able to engage with *Discourse* at a high level, and given levels of expertise in a range of fields, the responses were often delivered using examples from disciplines outside fashion as well as personal (consumer) experience and opinion.

The second workshop setting was at RCA in a series of workshops with first year and second year Fashion MA students. Though the aim was to encourage debate, analysis from data collected (sound recordings, survey-based feedback ,interviews) revealed that this was problematic for many participants due to lack of knowledge of specific industry terminology, conscious feelings of courteousness with peers and self-reported concern about ability to

understand the probing language of the questions. Although *Discourse* was designed to enable dialogue, interacting with it in a range of controlled settings revealed the wider challenges fashion students face in articulating and responding to the themes presented. Data collected from *Discourse* sessions with fashion students point to two major findings. Firstly, they appear to imply a lack of knowledge in certain aspects of the fashion system, in particular production and new technologies. Even if students had worked as designers, claims of being kept away from sites of production still persisted (Tham2008) Few if any students had worked in manufacturing settings. On the RCA fashion program, establishing means for language and skills acquisition through industry exposure, engaging in research projects as well as formal learning opportunities to develop meta- competencies aims to enable fashion students to critique, disrupt and innovate in the making, designing and fabrication processes, through and with the design of machines, new tools and systems.

Testing *Discourse* three sets of value were expressed: - students' value to industry, industry's value systems and consumers' understanding of the value of fashion. The findings show that students can sometimes feel ill equipped to tackle the complexities for the fashion industry. It is proposed that until students understand existing systems, they will be unable to challenge them and this becomes crucial for a post pandemic industry where returning to old ways is not possible or desirable. The absence of industry, engineering and science from fashion education can mean insufficient specific insights of the field graduates are about to enter. This is a historic problem in the UK which will see a dramatic change in fortunes in the coming years as the UK Government is faced with the new economic landscape facing fashion design. Meanwhile the reshoring the UK fashion industry looks like a more and more viable option.

Conclusion

The situation for Art and Design training at undergraduate and post graduate level in the UK remains complex and uncertain particularly in light of the UK 's withdrawal from the European Union. If the UK government continues to support the development of an advanced manufacturing sector and the reshoring of UK manufacturing industry then UK fashion education can rise to meet this challenge developing the way fashion is taught to engage more fully with Industry 4.0. At RCA the STEAM+D focus aims to give masters students a critical advantage, shifting towards becoming designer-practitioner-researchers. Through industry facing projects, collaboration with science and engineering they will able to engage more fully with industry partners both nationally and internationally, co-developing industry facing projects and placements, initiating collaborative industry PhD studentships and MA business sponsorship, and the establishment of research labs, co-situated within academia and commercial settings, to foster radical change. The development of fashion thinking is predicated on this engagement with industry. Within the context of post graduate fashion education, engineering and industry collaborations can enable acquisition of Discourse, where the role of the university will be to provide space for

learning - establishing meta knowledge, criticism and reflection through academic research channels.

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Acknowledgements: I would like to acknowledge support from Kat Thiel, Chelsea Franklin, Doug Atkinson, Margot Vadderpass, Marion Lean, the Future Fashion Factory and RCA fashion teams.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design culture of playing. The musical instrument industry: an important culture of made in Italy

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Abstract | The production of musical instruments is an industry where Italy is one of the acknowledged world leaders.
A musical instrument is a product with a high degree of technology and design, where historical tradition and cultural roots have been handed down, together with the necessary incremental innovations: it has all the features to be considered a very "Made in Italy" product.
In any book, conference, exhibition about Italian design it can be easy to find many small traditional companies that produce furniture, accessories, bathrooms, kitchens, tiles, handles, shoes, clothes, glasses, food, wine, and cars: Ferrari is immediately identified as Made in Italy; on the contrary, it could be very hard to find excellent products as a Fazioli piano, a violin from Cremona, an accordion from Castelfidardo, a Harp from Cuneo, cymbals from Pistoia.
Why is the Italian musical industry still not present in the spotlight of Italian design?

KEYWORDS | MUSIC, MADE IN ITALY, PRODUCT, TECHNIQUE, TRADITION

1. Economic data

Some economic data can help to understand the importance of the Musical design industry in Italy: 1.021 enterprises are operating in the production of contemporary musical instruments with an export amount of 116 million euros (source: Registro Imprese and Istat, 2015). We are talking about micro and small enterprises and in some cases medium ones: 85% of active enterprises are of artisan production, 15% (144 enterprises) are industrial ones, with an average of 6 workers. Despite the dimension, the Italian musical instrument industry is important in international markets, and in some cases (Fazioli piano and other) it represents excellence. The export trend is increasing so that Italy is the 9th biggest exporter of musical instruments in the world. If we consider big countries like the USA and China and technological excellence like Japan, we can assume that it is a good position. Approximately 70% of Italian enterprises are located in 6 regions: Lombardy, Marche, Emilia Romagna, Veneto, Piedmont, and Trentino Alto Adige. This is mainly due to the deep connection between the artisan tradition, local materials, the history of music and the history of Italy in general. Districts and supply chains are fundamental in our musical production: some famous examples are the Recanati – Loreto – Castelfidardo district, with its keyboards and accordion (fisarmonica) production, the district of Cremona with one of the most important string instrument production, the North-Eastern part of Italy with its excellence in raw materials such as the red conifer of Val di Fiemme and Panaveggio forest (the one used by Stradivari for his violins). (Antoldi et al., 2016). It is curious that those 6 Regions with the highest concentration of musical industries also are the Italian Regions with the highest number of Design schools, universities, and academies. Many of the most important design congresses and exhibitions are held there, many times about “Made in Italy” but rarely about musical design.

2. Deep roots in the Italian culture

The contemporary “design made in Italy” has many opportunities in the field of musical production, starting from the very deep and ancient roots of the Italian musical culture.

The name which is currently in use for the seven notes was invented shortly after the year 1000 by Guido Monaco from Arezzo, by taking the initial syllables of a Latin ode to Saint John. During the following centuries, the study of music and acoustic phenomena from a mathematical point of view became a fundamental part in the work of great Italian thinkers like Leonardo and Galileo, who contributed to the birth of the scientific method. Moreover, until then, the basic education of the medieval scholar included Music in the Quadrivium, which is the area of mathematical disciplines (arithmetic, geometry, astronomy, music) and not in the Trivium of philosophical ones (grammar, rhetoric, dialectic). Music was science even prior to art.

In the 1700s, in Italy, the scientific aspect (related to study of acoustic and building of big theatres) and the artistic one (for example the great authors, musicians, and singers) were at a very high level. As a consequence, with the diffusion of opera and melodrama, not only the name of notes but also the standard reference lexicon of sheet music was in Italian, and it still is: dynamic *(pianissimo, piano, forte, fortissimo, …)*, pattern *(allegretto, andante, adagio, moderato, …),* and, more in general, all the words related to agogics, that is the interpretation of a music sheet.[1] Italian is known worldwide as the language of opera: to learn Italian is a fundamental step for any opera singer.

Therefore, the Italian musical cultural scenario, together with the Italian craftsmen's ability to build musical instruments, could be an invaluable source of supply for storytelling, input, and idea in the field of Made in Italy musical-related products.



Figure 1. Ancient violin arch tips – (Author: Anoixe)

3. Several records of Italian musical design

When the right scenario conditions are combined (culture, society, technology, economy), certain design products can trace the history of a specific market field, for example, the Ford Model T. By connecting many cultural, social, technological and economical inputs, it gave a strong push to the automotive industry and its spread and improvement. It was the right

1 Except some modern terms derived from black music, that are in English: Blues, Swing, Ballad, …

product at the right time, such as the Vespa Piaggio that characterized the Italian boom-years after the second world war. In a similar way, in Italy, the atmosphere of great concern and ferment about music, musicians, operas, songs, authors, performers, theatres provided the right conditions for the development of extraordinary inventions in musical design.

The inventor of the piano was the Italian Bartolomeo Cristofori (Edwards, 2015): by changing the existing harpsichord (clavicembalo) to allow a dynamic modulation of the sound, he invented his arpicembalo, then pianoforte (his first recognizable piano can be dated at 1720) at the end of a decennial research and development path that took him from his native Padova to the Florentine court of Medici. This extraordinary invention allowed the introduction of the possibility to play gently and loudly on the same instrument as opposed to the harpsichord, lack of dynamic expressivity. Even today, the key feature of the contemporary piano industry, in Italy and abroad, is the same concept of dynamic sound modulation proposed by Cristofori. To focus on the importance of the piano, it is crucial to consider that, among all the musical instruments, the piano is one of the most popular and widespread and in every school, it is propaedeutic to the learning of other instruments.



Figure 2. Double-action pianoforte built by Bartolomeo Cristofori in 1720; in the Metropolitan Museum of Art, New York City. Source: Encyclopædia Britannica - www.britannica.com/biography/Bartolomeo-Cristofori

Another fundamental Italian invention was the modern violin: the first preserved model, dated in 1564, was realized by Andrea Amati from Cremona. Starting from the 16th century in the triangle Cremona-Brescia-Venezia the lutherie art developed (Baroncini, 1994) whose construction techniques are still actual today.

The Italian input was fundamental in the development of another popular and diffused instrument, the guitar: the Neapolitan luthier families (Vinaccia, Fabbricatore, ...) started to release the first guitars with six single chords, instead of 'cori' (couples of chords) formerly used. Those gave origin to the modern concept of guitar (Ravalli, 2018).

4. Made in Italy: stories of territories, materials, and culture of technique.

4.1 Pure design

If we consider the perfect relationship between the function and the shape, between the engineering and the ergonomics, between the aesthetic value and the playability we can say a musical instrument is a pure design. Since many of them have an ancient history, they become archetypes in their use, sense, and meaning: this implies an optimization in their materials, technology, and usability. All the components must be optimized for a structural resistance or the transmission of the vibration, for this reason, industrial machinery is not always effective, often a manual working action is necessary: the typical sound of many acoustic musical instruments, especially the more complex ones, is due also to their production technique that, despite a company's industrial structure, still requires craftmanship expertise in many cases. (Mancini, 2019).

Design products, local materials, expert craftsmen, long-time tradition and attitude to innovation are important ingredient of what is called "Made in Italy" and, in the best tradition of "Made in Italy" products, the history of Italian musical instruments starts from craftsmen with fine technique deeply connected with the materials of their regions, where creativity and talent are important features, too.

4.2 The sound of materials

According to a study commissioned by CNA (Antoldi, et al., 2016), it appears that in Trento province there is a high export value (€ 8.66 million in 2015) due to enterprises that select, season and work the local red fir tree, a wood which is unique in the world for its sounding features, used in the production of soundboards and other resonance components of top-quality acoustic instruments. European, Asian, American luthiers are faithful purchasers of Val di Fiemme red fir (Picea Abies), known as "the music tree" or "the resonance tree", the same used by Stradivari for his unique violins. Today, about 60.000 luthier instruments, 15.000 harps and 180.000 pianos in the world are made with some of these components.

The strong export-asset and the excellence level are the main reasons for the success of these enterprises, which apparently don't know international crises.

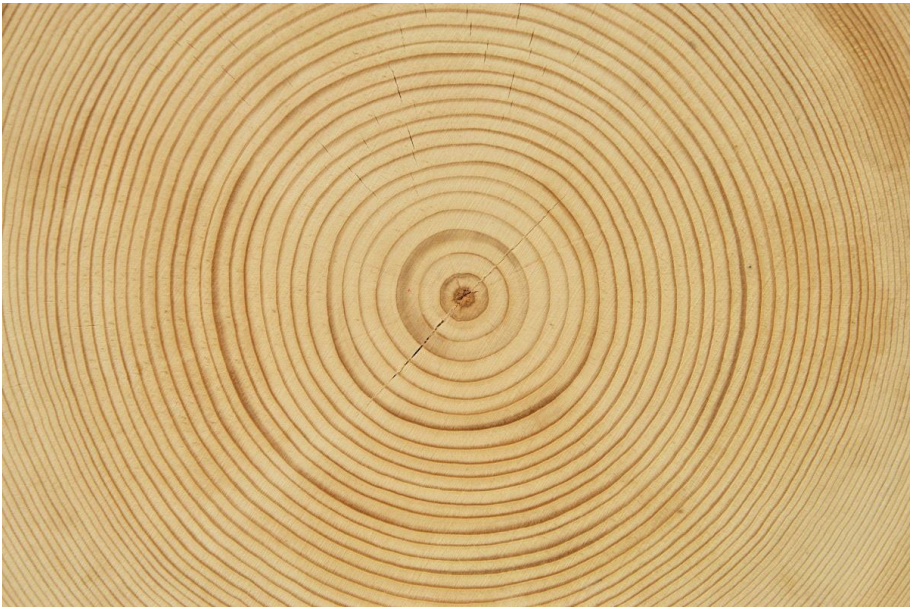

Figure 3. The perfect structure of a Trentino "Resonance Tree" – source: Archivio fotografico della Camera di Commercio I.A.A. di Trento (legnotrentino.it).

As often happens in the production of objects in many industrial sectors, local materials give the input for the birth of artifacts (i.e.: the alabaster of Volterra, the travertine of Rapolano, ...). Also, in the musical field, many instruments are built according to the natural sound of local materials: for example, in Budrio (Bologna), the local terracotta (pottery clay) is used to produce ocarinas, an ancient Italian wind instrument whose origins are lost in time, improved in the 800s by the local musician Giuseppe Donati who started the "modern era" of ocarina production, for which Budrio is famous.

4.3 Materials and manufacturing

Many histories of design products are related to the ability of craftsmen to work a specific material, derived from a long-time technical tradition: i.e., the ability to work the leather and the famous made in Italy shoe enterprises. In the musical industry, an important Italian tradition is derived from the millenary art of metalwork. In Agnone (Isernia), the *Pontificia Fonderia* (exclusive pontifical foundry since 1924) *Marinelli Snc* has a long tradition in bells

production (on the factory website they say about 1000 years of tradition) and today is famous worldwide in this specific production field.



Figure 4. UFIP – Est 1931 series cymbals. Courtesy UFIP – Pistoia, Italy

Another common feature of many Italian enterprises is the small dimension. Sometimes factories are family-owned as is the case of Pistoia, where in the 18th century the family enterprises able to work metal started to build church organs. Then the ability in the lamination processes was successfully applied to the production of cymbals. During an economic crisis, in 1931 four of these small enterprises decided to join, establishing the *Unione Fabbricanti Italiani di Piatti musicali e tam tam* (Italian cymbals and tam-tam united factories), called UFIP. The deep connection with its origin, that is the ability to work metal, led UFIP to innovate the cymbals production by patenting the *Rotocasting®*, a unique centrifugal casting system that allows the elimination of all the impurities of the bronze alloy. Today UFIP is known worldwide for the top quality of its cymbals, an Italian made in Italy excellence of design.

4.4 Manufacturing and culture

The knowledge of a working process can be another important factor in the development of a specific industry, on a regional basis, as it happens in many industrial districts (as Udine and its production of chairs, Florence and its leather products, …). In the musical field, the case study of accordion could be representative. The accordion is an instrument that was not invented in Italy and that is not necessarily built with local materials. The accordion probably was first built in Austria and from the mid-XIXth century was diffused in Italy, in the Marche region, above all by the work of Paolo Soprani. Today a great part of Italian popular musical culture is based on songs and rhythmic patterns played on the accordion. Especially in summer, there is no local festival (*Sagra*) without an accordion player in the live band. In the

Tuscan countryside until the 80s, the accordion could often be identified as “the” musical culture. This extraordinary diffusion, in Italy, of an instrument which is not native Italian (for materials or birth), was due above all to the great ability of Italian craftsmen: in 1924 93 accordion factories in the national territory were recorded. Today the most famous are produced in Marche (Castelfidardo and Macerata), Lombardy (Stradella, Cremona), Piedmont (Vercelli, Leini) and Tuscany.

As before reported about UFIP, an economic crisis was the occasion for a union of different factories: in 1946 the *Fabbriche riunite di fisarmoniche* (united accordion factories) was created, with the name FARFISA, an excellent company whose experience was based on the production of keyboard instruments (accordion, keyboards, electric organs, …). It started the development of the Italian most important musical production district - the Marche district. A famous FARFISA product was the Compact, one of the first electric organ produced on an industrial basis, widely diffused in the 60s and co-responsible (together with the Vox Continental) of the sound of the rock and psychedelic music of those years. An electric organ is an instrument based on a simple concept: the pressure applied to a key generates a sound through electro-mechanical internal components. It is the same concept of an intercom: by taking advantage to its achieved know-how, today Farfisa is an internationally known company that produces intercom and videophone all over the world. Another story of made in Italy.



Figure 5. Navini accordion. Courtesy G. Navini snc – Castiglion Fiorentino (AR), Italy

Differently from other product categories, where industry replaces small artisan factories, in the musical field, this substitution is rarely possible because the quality of certain components can be guaranteed only by manual work. Moreover, a big industry is not often able to provide the possibility of fixing damaged instruments. This particular attitude of Italian small enterprises is important because in music there is no programmed or forced obsolescence as in other industrial sectors: a good instrument is expected to last for decades, so the maintenance service is still fundamental. This is both the reason of excellence of Italian musical instruments and the reason why small familiar companies still survive, as G. Navini snc, established in Tuscany in 1936 (Castiglion Fiorentino), which still today is a reference point for accordions and maintenance service for many musical instruments.

4.5 Highly skilled enterprises and craftsmen

Many small enterprises in Italy are famous for their musical instruments, thanks to the extraordinary ability of their craftsmen.

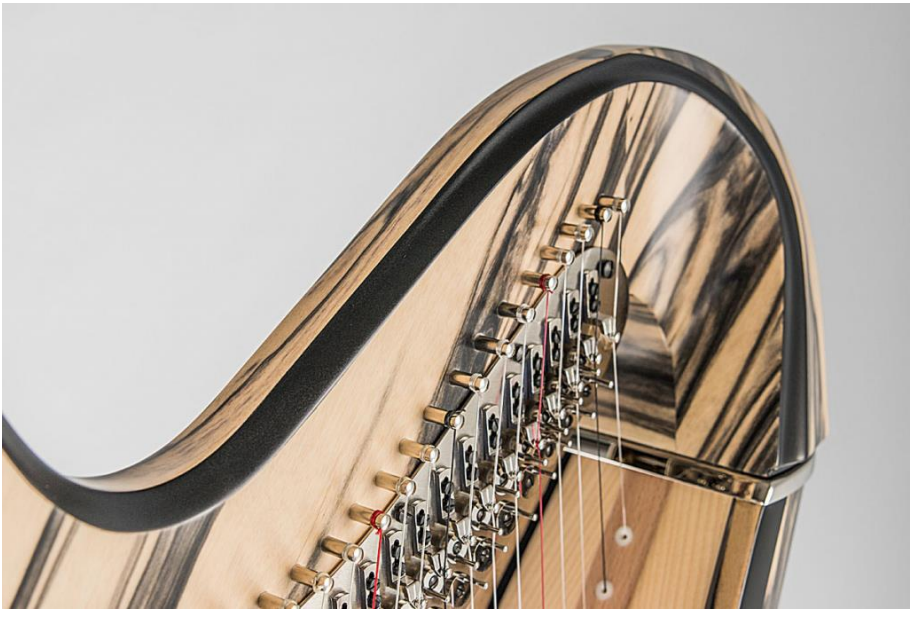

Figure 6. Salvi harp – model Whitney, with white ebony veneer. Courtesy Salvi Harps – Piasco (CN), Italy

Salvi harps is one of the most important harp producers in the world. Since the first appearance of a harp in an orchestra, thanks to the Italian composer Monteverdi (in the first year of XVIIth century), the harp and its soundboard had to adapt the volume to the

increasing dimensions of orchestras and auditoriums: for this reason, the research for materials with the best resonance features was fundamental, together with the study of optimal shape for the sound boards. The use of the best resonance material (the red fir of Val di Fiemme, used as the main component of the soundboard) and the continuous search for innovation (the company has its R&D department inside) are some of the reasons why this company ubicated in Piasco (CN) exports its instruments worldwide. Its long tradition, started in the mid of the XIXth century, permitted them to train generations of artisans: today the high expertise of the workers makes the difference and Salvi can be considered as an excellent Italian company.

Rampone & Cazzani is an Italian company ubicated in Quarna Sotto (VB) that has produced saxophones since the invention of the instrument (by Adolph Sax in the second half of XIXth century). Today it is considered a niche market manufacturer, thanks to the great sound of its instruments, the perfection of details, the possibility of customization.



Figure 7. Rampone & Cazzani – model R1 jazz. Courtesy Rampone & Cazzani – Quarna (VB), Italy

5. Fazioli, a made in Italy brand of excellence

In New York, in September 2003, during the celebration for the victims of twin towers destruction, a concert for 21 grand-pianos was played: they were Fazioli pianos; at the White

House, in 2016, during the celebration for the International Jazz Day, Aretha Franklin and other international stars played a Fazioli grand-piano (AGI, 2016). Fazioli is an Italian piano factory whose concert grand-pianos are famous worldwide and appreciated by many important pianists. The company was established in Sacile (Pordenone) nearly 40 years ago, from a spin-off of the main family factory, a wood working factory, and since then it shuns the production derived from an industrial nature but, on the contrary, it pursues a strategy that combines an absolute technical perfection – derived from in-depth studies of materials and sound engineering – with a traditional handicraft production. These factors combined with the choice of the best woods from the Val di Fiemme trees are the carriers of technological innovation and absolute quality. In a Fazioli piano, there are several patents: the exclusive three-layered soundboard, the unique fourth pedal, but beyond these innovations what matters is its recognizable sound, a strong brand value. The annual production is of about 140 pieces, 95% of which are exported all over the world: they are the numbers of a small company of excellence if we compare it with the biggest piano factory in the world, the Chinese Pearl River that produces 150.000 piano/year (Stefanato, 2018). The choice of the founder (Paolo Fazioli) was to create a high-level object with a special focus on a contemporary Italian sound that was different from the other famous brand (Steinway, Yamaha, …).



Figure 8 – A Fazioli piano – Credits: © Fazioli Pianoforti spa - Foto Roberto Zava / Studio Step

Today we can say that, if Fazioli is called the “Ferrari of pianos”, this ambitious goal was achieved (it is curious to notice that, similar to a car, a piano is a mechanical engineering product): many great pianists like Herbie Hancock or Angela Hewitt, in some interviews declared that they prefered Fazioli grand pianos instead of Steinway for their concerts.

6. The districts of the Italian musical production

In the field of design, the concepts of districts and supply chains are well studied. Even in the musical field the same features applicable to the definition of a district can be found: when companies use local materials, when they share competences, when they optimize their know-how, when they create a network for promotion and marketing, in these cases real sites of production born and music-related industries can develop. In Italy, two districts of musical production can be identified: Cremona and the Marche district.

In Cremona, the roots of the art of lutherie can be dated in the XVIth century with the products of the Amati family. Then, in the golden era of Italian music, the XVIIth century, Guarneri and Stradivari defined the archetype of arch instruments, today still in use worldwide. People in Cremona were able to take advantage of this long tradition of made in Italy, through structured actions regarding both the enhancement of existing asset (material and immaterial) and the promotion of “new”; actually in Cremona we can find: the Stradivari foundation, the international lutherie competition, the international lutherie school “A. Stradivari”, the Superior Institute of musical study “C. Monteverdi” and the academy “W. Stauffer”, the violinmakers and archmakers (liutai & archettai) consortium “A. Stradivari”, the international exhibition Cremona Mondomusica with more than 300 exhibitors per year[2], the innovative Violin museum, the “Laboratory of musical acoustics” by Politecnico of Milan, the Arvedi laboratory for non-invasive diagnostic analysis of University of Pavia. A strong component of innovation is the key to the enhancement of tradition. The institution of the “Cremona Liuteria” trademark based on a specific production regulation was set up to prevent industrial standardization and to preserve and guarantee the Cremonese musical instruments[3]. In 2012 the “traditional violin know-how in Cremona” was declared Intangible Cultural Heritage by UNESCO. The result of this organic approach is a strong growth in the sales, above all in exports: in 2015 the export of musical instruments in Cremona was € 4.225.170,00, + 11,85% as compared to 2014, +553,23% as compared to 1995; those data demonstrates that the excellence market is still able to grow, despite international crises, even because it doesn’t follow temporary trends. An interesting fact is also that 42% of the total of 154 luthier artisan workshops have a foreign owner: the attractiveness of Cremona is very high especially outside Italy, not only towards students but also towards entrepreneurs (Antoldi, et al., 2016).

[2] http://www.cremonamusica.com/en/

[3] http://www.cremonaviolins.com/il-consorzio/il-marchio-il-regolamento-la-tutela/

The Marche musical district is the biggest area of musical production in Italy, with the highest value of turnover. While in Cremona the district is connected with the specific production of arch instruments and its related technologies, in Marche the district is hybrid and not focused on a specific kind of instrument. All started with the production of accordions (see above about FARFISA), an instrument with keys where the sound is generated by a blower; during the following years the local factories could adapt to new technologies and the market changes: by electrifying the harmonium (where keys and blower are the same components of the accordion) in the 60s the electric organ was introduced, then the first keyboards (electric piano) were produced together with the first Italian electric guitars (Eko). Today many fields of music production are active in the Marche district: keyboards, electronics, amplifiers, speakers, … and many international industries such as Korg and Roland take advantage of the ability of local craftsmen and factories. Today Eko Music Group Spa, Fatar Srl, Korg Italy Spa are some of the enterprises with the highest turnover (ICRIBIS, 2020).

7. Some opportunities

The word design is paired with the word music in a very few cases, most of them referred to home acoustic speakers that are considered pieces of furniture to be put in a living room or in a bedroom: in this specific field, the good design seems to be considered a value for the product and is also used for advertising campaigns.
Among the musical instruments producers, few companies consider design as an essential feature of their products (on the contrary, in other market fields, in certain products the word design is shouted and exhibited, sometimes out of proportion, sometimes without any good reason). In musical instruments, Design seems to be an additional feature, that comes after all the main product qualities: tradition, materials, sound, prestige. Even amongst the companies mentioned in this paper, it is hard to find the word design in any of their websites. In the academic world, some books regarding design and music can be found (i.e. in Italy the recent book of Marano, 2019), but they are far too few to be considered as effective literature on the topic.
Another area with a lack of design-driven attention is the world of exhibitions or expo. In big design events as Salone del Mobile in Milan or 100% Design, visitors are not only operators, sellers, designers or entrepreneurs: a large part of public is made of curious people or people not directly involved in the topic of the expo; in those big fairs, however, musical products can rarely be found. In music fairs it is just the opposite, that is only a few are curious people amidst the majority of insiders.

Deep cultural roots, long-time tradition, fine materials, excellent craftsmanship, brand value, product durability, attention to innovation: many Italian musical industries possess all of the qualities usually related with the Made in Italy, a heritage that could represent a real opportunity to open new roads in the wide meanings of design.

Design related to musical instruments and accessories could be the topic for research projects, academic courses, workshops, conferences, fairs, and papers. Designers, professors, and students could be involved in this specific field and, for example, producing a structured survey of the Italian musical industries: each one of the factories, just mentioned in this paper, would deserve a wider discussion for the wealth of their technical know-how, their ability to work local materials, the durability of their products.

Italy always expresses high cultural value in music, both at an international level and at local and regional ones; this is another point of view to start from, for an inclusive approach to music design and its preserves.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Digital encounters in the culture of textile making: developing a hybrid craftmanship for textile design by fusing additive methods of surface fabrication with knitting technology

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Abstract | Digital fabrication technology presents an unfamiliar territory for textile design, thus requiring exploration and analysis of the emergent forms of textile crafting and materiality. Through practice-based research methodology, this research examines the intersection of two fabrication methods: industrial knitting and 3D filament printing, with the aim of outlining a hybrid material territory for 3D textile composites. Accordingly, the research addresses the notion of textile as a multi-material system. The physical results are presented as a material library of samples which have been produced through two methods: i) the exploration of geometric tessellations to generate self-folding surfaces by direct printing on non-elastic knitted structures; ii) the exploration of pattern arrays to generate self-forming surfaces by direct printing on pre-stressed knitted structures. Using this hybrid approach to textile crafting the research discusses the aesthetic possibilities of the fusion of these two technologies, and the potential for development within the Industry 4.0 model.

KEYWORDS | TEXTILE DESIGN, HYBRID METHODS, MULTI-MATERIAL SYSTEMS

1. Introduction: textiles as culture of crafting

Being one of the few disciplines which has the material–the textile–as the resulting artefact of the design process, textile design complies with Risatti's definition as a culture of crafting: one that is based on advanced technical knowledge and direct experience of the material in the creative process. Based on Pye's distinction between the two notions of design and workmanship, the concept of craftsmanship emerges in Risatti's definition as a unifying activity of the two rather than a separating one (Pye, 1968; Risatti, 2009). In this context the notion of crafting combines in its description the intellectual and creative nature of design activity, together with the proficiency of technique and material knowledge which is conveyed by the attributes of workmanship. Likewise, crafting as activity implies an integrated process between artistic expression, design, ideation, material and technical knowledge.

Consequently, artistic expression and technical proficiency are closely interrelated in the practice of textile design, as the culture of crafting and materialization have always been deeply rooted within it, even though the rise of industrialization has triggered major challenges for the textile design field by separating the designer from workmanship in the production process(Gale and Kaur, 2002). However, the value of craftsmanship and making through direct interaction with the textile has been preserved(Valentine et al., 2017). Likewise, knowledge of the material, together with the process of forming and making, define fundamental placeholders in the development of an intended design and desired textile quality. Another aspect resulting from the legacy of the culture of craftsmanship is that the development of technology and methods of making textiles are driven by the experience of the material as key to the design process, which then influences ways of creating expression in textile design(Ingold, 2009). Pye defines this process as "the workmanship at risk", where the designer's methods are not fully known, leaving a place for exploration and redefinition of the known technology by experience.

Today, the extended availability of digital tools and methods of fabrication have unlocked new design possibilities for the expression of textiles which rely on established textile techniques, e.g. weaving, knitting, screen-printing. In particular, the extended availability of 3D printing technology marks a complex material turn for the textile field (Smelik, 2018). Likewise, McCullough(2010) discusses the role of the digital tools in the design and crafting process; the digital has opened a hybrid territory of abstract forms of materiality which make the transition between tactile to haptic processes, and requires the development of novel forms of crafting.

Digitalization, in addition to enabling these novel material practices, has also influenced the development of new production processes and new models for co-locating industries: with reduced scale but with mixed competences and fabrication lines–Industry 4.0 (Lasi et al., 2014). Manzini envisioned this change of industrial models in the book The Material of Invention, published before the present turn to the digital in material and fabrication technologies:

> "The boundaries between privileged sectors tend to break down. What it comes into being is the formative nucleus of a situation in which the vertical model is replaced by a model in which relations are established, as they are needed between manufacturers in the various fields with a view to a specific objective-to develop and market a new, partially processed composite or else to manufacture a finished object, created by multimaterial components." (Manzini, 1986, p.43)

Hence, this territory is no longer defined by traditional technologies or mono-component identities; it is defined by cross-disciplinary practices and methods which stretch the borders of different design disciplines by fusing traditional and unconventional forms of making, e.g. shape-generative processes, composite materials, and novel fabrication methods, enabling the transition from bottom up to relational processes for the creation of textile artefacts.

2. On novel processes and hybrid craftmanship in textile design

Similarly to specific material classes such as wood, glass, and steel, textiles form their own class. The fusion of textiles with other materials requires a new classification for the multi-material created. Conventionally, the term "composites", however, introduces a mixed methodology and describes a broader cluster of materials which are formed through the fusion of different material identities and properties (Fernandez, 2006). Consequently, for the textile field, the term "textile composites" refers to a specific class of materials where the technology to fabricate them "implies fibre and resin matrix structures built from material laid up on a mold, and thermo-formed under heat and pressure." (Pearson, 2016, pp.305). Here the characteristics of textiles, such as pliability, lightness, and structural integrity, are mixed with the stiff character of resin. The casting and molding process is employed to enable the creation of textile composites with stable surface behavior and which can exhibit stiffness and three-dimensional shape (Bonder et al., 2019).

Compared to the conventional method of molding when creating textile composites, the use of 3D filament printing technology as an additive method for altering textile surfaces introduces another perspective. This method presents a hybrid space for creating textile composites which places itself at the intersection of known methods of textile composites– by mixing textile structures with polymers–and traditional 2D screen-printing methods. The pliability of the textile is mixed with the geometry and rigid behavior of the additive printed pattern, enabling surface shaping capabilities. This intersection of two material domains underlines a hybrid territory where 3D shaping, material behavior, textile construction and 2D surface pattern design meet to define a composite material system comprised of two distinct material identities: textiles and plastic polymers.

This cross-disciplinary textile territory is illustrated by the research and design of Van Herpen (c.f. Thys, and Connellan, 2012): her work with additive processes defines new perspectives on material agency and positions the notion dress as an architectural form for the body.

Clopath and Guberan, researchers at MIT, have proposed another perspective on 3D printing by combining this technology with textiles in a shoe that adapts to the wearer's patterns of movement (Active Shoe, 2020). Likewise, Moslemian(2016) further explores the principles of self-folding when 3D filament printing technology is applied on textile to design active textiles. By proposing and analysing different geometries her research presents methods to work with these hybrid materials in an architectural context, with the aim of designing light-weight structures.

Many other research examples that combine textiles and 3D printing come from the field of textile engineering, and examine the technical aspects of this combination, for example material bonding and interaction, or smart properties (Pei & al., 2015; Grimmelsmann & al., 2017). Consequently, the ubiquity of and increased interest in 3D printing technologies has resulted in expressive fabrics that present a visually attractive textile that is unfamiliar to us in its crafting. Here, the intricate geometry of shape and the combination of hard and soft material properties fuse attributes of the generative expression of form with the properties of the printed material and the qualities of the textile. The exemplary research discussed above outlines the research context by demonstrating different perspectives as to how these hybrid methods of multi-material systems can be approached through crafting design and technology. However, in most of these examples, textile base is used as background for the printing technology rather than foreground, thereby leaving an open question as to how the textile craftsmanship can be leveraged to a better advantage in this intersection of technologies. Subsequently, this research looks at the fusion between knitting technology and 3D filament printing, starting from the making of the textile structure in a bottom-up perspective of the knitted structure.

Using a practice-led research methodology, this research analyses the textile design possibilities resulting from the fusion of two methods of crafting and making: digital fabrication and knitting technology. What is crucial to this research is: i) to exemplify a hybrid method of designing textures and self-folding forms in knitting, and thus go beyond the current limitations of this textile technique with the help of digital fabrication; ii) to articulate a design vocabulary describing the textile qualities resulting from the fusion of the two techniques, and the advantages of doing so in terms of combining the properties of two distinct cultures of making–digital and textile fabrication–as a means of suggesting new possibilities for material design and to broaden perspectives on form-thinking in the textile design process.

3. Fusing methods

Knitting as a textile technique was primarily developed to enclose the body. In knitting the loop is the fundamental unit of construction(Black, 2012). Therefore, loop geometry, multiplication and arrangements decide the end design of the knitted surface and the geometry of the 3d shapes. Similarly to other textile construction techniques, in knitting

there are two perspectives that interact in the design process of a material: the microscale (near-field), which is defined by the construction unit and yarn dimensions; and macroscale (far-field), defined by the design of the overall surface and shape. Alongside the process of creating complex shapes, the character of the yarn as raw material for design, and the structural design, are equally as important in the process. These two elements determine the aesthetic and functional properties of the surface: the feel of the surface against the skin, the outline of the shape, and the folding behavior in relation to the body. The construction techniques specific for knitting allow designers to work with both the 2D surface and 3D shaping (Glazzard and Breedon, 2012).Compared to other textile structural techniques, the fundamental properties of knitted textiles are elasticity, pliability and self-folding. Thus, 3D printing as a fabrication technology introduces the opposite elements to knitting into the textile design process: working with 3D solid objects with contrasting qualities to textiles–stiffness, transparency, smooth surfaces–and crafting in a non-physical process. The result of joining together the two technologies proposes a series of textiles as a multi-material system(Grimmelsmann et al., 2017).

Similarly to textile yarns, there is a large variety of 3D printing filaments which vary in terms of materials, colors and stiffness, e.g. PLA, ABS, Nylon. These filaments may also vary from soft to hard. However, in this research the interest was to fuse textiles and 3D filament printing variables with contrasting properties in order to be able to generate a composite material system situated at the intersection of the two fields, and therefore [hard/stiff] filaments were used.

The experiments explored various possibilities for generating three-dimensional surfaces when the pliability of the knit is forced into shape by the rigidity of the 3D printed layer. Two strategies have been employed: the principle of self-folding by 3D printing geometric tessellations on non-elastic surfaces; and the principle of self-forming by 3D printing on elastic surfaces. Figure 1 presents a material library with selected expressions resulting from the fusion between the two technologies.

2.1 Material Set-up

The knitted textiles were fabricated using circular single-bed (gauge 12) and flat-bed (gauge 14) industrial knitting machines using simple typologies: for example, on the single-bed machine single jersey, three-thread fleece knitted fabric, and meshes, and on the double-bed machine 1x1 rib structures. These structure types provided a greater degree of control over the stretch directions of the fabric and ensured equal distribution of tension on the textile surfaces. The quality of the surface of the additive layer was also dependent on the uniformity of the textile surface, as a high level of variation would obstruct the smooth movement of the 3D printer's nozzle, damaging the fabric. In order to be able to add colors and patterns to the textile surfaces without influencing the geometry of the knitted base, two plating methods were used. In order for the circular knitted textiles to have two distinct faces, yarns with different colors were knitted simultaneously on the front and rear of the

fabric. For the weft-knitted textiles, the colors were added as patterns on the front, and randomly mixed on the rear; this was achieved using the programming environment of the Stoll machine, which uses a color-arrangement system that allows simultaneous work with color, pattern, and structure using plating technology. The fabrics used for the final experiments were knitted using natural fibres, e.g. cotton, viscose and wool, along with elastane. The choice of yarns was the result of the intention to create a contrasting expression between the textile base and the printed filament. Previous experiments showed that these materials have the best adhesion to 3D-printed filaments, and that they do not melt when the hot extruder comes into direct contact with the textile surface.

With regard to the exploration of the variables of the 3D-printed layer, filaments made of different materials were tested as additive layers on the knit, e.g. PLA, ABS, and nylon. However, ABS, PLA and nylon were considered to have the best adhesion to the knitted fabrics and the best bending behavior with regard to the explorations of self-forming behavior. Previous experimentation showed that the thickness of the printing layer, along with the character of the filament used, influences the attributes and behavior of the additive pattern. The height of the 3D-printed layer is dependent on the size of the printed area and the outline of the two-dimensional pattern to be applied to the textiles. The experiments were undertaken using a 3D printer with a printing area of 220 x 220 mm. For the explorations of self-forming behavior the thickness of the printed layer was 1.5 mm; for the explorations of self-folding behavior the thickness of the printed layer was 2 mm.

2.2 Strategies for three-dimensional forming

The physical results of this research are a material library of samples, which were explored using two methods:

i. Geometrical tessellations that resulted in self-folding surfaces as a result of 3D printing directly on non-elastic knitted structures.

ii. Pattern arrays that resulted in self-forming surfaces as a result of direct printing on pre-stressed knitted structures.



Figure 1. Samples that explored the self-folding behavior of three-dimensional prints on knitted objects.

i. The first method involved the creation of different geometries with self-folding behavior through 3D printing on knitted structures. The self-folding behavior of the surfaces was not dependent on the elastic property of the surface; this type of pattern can be applied to non-elastic surfaces as well. The self-folding expression of the 3D-printed textiles was dependent on the relationship between the 3D-printed facets and the textile creases (Saito et al., 2015). During the drawing of the pattern to be 3D-printed, the initial mesh was split into individual elements. Each cell was offset by 3 mm from the neighbouring cells, allowing the formation of creases on the textile surface after the fabrication process, and the cells as a whole constituted the surface of the textile.

Samples 2, 3 and 4 (Fig. 1) illustrate the design of quadrilateral meshes composed of regular and irregular cells. Sample 2 and 4 have a regular pattern. The pattern of Sample 2 was printed with a thermochromic filament which changed from green to yellow. Due to the plating methods used in the knitting process, the color of the textile base varied from green to beige to yellow. The sample was intended to explore how the three-dimensional perception of a surface could be enhanced when working with tone-on-tone using color combinations (Fig. 2).





Figures 2 and 3. The three-dimensional forming potential of Samples 2 and 1, respectively.

Sample 3 was 3D-printed with an irregular quadrilateral mesh which restricted its self-folding behavior as compared to Sample 2. The printed mesh had a discrete expression due to the use of a transparent nylon filament. The folds of the surface were emphasised due to the textile substrate, which was knitted with a three-tread fleece pattern. The 3D-printed facets of the quadrilateral mesh of Sample 1 were narrow and high. The pattern was printed on a pre-stretched fabric (single jersey, gauge 12, cotton and elastane). When the textile was released from the printing bed, the filament formed a dense structure which maintained the softness of the textile; although the expression of the textile was two-dimensional, the surface was possible to shape in three dimensions by twisting the two ends in opposing directions (Fig. 3). Samples 5 and 6 illustrated ways of folding using the method of aligned curves (Mitani, 2019); this method facilitated the creation of less structured geometries with softer edges and smooth gradation of the sizes of the three-dimensional printed patterns. As compared to Sample 6, wherein the knitted textile is rather neutral being a single jersey fabric which was plated using a light blue front and white rear, the textile of Sample 5 merges in the foreground of the expression with the 3D-printed layer adding color and texture to the end design.

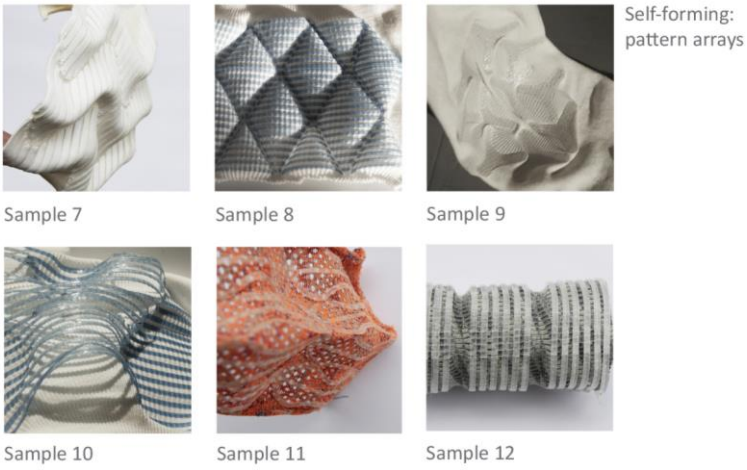

Figure 4. Samples that explored the self-forming behavior of three-dimensional prints on knitted objects.

ii. The second method explored the potential of 3D-printing primary shapes, e.g. lines, squares, circles, and triangles, with the aim of creating three-dimensional self-forming fabrics. The edges of primary shapes printed on textiles have the potential to bend due to the tension of the textile surface; this method thus facilitated the creation of various curved three-dimensional shapes (Aldinger et al. 2018; Moslemian, 2016). Consequently, a good understanding of the bending behavior of primary shapes on pre-tensioned knitted structures would be a great support for the ways of working in textile design, as the simplicity of the 3D-printed pattern would allow for more freedom for the actual design of the textile base. Samples 7 and 8(Fig. 4) show the effect produced by the alignment of fine 3D-printed lines on a fabric which is stretched in both directions. Sample 7 used a single-jersey fabric as a support material for the 3D-printed pattern. The fabric exhibited uniform elasticity because every row was knitted with elastic yarn and wool. The fabric was stretched in both directions, but more in one direction. When steamed, the flat fabric compressed more in one direction, causing the 3D-printed pattern lines to curve. The lines of the 3D-printed pattern became closer in the other direction, emphasising the regular folds of the emerging texture. In the image of Sample 8 shown in Figure 4, the 1x1 rib structure was stretched during the 3D-printing process such that the 3D-printed lines curved the diamond pattern. The lines of the 3D-printed pattern thus interacted with those of the pre-stretched rib forming an unified expression.

Sample 9 explored another way of forming a dome-like shape; by designing an array of triangular units that were printed on a fabric that was stretched in two directions. In this example, the complex outline of the 3D-printed shapes formed the elements of the textile surface design by distorting the lines of the fabric. The textile fabric of Sample 11 combined

an advanced textile design defined by variables, such as pattern, color and structure, and an array of curved shapes which changed the surface expression. As compared to Samples 7 and 8, wherein the design of the print comprised the foreground of the textile expression, the 3D-printed layer of Sample 11 became a background in the overall expression due to the design of the textile. Samples 10 and 12 utilised a method of partially printing the filament on the textile. In both examples, a secondary layer of three-dimensional patterns emerged due to the fact that the filament was partially attached to the knitted fabric. Whereas in Sample 10 the filament constituted the foreground of the textile expression due to its textured shape and color, in Sample 12 the three-dimensional print merged into the surface design of the textile. This textile was knitted using a 1x1 rib technique, onto which an abstract surface pattern was applied using plating.

4. Discussion

The result of this research presents a strategy for designing textile multi-material systems for 3-dimensional surface design when combining 3D filament printing as an additive technique with knitting technology. Accordingly, the research presents two methods: i. the first method uses patterns of geometric tessellations to generate self-folding surfaces by direct printing on non-elastic knitted textiles; ii. the second method uses geometric pattern arrays to generate self-forming surfaces by direct printing on pre-stressed knitted textiles. The material library illustrates some of the variety of expressions and surface behaviors that can be achieved with this fusion of technologies.

Similar 3D textural effects in textiles can also be achieved through conventional screen-printing methods, using materials such as flocking or printing foil, as the exemplary research of Philpott (2012) illustrates. However, the great advantage of using 3D filament printing is the robustness of the additive material on textile which allows the formation of 3D shapes without limitations of the layer's thickness and scale. The effect of the character of the printed material–the transparency, translucency or smoothness of the plastic layer–gives the textile materials, e.g. wool or cotton, a hybrid tactility, altering the conventional textile expression. The pattern generation work in the digital space introduces a new form of textile crafting since it goes outside established 2D textile methods to create pattern repetitions–while being influenced by traditional textile craft techniques. Based on haptic processes, the digital space enables extended possibilities when working with complex 3D typologies and for enhancing the perception of depth of the 3D surface by manipulating directly the pattern design on it.

By fusing contrasting material behaviors and merging two distinct technologies, the proposed method exemplifies an alternative way of approaching the design of complex knitted constructions with the aim of achieving post-fabrication formation of 3D textures and shapes. The method places itself at the intersection of textile technology and digital fabrication, outlining an alternative method for designing and fabricating textile multi-

material systems which may open new material functionalities and extend the limits of textile design and crafting. This hybrid method relates to the perspective of textile as a multi-material system, defined by changeable variables which can be modified according to the function of the material in the object design process, rather than producing a unique textile design. It is a textile system in which the digital–characterized by extended possibilities to create 3D patterns and arrays–is merged with knitting technology in order to re-design the materiality of the knit as a foundation for the design. If so far the role of the material in the process of object-oriented design disciplines, such as fashion, product design or architecture, has been described using linear models of design, e.g. bottom up or top down, the notion of textile as multi-material system relates to Manzini's description as a "model of relations" or to Frayling's(2011) New Bauhaus as model of "convergence" might introduce an alternative perspective of a distinct nature from the previous ones; this perspective can be defined by flexible boundaries capable of extending the synclastic model of design(c.f. Ingold, 2009) to the object-oriented design disciplines–where the material and object define each other in the design process.

Nowadays, due to a high interest in developing sustainable processes and products, the structure and premises of the current industrial model are highly debated. The advanced digitalization of fabrication tools and methods of communication are driving the textile industry towards a new era: that of Industry 4.0, where product design and manufacturing processes are not separated but become co-located, alongside the different disciplines engaged in the process. The total re-definition of the industrial model also enables a re-positioning of material in the product design process, towards finding new forms of craftsmanship inside the established methods of each design discipline. Although Industry 4.0 is a relatively new concept, it presents novel possibilities for the role of material in design processes and an opportunity for textile designers to work closer to technology and fabrication, where textile digital crafting proficiency will be most beneficial.

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Acknowledgements: The author would like to that to the knitting technicians Kristian Rödby and Stefan Gustafsson for their support in programming and producing the knitted fabrics. The work was funded by the Smart Textiles part of Science Park Borås and the University of Borås.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Distributed design and production for distributed care. Investigation on materializing bottom-up open and indie innovation in the field of healthcare.

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Abstract | The paper investigates the role of distributed design and digital fabrication in the materialization of open source healthcare solutions co-developed by designers, makers, and user innovators with or within enabling environments such as makerspaces. A participatory and experimental design-oriented approach allows to refine the nonlinear development path that characterizes new fields in which design, technological experimentation and medical research may find application possibilities can also be identified. With these premises, this work aims to explore the dynamics of designing products related to the emerging field of Distributed Care. Firstly, the paper defines the emerging field of distributed design for healthcare and analyses experimental initiatives exemplifying the field of Distributed Care. The second part of the paper interprets the results of the use case analysis to demonstrate how designers, makers and independent innovators interacting with care specialists, patients and caregivers – can design, produce and distribute solutions with a real market potential.

KEYWORDS | DISTRIBUTED DESIGN, DIGITAL FABRICATION, MAKING, OPEN SOURCE HEALTHCARE, FAB LAB

1. Designing (for) distributed systems: an introduction

Nowadays, terms such as "distribution" and "distributed systems" have become a common, constituent and characterizing part of the production, release and diffusion models of many goods and services on the market. *Blockchain*, *cloud computing* and *manufacturing* are examples of distributed technologies. It was not until the early 2000s that the theme of distributed systems crossed the discipline of design. The scientific literature on the design of distributed systems mainly refers to the world of computer science and in particular to the design of computer systems (software engineering). We speak of distributed systems design or distributed computing environment to define a system whose components are located in different networked objects (e.g. computers). These components act in a coordinated way by sharing information to achieve a common goal. A distributed system is basically a set of independent processors that enable the sharing of resources through the use of software and allows the system components to operate autonomously, independently and geographically spread. The distributed systems are characterized by certain properties: *transparency* in the access and use of its resources, *openness* that facilitates the configuration and modification of the system, greater flexibility and interoperability, reliability in the resolution of errors and problems, and the ability to concentrate performance capacity and to scale physically, geographically, organizationally (Wu, 1999).

Another strand of scientific literature on distributed systems comes from the world of industrial engineering and management, more specifically related to the concept of *distributed manufacturing* (Marsh, 2012; Künhle, 2010). Basically, distributed production is a decentralized and networked model to organize local manufacturing processes. Digital transformation, especially the development of digital fabrication, has empowered this model and its operability. Organisations and individuals (professional, citizen, and *indie* innovators) can use a network of production facilities and technologies geographically dispersed but connected and coordinated through ICT technologies (Seravalli, 2013; Wolf et al., 2014). The spread and the convergence of a growing number of small-scale production activities, which are fuelled by a plurality of subjects and organizations and characterized by a democratized access and use of manufacturing resources, fosters the growth of forms of *Commons-based peer production* based on distributed production (Gershenfeld, 2012; Rifkin, 2013). Open and distributed production refers to an emerging collaborative production model which may be web-based or in physical facilities such as makerspaces and Fab Labs. This form of production is going beyond the Maker movement (Anderson, 2013; Dougherty, 2016) and allows an open and close-to-the-user materialization of artifacts.

Distributed Design (DD) is a very recent concept that has a strong link with the two abovementioned domains of knowledge and practice. Essentially, DD connects participatory, open source and DiY design processes with parts of existing production and distribution models, digital manufacturing technologies, thanks to computational capability and systems.

Moreover, Distributed Design - intended as open design for distributed products, services and systems - (Diez, 2018; Armstrong et al., 2019) requires users and indie innovators to

question themselves, to overcome their limitations and to experiment with new ways of making and doing things. Creators and innovators make use of digital-enabling technologies as digital fabrication platforms, prototyping spaces and community-based labs to make tools and tech accessible. Personal and personalized solutions can be created on- demand, on-site, and then shared with others. Recently, the theme of innovation, as far as design disciplines are concerned, is increasingly linked to experimental practices directly related to the dimensions of open and distributed knowledge and production. According to Aleinikoff (2014), *"innovation is a dynamic problem-solving among friends".* Innovation is a practice closely linked to the bottom-up experiential dimension, often coming from a group of users who seek to respond to design niches through the increasing accessibility to spaces, places, communities and technologies more widespread in cities. This aspect can be connected to a constant growth in the dimension of participatory design, intended not only as a methodological approach but also as a spontaneous practice, with the aim of developing design solutions together *with* or *by* the citizens-users.

2. Patient innovation and open care: an emerging scenario

Unquestionably, digital transformation increased innovation capabilities in designers but also in final users. When that kind of design-driven and user-driven innovation become *mission-oriented* (Mazzucato, 2018), it can be work support the autonomy and quality of life of people, especially those affected by diseases or disabilities, as well as their families and caregivers. According to Bertalan Mesko (2016), the development of new forms of care enabled and enhanced both socially and technologically, the increasing digitization of patient data, and the increased permeation of so-called disruptive technologies, acquire a meaning only if they put the person at the center of their action. This means, first of all, strengthening his or her personal knowledge, and making him or her an expert capable of autonomously managing the prevention, self-diagnosis, and collaboration with the doctor to actively participate in the development of his or her own care. It is precisely the emerging trend of active participation by patients - both individually and in the organized manner of associations and caregivers - that brings to light new levers and new ways of innovation. What gradually emerges is the concept of patient innovation (Zejnilović, 2016; Maffei et al., 2017), a bottom-up and user innovation formula that is divided into four main dimensions: design, production-technological, social, regulatory and legislative (Maffei et al., 2019).

As far as the design dimension is concerned, there is an important need to aggregate different skills, professional and non-professional, in a collaborative dynamic through informal design practices. The productive-technological dimension of patient innovation is expressed in the choice and use of technologies - particularly digital technologies - which can also be modified by the patient himself or built ad hoc. The creation of communities united by the desire to solve specific needs, goes to perimeter the social and/or socializing dimension. Finally, patient innovation must necessarily confront (face of) the regulatory and

legislative aspect, which often slows down or blocks the production and diffusion of certain design solutions, as they are not part of the traditional certification chain.

Digital transformation allows patients to access and exchange data and information, create a dialogue with health services and ministries, organise and participate in associations, and raise funds to develop scientific research. The health system is becoming increasingly advanced when it comes to monitoring the body and its physical performance, with biometric data collected by interactive personal and environmental devices.

One of the areas in which this shared synergy can give concrete expression to relevant ground-breaking solutions is the *open care* (Day et al. 2017). Nowadays, types of products such as aids and prostheses can be designed using open source knowledge, software and hardware, and materialized within makerspaces combining makers' skills with digital manufacturing technologies (DeMonaco et al., 2019). Starting from this logic, a multiplicity of different solutions can be conceived and implemented answering to personal or social needs related to diseases or disability conditions. The personal and collaborative dimension in the path of disease management is, probably, the main catalyst that has made possible a series of innovative open care projects.

Within this transformation framework, it is interesting to explore the role of distributed design and production for open healthcare that we go to define as *Distributed Care* (DC), investigating emerging design skills and the use of digital fabrication within makerspaces, distributed labs where bottom-up experimentations developed by communities of makers, professionals and users are recently condensed. In particular, after a preliminary introduction on the main dynamics of open and distributed design, we will try to trace areas of opportunity and criticality, points of convergence and difference that may emerge in designing solutions for DC. The methodology proposed is the analysis of two case studies related to experimental initiatives developed by designers, makers and user innovators, materialized within an Italian Fab Labs, Polifactory - the makerspace of the Politecnico di Milano, and released through a distributed design platform (distributeddesign.eu). The analysis of these experiences in the field will serve to reflect on the development of Distributed Care, an innovation area characterized by a design culture strongly hybridized with the maker culture (Bogers et al., 2010).

3. Distributed design for open healthcare: two stories

Thanks to the systemic interpretation of the main elements of the emerging healthcare scenarios, it has been possible to scale up the proposed interpretation within a funded design project, explicitly conceived to be open and distributed.

FabCare and Next Steps[1] are two experimental initiatives part of Distributed Design Market Platform (DDMP, distributeddesign.eu), a project funded and supported by the Creative Europe Program of the European Commission to implement the global network of Fab Lab promoting and improving the connection between makers and designers with the European market. DDMP is an opportunity to consolidate this network, focusing on the development of a European Distributed Design Market Platform for makers and designers. it is particularly relevant as a specific case study in order to explore the dynamics of product design in the healthcare sector within the Fab Labs.

FabCare (2018) and Next Steps (2019) are experimental initiative promoted and developed by the makerspace Polifactory in order to stimulate designers, makers and independent innovators to design open source products for healthcare that can be distributed through digital platforms and materialized in Fab Labs. Both these experiences aim to demonstrate how designers, makers and independent innovators – also interacting with patients, caregivers and their associations – can concretely design, produce and distribute open source healthcare solutions with a real market potential.

The reasons why this is a relevant case study can be properly traced back to the nature of distributed dissemination with which the project outputs were originally conceived. According to Armstrong et al. (2019), the distributed design idea is one outcome of the intersection of two global trends: the maker movement and the digitisation of the design discipline. The entire DDMP European project integrates design skills and the making approach to enable the development of new entrepreneurial types of professional producers and in the case of the FabCare and Next Steps initiatives, this has generated open and distributed healthcare projects.

The parameters adopted for the case studies analysis are:

- physical and virtual places where the design process become "distributed" (Fab Labs, makerspaces, digital manufacturing platforms, etc.);
- enabling tools and digital technologies used to materialize the solutions;
- kind of solutions developed (e.g. product, product-service, on-demand, customizable, shareable solution);
- actors and stakeholders involved in the design and materialization process (e.g. community of users, caregivers, patient associations, etc.);
- release of the solutions (e.g. marketplaces, open source form although not necessarily free).

[1] Other interesting cases studies that cannot be analyzed in this paper are: *Hackability, Careables.org, Open Rampette*. Detailed information on these cases have been published within the MakeToCare reports (see www.maketocare.it/report)

3.1 FabCare. Open devices for smart monitoring and care awareness

Table 1. Synthetic overview of the FabCare initiative.

Level of analysis	Short description
Places (Physical and or virtual)	Fab Lab, university, medical centre, online platform
Technologies and enabling tools	3D printing, 4D printing, Laser cutting, CNC Milling machine, Electronics, Soldering station,
Kind of solutions developed	Electronic devices and analog products for monitoring and prevention
Actors and stakeholders involved	Designers, makers, researcher, doctors and specialists (CM Santagostino), users, patients
Distribution	Release of the solutions through CC-BY license; download available on the online platform distributeddesign.eu

For the first year of DDMP research, Polifactory based on the experience gained in the healthcare field, thanks to the MaketoCare research initiative (makertocare.it). Nowadays, types of products such as aids and prostheses can be designed using open source knowledge, software and hardware, and then be materialized in Fab Labs combining makers' skills with digital manufacturing technologies. Starting from this logic, a multiplicity of different solutions can be conceived, intertwined and implemented answering to the needs of prevention or care for everyone. The experimental initiative that has been developed has taken the name FabCare, with the purpose of stimulating designers, makers and independent innovators to design open source products for healthcare that can be distributed through digital platforms and materialized in Fab Labs. FabCare was developed by Polifactory, within the Distributed Design Market Platform project. Therefore, FabCare's challenge aims to demonstrate how designers, makers and independent innovators – also interacting with patients, caregivers and their associations – can concretely design, produce and distribute open source healthcare solutions with a real market potential. Furthermore, Fabcare was technically and scientifically supported, as well as endorsed, by Centro Medico Santagostino, that is one of the first Italian network of specialist polyclinics managed by a social venture capital company, and it is aimed at experimenting healthcare service models economically sustainable and socially responsible.

The whole project lasted only a few months: from May to October 2018, FabCare has developed an intense mix of events and activities. The main milestones of the project were: (i.) the Open Call for Ideas, (ii.) the selection of ideas to prototype, (iii.) the projects' implementation and materialization, (iv.) the projects distribution and promotion.

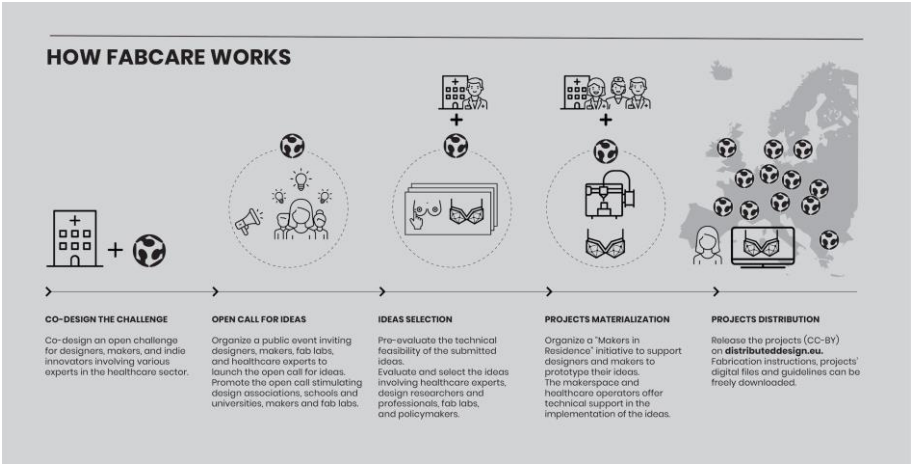

Figure 1. Fabcare's project phase scheme

First the Open Call for Ideas (i.) was co-designed, launched and promoted. Polifactory and CM Santangostino have collaborated to define themes and design challenges, and participation rules for designers, makers and independent innovators. Then, FabCare's Open Call for Ideas was officially released during the European Maker Week, and from May to July the it has been promoted to the italian Fab Labs network and the main design schools and university in Italy. Afterwards the selection of ideas to prototype (ii.) was made. Starting from a list of twentyone projects submitted by a group of sixty designers and makers, in July 2018 a panel of experts in design, healthcare and digital fabrication have selected the five ideas to be developed and prototyped within Polifactory. The winning ideas were: DermAware, Dermap, Mole Mapper, Palpatine and Zero2. It is important to note that they are specifically defined as ideas, because they were mainly interesting intuitions and concepts, still far from the logic of open and distributed design and production.

For this reason, the evolutions acquired during the phase of projects' implementation and materialization (iii.). From July to October 2018, seventeen designers and makers have operated in Polifactory with the aim of developing the five selected projects. During the phases of executive design, experimental prototyping and digital fabrication they have been supported by a network of technicians, professors and researchers of the Politecnico di Milano. In the end the phase of distribution and promotion (iv.) was held. The five projects were published on the platform distributeddesign.eu and on Polifactory's website, thus promoted and presented at European Maker Faire Rome through an exhibition and a talk.

Despite the fact that these are projects with very different complexities, it is important to emphasize that anyone can actually reproduce them, because for each project the documentation is still available online, which includes digital files for production, fab-instructions, and the user manual. It is important to point out that all projects developed

within FabCare are not medical devices. These are open source solutions at the first stage of release and development that can be freely implemented following the instructions provided by the CC-BY license. All FabCare solutions provide informative support and/or help with prevention or monitoring activities regarding the problem or pathology for which they were designed. In no case can these solutions replace a consultation or relationship with a doctor or a medical specialist.



Figure 2. From left to right and from top to bottom: "Dermap", a device that supports people in measuring the evolution of their vitiligo, designed by Marianna Accorsi, Giulia Sala, Giuseppe Valentino; "DermAware", a digital bracelet to educate people on the burden

associated with atopic dermatitis, designed by Nicolò Bisi, Nur Eral and Mattia Fantoni with the support of Angelo Geraci, Nicola Corna, Fabio Garzetti and Nicola Lusardi; "Mole Mapper", a small tool for your skin health. Keep your moles in check and share info with your doctor, designed by Ilaria Vitali, Patrizia Bolzan, Mila Stepanovic; "Zero2" a device for patients with respiratory deficiency used to monitor their blood oxygen levels, designed by Tommaso Brioschi, Lorenzo Lanzoni, Giovanni Luca Fidone; "Palpatine", an analogue wearable educational device to learn the correct breast palpation techniques, designed by Francesca Poli, Daniel Sanchez, Benedetta Beltrami, Luca Sommariva, Chiara Parise.

3.2 Next Steps. Co-designing open source walking aids

Table 2. Synthetic overview of the Next Steps initiative.

Level of analysis	Short description
Places (Physical and or virtual)	Fab Lab, university, co-design workshop, online platform
Technologies and enabling tools	Available walking aids, 3D printing, Laser cutting, Electronics, Soldering station,
Kind of solutions developed	Aesthetic and/or functional solutions for the customization and reconfiguration of walking aids
Actors and stakeholders involved	Designers, makers, researcher, patient association (AIG), healthcare company (Sanofi Genzyme), lead users, patients
Distribution	Release of the solutions through CC-BY license; download available on the online platform distributeddesign.eu

In the second year of the DDMP project, Polifactory has once again proposed to work on the issue of healthcare, this time articulating differently the identification phase of the project areas of intervention. The new action, called Next Steps, started from the desire to stimulate designers, makers and patients (as user innovators) to co-design and prototype a collection of open source walking aids that can be distributed through digital platforms and materialized in Fab Labs. Next Steps was developed thanks to the collaboration with Italian Glycogenosis Association (AIG), a patient association that represents people affected by this rare and degenerative metabolic disease. AIG prompted the involvement of patients in the co-design and prototyping of walking aids and for that very reason, the whole project was built around the co-design phase. Thanks to Next Steps, patients were able to experience a real process of patient innovation. Next Steps was articulated in three steps: (i.) the Challenge assessment; (ii.) the Maker in Residence activity; (iii.) the the projects distribution and promotion. During the Challenge phase (i.), from March to May 2019, the starting point was an open call to action that stimulates the engagement of a group of patients that will be involved in the co-design of walking aids together with a team of designers and makers of Politecnico di Milano. During the Challenge phase, the product ideas were presented and

shared with AIG, within one of more events. Patient innovators such as Antonella Ferrari[2] caregiver innovators such as Fabio Gorrasi[3] were able to participate in this phase.

From May to September 2019 the Makers in Residence phase (ii.) was held. In this phase patients interacted with the designers who supported them in the development and prototyping of open source walking aids, thanks to the technical and scientific support provided by Polifactory, and the medical and scientific support provided by Sanofi Genzyme.

The last step, the promotion and distribution of the projects (iii.), took place in September and October 2019. As for the previous edition of DDMP, the results of co-design and prototyping were published both on the distribuddesign.eu platform and on the Polifactory's website, and were also presented in Rome during a speech at the European Maker Faire 2019, and in Milan during the Manifatture Aperte event. Reflecting on the previously established co-design phase, an in-depth examination of the type of information obtained by strengthening the involvement of patients and caregivers is reported.

The results of a first survey with the patients from AIG association, the suggestions received by the patient-innovators during the co-design workshop, and the feedback obtained interacting with patients and their families during the AIG meeting evidences aspects that influence the design phase. First of all, the aesthetic dimension of the walking aids is as important as working on functional aspects. Secondly, walking aids tents to become physical extensions of the people; personalization is an important issue because characterizes the identity of the walking aids in order to be tuned with that of their users. Then, Next Steps solutions must be adaptable to the walking aids already available on the market. Last but not least, the digital manufacturing processes and the digital technologies embedded in the walking aids have to be adaptable for DIY, makers and Fab Labs, craftsmanship but also industrial sector. The result was four projects, focusing on different aspects of walking aids. The first project is Twistr, a parametric stick that has developed a design and digital fabrication method to materialize personal parametric sticks – with kinect and grasshopper – having a 3D printed structure. The stick is printed with the carbonium material. Another stick project, this time made with a generative logic is called Taylor. This is a project of a method to create generative sticks, which change according to the weight, height and gender of the user. Another result was the project of an IoT rollator named Wander3d.Thanks to this hacking it is possible to transform a traditional walker into a motorized and sensorized object. The user can activate or not the motors according to the needs. The last project dealt with the aesthetic dimension of walking aids. Clip Clap is a project that allows the personalization of your crutch. This project concerns the co-design of removable clips for all

[2] Antonella Ferrari is an Italian actress suffering from multiple sclerosis who, acting as an innovative patient, has designed and developed her own collection of hand-decorated crutches.

[3] Fabio Gorrasi is an Italian caregiver innovator who has designed and make a special brace for his daughter affected by Spinal Muscular Atrophy, in order to give her more movement and freedom.

kinds of crutches that can be easily personalized and digitally fabricated. The projects developed will have to be available in open source mode according to the Creative Common License (cc-by and cc-by-sa).



Figure 3. From left to right and from top to bottom: "Twistr", the parametric stick designed by Angelo De Iesi, Andrea Ascani, Ewoud Westerduin, Aurélie Marie Glaser; "Taylor", the generative stick designed by Alessandro Ceriani and Marco Ceruti; "Wander3D", the IoT rollator designed by Leonardo Lucchetti and Silvia Meregalli; "Clip Clap", the customization of crutches designed by Lorenzo Cereda, Nicola Colombo, Giovanni Cortellessa and Andrea Stefanelli.

4. Designing for Distributed Care. A new scalable model?

The literature review and the experiences analyzed stimulate two levels of reflection.
The first level concerns the key elements of a distributed design and production process for the development of open source solutions in healthcare. The second level concerns the characteristics and properties that define Distributed Care as a possible area of innovation.

The analysis of project experiences in the field identify the following key elements previously highlighted in the summary tables of the initiatives:

- *Actors.* The importance of cooperation between heterogeneous subjects such as designers, makers, but also specialists in the institutional care sector, patients, caregivers and associations. Distributed design stimulates the creation of transversal project teams that participate with different contributions in the development of the final solutions, especially during the initial phase that range from needs analysis and development of the project brief.
- *Places*. The importance of the places where the project development process is materialized. From the initial idea to the final solution distributed design generates a progressive delocalization of the innovation process. In fact, the first phases generally need the support of different "physical" places that function as "facilitators" and aggregators of (Fab Labs, research labs, medical and rehabilitation centers, schools, etc.) where the different subjects involved in the project development have the opportunity to meet, confront each other, work together. The prototyping and design development phases generally take place thanks to the support of a Fab Lab network.
- *Technologies.* The importance of the access and use network of advanced digital manufacturing technologies thanks to which production can be customized, decentralized and potentially close-to-the-user.
- *Distribution/release.* The importance of the concept of "openness" applied to the distribution and release phase of the final solutions. Distributed design makes the solutions accessible and materialize everywhere by downloading digital files from peer-to-peer platforms (e.g. GitHub). The available documentation allows to elaborate subsequent customizations and implementations of the solution, opening the entire design process and connecting it to a distributed production network.

What can we learn from the promising direction of distributed care?

- *Not only medical devices:* Distributed design promotes and stimulates a biodiversity of solutions, exploring the theme of prosthetics, orthosis, medical devices and a new generation of personal objects. Many solutions – especially in the field of healthcare – are influenced by the regulatory system, which is fundamental to protect users and patients. This is a bottleneck for distributed design, but it is also an opportunity. The development of non-medical devices can be complementary to medical ones. Distributed design can support users and innovators to create solutions that demonstrate how existing rules, standards and market barriers could be reconsidered.
- *Not only functional solutions*: Many solutions are designed following functional and technical requirements, but their aesthetic dimensions can be as important. Healthcare objects and aids tend to become physical extensions of people. Aesthetic personalization is important, because it characterizes the identity of objects and establishes a personal or familiarity for users.
- *Not only complex and expensive solutions:* Many objects and devices are complex and expensive. Distributed design can design solutions that can be adapted from

objects already available on the market, taking into consideration open hardware and low-cost technologies that are easily accessible for the everyday user and disadvantaged or vulnerable people.

- Not only new products: Many objects are unique and irreplaceable owing to a relationship that is established with their users and owners. Distributed design perfectly fits with hacking, repairing and upgrading practices and is compatible with remanufacturing and refurbishing processes.

What's next? We could be at the beginning of an augmented concept of 'care' where people can develop a distributed awareness, responsibility and participation in the design of innovative open source solutions that work to take care not only of people, but also other living beings and the environment. This can be Distributed Care.

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Acknowledgements: Thanks to Centro Medico Santagostino, Associazione Italiana Glicogenosi (AIG) for participating in the co-creation phase, and Sanofi Genzyme for supporting Polifactory and the projects' authors in the promotion and showcase of the results.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Heterotopia of Space: How capitalism is alienating and controlling societies

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Abstract | Multimedia has historically been the tool of choice preferred by political capitalism to gain control over people. This has been massively aided by the upsurge in the political sector's machinery and progressive technology. Governments, and the private sector control multimedia tools such as advertising, social media platforms and technology to control people. Cities have risen to become heterotopias; vast-growing high-tech infrastructure capitals that transform people's behaviour. A marked change was visible in the 21st Century. Technological devices previously only available to governments and the military became commercialised, packaged and marketed to people. In our capitalist consumer societies, such private sector corporations take advantage of social media platforms to further control social groups largely influencing their politics. The private sector, through its multiple alliance to governments, moved to exploiting technological tools commercially. Thus, progress became a basic process solely for gaining power and control over people.

KEYWORDS | CAPITALISM, CONSUMERISM, IMAGERY, SPECTACLE

1. Introduction

This paper defines heterotopias as manufactured spaces that alter people's behaviour. In this day and age, it is very easy for governments, together with the private sector to manipulate multimedia platforms to create spaces where human behaviour can be controlled, almost expected. This paper sheds light on these manipulative practices by governments taking examples some historical, some modern, to exemplify how people's behaviour can be almost orchestrated. A consumer society relies heavily on progressing its technology. Accordingly, technology took the upper hand guiding mankind's gaze. As Virilio noted, "one can only see instantaneous sections seized by the Cyclops eye of the lens" (Virilio,1994, p.13). However, for Debord sight is "the most abstract of the senses, and the most easily deceived" (Debord, 1995, p.17). Thus, in a world that is mirrored by images, reality is lost to the point of being obscured and even non-existent.

Multimedia has historically been used exploitatively with large socio-political implications. Originally, advertisement has been manufactured to lull public opinion. This has been achieved through the use of attractive visuals. Images, then, have become the new norm used by governments, and the private sector to derive their legitimacy in societies armed with technology. Previously, the exploitation of people, particularly the proletariat, was made by normalizing societal conventions through a visual illusion of imagery. However, today, this can be achieved through different online platforms as images spread instantaneously. This maintains cultural and political sustainability and ensures governments and corporations stay in place through the ongoing argument that people need government protection as there is always a security threat and people will always need things to consume. Our behaviour is currently controlled by the images that we see online. Online platforms provide us with an arena for interconnection as well as for discovering difference. While there is a high degree of homogenization, it is imperative to note that there is also forms of diversification.

Visual communication literature addressed topics relevant to the exploitive image and how it's used for changing social perceptions. Government's newest trend is creating a hybrid image that juxtaposes violence with refined spectacle. It becomes impossible for some spectators to identify this metamorphosis. This is an approach that rounds people collectively leading to a homogeneous society. This method is used by governments and the private sector to control people by manipulating codes and symbols. Ideologies of suppression and obeisance are hidden in imagery that are innocently absorbed. Although ideologies have been reconstructed over time reflecting democracy, across societies yet, democracy has been long dead. It is only the illusion of democracy that we find across countries and societies nowadays. Dictatorship is ever present but is concealed behind concepts and imagery. In *One-Dimensional Man*, Marcuse suggested that with "technical progress as its instrument, freedom-in the sense of man's subjection in his productive apparatus-is perpetuated and intensified in the form of many liberties and comforts" (Marcuse, 2002, p.35). Voting, freedom of speech, debates, open arguments, advertisement

all reflect an image of a liberal, democratic, equal, representation society. By taking part of governmental decisions, the majority of individuals think they are free under totalitarian regimes.

As societies advance technologically so do corporations driven by capitalism. Private sector corporations used technological developments, to camouflage its exploitive tendencies. Governments and the private sector have become intertwined and synonymous due to their enmeshed interests. They hide behind a polished and mediated representation. Societies become more and more intertwined with the spectacle, but also alienated due to their experience with mediated representations. For Debord, "the spectacle is not a collection of images," but a social relation among people mediated by images" (Debord, 1995, p.12). He considered that anything representative can alter reality and may be harmful.

Today, with these easily affordable devices, imagery and the spectacle that has been commercialised by the private sector people can be reached collectively, thus rendering images more dangerous and exploitive. The purpose and use of images with new technologies has highly affected image production. These technologies were able to copy the image of the actual in the virtual. It bred a duplicate, almost virtual, space within the actual where societies can move from one interactive space to another. "This act of cutting reality into a sign and nothingness simultaneously doubles the viewing subject, who now exists in two spaces: the familiar physical space of her body and the virtual space of an image within the screen" (Manovich, 2002, p.104).

Not only did these new devices change the way people communicate and interact but it changed their behaviour and perception as they continuously disappeared inside the virtual. Technology took control over the body as people are delving more inside the virtual. Virilio's point of view on these new technological devices is that it will "colonize human behaviour, just as television and the computer are doing, but this last form of colonization is a much more intimate, and a much irresistible form" (Virilio, 2000, p.51). Since many people are equipped with these tools, such societies become intertwined inside webs of technologies that are communicative, interactive, mobile and more importantly monitored and observed.

2. Aestheticization and the image

Totalitarian Governments have historically exploited artists to camouflage and propagate messages aesthetically. Before the industrialization of the screen, images were passed on differently. For example, in his essay, *The Work of Art in the Age of Mechanical Reproduction*, Walter Benjamin argues how political regimes can exploit new machinery. Previously, with inventions like cameras, film and printers which can distribute messages equally leading to a collective response.

Historically skilled painters, sculptors, or craftsmen were commissioned by patrons. As churches grew in power, so did the development of its artistic flair. Artists created artwork

as truthfully as possible filling it with illusion through a dynamic display. That said, it was designed to impress. In order to hone its message churches commissioned artists to spread its holy image to the public. City streets, towns and public shrines were covered with art, associated with the church's influential power. This type of art was made to appeal visually and emotionally to the public. Comparing this to the Nazi regime who exploited the use of new emerging art media like films, newspapers, the radio, advertisement, symbols, speakers, ceremonial events, exhibits and schools, which all exemplified as Nazi propaganda and exploited the public opinion. This is when Benjamin differentiated between two poles, exhibition and cult values. "Originally the contextual integration of art in tradition found its expression in the cult. We know that the earliest art works originated in the service of a ritual – first the magical, then the religious kind" (Durham G.M. & Kellner M. D. 2006, p.22). He asserts that exhibition value had exceeded its dominance over cult value as the first can be distributed faster. These inventions changed the functionality of art that was only used for cult and religious ceremonies. Within the framework of Marxism, Adorno and Horkheimer's essay *The Cultural Industry: Enlightenment as Mass Deception,* inspects the use of such media are propagated within the arts particularly during wars to gain control over the people. "Culture today is infecting everything with sameness. Film, radio, and magazines form a system" (Durham G.M. & Kellner M. D.,2006, p.41). This allowed political regimes and governments to control and divert human behaviour and perception according to the imposed system. "The basis on which technology is gaining power over society is the power of those whose economic position in society is strongest". (Durham G.M. & Kellner M. D.,2006, p.42). Within these media of films, radio and magazines, propaganda becomes harder to distinguish, for some, when it's aestheticized and blended with art.

Another more recent example of governments manipulating public opinion through imagery is the United States diverting public opinion by selling an image of a picture perfect life. *Picture-perfect America* is known for its nation building, technological military advancement, and financial means. Although the United States is also known for exploitation of slavery, imperialism and racism yet any anti -humanitarian atrocities committed by this nation has been camouflaged with a polished spectacle. Identified as "a visually striking performance or display" (Spectacle, para 1), the spectacle of the United States was fed to its people by advertisement and films. With the advancement of visual communication devices, the US as Debord noted "It has invented a visual form of itself "(Debord,1995, p.14). As a predominantly capitalist consumer society, some of its citizens are living the glamour of the United States. Therefore, this psychedelic image was manufactured by media. Its beliefs and values have been constructed through its Hollywood image where other societies struggled maintaining their culture because they tried replicating a phantasmagoric image.

In a controversial title, *The Gulf War Did Not Take Place*, Jean Baudrillard argues that this war was a virtual war produced by the media. The only access to the public to see the events of this war was through the US media like CNN. "It is a masquerade of information. No images of the field battle, but images of masks, of blind or defeated faces, images of falsification. It is not war taking place over there but the disfiguration of the world"

(Baudrillard, 1995, p.40). The real events of this warfare disappeared behind the curtain of simulated reality made by the media and images. “The build-up is unreal as though the fiction of an earthquake were created by manipulating the measuring instruments” (Baudrillard, 1995, p.26).

This was a modern speculative war promoted by the media in a form of global entertainment and suspense. It was a broadcasted war that took place on the screen. In an interview with Paul Virilio, he stated that the Gulf war was considered a live war. (Virilio, 2004, p.66). This war was taking place globally and on every screen. But because the United States controlled the media, the image of this war propagated globally, from the US point of view. Very little was revealed from the actual combat between the American and Iraqi armies. What was exposed about the reality of the combat to the public was one sided. The United States wanted to promote to its public a strong and heroic image in order to maintain a hierarchal dominance. Their audience was introduced to a new militarized media that depicts a spectacle image and patriotic illusion.

For Baudrillard’s explicit view about the United States is that “it is neither dream or reality. It’s a hyperreality “(Baudrillard,2010, p.28). “The whole country is cinematic” (Baudrillard, 2010, p.31). Through different media devices, the world of advertisement expanded. The placement of ads varied from billboards, to buildings with screens, or popping out randomly on different social media platforms. This excessive bombardment of advertisement is infused with multiple forms of ideologies. Directed by John Carpenter, *They Live* is a Hollywood film that illustrates a typical consumer society that is ruled by a Capitalist government and its private sector. The film exposes how advertisement can spread ideologies and things to consume that lay within its spectacle. The glasses in the film exemplifies living a hyperreality of the fake and real. For Zizek wearing the glasses is “you see the dictatorship within democracy” (Zizek,2012, 02:58). When Nada wore the glasses, he saw what lies beyond the ads. What seems to be innocent, is a spectacle of control, and regulation. Through the ads, there is a message that promotes reproduction, sleep, and consumption. Zizek explicitly illustrates the strange lengthy fight between the two characters which represents the fear of stepping out of societies’ norm. This shows how people crave the hypnosis of ideologies since it embodies a comfort zone. Frank’s character illustrates the majority of daydreaming individuals who refuse to wake up to the ugliness of its society and the evil of these corporations. Zizek identifies this rejection, associating it to fear and pain. “To step outside of it, it hurts, it is a painful experience” (Zizek,2012, 04:42).

3. The King and Queen’s Gaze

Methods of people control exerted by governments throughout history has always changed in ‘how’ it dominates people. Early on, societies normalize traditions in order to control the public’s views, tunnel sight, and behaviour. Overtime, methods of control obscured what was once visible into becoming invisible. Michel Foucault identified representation as a

process of symbolization or coding linking it to power. To this, he examines Diego Velázquez painting titled *Las Meninas* dated 1656 and how power and hierarchy is presented in this painting yet remains invisible to the spectator's eyes. Velázquez painting captures a photographic picture of the Spanish court. The skilled artist steered the viewer to look at particular figures and angles in the painting. What is visible in the painting is what the artist gave emphasis on using light and dark contrast. Relatively, Velázquez directs the viewer's gaze on specific subjects and hides those who are in power. Both figures of the king and queen are obscured in a mirror placed in the middle of the artwork who gaze back at the oblivious spectator.

In the Middle Ages, the image of power was made visible to the public gaze. The image of power was visible to the public through public executions. Those were purposely visible for implanting an image of power and control over people. Pain and torture were used as punishment applied on the physical body. This reminded people of the authoritative power commanded by rulers. Torture devices varied in their instruments and practice. They were exploited in accordance to the severity of the crime. "Skilled torturers would use methods that delayed death while inflicting agonizing pain" (Foucault,1995, p.34). Therefore, the image of pain was key instrument used to exert control.

Public executions were somehow ceremonial and entertaining. "The tortured body is first inscribed in the legal ceremonial that must produce, open for all to see, the truth of the crime" (Foucault, 1995, p.35). It publicized a specific image of justice – that of cruelty. So, in order to restore peace, abolishing riotous behaviour is a must in societies. The convicted used to endure public humiliation and physical pain in the most indisputable abhorrent ways. Because this power exposed its barbaric methods in public spaces, to some extent it normalized its barbaric ways onto its subjects. This form of power controls the public through the implementation of violence on bodies.

In modern societies, public torture is no longer used as a means of public control. New forms of power have emerged and replaced older ones. Works of architecture such as prisons replaced public executions. Instruments of torture gradually disappeared from public spaces and punishment was concealed behind prison's walls. Additionally, other forms of discipline were conducted by different institutions. These new forms of power are different from medieval ones. The new power wanted to create obedient bodies that self-regulate according to the laws. "For example, institutions as schools, hospitals, and military are places that train individuals to self-regulate" (Foucault, 1995, p.136). These institutions became the norm of societies and concealed the system of control behind its disciplinary and cultured methods making it almost invisible to the eyes of the public. With technologies, power becomes invisible. Similar to Velázquez painting, it also gazes at the spectator directly and from every angle. "This power had to be a faceless gaze that transformed the whole social body into a field of perception" (Foucault,1995, p.214). These devices allowed visibility to be everywhere. Watching people from multiple angles can be seen in Jeremey Bentham's architectural design, the panopticon. The panopticon is a central tower from which prisoners

could be observed. Because the tower is always lit; prisoners assumed that they are being watched at all times. Consequently, these devices function as Bentham's panoptic tower and Velázquez mirror. The spread of these devices within societies in order to monitor people, from any point in space and time thus making everything visible. Today, many public spaces are equipped with machinery that monitor everything. However, the system of control and power is hidden and remains invisible from the eyes of the public. With the new technologies, the mirror from Velázquez painting is positioned in the heart of societies as Bentham's panopticon. In consequence, totalitarian regimes become invisible to the naked eye and it's "gaze is alert everywhere" (Foucault,1995, p.195).

This illustrates how the structure of the panopticon and Velázquez mirror is reflected in tools such as the CCTV, global positioning systems, wireless internet, smart mobile phones, smart watches and many more which are employed everywhere in the physical space. This in turn creates an augmented space, identified by Lev Manovich as "a space of monitoring and control" (Manovich, 2002, p.5). Therefore, an augmented space is a space of surveillance because these technologies function as the panoptic tower and Velázquez mirror. Therefore, the invisible gaze of the king and queen had moved from center of the court to be everywhere because of these devices. The power of the capital is reflected behind the shiny screens of these devices, creating different levels of control. Today, both the actual and virtual are spaces of monitoring and control over the masses.

4. The Shift of Heterotopias

Currently we live in heterotopias, spaces created by the government and private sector that control the way we behave. A utopic society represents a perfect image of itself. It is identified in Oxford Dictionary as, "an imagined place or a state of things where everything is perfect (Utopia, para 1). On the other hand, heterotopias are other places, spaces that relatively carry several layered meanings and are characterized by juxtaposing different settings together. "We live inside a set of relations that delineates sites which are irreducible to one another and absolutely not superimposable on another" (Foucault, 2006, p.23). Heterotopias subjugate people in several spaces. Because heterotopias are part of a social structure, people are unaware of their existence as they are naturalized within the social system. They become natural and part of societies norm. Heterotopias have many characteristics and are experienced within the frames of culture. The masses are unaware of the existence of such spaces that are used for reconstructing behaviour. These spaces are used as a form of control over the body. People in heterotopias behave according to the place they are in.

Some heterotopic examples can be relevant to urban spaces, as they are able to juxtapose different places and environments together. Moreover, they accumulate time, preserving the past such as Foucault's example of museums, libraries or cemeteries where the body is persevered. Another characteristic is that they can create a non-existent imaginary place as

well as differentiate and categorize people within groups and identities. Since people are living in online landscapes, heterotopias then are experienced in the virtual realm. As Foucault had noted, the existence of heterotopias is to regulate, examine, and restructure societies and people, for example the prison is a heterotopia. Although they seem harmless, yet they can regulate and discipline society's behaviour. Since mankind is currently swinging in spaces of virtual and actual, mankind is nevertheless living the heterotopic "placeless place" (Foucault,2002,p.4). Online landscapes reflect a "placeless place or a place without a place" in virtual reality. Going through the World Wide Web, social media, google earth and other spaces are all kinds of heterotopias.

The virtual has the ability to create heterotopias that originated from spaces of society. Since many societies are wired with virtual spaces, therefore they adapted their behaviour to virtual agreements. Today, the actual space relies heavily on the virtual as most of its daily operations are conducted online. Businesses, finances, finding locations, interactions, and money transactions are conducted virtually. Online landscapes are colonizing societies inside its cybernetic frames that are limitless with its boundless pot of networks that promises the manifestation of any human desire. The new maps of many civilizations become identical because of World Wide Web and social media.

Societies find themselves more immersed in these happier spaces. These spaces are considered the new heterotopias as they impact people's behaviour and actions. What people experience within online heterotopias are different than the ones in the actual. They can regulate and control people's behaviour targeting specific areas such as consumption of commodities. For example, virtually, people are engaged in images. The image of fame, identity, lifestyle, and youth stream everywhere within these spaces. Virtual heterotopias are prevailing over reality and over the actual space leading societies to fall inside its illusions and imagery. And while consumer societies aim for similarity through fashion and style, this is leading to mass-producing behaviour. This alternative reality may lead to dangerous delusions. Adapting in the virtual heterotopia meaning sustaining self-image but leading to loss of identity.

The image of delusion and loss of identity heads in the direction of plastic surgery. The art of modelling flesh becomes the trend of consumer societies. The obsessiveness of extending youth resorts to extreme reconstruction of the body in order to maintain the youthful look in the virtual. Not only fashion can print a specific look with clothes and accessories also plastic surgery can print bodies. Duplicates of bodies, and faces exist because of these surgeries. Societies are living in the delusion of these images inside the virtual. They are trying to mimic and look as their virtual image. The strains of the virtual is maintaining the fake identity that lives differently in the physical. This is how new heterotopias operate on regulating societies as the focus today is mostly on appearances. Instead of controlling behaviour with instruments of torture, people are going under the knife willingly through surgeries in order to enhance their self-image. Furthermore, controlling people's behaviour goes further towards what they consume. Since heterotopias are known for merging sets of places

together, social media is a place where the intertwining of places is formed. Social media tools like Instagram and Facebook merge things together. The user can go live, play games, shop, promote, follow pages, create pages, watch the latest news, among other activities. These spaces offer new ways of living as users become more dependable on them. Whether food, clothes, shoes even sports, people behave in a specific way according to the language of the virtual. Opening businesses is possible and easy virtually. Everyone can go online and promote their commodities and goods. Instead of investing growth in real urban spaces, businesses now aim to grow virtually. More Instagram followers means product popularity. Investing in followers and fake social media accounts, is used to gain consumer trust and increasing product sales. These virtual businesses are their own advertisement agency in marketing and promoting themselves.

With easy and inexpensive strategies like following accounts casually, random discounts and shout outs, online challenges, collecting funds for a cause, and free give away. Seeking popular online bloggers with over a million followers to promote merchandise is essential. Virtual businesses implement regular strategies and the linguistic language of the virtual space, were consumers are swayed by these strategies falling into this trap of virtual spectacle. The new heterotopias of the virtual space controls societies to behave and consume in a specific way. In the current consumer societies, people are completely alienated from their actual space and have no sense of identity as they behave, dress, and look the same.

5. Conclusion

Images created by processes within a capitalist system: one that is controlled by both governments and the private sector due to their common interests, have created communication tools such as film, advertising, and online platforms reaching global destinations, crowding out place-specific identities. This capitalist modern system has succeeded in alienating societies stripping it from its identity, physical body, and urban spaces. “It’s the disappearance of the place and the individual at the same time. It’s now proven that this technique is spreading all over the world. It’s easier to make people disappear one by one, ten by ten, or thousands by thousands” (Virilio,2008, p.147). Although it might seem that these technologies had helped societies however, stipulated a specific way of living in a capitalist consumer society.

While we think we are living in enormously technologically sophisticated worlds governed by democracies and catered for by the private sector, this is nothing more than an illusion. As our lives became more virtual, politics and Capitalism resulted in exploiting the internet and social media for their own personal benefit. Methods of control vary from trending a cultural demand to distract people with the latest fashion and trends, to services and products, to abusing global information systems and bombarding populations with endless and useless information to the point of conditioning human response to it. As capitalist consumer

societies continue to grow, their individuals latch onto these technologies as if they are means of survival. Yet, these societies are failing to see the exploitive tendencies of these devices since their communication was made easier. Consumer societies directed by capitalism are alienated from the fact that to some extent behave, act, in the same manner. Moreover, they are monitored and observed from every single point by the panoptic gaze.

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Acknowledgements: I would like to express my gratitude to Dr.Hassan Choubassi, and Ms.Nadine Khayat for their continuous guidance and support for this paper.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

I - D

(I – Design _ Idiosyncratic Meta Design) Idiosyncratic Proceedings on Reading and Production Meta-Objects in Contemporary Industrial Design

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Abstract | This subject-object oriented research, in post-industrial socio-economic condition, refers to a protocol design on reading industrial objects and measuring how their "hyper value" increases. The term idiosyncratic design will be read as a logical protocol, to be transferred in its digital performance. At the same time, software and its projection on computational design will be read as a tank of instructions– created by subjects – that awaits a subject to schematize them and, eventually, construct his own map of expression. Therefore, idiosyncrasy as the evolution of the designer's description language becomes an expressive medium to produce new predicaments (in the Aristotelian logic). The purpose of this paper is to present a relational epistemological map of “idiosyncratic software”.

KEYWORDS | IDIOSYNCRATIC DESIGN, EPISTEMOLOGICAL MAP, LOGICAL PROTOCOL, SUBJECT-CENTRIC CULTURAL IMPRINT, POST-DESIGN

1. An ontological approach on the idiosyncratic object

1.1. Idiosyncrasy as a medium

According to Hippocrates, who first formulated the theory of the four peculiarities in his work "On the Nature of Man", idiosyncrasy is the particular/unique way a person reacts and expresses his feelings or his particular organic or psychological state and mood by which reacts to external stimuli. The etymological analysis of the word relates to "unique" - "plus" - "crassos", which in ancient Greek are interpreted as "unique blend". However, the English translation as "temperament" is also interesting; here, temperament, taken as a behaviour pattern, relates to a time condition from “Tempus”(Merriam-Webster, n.d.).

It is difficult to fully grasp the definition of idiosyncrasy. However, we can denote that it has a dynamic base through which it can be perceived as an open, “metabolic” process that expands in time. It is open because it cannot be set into a stable and concrete meaning, due to the multitude of the different perception frames each subject creates for every stimulation. These frames create properties-substances which enable metabolic reactions from the subject as they relate the logical and the emotional parts of humans’ behaviours. Additionally, timeliness can be perceived both as the human temporal perception in a given moment of time and in terms of a broader cultural evolution of the notion per se.

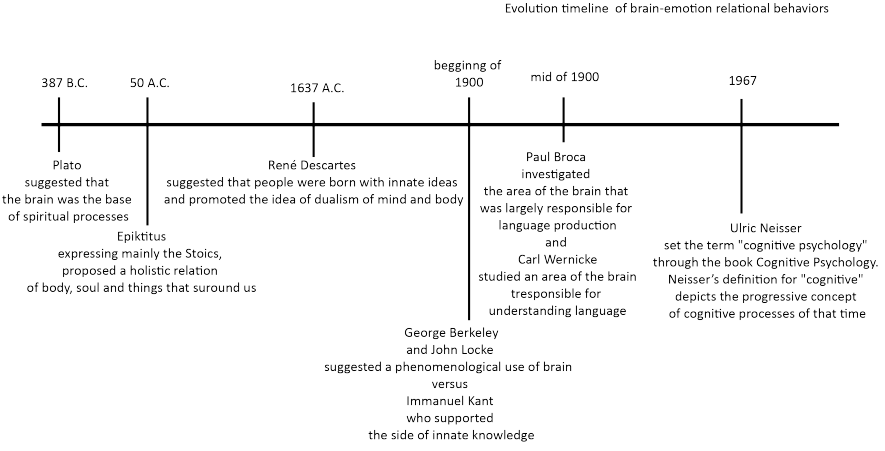

Figure 1. The conceptual evolution of brain-emotion relational behaviors.

According to the chronological line above, the emergence of humans' cognitive processing is directed through the divergence and convergence of the soul-brain function. The term "knowledge" refers to all these processes through which sensory input is transformed, reduced, stored, retrieved, and used. Knowledge deals with all these even when operating without proper stimulation, like with images and hallucinations. It is a dynamic phenomenon

that is inherent in every individual personality but evolves alongside it. Also, however, there is an intermediate/hybrid behavioural condition, referring to the blending of brain and soul. This hybrid condition is the personal filter or medium, both as an in-between as well as an operational condition.

By examining the relation of reason-emotion we can recall references on a mechanism on the definition of the relation between Subject and Object. In that context, we cannot omit to mention Merleau-Ponty, Foucault and The Dispositive, Agamben and The Apparatus, the Gestalt theory, and Zizek with the Parallax view. Although their extensive analysis will not be examined in the present work, we could summarize them under the formula: “what I see relates”. Therefore, when the question "what is this" pops up, instantly a chain of relations emerges, which are defined by the properties the Subject embeds to the Object of question. The properties are placed into the context in which "this" is, transforming the Object into “it is”. Nevertheless, it is important to clarify that the concept of “this” is not related to a psychoanalytic framework of perception, analysis, and interpretation, but is closer to the concept of the “thing”.

Hence, the mechanism of idiosyncrasy is a method of perceiving and conceptualizing the Object ("it"), and we can say that it is linked to the notions of exhibiting and curating. As such, it extends to the construction of a collective thing as a real-time interpretation. Examples of such mechanisms are both Aby Warburg's Mnemosyne Atlas (1930) and Herbert Bayer's curatorial mechanism in the historical "Points of View" exhibition in 1930 (figure 2, 3). In the first example, Warburg's very personal aesthetics and philosophy can be interpreted as a whole that produces generalizations. These extensively mapped generalizations serve as his own insight of a (new) knowledge and have the potential of becoming collective. The second one proposed a visual mechanism through which the observers created their own perspective through multiple views about the exhibited items. What is common in both examples is the ability to relate hands-on cultural perception and memory. Although the senses, as receivers of idiosyncrasy, are the way that materiality provides reminiscence and forgetfulness, as Hamilakis points out in his work "Archeology and the Senses: Experience, Memory and Emotion", p. 25, the fact that the Subject becomes a part of a testimony process reveals an enhanced experience, where the dominant sense is vision.

Nevertheless, what is happening in the digital realm? How sensorial experience is amplified when the subject is isolated in front of a computer screen? The answer to both questions is associated also with vision. The “thing” is formed in a process of “becoming”, a design process, and it can be read and interpreted always in relation to the quintessential conceptual term required by the design tools; the request of obtaining presence through representation (figure). An interesting example is the work of Lionel March, mainly in the context of the link between instruction and interpretation. Typically, March attempted to render interpretations to the built architecture through acts of the Boolean Operations Binary System 1-0. (March, 2010).



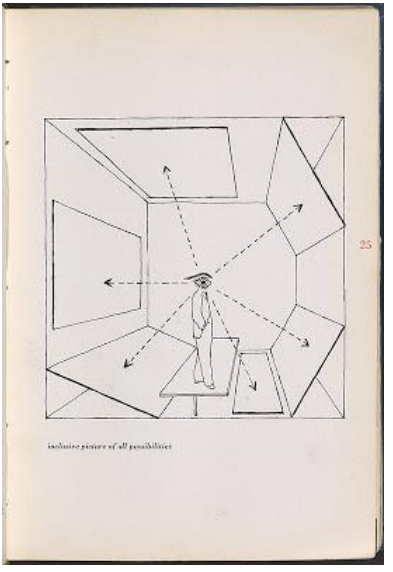

Figure 2. Extract of the Mnemosyne Atlas of Aby Warburg (1930).

Figure 3. The curatorial mechanism by Herbert Bayer (1930).

Hence, idiosyncrasy enables understanding of common principles and rationales within a given time and cultural context and helps us to synthesize trends and theories, which describe forms and "spatial productions" of the main elements used to characterize them. Forty years after J. Habermas's theory of communicative action and N. Luhmann's systemic theory, A. Reckwitz formulates an original theory of late modernity referring to the distinction between particular and general in culture, digital technique, and lifestyles, introducing the notion of uniqueness. In this society of uniqueness, which is described as the modern society that revolves around the pursuit of uniqueness both in objects, in subjects, both in space and in time, idiosyncrasy can become a tool to construct collectivity. To be able to properly describe this constructing process we introduce a digital idiosyncratic methodology, which will record, archive, categorize and interpret the subject's idiosyncratic expressions during a real-time design process, within a digital design software/environment. This methodology allows a "dissection" in the design process itself, while at the same time offers the possibility to redefine the design and its implementing instrument; the design program.

1.2. I (eye) – valuate

Although idiosyncrasy is enabled by desires, fantasies, and immaterial interpretations of the real, it leaves traces that can be read and measured. Thus, the triggering object of

idiosyncrasy, which we name “idiosyncratic object” is an unattainable object; an object that escapes perception. Our goal is to try to create a system of understandings for the idiosyncratic object. This object, which we name ID-Object, can be grasped by reconstructing the many different frameworks to which it can be exposed, displayed, and exhibited. When exposed, the ID-Object is viewed in a raw state of/for use. When displayed it requests the condition of a filter between the ID-Object and the Subject-Viewer. While exhibited it becomes an Object-of-Value. Through all these states a new system of relationships emerges; relationships of transition are released by the narratives that the Subject uses to “dress” the ID-Object so that it becomes attractive. To describe this complexity, we focus on the tool of the diagram, which becomes a medium of presentation for the relations that arise. Hence, the ID-Object is converted into a field of interpretations that reveals the idiosyncratic imprints of the Subject.

Via this context, we can extract the value of the idiosyncratic object, and, subsequently, we obtain the possibility of detecting and describing its characteristics. Thus, there are three modules of value in the design process: theological materiality, the everyday object, and the time(less) cultural object. These modules of value re-establish the conceptualization of the framework of the idiosyncratic object; it shifts towards historical materialism and closer to an idealistic/fantastic/imaginary approach to the idea of history.

Therefore, idiosyncrasy obtains a functional role as it produces an intermediate space within the relationship of Subject and Object. Therefore, as the Object gains a multitude of interpretations and facets, at the same time the Subject gets endowed with multiple roles through its socialization, becomes multiple, and is transformed into a field. This multiplicity affects the empirical process of understanding the system of objects that comprises its environment, in a way that differs from previously established theories. Hence, idiosyncrasy works in a subconscious way that contrasts with the systems of perception and the rational methods of the Gestalt theory.

Here’s an example: I see a director's chair or a mug or every-day object, in a warehouse, in my home, in a museum, in an online shop, and so on. As I attempt to describe the subject as a whole, experiential associations are created (Hamilakis, 2014, p. 29). Images are retrieved from multisensory memory forming a web. The relationships between them also create meaning - the hyper value of the object itself. Thus, perception with its multiple views, associations, and metaphors creates a system of interpretation, which enables a process of interaction. I see a stimulus, I perceive it and interact with it (buying, using, and designing) and eventually, I am led to a meaningful construction of multiple subjective views and idiosyncratic associations. All these metaphors create an idiosyncratic value system. Moreover, the tools used in the process of perception can be also used as tools for interaction, where understanding manifests the minimum expression of interaction.

Back to the design process, an important field to study is the transition from engraving to the design process and from drawing to design production. In other words, the study of

communication and description, through the process of material-immaterial translation, and how it yields the expression of the subjective "vision" of the designer. At the same time, the process described above is also involved in the transmission of design knowledge through different regions, epochs, and cultural backgrounds.

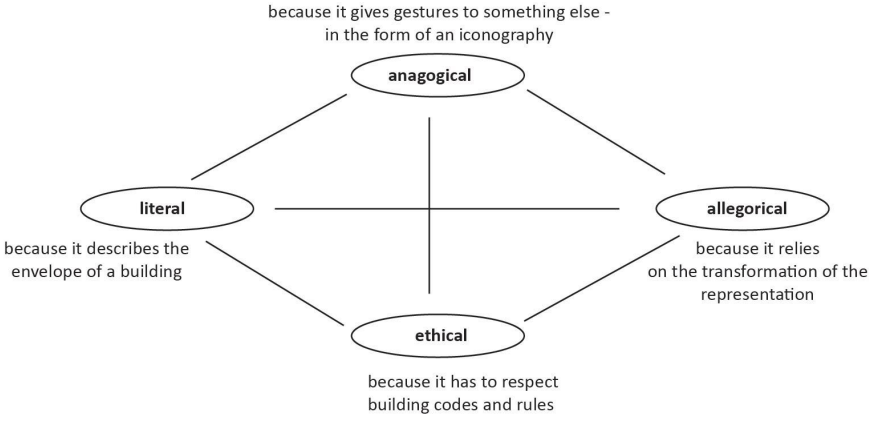

Figure 4. The four senses of Paper as an interpretation of Paper according to M. Frascari.

Marco Frascari, studying paper as such a condition, and at the same time in conjunction with the invention of typography (Frascari, 2017, pp. 23–32), uncovers the four senses of design (Figure 4). If we extend these senses to digital design, during the transition from analogue to digital the reduction is lost (anagogia). Anagogia can be traced back if we “capture” the relationship between a designer (user of the program) and the creator of a design program in an imaginary piece of paper. Via the medium of the tracing paper, the architect prepared a "sotto Lucido", that is, an underdrawing, where one can then draw the Lucido on top of it. One way that the concept of transparency as an intermediate space could be applied to digital design is a research area for the present work and will be further discussed below, as well as the design of the very transparency itself. Therefore, we understand that the design of an intermediate space is also a practice of meta-evaluation. What follows next is a series of other practices: the creation of uniqueness and the creation of intimacy. Uniqueness is experienced emotionally, as a sense of the sublime, of harmony, enjoyment, admiration, fear, pride, and so on, either bi-subjectively or solitarily (Τάσης, 2019, pp. 159-175).

2. The Unseen in Design

What is the value of idiosyncrasy for the Subject-Designer? Is this value constant both in an analogue and digital process? Diagrams as interpretations, introduce tools for measuring value?

In the synthetic phase of design, we refer to a “hypertextual” process that attributes the basic properties of the logical description of the design (in-port). When an object is interpreted performatively in an in-display condition, it is destabilized and transformed (ex-port) into a cultural symbol. But how can these two readings be correlated? The terms "import" and "export" are transferred into a new conceptual spectrum as "in-port" and "export". The reason is that we are trying to examine in depth the two fundamental processes of (digital) design, namely its start and completion.

The question of why architects choose programs (ready-made interface environments) to create, instead of choosing to design spatial relationships, conditions, and constants in a single programming language is a starting point. This question underlies the problem that we are planning by evaluating one export rather than a multi-export network. We see the representation/form of what we want to draw in a frame, in a picture instead. So what we design is constantly modified one-dimensionally by the image through the interface. But what is it that we do not see when designing? In Figure 5 we can see the "space" in which "what" we are designing is conceptualized by monitoring the invisible by-products of a digital design process. (Figure 5)

According to the diagram below, it is understood that there is a "latent" design in the design process itself. There are a basis and a system that allows us to "enter" and add our expressions. So, going back to the ratio of tracing paper, the design program is a Lucido on which our temperament carves out its own sotto Lucido, but which we can explicitly identify and highlight. To do this, the digital measurement methods of design temperament we propose are the following:

1. A Digital Interview, through the creation of a pop-up plugin, which will appear on the user's screen with a short questionnaire asking the reason of choice of the action-section made while designing.
2. Recording and interpreting those elements that are not immediately visible in (digital) design by:

- The use of the MouseTracker program to create a heat map of the subject's designing paths.
- Recording (quantitatively and statistically) not only the number of errors (via the Delete and Undo commands), but also the multitude of copies and alternative versions of files and designed-objects the user creates.

Thus, what we propose is a monitor device that captures the logic of the program, by supervising how it establishes and transforms the invisible space between the user-designer and the in-design object.

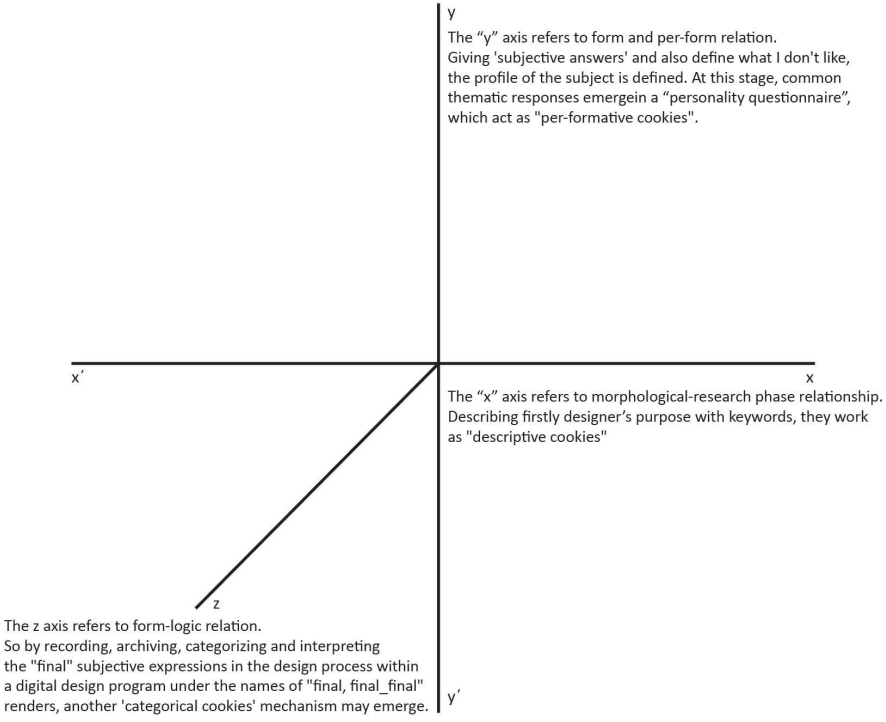

Figure 5. Space-making / poetics of space condition diagram of an algorithm recording the unseen by-products in a digital design process

2.1. Inter – View in Design

The first step of our study refers to a recording of the design context a Subject-Designer creates in actual design software. The testimony of such recordings derives from highlighting the subject's uniqueness. Uniqueness enables singularity which can be defined as the merge of biological and technical evolution (Τάσης, 2019, p. 28). This process reconstitutes a different understanding of the idea of an interview. In our research interview becomes performative; it provides and surpasses general identification data (such as sex, age, etc), by focusing closely to design preferences that are highlighted through technical evidence (geometries, materials, processes of assembly).

What we observed is that etymologically "interview" withholds a performative and collective vector. It brings together Subjects in a meeting/festive/happening condition to create (new) knowledge. We emphasize that the importance of the interview allows the quantification of user-designer data, from which we can draw - through repeatability - qualitative conclusions about their modality; the way designers design. Thus, it gives us a more penetrative view

into the soul of the designer. However, it is important to note that we are not talking about an interview in the traditional way, where the journalist asks questions to an interviewer and expects answers that are recorded or documented. In our research a "translation" takes place. On one hand, the role of the journalist is replaced by that of the investigator, and on the other, harvesting of the temporal moods of the designer becomes palpable and accessible.

If we further elaborate on the performative side of this interview we can gain access to "pre-positions" of the Subject-Designer. These pre-positions refer to all these genetic principles that establish and institutionalize the manifestation of a design act, and they serve as a key to gaining access to the idiosyncratic status of the designer. Therefore, a dual nature is detected in the designer himself; in addition to being a designer he is also a user, and as such he can be examined for the causality of his actions while using the specific syntax of actions that legislates the design software. Consequently, what is permitted and enhanced is the gain of knowledge of idiosyncratic design methods produced during the real-time design process. In particular, by asking a question, while designing and not after or during a break, a kind of "shock" is created in the quality of the interviewee's response. It is a form of "epiphany" not in its theological complexion, but the anthropogenic and deeply intrinsic aspect of the subject.

Therefore, the randomness of the interview turns into an “idiosyncratic snapshot”, which aims to elicit answers from one or more users of a design program. It is an infiltration into the subconscious, inner thoughts of the subject-during-design; those thoughts that only an immediate "why?" can shock and respond with both immediacy and "purity".

These interviews, to be real-time, must have some trigger (triggering actions). These activators are characterized as cut-outs because they stand out from all other operations that are repetitive, purely mechanical, or have to do with improving the productivity or modes of displaying objects in their digital dimension.

From the example of Autodesk AutoCAD and how its interface commands-acts are categorized, we can immediately conclude that over the whole range of this program, fundamental genetic design acts are summed up in a set of 50 commands, which are called "operations-cutting points", because they produce something new, by transforming the existing under-design object through idiosyncratic intentions that push the subject to perform. These are just two subcategories with about 20 Draw commands and another 30 Modify commands. In our research, we are interested in establishing the primary definition of the designer’s idiosyncrasy-measuring program and distinguish all idiosyncratic answers from the ones that have legislative or other technical constraints. The purpose is to comprehend the questions in detail and to determine when and how they will appear in a small window on the interface of the program used by the designer (pop-up window with feedback). (Figures 6, 7)

An example would be:

Q: Why did you choose to make this Fillet? (Note that for example, this fillet may have a very large radius)

A. Aesthetic Answer: I want spherical outlines that do not have sharp and aggressive angles. I want the shape to soften and become more organic so it can blend with the environment.

B. Technocratic Answer: I want all corners of my plot to allow large objects to rotate.

2.2 Design the value of MEmory

Beyond the speed of computing, interconnectivity, openness to knowledge, and many others, one of the greatest and probably the most important virtues that the computer has brought to our daily lives, but especially in our way of thinking, is that of "going back in time; recalling and correcting an error. In a computational environment, it is possible to press the undo button and erase an action without having to bear any consequences. This allows us to try and experiment up to the point where the program can write in its memory the history of the actions of the user. In our case, our interest focuses on identifying if and to what extent it is possible to operate alongside other programs that will be able to collect design-related data in digital design software. What interests us is data that refers to the way and to the duration of usage of the design software, as well as data that indicate repetitions and "errors" in the design process.

An example of this ability, to export real-time usage data, is the program[1] "MouseTracker" developed by Jon Freeman (Freenan, 2020). Through the transition from the non-descriptive of the unseen side of the design to the descriptive one, through the designers' footprints in real-time, the design in its entirety produces a multiple-subject (subject-designer-user) tank. Thus, a whole new world opens up in how we can recognize and study the uniqueness of each individual, simply by measuring how he designs, molds, and archives. However, this is an undergoing process of our research and it will be developed in the future.

[1] Indicatively, we mention other similar programs, such as Mouse Monitor, MouseFlow and MouseTrap-os. On the latter, see (Kieslich & Henninger, 2017).

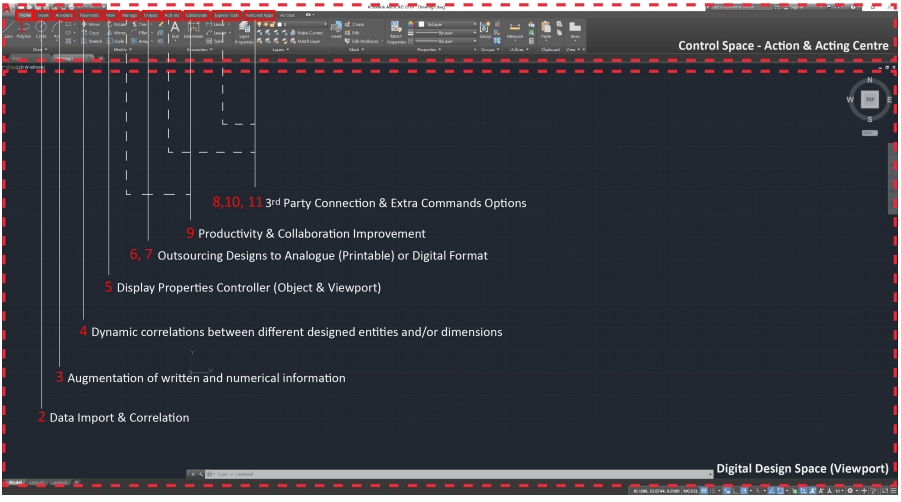

Figure 6. Digital Design Viewport as a framework for applying the idiosyncratic performance in design. Classification of commands and their signification as realization processes. Processes that embed properties into "That" that is under the design process.

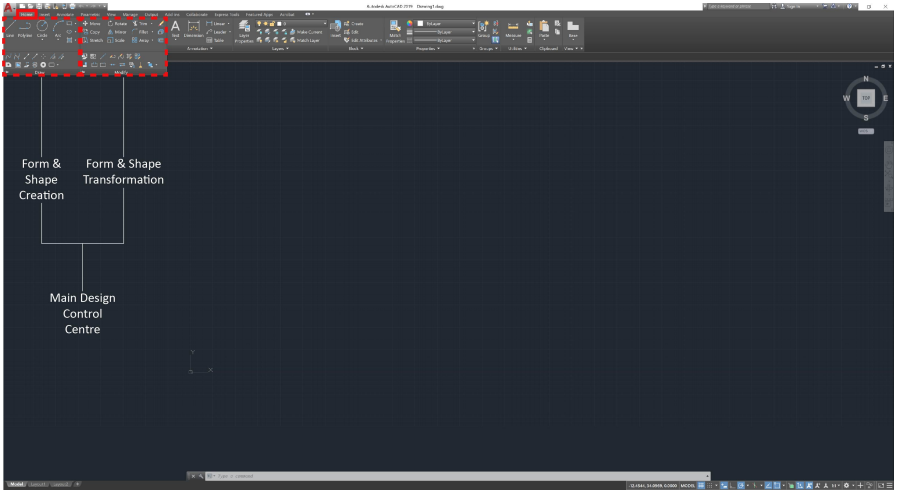

Figure 7. The main menu of Morphological processes. Their interpretation as objectification processes. Procedures for the emergence and application of "idiosyncratic" logic.

3. From ontology to ontological form

If we think back to what our mechanism ultimately produces, we could probably say that it captures, transforms, and expands the Subject-Object interface in digital design environments. We map the intermediate and bring out the uniqueness of each subject by extracting memory from the physical (digital) evidence, not only from their actions but mainly from their intentions. Such a proposal, an algorithm recording unseen parameters during design, is a development of the design language vocabulary within the existing digital design environments.

Therefore, an ontological identification map of the post-designed object is produced. The user has the choice to intervene on this map without the actual object being visible, drawing it in an ontological context. And then there is the command that transforms the ontological map into an image. These images are the reflection fields on the original object. So, what is produced? A time gap or otherwise a dialogue between the designer and the object.

Moreover, one result is the design of the framework in which our temperament is more freely expressed. We do not define freedom as an arbitrary and meaningful concept that comes to fill gaps in our study. This freedom depends on the degree to which we can narrow the boundaries of design software to do things out of context. The result of such a process will be to create a new structure in the hub of forums that the design software already has, and where the users are looking for solutions to problems or improvements to existing and incomplete commands. Such a forum will not only send analytics and feedback to the design software provider/company but will be essential for further conceptualizing the Subject-User. In other words, it is a meta-forum, more immediate, personal, and practical.

Finally, a reflecting point of the outcome of this idiosyncratic plugin is the importance of ethics in such a software, which is based on the sincerity and validity of the subject's responses. This is certainly its “Achilles heel”, but not a manufacturing mistake. This condition is the "necessary evil" to grasp the importance of the outcome of this software in design. The inability to create social meaning and the introduction of new values have contributed to the emergence of the life-craft industry (Τάσης, 2017, pp. 83–117), where the question of meaning arises in individual terms. Guided towards a narcissistic collectivity (a reflection of society), self-realization, and the acquisition of design confidence through exposure to and acceptance by design collectivity, this specific plugin, by giving the choice of true/untrue answer, ultimately might work reflectively on the Subjects themselves, as a view of emancipation.

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Acknowledgements: Special acknowledgements to Professor Mr. George Parmenidis, Prof. of the dep. of Architecture NTUA, for his lifelog companionship and mentoring. “This research is carried out / funded in the context of the project “I-D (I – Design, Idiosyncratic Meta Design) Idiosyncratic Proceeding on Reading and Production Meta-Objects in Contemporary Industrial Design” (MIS 5049532) under the call for proposals “*Researchers' support with an emphasis on young researchers- 2nd Cycle*”. The project is co-financed by Greece and the European Union (European Social Fund- ESF) by the Operational Programme Human Resources Development, Education and Lifelong Learning 2014-2020.”

European Union
European Social Fund

Operational Programme
Human Resources Development,
Education and Lifelong Learning

Co-financed by Greece and the European Union

ΕΣΠΑ 2014-2020
ανάπτυξη - εργασία - αλληλεγγύη

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

If we can't make it together, we won't make it alone. The challenge and potential of collective making

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Abstract | The culture of making has always been seen as an inseparable part of design. Still in recent years we have witnessed that "making" gets less and less attention (i.e. time and resources) in our design education. The reasons for this are manifold. Among others, it reflects developments within the evolving field of design, as described by Bremner and Rodgers (2013). In contrast to this development, we argue that the action of making remains an utterly valuable part of design education – a valuable linkage of knowing and doing (Ingold, 2013). As an alternative, we propose to advance the culture of making, its inherent focus and assumptions instead of neglecting them. This essay presents insights and reflections of a collective exploration into making by four design educators and practitioners. The collaboration happened in different settings, sometimes with other local actors, was always guided by constraints. During the research, questions of how design education can facilitate meaningful learning processes around making, while not ignoring the evolving field of design were explored. The result addresses the complexity of co-creation, dialogue and practical knowledge in the setting of a contemporary design education.

KEYWORDS | COLLECTIVE MAKING, CREATIVITY, PRACTICE BASED KNOWLEDGE, CHANGE

1. Introduction

The culture of making has always been seen as an inseparable part of design. Still in recent years we have witnessed that "making" gets less and less attention (i.e. time and resources) in the design education we teach at. The reasons for this are manifold, but we don't think they are unique. In our particular case, the driving force has been a concern to orientate design towards a less materialistic, and in result less wasteful practice (Findeli, 2001; Tonkinwise, 2003) and to focus on the role of designers as researchers and facilitators. In addition, the aim to develop a critical view on designing, to explore dissolving disciplinary and conceptual boundaries which paved the way for new and multiple ways of practicing design (Bremner & Rodgers, 2013) as well as the effect of establishing design education within academia and its rather logocentric knowledge traditions have all played their part in this development. At the same time, the rise of 'design thinking', too often highlighting only 'thinking', has also enhanced the distinction between thinking and practicing design, instead of "acknowledging the situated, embodied work of design thinking in practice" (Kimbell, 2011).

In contrast to this development, but not in ignorance to it, we argue that the action of making remains an utterly valuable part of design and design education – a valuable linkage of knowing and doing (Ingold, 2013) – that deserves to be cared for. As an alternative, we propose to advance the culture of making, its inherent focus and assumptions instead of neglecting it. This essay presents reflections of a collective exploration into making by four design educators and practitioners. Our goal was to explore "making" in an explorative research project, addressing the complexity of co-creation, dialogue and practical knowledge within the setting of a contemporary design education in reaction to situations we experienced as the "theoretical turn", allowing theory to dominate practice – or even render it irrelevant. Our work was inspired by the idea to create a form of seminar series around making. Instead of focusing on a theoretical piece of work, and exploring it through discussion and dialogue, we focused on recurring meetings around a particular task or material and explored it through practical work.

2. The making of our worlds

2.1 Our context

Our self-initiated research project was set up in the context of a rather broad design education that abandoned disciplinary boundaries a long time ago. As a consequence, our educational situation differs from design educations with an outspoken focus on a particular discipline or material. But at the same time, our education is based in one of the few state-funded educational higher institutions in Sweden that are allowed to award a degree of Fine Arts at both bachelor and master level. For this degree, the Higher Education Ordinance defines that students need to show evidence of both practical and theoretical foundation, to

demonstrate the ability to create, realise and express their own ideas and to undertake artistic tasks. Artistic education, like artistic research, has artistic practice as method and as knowledge object (Lilja, 2015) and assessment is closely tight to the idea of artistic quality, which can be summarized as technical craftsmanship, material skills, personal expression and a relevant process methodology (Karlsson Häikiö & Olsson, 2015). As teachers, we therefore have to strive for a balance between the theoretical and abstract and the practical, concrete dimensions in a way that supports this development.

Our project was an attempt to explore and develop making not from an individualistic point of view (how to improve one's individual skills), but from the perspective of educators and collaborators in a wider context of making. It was meant as a challenge to reflect on our own knowledge around making and to test new things – before we bring them into the classroom. Last but not least, we hoped it might offer a dialogue around making and its role in the curriculum. Contemporary demands on designers differ widely from the traditional ideal of being a skilful craftsman. Still the ability to make something real remains essential and as influential as creativity in the world of design (Nelson & Stolterman, 2014).

2.2 Making

> "I want to think of making instead, as a process of growth. This is to place the maker from the outset as a participant in amongst a world of active material. These materials are what he has to work with, and in the process of making he 'joins forces' with them, bringing them together or splitting them apart, synthesising and distilling, in anticipation of what might emerge." (Ingold, 2013)

Making has been central to our project. In design and craft, making can be defined as the skill, experience, and mastery of working with material and/ or processes (Design dictionary, 2008). "Making" as a verb refers to action and process and is more than producing an artefact. It can be a teacher, a process of growth and an inquiry into the world (Ingold, 2013) or "thinking" (Sennett, 2008), supporting exploration, understanding and discovery.

The field of making has changed and expanded its role in society during the last decade. In the agricultural society people used making and crafting in their everyday life to make the objects they needed – for their homes, for cooking or farming. During the industrialization in the 18th and 19th centuries, making became something a craftsman did. Artisans or industries made objects for everyday use, or exclusive items of very good quality. Crafted pieces could also be seen as art (Bringéus, 2005). From the 1990's onwards status of making became low as people started to work digitally. Craft seemed boring, unnecessary, and unfavourable in the process of establishing academic and professional legitimacy for design (Design dictionary, 2008).

Today we can find making again in many contexts. The maker movement has grown widely (Anderson, 2013), craft bars and craft clubs with the aim to make craft together and socialize with others have become popular, as well as knitting cafés and craft pods. Their aim is rather to make, learn and have fun together, than to craft high quality objects. As an offspring to

this development, making is also seen as useful for people's wellbeing and as a kind of stress relief activity (Davidson & Tahsin, 2019).

Another field of the maker movement is craftivism. People use craft as a form of activism to make a statement on political and social topics. By making embroidery and showing them in public spaces, people try to affect and change societal development of society (Corbett, 2013; Arnqvist Engström, 2014; Greer, 2014). On the other end of this spectrum are handmade objects of high quality with a comparable status to art, that are shown in shows and fairs like for example Collect, a gallery-presented art fair dedicated to modern craft and design. The handmade object is valued as more authentic, more real, than machine made or digitalized work (Design dictionary, 2008).

The culture of making has always been seen as an inseparable part of design, but both in society and in education the role of making has changed. The authors Press and Cusworth (1997) fear that in the general opinion craft has little or no educational value in our post-industrial, information centred age. It seems to embody all those qualities that are considered irrelevant or inappropriate: individualistic, self-centred, low on technology, and with little contextual or critical context (Press & Cusworth, 1997). In addition, concerns regarding designs damaging and wasteful practice have questioned the need to make (Fry, 2009; Tonkinwise, 2003; Findeli, 2001).

> "This, in turn, yields to the end of the "product as work of art" paradigm in design, and of the design act as a heroic gesture; in short, the end of the fetishism of the artifact." (Findeli, 2001)

But the criticism against making often refers to what is brought into existence, and is less concerned with what the activity entails. Design education can still view making as a useful tool for exploration, visualisation and finished objects. Making workshops are organised for different reasons, either as introductions to new fields of making, or to give people with different backgrounds possibilities to explore and work together. In the field of speculative design, crafted objects of high quality are used to convince the audience that the design proposal is realistic.

In our research project we have used collaborative, artistic making. Each member of the research group has contributed to the research with their professional knowledge around making as designers, artists and artisans and shared their knowledge in different materials, methods, techniques and processes. In an exploratory form, we have tried materials and contexts new to the individual, by using the whole groups practice based knowledge. We have tried our working method in different projects for more than two years.

2.3 Design and the nature of knowledge

There is no simple or ultimate answer to what design is. As a field it is constantly evolving and boundaries of what were once recognised as individual design disciplines (such as product, graphic, textile, and fashion design) change, dissolve and expand (Wilson &

Zamberlan, 2015; Bremner & Rodgers, 2013). As a consequence, it is impossible to speak about design education as a unified or even static concept. Still the design researchers Nelson and Stolterman (2014) suggest that the learning outcomes of design education are a set of interrelated competencies (mindsets, knowledge sets, skill sets, and tool sets) that relate the abstract epistemological (thinking/ knowing) with the ontological concrete (doing/ acting/ making). While there is definitely a general understanding that shaping and making are part of design, questions regarding content, focus and importance remain. The activities of making, shaping, doing and even acting are as multifaceted and evolving as design itself.

Many things that could be said about design education. One aspect relevant to our work, is the intuitive nature of knowledge. A study by Karlsson Häikiö and Olsson (2015) suggests that the academic demand to formulate practical knowledge within academia clashes with the fact that artistic knowledge often develops through the unknown, undefined, and varying (Bauman, 2002, as cited in Karlsson Häikiö & Olsson, 2015). As a consequence, design teachers in their study experienced the assessment of artistic processes within the academic setting as antithetic and conflicting.

> "Within art and design education intuitive modes of learning and doing are very important … under various labels (tacit knowledge, implicit knowledge, non-verbal learning, learning-by-doing etc.) these intuitive modes may be very resistant to analysis or conscious awareness but are central features of practice and learning in the arts and in design." (Danvers, 2003)

But the conflict goes deeper than that. A logocentric culture sees knowledge as something that can and needs to be articulated in precise words. In extension, it doubts other forms of knowledge which affects how education is shaped.

> "Current theories of learning typically emphasize cognition and the mind, rather than embodiment of mind and self. A consequence of seeing mind, body and world as separate entities is that the significance of our entwinement with the world of practice is overlooked." (Dall'Alba, 2009, as cited in Adams et al., 2011)

Especially in design those different knowledge traditions collide - the practical knowledge tradition with its roots in experience and practical work and the theoretical knowledge tradition with its roots in research, concepts and theory. Nelson and Stolterman (2014) emphasis that the integration of thought and action in design sets it apart from other disciplines. And the authors Press and Cusworth (1997) suggest that intelligent making "a mix of formal and tacit knowledge, physical and mental skill, theoretical and contextual awareness, innovation and personal creative autonomy" is able to convey new styles of thinking, acting and problem solving, which might be more suited to our changing world. All in all, making connects back to a dimension that should not be given up on easily.

3. Our Research

This essay focuses on two years of seminars and work around making. Two particular design tasks were done in collaboration with local actors; the design of an insects shelter for a local urban farming initiative and an artistic project around industrial waste. Especially in this project we looked in depths into the waste materials origin, their journey, related issues and used making as our research methodology during the course of roughly one year. In between those tasks, we engaged in smaller projects in which we explored different materials and techniques, and reflected on our experience afterwards.

Our research can be described as practice-based (Candy & Ernest, 2018), an investigation in order to gain new knowledge partly by means of practice and its outcomes. We embarked on it in a collaborative way, emphasising our professional development rather than hoping to generate new theory or knowledge (Clark et al., 1996).

Our research was organized in the following way: One-day workshops started always by the presentation of the task though one member of the group, followed by approximately 6 hours of working time. The reflection happened several days apart, in the form of conversations and a written documentation. The larger projects started by on-site and industry visits and material explorations through one-day workshops. Subsequently we tried to find a story in the material or place. In the idea generating and sketch phase the practical work was interwoven with reflection and discussion meetings. The methods used to document the work were photography, individual notes and sketches as well as all three-dimensional traces of the process like mockups, material experiments and moodboards. In order to evaluate our work and to identify the learning outcomes of the entire project, we summarized individually we felt we had learned and experienced during the project. The goal was to relate those findings to the educational situations we find ourselves in and if possible to develop ideas on how to advance it.

Our most time-consuming part was a project that resulted in an art installation called “Waste camp”. The installation consists of a tent, a fireplace as well as relevant equipment. We chose camping as a theme as it represents both the aim to be close to nature as well as shows how this is choreographed by numerous artefacts that rather reinforce our separation. This duality was also present in the waste we had at our disposal. All materials had once thrived as part of nature; still humans had spared no effort to transform them into an artificial state. While our work was always guided by constraints, it was most dominant in this project. We allowed us only use waste material from three local industries. One producing high-end furniture, one matches and one manufactured everything from gaskets, sound absorbers to insulation and furniture components to supply various industries. The majority of the material would usually get discarded and most likely burned. We tried to develop a concept that was true to the origin of the material. Our aim was to create a new and different context for industrial waste in which its value is emphasized by treating the material with care.



Figure 1. Waste camp – the final result. November 2019.

The result gives on one hand tangible form to our collective knowledge around material and making. It is characterised by what we already knew, what we learnt and what the material made us do. As a material result it is left to the mercy of the spectator and the question if it qualifies to the standards of creativity, ingenuity and aesthetics, as well as if it as a symbolic representation of an idea affords to "be interpreted within the hierarchy of constructs and degrees of abstractness imposed by its cultural context" (Press & Cusworth, 1997). At the same time, the entire project is a document of a process and a conversation around collective making. In the process we had to articulate and discuss our making in order to collaborate, and to drive the process further. We had time to elaborate about how our work could translate into an educational context and what would be important to consider. Reflections we will try to share in the following text.

4. Reflections – a manifesto for making

4.1 Glue guns and post-it notes are not enough.

> "A conceptual idea is not worth much if it is not made manifest in the world."
> (Nelson & Stolterman, 2014)

Making is the ability to translate ideas into this world. As this, it is a highly complex activity

that connects materials, skills, tools and methods to a reality. In our projects we needed to respond to limitations, show resourcefulness and the ability to improvise, understand complex realities and networks and work with care towards materials and tools. We had no idea about the final result before we started, and despite sketches and models, the work developed constantly throughout the process. Much of the discoveries and learning happened physically and through tangible interaction. As Nelson & Stolterman (2014) highlight 'wise crafting' nurtures and matures a design idea and is also characterised by the carefulness of the process itself.



Figure 2. The process of preparing the floor. September 2019.

In education we nowadays engage often rather in forms of "speed making" – with post-it notes and glue guns as main ingredients. "Speed making" is quite often similar to brainstorming and works well to start or to swiftly focus in a longer process, but is deprived of knowledge about material, construction and production and other constraints that eventually need to be addressed in order to make something real. Still all making is a good beginning, if it is communicated to the students on what kind of level the making is happening and what other levels could be there.

4.2 Material carries a narrative.

We do not ignore the criticism against making. The industrial waste we worked with was brutal and real proof. To see material turned into objects that people use is one thing, to see it turned into useless waste another. Waste has consumed natural resources, energy and water for nothing. But the waste we encountered was not solely an unavoidable part of industrial production, it was also the result of rigid quality assurance and fashion. Within high-quality products, insect bites, butcher mistakes and small changes in structure can for example render large parts of leather useless. We also received large quantities of spotless

material which only fault was an unpopular colour.

From this experience, we draw the conclusion that making is always part of complex systems and should be taught like this. Making is not only the skill of creating something with a certain level of expertise, but an array of knowledge connecting it to entire systems and a context in which the making takes place, including values and norms. By avoiding to work with making in education, we avoid the chance to evoke reflection and a deeper understanding for this. Instead we foster consumers by impairing the ability to create by oneself.

4.3 We create in order to understand.

As a research group we got the opportunity to work collaboratively on artistic, practice-based projects. The projects developed in a way that none one of us could have achieved alone. In the end, all skills and efforts were needed to connect to the industries, to collect the material, to explore and create and to articulate the concept and the project in its entireness. The group multiplied our possibilities. To take part in a creative process can be fun but also challenging, not at least when you are working in a group. The most prominent in our own evaluations are reflections regarding the group process and how it had affected the process and result. Did we actually make the best use of our abilities? Several aspects of the artistic process, the idea of an individual voice, individual interpretation, creativity, trusting the process, intuition do not lend themselves perfectly to group processes. Conflicts do not only arise to push for one's own idea, but to make an idea coherent. Moments of 'flow' and 'anti-flow' appeared at different stages, caused by different opinions on the process or expected outcome, but also by stress and different working methods. "... we all know how tough a conversation among peers - particular designers - can be, each one defending his/her culture, experience and belief" (Devecchi & Guerrini, 2019). We realized that clearer communication in all stages would have made the creative process more enjoyable.

4.4 Experience, our own and others', is the basis for innovative practice.

Working in groups is becoming more relevant for designers (Wilson & Zamberlan, 2015, Sanders & Stappers, 2013) and as a result it becomes important to address collaboration and collaborative skills in education. So far, we often underestimated the demand for facilitation that group work places on teachers and students. How can we prepare students and support group processes in the best possible way? How can we balance individual artistic development and skills that benefit group work? How can we evolve values and methods that are still influenced by design as an individual activity?

This research has had a transformative approach as it sharpened our awareness and made us critically reflect on our assumptions and ways of teaching. In the project we used our knowledge about material and practice in different ways than we usually do as educators, which helped to illuminate our habitual ways of working, communicating and making

judgment. We experienced the competences and skills of colleagues in new ways and subsequently developed an understanding of our own skills and took responsibility for being a good collaborator. While the dissonance between practical and theoretical; situated, embodied and abstract will persist for a while, we need to continue the dialogue, as not speaking about its value is damaging our own situation. “Inarticulacy gets mistaken for a lack of knowledge and an inability to rationalise actions.” (Press & Cusworth, 1997)

4.5 It takes time.

And finally, making and refining skills takes time. Due to an increasing complexity of the design field, this of course raises many questions. Within the education we teach, it was never an official strategy to eliminate making and practical work, rather making was taken for granted, while in reality other tasks demanded more and more time and attention. At the beginning of our research, we often accepted that making received less and less time. By the end of it, we had managed to make this an issue within the department and achieved partly to halt this development. Still, in the future, we will need a continued dialogue around making and its relevance.

5. Conclusion

We still believe that the action of making remains an utterly valuable part of design education and culture – a valuable linkage of knowing and doing (Ingold, 2013). Making is a way of understanding and exploring the world with all senses, as well as a mode of action in dialogue with the world, but making, as an activity beyond post-it notes and short workshops will continue to be a time-consuming, exhausting and complex activity, always in danger of being rationalised away.

Our collaborative journey has deepened our own understanding and given us time to explore making in various ways. The times we live in demand us to discuss what we see as the material of design - physical as well as abstract - and what the craft involved in the production process actually is, from a broader perspective than the traditional practice of material design (Nelson & Stolterman, 2014). But nevertheless, if we act through making, doing or acting – as they all are of relevance for design – we should treat them with the same care, ingenuity and skilfulness as wise makers always have. If we can’t make it together, we won’t make it alone.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Inter-Weaving Culture and Crafts in Design Education

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Abstract | Knowledge of Culture and History is a very important component that dictates Design and it is from our past that we learn and create for the present and the future. The question facing Design educators today is how to align the present generation of millennials with the sensitivity and appreciation of our rich cultural heritage? The paper is focused towards the Future of Design Education, by stressing the need for the knowledge of Culture and Crafts as an integral part of Design Education that will help the Designers of tomorrow to be prepared for the Future. According to the authors, simply sitting in the classroom or searching online cannot help students learn about Culture and Heritage. To experience culture one has to actually go out into the field, dirty their hands and gather first-hand experiences. This will, in turn lead to a better understanding of the issues and challenges that present themselves to a Designer in the course of their Design journey.
This paper examines ways in which these qualities and skills/knowledge can be nurtured, with a specific example of an Interior Design course in India. Based on literature study and their findings from student assignments, the authors believe that Design Education should aim at sensitizing students about the cultural heritage and provide them with avenues and exposure to explore their cultural and contextual backgrounds as they are the future custodians of their culture.

KEYWORDS | TRADITIONAL CRAFTS, DESIGN EDUCATION, EMPATHY, HERITAGE, CULTURE

1. Introduction

> "Without culture, and the relative freedom it implies, society, even when perfect, is but a jungle. This is why any authentic creation is a gift to the future."(Albert Camus)

Knowledge of Culture and History is a very important factor that dictates Design and it is from our past that we learn and create for the present and the future. Cultural traditions and crafts along with the knowledge/skills form the cultural identity of a people.

In India, Traditional crafts have been an inherent part of the process of making. Such processes are organic and involve traditional knowledge of socio-cultural and religious needs, climate response, geography, local materials and the particular context in which they are located. All this collective wisdom has been handed over from one generation to the next as a legacy. It is seen that culture has an important place in the psyche of a community, in fact, a reflection of their identity and their histories, forming a composite whole that has many facets: social customs and mores, religious practices, language, food, shared histories and memories. India has a vast storehouse of traditional crafts, and almost each one of these crafts comes with a deep sense of history, and inherent stories, motifs, myths and rituals. The living crafts (and the ones that are already lost, or the ones that are dying) are practiced over generations, passed on as a legacy, and imbued with familial and societal stories.

"Design creates culture. Culture shapes values. Values determine the future" (Robert L. Peters, President Ico-D, 2001-2003). Similarly, culture also shapes Design.

Design education is a complicated process where inculcating skills of creativity and design knowledge is obviously aimed towards the users/consumers, keeping in mind their needs. However, this process must also be balanced with engendering empathy and respect towards the actual creator/maker and the society in general. The authors believe that this awareness about Culture and traditional crafts, especially in design education, engenders opportunities for growth and revival of our rich cultural heritage and traditions, and this further allows students to explore their milieu and its antecedents, and this fosters creativity. Culture therefore plays an important role to play in education.

The authors believe that in the context of globalization, the understanding of culture, crafts, indigenous knowledge and systems has a very important role to play in design education. The authors aver that awareness of culture is almost a necessity for urban lifestyles. As more and more people are moving away from their hometowns, migrating to urban centres in search of employment opportunities that exist in these cities, they are increasingly coming in contact with people from different backgrounds, both at the workplace and where they live. Awareness and respect for culture, one's own as well as others, leads to fostering tolerance and harmony in a society, and helps that embraces diversity.

"Cultural awareness refers to the developing consciousness of culture and the ways in which culture shapes values and beliefs" (Burchum, 2002, p.7).

The question facing Design educators today is how to align the present generation of millennials with the sensitivity and appreciation of our rich cultural heritage? Thanks to the interconnected world that they inhabit, today's students, although well-informed and more aware, are still living in a protective bubble, inured from the harshness of reality in many cases.

India is a nation with diverse cultures and traditions, and this paper looks at ways and effects of incorporating culture and understanding of crafts and traditions in design education from an Indian perspective. The paper is focused towards the Future of Design Education, and by stressing the need for the knowledge of Culture and Crafts as an integral part of Design Education, the authors feel that this will help the Designers of tomorrow to be prepared for the Future. According to the authors, simply sitting in the classroom or searching online cannot help students learn about Culture and Heritage. To experience culture one has to actually go out into the field, dirty their hands and gather first-hand experiences. This will, in turn lead to a better understanding of the issues and challenges that present themselves to a Designer in the course of their Design journey.

2. Background

"Culture is that complex whole which includes knowledge, belief, art, morals, law, custom, and any other capabilities and habits acquired by man as a member of society." (Tyler, 1870 as cited by Avruch 1998).
The United Nations agency UNESCO defines Culture as the "set of distinctive spiritual, material, intellectual, and emotional features of society or a social group, and that it encompasses, in addition to art and literature, lifestyles, ways of living together, value systems, traditions and beliefs."

Cultural traits and patterns are transmitted from generation to generation and this is an on-going process. At the same time, culture is also dynamic in nature and it evolves and adapts to the stimuli from what is happening around us. According to Burchum (2002), cultural awareness begins with understanding the influences of one's own culture.

It has been amply seen that Culture and Design are interlinked and each complements the other. They are both influenced by and influence each other, mirroring and echoing and also acting as sounding-boards for each other.

Design education, also known as creative education is the teaching of theory and application in the design of products, services and environments, and it involves problem-solving by applying prior knowledge, practical methods and native intelligence to solve the problems.

2.1 Impact of Globalization on Design Education

The modern education system that is prevalent today is primarily influenced by Western ideas, and Post-Industrialization thought process has come to dictate educational process, much to the detriment of indigenous knowledge, traditional lifestyles and cultures. Globalization is the prevailing force today, and it is impossible to not be influenced by it in the march for progress but this suppresses cultural heritage. The authors believe that it is necessary to move with the times, but still keeping the cultural identities in sight through ways and means to adapt to a globalized world-view, tempered with respecting and placing value to the traditional cultures can be a way to achieve this balance. Such measures to make Globalization more inclusive of traditional cultures can lead to a richer experience where the modern coexists in harmony with tradition. Design Education is one important means by which this can be achieved.

Design; like any other facet of the act of creating/producing evolves with times, getting influenced by whatever is happening around us. Advances in technology being an important part of Globalization, have a great impact on Design too. With Globalization generating newer market demands and producers/manufacturers and economies finding ways to cater to these demands, the Design community has also been partly responsible for catering and supporting these burgeoning demands. More and more developing and under-developed nations are trying to emulate the Western ways of life, as these are seen as aspirational, but in this process these nations are abandoning their traditional ways of life that had served them well in the past.

It cannot be denied that cultural and traditional knowledge is a unique response to the local context and have evolved to create a distinct identity for a people. However, this aspirational pursuit of something perceived to be superior (Western ideas) harms what was good in the past in a particular community.

Therefore, these market-driven exigencies ultimately affect Design, and by corollary, Design Education as well. Globalization has meant the rise of a universal mono-culture, and losing sight of the unique identities of traditional ways of life.

A culture based education is defined by Assembly of Alaska Native Educators (1998) as one which reflects, validates and promotes the values, world views and languages that form the culture of a community.

Design is a continuum between the past and the future. Learning from tradition and innovating at the same time, it acts as a connector between creativity and technique, serves to connect creativity, techniques and skills with traditional knowledge.

Culture and craft plays an important role in education and particularly in design education. At all levels of education, essence of culture should be imparted to students' to make them aware about their roots.

2.1 Why it is important for India in the present scenario of globalisation to have knowledge of Culture, Traditions and Crafts incorporated in design Education?

Interweaving culture in design education can be reinforced by engaging students directly with crafts, culture, history, back ground research and analysing so that the students can gain a deep understanding and awareness of their own roots. This further inculcates knowledge of the deep sensitivity and tenuous bonds between a craft and its practitioner, and how the lifestyle of the craftsmen of a particular community is linked to, and directly influenced by the craft itself.

Such interactions with culture and crafts can provide the students with first-hand experiences and further enable them to develop skills and understanding that will help them to explore and experiment with materials, techniques and technologies, and this will lead to creating better self-awareness and critical thought processes.

As cultural heritage has a very important role in forming national identity, therefore the tangible and intangible aspects of this cultural heritage must be preserved and nurtured, and this can be achieved by incorporating the respect and understanding of cultural heritage in Design Education.

According to the International Indigenous Design Charter, designers must make sure that any representation of the indigenous cultures must reflect the cultural values of the community; respects and protects the environment and honors the values enshrined in the traditional lifestyle of indigenous cultures; such works must also be an authentic reflection of indigenous knowledge. In addition to this, and equally important is the need for the designers to ensure that representation must also empower as well as positively impact Indigenous peoples: from the past, in the present, and the future.

As mentioned by Purnima Rai (2016, pp. 27-28), in the present era of technology where everything is mechanized and digitized, India is fortunate that there is an unparalleled resource of hand skills that gives us a distinct edge over any other country in the world.

This rich storehouse provides an opportunity area for young designers to tap into, and create newer synergies. It is the authors' belief that inclusion of Craft education in design curriculums can lead to enhanced creativity, better communication, the spirit of collaboration, problem-solving and resilience, qualities that are expected to be possessed by employees.

During an interview (conducted by authors) on 5 July, 2019, Usha Nehru Patel, a design educationist, Dean IIAD, New Delhi, stated that she strongly feels that being aware of their heritage and culture is very important for the present generation, thus exposure to culture in design courses is essential for the students to develop a clearer understanding of their own milieu and background. Usha also feels that this gives rise to an interesting dichotomy; if one needs to have one's own identity, they need to have something that is different and

original and In the global context this means something that nobody else knows, but only they have an experience of. How a student reacts (embraces or rejects) the cultural aspect would depend on the individual, but it is essential that design institutes provide exposure to traditional crafts and culture to the students. This exposure brings a newer dimension to the whole cultural ethos, with everyone bringing in their original bits, their embodied understanding of their embedded culture to the table. Usha believes that exposure to crafts is important, and it is not only just exposure to craft techniques or a material, but also deeply rooted beliefs and a way of life. Another facet discussed was that while keeping culture intact is not possible since it is not static, but it has to evolve and redefine itself. In this process, some of the old ways would be still embedded in the new.

During a discussion on 5 July, 2019 with Pankaj Narain, a practicing designer and academician mentions that Globalization has had positive and negative effects as well. The good part has been that it has led to a boost in the economy, which has translated into increased opportunities for designers and craftsmen alike but the biggest fear is the dilution or even loss of culture. This is an effect of the current generation getting attracted to things foreign, and ending up losing touch with their own cultures due to availability of too many choices and an overload of distraction. During the interview, it emerged that in his experience, not every student would be interested in crafts and culture, and only a few would genuinely be keen on pursuing more knowledge about crafts and culture. The approach followed by Pankaj means that the craftsman is brought to the classroom as well as students going out in the field to crafts clusters and getting their hands dirty, thus gaining better understanding of these crafts. Thus, empathy is created in the mind of the students toward crafts and culture. Therefore, he feels that in spite of waning interest today, providing a platform to students to explore culture and heritage is still very important.

As the younger generation is rapidly embracing modern technology and increasingly being influenced by globalization, the indigenous and traditional technologies and skills are almost being forgotten and shall soon disappear for want of any patrons. According to the authors, simply sitting in the classroom or searching online cannot help students learn about Culture and Heritage. To experience culture one has to actually go out into the field, dirty their hands and gather first-hand experiences. This will, in turn lead to a better understanding of the issues and challenges that present themselves to a Designer in the course of their Design journey.

According to Darlie Koshy (2017, pp. 1-4) crafts provide differential advantage to design by providing sense & sensitivity. With values, stories and aesthetics all embedded within them, crafts can provide a connection to the heart unlike any other expression. As crafts have both tangible and intangible aspects, they provide a sense of realism and continuity in a globalized world, where a single, standard identity is slowly emerging, with everyone striving to conform to this global identity.

The authors suggest that Design education should aim for the following:

- To create a balanced curriculum that includes the vast repertoire of traditional knowledge that exists with the craftsmen.
- To develop empathy and respect in the minds of the students for culture, crafts and crafts practitioners. This can be achieved by interacting and collaborating with the craftsmen.
- To create design practitioners who can think local and act global at the same time
- To create and shape designers who can think beyond stereotypical expectations of industrial design.

3 Incorporating Cultures and Crafts in design Education (A Case Study)

The curriculum of the Post Graduate Diploma in Interior Design & Styling department in the School of Design, Pearl Academy attempts to address the issues and possible ways forward for students to develop an understanding of the cultural and crafts aspect, and this is done through assignments and design projects that teach self-awareness, empathy, cultural awareness, and ultimately a global view. The projects are hypothetical in nature, and the project brief includes research, case studies, design and documentation.

3.1 Semester One: Familiar to Unfamiliar: Project 1: The Familiar

The cultural and self-awareness aspect is introduced to the students in semester 1 under the Interior Theory Module. As part of this module, 2 projects /assignments are assigned and completed during the course of 10 weeks. Each assignment/project builds upon the learning established in the previous project. Projects also progressively increases in size and complexity.

The first project is very personal, focusing on the individual student's family history-where each student reflects on their family culture, their backgrounds, history, rituals and traditions followed in their family. The teaching and learning strategy in this assignment is based on learning through one's own self experiences and the experiences of their peers. The students are encouraged to discuss on their own experiences of their family culture, and this is designed to encourage cultural awareness.

They talk about their family tree and family backgrounds, their surnames and how surnames generally are markers of community, traditional family occupations, region of origin etc. As a first step, the students gather information from their family members through interviews; discussions etc. and after data collection share their stories with the class in the form of a piece of reflective writing followed by presentation to the class. The students also reflect on the interior design/space planning aspects of their own house. For example: How spaces

were used in their own houses as per their family culture; the concept of purity and impurity in kitchen or in entire house; family shrines and sacred space within the household; the practice of removing shoes outside while entering the house.

The project is important for the student to become aware of the history that has made them who they are, to realize that there is so much similarity yet lot of differences in the way spaces are used in each other's family (for example, most Gujarati families will have a culture of removing shoes outside their house near the entrance). In many cases the students also discover that their family traditions are no longer practiced nowadays due to living in modern houses /dwelling designed keeping in mind global trends. This process of enquiry and exchange of ideas helps students to identify practices unique to a culture/community, and sometimes there are situations where similarities are also seen in diverse cultures.

This sharing of cultural practices and family traditions by the students in a studio setting creates a lively exchange of ideas and thus leads to increased awareness about culture.

3.2 Project 2: Familiar to Unfamiliar

The second project in the module is a group project under the name Design project 1 where the students move to an unfamiliar context i.e. a semi urban scenario/setup. They are asked to do a background research to understand the location/area and then they are taken to the site where each group is assigned one area or scenario and asked to collect data related to background, history ,culture from past to present. The students observe in detail how people are interacting with the space, with each other and understand the culture and context. For research and data collection, various tools are used: interviews, surveys, recordings, sketches etc. After a detailed research for 2 days, students are asked to present a visual scenario of the present culture/trend /pattern. After the second day, the students work in their studios and brainstorm on opportunity areas for design – they have to go back to the background data collected and the scenario to understand the problem /design opportunity in terms of contextual; cultural, social influences. In their final presentation to the class, the students present their design solutions and explain how these solutions will benefit the users, the location and the context and all the stakeholders.

The faculties try to ensure that this particular design project is done in the older parts of the city (Delhi) where some cultural aspects are still alive and where modernity is rubbing shoulders with tradition.




Figure 1 & 2 : Students work as part of Project 2: Familiar to Unfamiliar, Scenario building for Chandani Chowk, Delhi.




Figure 3 & 4: Students in groups presenting Project 2

3.3 Semester Two: Craft Techniques for Interiors

This project is designed with the aim of engendering interaction between design students and craftsmen for design and product development for the contemporary Interiors market. The objectives of this project are: To encourage students to engage with traditional craftsmen; To create areas of shared opportunities for the designers and the craftsmen, within a collaborative process; To foster a two-way learning process along with the spirit of cooperation; To develop a sense of empathy in the students towards the act of creating/making and the maker.

After giving basic input on crafts, meaning of crafts, Indian crafts, the students are explained the importance of crafts in the globalized world, this also includes interaction with designers who are already working in crafts sector. Students are made aware about 'crafting of the spaces'; incorporating crafts- surface making crafts and surface finished crafts in interior spaces. Crafts of all kinds: architectural, functional, decorative are used to enhance and accent these places, which are incorporated on walls, ceiling, floor, furniture, paneling/partitions etc.

The students are asked to choose a craft that they would like to work on, and do a background research on the chosen craft and its context, community practicing the craft, to the present status and then identifying a craftsman with whom they can work with to

develop a product (with application of craft on a contemporary product that can be used in modern interiors)

This module not only helps the students in terms of understanding how design intervention works, but the craftsmen also benefits by getting new ideas for products. As part of an informal survey conducted by the students with their chosen craftsman, it was found that these new products did have acceptance and value in the market. This collaboration develops more confidence in both the students and the craftsmen.





Figure 5: Crochet Lamp (Designer + Craftsmen) *Figure 6: Paper Mache' wall clock by student*







Figure 7, 8 & 9: Madhubani Craft Lamp (Designer + Craftsmen)



Figure 10, 11: Pattachitra Lamp depicting the Traditional Fish story (Designer + Craftsmen)



Figure 12: Space Divider with Chamba Rumal Craft (Designer + Craftsmen)

Figure 1 to 12 showcase different Interior Products Developed as part of Craft Techniques for Interiors (Designer + Craftsmen) using different craft from India. These products are designed by semester 2 students of PG Interior Design & Styling course at Pearl Academy.

3.4 Semester Three: Hospitality Project: Boutique Hotel

Building on the learnings from the earlier semester, where the students are sensitized towards the understanding of craft and culture in a broader sense:(after incorporating craft in products, another aspect of incorporating craft in 'crafting of spaces' is introduced), In this semester the students work on hospitality space - a boutique hotel, and are given a choice to select one from two typologies, i.e. Contemporary or Heritage. They develop their

understanding about the culture of that region(here culture plays a vital role that dictates the design, and the demographics, climatic response, geographic considerations, local materials, motifs, patterns, colors, styles, crafts etc. all form part of that cultural context).



Figure 13: Mood board for "PadharoMarheDes"- Heritage Boutique Hotel on concept of celebrating different aspect of Jodhpur's, varied culture and exquisite beauty.



Figure 14: View of Bedroom



Figure 15: View of Dining Area for Heritage Boutique Hotel

The student's study how traditional crafts and techniques and indigenous process of construction are used to the best advantage and can also be contemporized without losing their essence. The study of old buildings and their interiors as case study like *Neemrana fort resort*, *Tijara fort resort etc.*, can give us a glimpse of crafts that imbue such habitats with their characteristic regional and cultural flavor, which are missing from modern buildings.

3.5 Semester Four: Final Project

In the last semester of the course, the students work on a project of their choice, and it can be based on any Interiors related topic or space to design. As part of the thesis project, some students tend to choose topics that related to Indian culture and its application in Interiors. It has been seen that exposure to culture in the earlier semesters , does whet the appetites of some students towards the cultural and heritage aspects, and some projects that emerge from this are focused on heritage and culture issues. A few examples:

- The Central Maharani (A Luxury Train that showcase the cultural heritage of Central India).
- Experience Centre for handicrafts of Varanasi, Experience cum Research Centre for Traditional Surface crafts of India at Varanasi for handicrafts of that region.

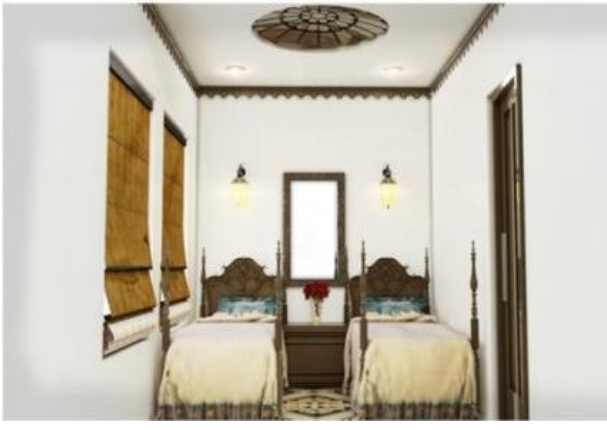

Figure 16: Interior of a Luxury Train depicting crafts , textiles and culture of Madhya Pradesh, India in Interior elements like upholstery, furniture etc.



Figure 17: Experience Centre for Surface Crafts of Varanasi, India showcasing regional crafts & culture

As part of these projects students undergo a detailed research that involves studying the cultural and historical aspects relevant to the topic of their study. In the two year PG course, an attempt has been made to make students connected with an aspect of culture in order to sensitize them towards our rich heritage and cultural background. All these assignments and projects help student to explore ways in which traditional crafts and cultural heritage can be incorporated into our present day built environments, forming an evolutionary response to the changing times, and maintaining our own cultural identity in the face of the onslaught from globalization and not just following a bland aesthetic that eschews all individuality. Students also learn about unfamiliar culture and how culture can be incorporated in a public space. Focus is also placed on application of traditional crafts and local materials in its own traditional essence or contemporized.

4 Conclusions

Design as a formal discipline has emerged after the mid-20thCentury, an era that has been dominated by modernist thought and ideas. Therefore, traditional art and craft have not been considered worthy of inclusion in Design and design research. The Euro-centric models have thus coloured enquiries in design and design education, and relegating a majority of traditional crafts under the umbrella of Ethnic.

However, an increasing call for understanding of issues related to diversity in today's world has also triggered a need for re-examining the Euro-centric ideas and be more inclusive of the indigenous knowledge and skills. According to Alain Findeli (2001, pp. 5-17) twenty first century design must "open up the scope of enquiry". The decline of crafts as seen in today's

scenario has many reasons, few of them is due to globalisation. According to Laila Tyabji (2017, pp. 115 -124) one of the reasons is due to the saturation of ideas, not a saturation of demands, the authors feel that integrating crafts and culture in design education can help in filling this gap.

As seen above in the preceding paragraphs, Design bolstered by tradition oversees the transitions from the past to contemporary values. Therefore, the changes wrought by Globalization are not confrontational with the past; instead, it can be integrated with the past to help perpetuate traditional ideas and sensibilities and prepare them for a new world. Thus, the future can be shaped by the past.

The authors strongly feel that understanding about ones roots, and learning through action must be an integral part of the curriculum for Design education.

The authors believe that Design Education should aim at sensitizing students about the cultural heritage and provide them with avenues and exposure to explore their cultural and contextual backgrounds as they are the future custodians of their culture. Going by current global trends: “Handmade is the new Luxury”, and as we hurtle towards a more technology driven modern world, leaving behind our heritage in oblivion, it becomes imperative to take stock of the value of Heritage and finding ways to keep the traditional knowledge alive. And as mentioned by Purnima Rai (2016, pp. 27-28) in one of her papers that In an increasingly mechanized and digitized world, our unique good fortune in being able to access an unparalleled resource of hand skills gives us a distinct edge over any other country in the world.

> “Whoever wishes to foresee the future must consult the past; for human events ever resemble those of preceding times. This arises from the fact that they are produced by men who ever have been, and ever will be, animated by the same passions, and thus they necessarily have the same result.” (Niccolo Machiavelli, 2017, p.222).

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Learning through codesign toolkits. A case study on codesigning the cinema of the future.

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Abstract | Codesign includes end-users in the design process. Ideally codesign occurs at many points in the design process however, in an education setting often only one codesign workshop is arranged. This study investigates teaching design students the value of codesign through a long-term funded project aiming to reinvent the future of the cinema for millennials. We involved non-designers, in codesign activities with mixed disciplined design students. The projects favoured by the end-users intertwined the ritual of going to the cinema, with the culture of sharing experiences with friends, with modern digital services. We argue a minimum of two codesign workshops are needed to generate valid ideas and maintain an ongoing voice of end-users in the process. Codesign materials needed to be carefully chosen for end-users to articulate their ideas and for design students to trial this new language, translating end-user views into innovative designs for the cinema sector.

KEYWORDS | CODESIGN, USER-CENTRED DESIGN, DESIGN METHOD(S), DESIGN EDUCATION, PARTICIPATORY DESIGN

1. Introduction

Design has been characterised as an intuitive, inward-looking process that ends when designers arrive at an aesthetically pleasing concept, they consider fits the client's brief. Traditionally, in design practice, clients provide the content and designers create the form. The view that designers owe their allegiance to clients rather than end-users is still prominent in practice however, with the rise of participatory and user-centred design approaches, designers want to know how to engage with end-users and what the benefits are. Codesign includes end-users as design partners in the process with the aim of harnessing their contextual knowledge and creative ideas. Ideally codesign occurs at many points in the design process however, in an education setting often only one codesign workshop is arranged, making it easy for designers to ignore or misunderstand end-user voices, extracting ideas using intuitive idea generation processes. The main challenge is choosing codesign materials suitable to give end-users a strong voice and enable idea generation that informs innovative design at several points along the design pathway.

This study specifically looks into teaching the next generation of design students the value of a codesign process on a long-term funded project aiming to reinvent the cinema of the future for millennials. The authors of this paper led and taught and the codesign process to mixed disciplined Master of Design students, at Swinburne University of Technology inviting non-designer end-users into our classes. Each year, for four years we arranged two codesign workshops to understand the current cinema context and why cinema attendance is declining in Australia, following a global trend. The design students and non-designers then co-created future cinema scenarios suiting millennials' preferences. The codesign processes included games, card sorting, think aloud, probes, and superhero toolkits. A thematic analysis of the barriers to cinema attendance across the four years showed that millennials regularly choose to watch movies at home alone or in social settings with food. They reported barriers such as getting dressed up, finding a friend who liked the same movie choice, the high price of cinema and travel to the cinema, and surprisingly leaving pets at home after a day at work or study. The codesigned project solutions presented in this paper centre on reviving cinema attendance through, personalised collectable tickets, making memories with friends, enhancing the cinema atmosphere by digitally lighting the corridors and combining going to the movies with treasure hunt gaming experiences.

2. Understanding codesign and the cinema experience

2.1 The stages of codesign

Codesign is growing as a design method, however debate continues about when and how many times to include end-users in codesign workshops. A design project typically involves three stages, each presenting an opportunity to include end-users, the exploratory,

generative and evaluative design stages (Hanington, 2007). In codesign, the exploratory stage aims to understand the project goals and context and reviews past design concepts; in the generative stage designers and end-users redefine goals and co-create a range of design options and prototypes, in the evaluative stage, designers and end-users iteratively shape the designed concepts into final design prototypes continually checking they suit end-user needs (Spinuzzi, 2005).

Most of the research literature agrees, incorporating end-user ideas early in the design process is vital to ensure project goals are sound (Hanington 2007; Lofthouse & Lilley, 2006). Research shows that eighty percent of decisions are made in the first twenty percent of project time, showing the importance of planning a codesign workshop early in the project duration (Kleinsmann et al., 2007). Some argue typically the largest proportion of codesign activity happens in the early phases of design, called the "fuzzy front end" (Sanders & Stappers, 2008). Planning a second codesign workshop in the generative stages of design is shown to help to reduce the number of unworkable ideas (Hoonhout, 2007).

Authors claim codesign workshops should occur at many points in a project duration, in the pre-design, generative, evaluative and post-design stages (Sanders & Stappers, 2014). If designers can develop an ongoing relationship with end-users then all stakeholders become invested in the project (Honnhout 2007; Visser et al*.,* 2005). Working with end-users has been described as "a cascading process" suggesting better designs will result from a continual cycle of end-user research (Reich et al., 1996). By listening to end-users' views, drawing on end-users' expertise and understanding end-users' goals at all stages of the design process researchers advocate the end product will more likely suit end-users' needs and preferences.

Generative toolkits in the context of codesign workshops are a means to uncover the needs and preferences of end-users, allowing hidden project issues to surface (Sanders & Stappers, 2014). Generative toolkits are design-led activities where designers create the toolkit to suit a project context and support end-users to give creative input. Previous authors have designed maps of when generative toolkits should be employed across the various stages of codesign workshops (Sanders & Stappers, 2014).

Teaching design students end-user research methods has in the past revolved around techniques such as focus group, observation, questionnaire and interview, where end-users are observed for insights and information is extracted for a designer's brief. This review shows that understanding how and when to invite end-users into the classroom to participate in codesign workshops with generative toolkits with real world clients is little known. The study presented in this paper began with the broad aim to understand how codesign processes benefit design student learning.

2.2 Challenges of cinema design: Why do people go to the cinema?

Cinemas are sites of cultural significance and there is a renewed interest in studying the

social and spatial dimension of cinema attendance (Bowles, 2011). This is relevant as the design of the theatre spaces reflects social practices such as "getting together with strangers in a darkened public venue" (Bowles, 2011, p. 854). The architecture of the theatre has been designed so that patrons may forget the outside world and become immersed in an environment free of reminders of 'reality'. The notion of escaping reality is common in cinema marketing strategies. The design of the lobby, screen, lighting, room proportions, sightlines and seating are used to create this phenomenon (Muffoletto, 2011).

Part of the positive experience of going to the cinema is explained by its quality to escape from everyday life (Addis & Holbrook, 2010; Katz et al., 1973). According to Muffoletto: "People go to the movies to be emotionally immersed in an environment that excludes reminders of their daily routine" (2011, p.1). In times of stress, such as war, movie theatres sell escapism, contributing to their success and longevity (Jeacle, 2009; Ratner, 2003). However, Muffoletto (2011) proposes that the escapist quality of the movie theatres has declined due to increased contact with the outside world whilst being in the theatre. He suggests the use of smartphones to text, social media and access to movie reviews or trailers, is responsible. He also suggests that for the younger generation "letting it be known what they are doing" has become a part of the shared social experience as much as the film viewing itself. According to Lee and Ma (2012) the value of any form of media entertainment lies in an ability to satisfy users' needs of which one can be escapism.

The cinema industry has a history of success due to its longevity, its financial success and cultural significance. Despite millennials spending more time watching movies at home via evolving technology, the time spent watching movies in a movie theatre has remained consistent since 1970 (Sedgwick, 2004). Traditionally, cultural theory and the importance of the film script itself have been areas of research in the film industry (Sedgwick, 2004). Research has been conducted into film form and content over other factors (Bowles, 2011), however there is a gap for designers to reinvent the cinema as a space, service and desired experience.

Research supports the theory that consumers use media such as film, online gaming and social media as a form of escapism. There is evidence that providing patrons a sense of escapism through the movie theatre experience is a key element of cinemas' ongoing success. While some research into how the design of the physical space of a theatre creates a sense of escapism exists, service design, and the overall cinema experience (including before and after the film) are neglected topics. With progressing technological advancements, the underlying traditional desires of escaping and new trends of sharing the experience should be catered for in innovative ways. This is what this codesign project aims for.

3. Method

This study sought to understand how codesign processes benefit design student learning in regards to the future cinema experience. The spirit of entering into the codesign process was positioned according to Cross (2004), that anyone can be taught designerly ways of knowing. Each year, over a four-year period, two codesign workshops were arranged during a twelve-week semester, involving an iterative process of exploring, designing and reviewing ideas. First the designers undertook a literature review, then they conducted site visits to the cinema to understand the design context. After this, a variety of generative toolkits were trialled in the codesign workshops for a large cinema retailer in Australia. The workshops were each two hours long and held in large open space rooms in the university.

The designer participants were from the Bachelor of Design and Master of Design programs in an Australian university, ranging in ages from 22 to 40 years. They were all from different design discipline backgrounds including architecture, interior design, communication design, digital design, product design and fine art, most with previous design industry experience. The non-design participants were family and friends of the designers, other university students and staff, representing lead end-users of the millennial age group. By inviting non-designers into a series of codesign workshops, the designers were challenged to create generative toolkits to build ideas together with non-designers, which they had never experienced before. Here, the study built on Sander's call for designers to create spaces that she terms "scaffolds" where everyday people express their creativity (2002).

Experienced university lecturers art directed the design work each year and this paper's authors supported the design students to facilitate the codesign workshops themselves. Other student designers took notes of their general observations of the codesign workshops, participant survey question answers and they wrote their own reflections immediately after each workshop. The informal nature of notetaking was important to allow transparency and continuous checking to occur (Lincoln & Guba, 1985). This paper's authors photographed the workshop process and the design outcomes.

The data sources used in this case study included existing marketing material provided by the client, site visits, workshop photographs, design prototypes and ideas used before during and after the workshops, design outcomes, observer notes and survey reflections. For analysis, all the data sources were organised chronologically under activity headings into a large case report. The analysis was organised in colour coded themes answering the broad question: "What are the lessons learnt from trialling codesign workshops in design education?" Following are the findings, outlining what students discovered from trialling two codesign workshops and the overall lessons learnt.

4. A case study: Codesigning the future of cinema

The client had undertaken previous market research to understand the barriers to cinema

attendance and the strategies to attract millennials out of their homes, bars, restaurants and into the cinema. The authors of this paper focused on two issues: teaching the students codesign skills and codesigning novel solutions to attract millennials back to the cinema.

Before embarking on the first codesign workshop the majority of students admitted they had not heard of codesign as a design method. There was confusion about who they would be working with. Some said they thought codesign would be about engaging with clients, others said they imagined engaging with different designers or people with different backgrounds. Others said they were excited to learn a new method that they could use in their jobs. One student commented: "I didn't know too much about it, however I knew it would be a good skill to develop as a designer." Several students were nervous for example one student said: "I'm unsure about codesign, it sounds messy and scary because you have to deal with strangers." However, on the whole, comments were positive such as: "It sounds like a really interesting area that I would like to be more involved in and learn more about."

4.1 Co-design workshop one

Students were encouraged to create activities with inspiring materials that would help them find out about moviegoers needs and preferences and the barriers to cinema attendance. The codesign activities ranged from model making with beach, forest and outer space themes, Lego play, creating mood boards, journey maps and card games aiming to find out what end-users would like as an ideal cinema-going experience and about their nostalgic memories of past experiences. One student's activity was to create a future mood board about the experience of waiting for the movie to start. This student used a pop-up stage moodboard where non-designers pegged images onto the string (Figure 1). Another student used superheroes in the corridors to prompt discussion about how the corridors could be lit up after an initial finding that they were dark and depressing. One student was to create a personal cinematic profile card. Another activity was to map positive and negative experiences in the cinema on a mood board. One student asked the user to imagine themselves as a superhero either in the café, foyer, or entrance of the cinema (Figure 1). He wanted to find out what characters they liked. One activity asked participants to view images of a specific movie, and then pick out given words to describe what they were feeling. Finally, one student created a 'cinema experience' journey map. She provided printouts of different items (popcorn, wallet, tickets and emotion icons) to facilitate a creative conversation.

When analysing the success of the codesign toolkits, the authors discovered that games were the most engaging form of toolkit activity. Games provided the opportunity for participants to chat about their ideas while playing. The students were delighted with how much conversation they had with the participants while playing games, gaining great insights, information and opinions from the participants. Students were pleased that their codesign toolkits prompted many ideas: "It was really engaging and a lot of brainstorming was done"; "It was quite engaging and straight to the point"; "The users liked it and we got a lot of suggestions"; "People were very interested to participate in the activity because they said it

was very creative." The toolkits acted as prompts for quick engagement as one student said: "Because my fortune wheel was very attractive, it was a good excuse to get them engaged." Another said: "I not only gathered the information I needed but I also found other concerns and possible solutions related to the cinema experience".



Figure 1. Top row shows the trivia hunt toolkit investigating options for the game. Bottom row shows three toolkits: a cinema mood board on a stage with pegs; a superhero dress-up game, and a build your ideal cinema with Lego activity.

After the first codesign workshop, we discussed ways of improving the students' codesign toolkits in preparation for the second workshop. Students commented in the future they would make their toolkit more fun and more flexible. Students realised, if a non-designer participant wasn't comfortable sketching, then their toolkit was wasted on them. Overall, the students concluded that most of their toolkits in the first workshop were far too complicated while others needed to be more varied to prompt conversations without requiring a lot of explanation. The students reflected that group toolkits save time where more people can listen and record ideas on the spot. One student said: "It was hard to capture ideas quickly – have two people, one can scribe". Students realised the benefit of having attractively designed toolkits to create interest. At the same time, they realised a lot of money didn't need to be spent to make the activity still worthwhile which was a relief for international students without a lot of access to resources. Some realised activities can be too open ended, where it would be better to ask more specific questions. Many decided for the second workshop a game would be the best to allow for fun interaction. One student reflected: "The activity was so fast, so I think I can make it a little longer and deeper to explore more information".

The students all agreed in the second workshop, it would be better to include more visual materials such as images, cartoons (for example movies scenes and characters) and have less text, words, rules and descriptions as part of the activity. One student said: “Next time I need a toolkit where people don’t have to write a lot”. The students realised in the future they would sit back and allow the end-users to take over creating artefacts and models themselves. One student admitted he was not very good at facilitating but learnt a lot by listening to the discussion of the group. Another student said it would be better to: “personalise the experience more, for example having a photo that shows you as the principal character”. This student went on to design a personalised collectable cinema ticket with a photo of the person buying the ticket embedded on a printed ticket. Many of the participants said collectable tickets would be something they would put on the fridge or share with friends or hold onto as a keepsake (Figure 2).



Figure 2. A student design proposal showing how cinemas could use a photobooth or an app to create personalised, collectable tickets.

4.2 Co-design workshop two

The aim of the second workshop was to trial refined codesign toolkits to further understand the barriers and preferences of cinema-going millennials. The students were challenged to propose a design solution to refine with non-designer participants. The second codesign

workshop was an important chance to gather end-user insights to help shape their design outcomes for enhancing the youth's movie-going experience. One student thought the entry hall was the key area to focus on, as he discovered that participants thought the corridors were dark and depressing which was an opportunity to redesign. He codesigned a corridor with projectors installed to light up the corridors with images of the next blockbuster movie and lights to lead people into the cinema where the next movie would be shown (Figure 3).

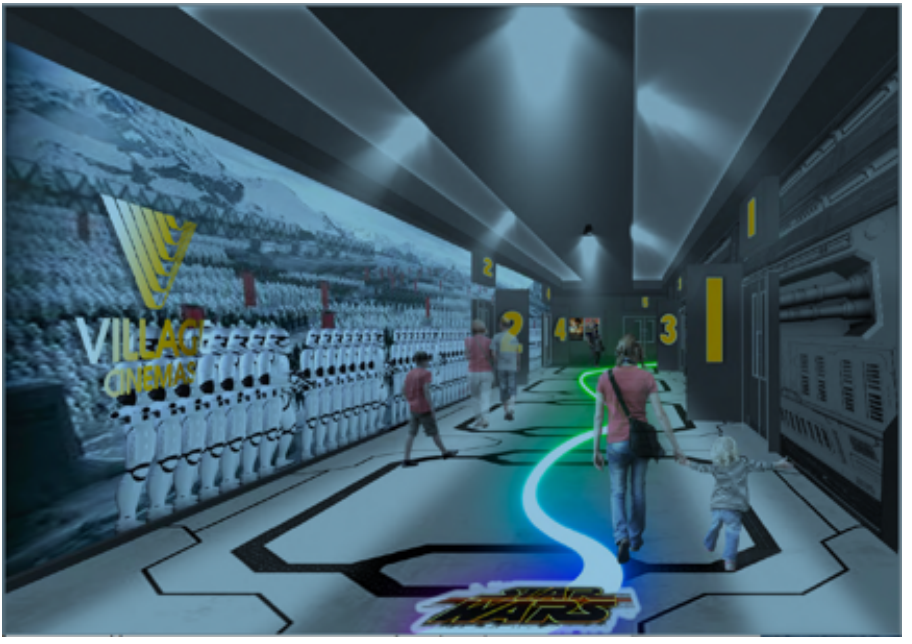

Figure 3. A student design proposal showing how the cinema corridors could light up with projections of movie images and show the path to the cinema door.

One student said: "Users are more creative than I thought". She discovered, that: "People like the idea of a game that makes you walk around the cinema". It was one of the end-users who came up with the idea of augmented reality for a treasure hunt game she called a "Trivia Hunt", showing how the codesign activity directly influenced her design concept. She explored a scavenger hunt idea, combined with trivia creating the Trivia Hunt concept (Figure 4). The idea was that trivia questions based on a film represented in a poster would be hidden in locations around the cinema for patrons to search for. Once patrons find the answer to the question, they enter it into their phone linked to a QR code for the chance of winning a prize, such as a movie ticket or a free popcorn.



Figure 4. A student design proposal showing a poster advertising the Trivia Hunt concept linking to an app with the clues to follow.

The designers' rule "form follows function' was stressed by a non-designer when one student said: "I found that cinema goers valued function above all… for example expense was an issue". Millennials repeatedly discussed the price of the movie as a major barrier to attending the movies. The social aspects of going to the cinema was also repeatedly discussed. Debriefing and chatting with friends after the movies, was something that all participants wanted a design solution to cater for. One student found: "The obstacle of deciding on when to go [to the cinema], with who and what to see is much bigger than I anticipated". In response to this, the student recommended the cinema team up with a dating app to find a friend to invite on a first date to watch a film together. Another student found: "People really want to bring their home to the movie theatre." So the interior design students got working on comfortable seating like couches with rugs and cushions. Others worked on solutions where a dog salon would see their pets being pampered in the foyer while they relaxed watching a movie as leaving pets at home after a day at work was another barrier to going to the movies.

4.3 Lessons learnt

At the end of the semester after conducting two codesign workshops, the authors of this paper asked the students about their experiences. The students used the words 'fun' and 'engaging' to describe their experiences with codesign toolkits and real-world participants. One said: "it was fun, I gained practical and new perspectives" another said: "I got lots more insight than I imagined." Another said: "People talked more after fun activities, and they felt more comfortable in this kind of atmosphere." Several students acknowledged the importance for final design outcomes to include end-users' perspectives. For example: "It's a

very unique way to shape your design development with solid information from the real users" and "it is a very good tool to design not only products but experiences as it is important to know the thoughts and opinions of end user." One student acknowledged that in the end the designer needs to make a decision to move the design forward, stating: "It can be very fun and creative … designers still need to make a call". In order to get feedback whether the final design proposals were suitable from a business perspective, the client was invited to the final student presentations to give feedback on the fit of the ideas for their business. The feedback was overwhelmingly positive – in particular on the ideas presented.

5. Conclusion

We found codesign to be a useful method when applied twice in a twelve-week university semester: the first workshops uncovered barriers to cinema attendance and the second suggested suitable prototype ideas. Two codesign workshops are sufficient to give designers a taste of working with rich data, where final designs are not based on intuitive assumptions. We found a codesign process trialling toolkits became a language facilitating ideas between different disciplines and stakeholders. We suggest a new important role for designers is to find their voice in orchestrating this language. We argue a minimum of two codesign workshops are needed in design education to generate validate student ideas and keep an ongoing voice of end-users in the process. The codesign materials need to be carefully chosen for end-users to articulate their ideas and for design students to trial this new language, translating end-user views into appropriate designs. The projects favoured by the end-users intertwine the ritual of going to the cinema, with the culture of sharing experiences with friends, with modern digital services. Revisiting past social connection behaviours such as going to the cinema can benefit future generations. This study reveals the potential of codesigning a cinema attendance strategy, moving beyond pure entertainment into concepts that contribute to improving society's isolation and loneliness concerns. We suggest that codesign processes rather than traditional designer-client processes, offer novel solutions for clients looking to come up with innovative concepts for enhancing their existing business models.

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Acknowledgements: We would like to thank our Masters students (DDD60001 2016-2019) for working on the ideas and designs in the presented case study. Thank you to Village Entertainment for their support over four years of codesign research and appreciating and applying some the students' work in practice.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Letterpress: A Survey of Print Culture or an Immersive Learning Experience

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Abstract | This paper explores the culture of letterpress printing within Art and Design education in the UK and Ireland. It describes two phases of research over the last four years. The first is based on an immersive collaborative letterpress research project, in which staff and students from six UK Colleges worked together to research, write and print a letterpress publication. The second phase is a comprehensive, systematic field survey of all of the remaining letterpress workshops within Art and Design Higher and Further Education in Britain and Ireland since 1955. The combined findings of these two phases of research enable the authors to form a position in relation to the changing culture of letterpress and its role in education.

KEYWORDS | LETTERPRESS, TYPOGRAPHY, PRINT HISTORY, DESIGN HISTORY, PRINTING

1. Introduction

This chapter outlines the current breadth and depth of letterpress practice within contemporary art and design pedagogy across the UK and Ireland. It is based on the field research data which has been systematically gathered through visiting the letterpress workshops in Further and Higher Education. These research survey visits to Art and Design Schools involved traveling over 8,400 miles between 2014—2019.

Throughout the major part of the twentieth century, the teaching of letterpress was organised through training centres in technical colleges and art and design schools. This 'training' as opposed to 'educational' model is now long redundant, largely due to the growth of digital technologies the 1980s and developments in design Education. Letterpress printing, however, is more popular than at any time in since the 1990's. The current resurgence of interest in the letterpress process makes this research timely as it examines how the education of artists and designers has changed and developed since the 1960s.

The collaboration between the principal researchers began 2011. It has involved two interconnected research projects. The first part linked six colleges with active letterpress workshops from around the UK. Staff and students from each college united in a collaborative project that allowed them to consider both the practical and philosophical approach to letterpress practice. Entitled *6x6: Collaborative Letterpress Project,* it provided an insight into the different approaches to letterpress within the six colleges.[1]

The second part grew out of this first collaboration in 2014. The research team asked the question, how widespread is the use of letterpress in art and design education today, as compared to its mid-century heyday?

The research has identified 43 Art and Design institutions which have active letterpress workshops. We have visited and surveyed 41 workshops, the research has systematically identifying and cataloguing the equipment and presses, type sizes and faces, both wood and metal. We have undertaken a measured survey of each workshops which supported the development of orthographic drawings to a common scale providing a physical representation of each space.

[1] The collaboration was between the *University of Brighton*, *Camberwell College of the Arts* (UAL), *London College of Communication* (UAL), *Central Saint Martins College of Art and Design* (UAL), *Lincoln School of Art* and *Glasgow School of Art*. Each had an established history of using the letterpress, and with the exception of Lincoln, had workshops staffed by a dedicated technician. The staff and students involved were all from Graphic Design or Visual Communication programmes.

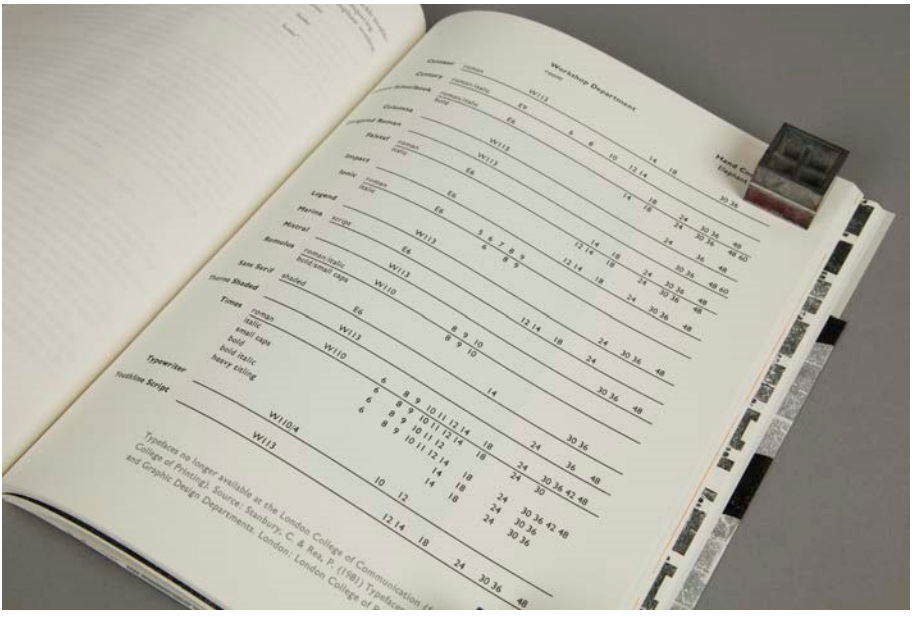

Figure 1. Student work from 6x6: Collaborative Letterpress Project, 2014.

2. Identifying a timeframe and the extent of the field of research

In order to trace how letterpress workshops and teaching have changed within Further and Higher Education it was important to establish a clear datum point from which to start. Two key sources from the *Charles Pickering Archive* LCC provided this datum point within an appropriate time frame. The typed and hand-annotated list entitled *List of Establishments for Further Education Where Courses or Classes in Printing are held 1955* is believed to have been compiled by Beatrice Warde and the *Guides to Educational Courses in the Printing Industry 1967.* The 1955 list has 72 colleges and 1967 44 colleges (44 colleges appear on both lists) and provides a list of courses leading to qualifications that could be studied relating to training for the print trade. The two principal sources were combined together with the eight additional institutions, and organised into a single list alphabetically by city or town. The total number of letterpress workshops within educational art and design FE and HE schools and colleges responsible for the training of designers and printers was established as 104 in 1967.

Tracing the history of institutions on the combined list reflect the major changes in art and design education in the UK during the twentieth century. The first significant change was the

move from the *National Diploma in Design* (NDD, 1946–1961). In 1960, the *Coldstream Report* outlined decisions to develop a *Diploma in Design* (Dip AD, 1962 – 1974) (H.M.S.O. 1960), with only sixteen colleges awarded it in the first round. It is this legacy that is evidenced in the absence of many of the original colleges listed, for '*Coldstream had promised institutional autonomy but his committee's reforms led to increased centralisation and the closure of almost two hundred art schools across Britain'* (Llewellyn, 2015). This was a significant watershed as Technical Colleges and Art and Design Schools either retained pre-degree courses, in Further Education, or developed degrees within Higher Education. The next substantial change came in 1992, when Polytechnics were granted degree awarding powers. This has been referred to as *'The polytechnic era'* (Llewellyn,2015), the period 1965—1992 that was dominated by the *Council for National Academic Awards* (CNAA, from 1974 –1992). The last major educational change was the shift from a student grant to student fees and the adoption of student loans first introduced in 1998, followed in 2009, by a rise in student fees to £9000. The dates 1967–2020, provide bookends for our research.

2.1 Research Methodology: The Field Survey

The field survey set out to answer four interrelated research questions:

1. How many active letterpress workshops are operating within British and Irish Higher and Further Education?
2. Where are they located and within which Institutions?
3. What do they contain and how are they arranged?
4. How are they being used?

Having established the number of institutions which could have active letterpress workshops we began to systematically contact each by phone and then email. We established that 43 Institutions from 104 had retained letterpress equipment. The field research was supported by small funding streams from a range of sources.

2.3 Plotting the Scale of the Survey

Using an OS map~~s~~ of the UK and Ireland we began to plot the position of the 104 workshops using a single yellow dot for the 1955 list, single orange dot for the 1967 list and an orange roundel with a yellow bull for those institutions identified as entries on both lists. We now had a distribution pattern that revealed the post-war period had a significant number of small institutions located across the UK (Beck and Cornford, 2012). The distribution pattern linked, as might be expected, to major cities towns or urban conurbations. We developed a second map plotting the 43 institutions which had confirmed letterpress workshops. These colleges can be broken down geographically: Scotland (4), The North England (10), The

Midlands (5,) Wales (1), Republic of Ireland (2), South East England (15), South West England (7).

2.4 Ensuring Consistent Data Gathering

To ensure consistency and comparable results it was important to develop a transferable methodology for collecting the data. Letterpress type is stored in cases within cabinets which characteristically have space for 22 cases. We designed a simple form with 22 lines, and columns for: font, weight, size points/didots, foundry/manufacture to catalogue wood and metal type. A comments section at the bottom was used to record the cabinet maker, where this could be identified. As all the workshops contained several cabinets each form was numbered. This systematic process has provided a record of every cabinet and every case, workshop by workshop. A second form was designed to record the equipment.

2.5 Surveying Physical Workshop Spaces

As well as the type and equipment we wanted to survey the physical space. We made the 1:50 digital scale drawings. The scale drawings enabled us to compare workshops: size, organisation, workflow and student capacity. A combination of the survey and conversations with technical and academic staff, revealed how many students could be taught in ~~t~~each workshop. This is a critical feature of modern HE education where institution wide staff student ratios (SSR) are often applied to funding models which can restrict small group workshop teaching or make it prohibitively expensive.

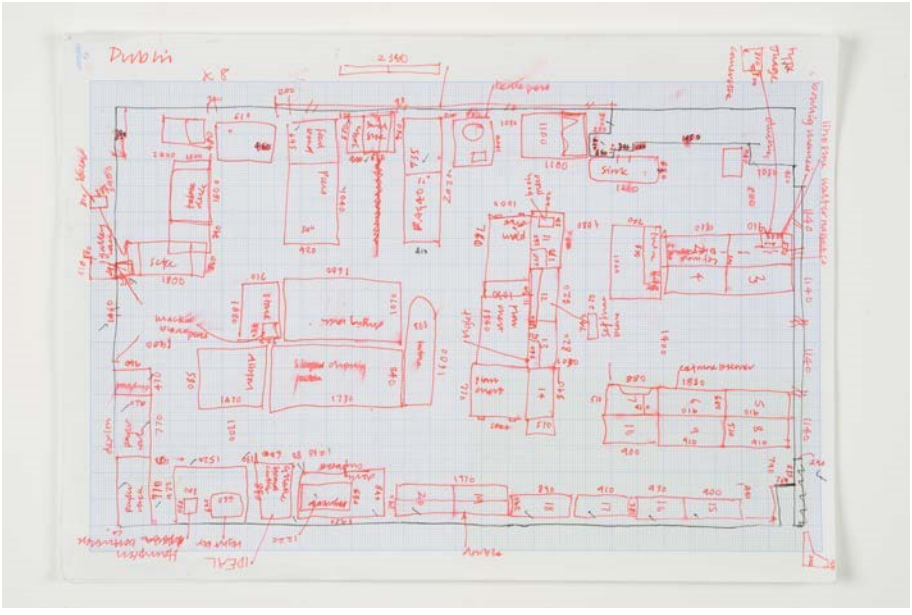

Figure 2. A sketch of the workshop at National College of Art and Design, Dublin. This information was gathered onsite and worked up into a digital map afterwards.

3. Workshop Initial Findings: Type

We have completed surveys of 41 of the 43 institutions (44 workshops), a further three surveys have yet to be undertaken. The 41 workshops surveyed to date contain a total of 490 cabinets or type frames, which hold 9,272 cases of type. This figure can be further broken down into lead type, 8,132 cases, wood type 1,140, cases and 22 cases of Acrylic type. Today there are no institutions working with 'hot metal composition'. No college has the capacity to cast their own type. The restrictions of contemporary Health and Safety practices identify the risks involved of working with molten lead. The *Monotype* casters from the *London College of Communication* (formerly *London College of Printing*) were donated to the Type Archive (London) in 2003. As a consequence of this loss, the quality of the type catalogued varied tremendously across different workshops. Some had seen heavy usage, some remained pristine in cases – particularly smaller, composition sizes that are labour-intensive to typeset and print.

Collections of wood type are vulnerable to theft as the attraction of acquiring a large wooden initial has appealed to generations of design students and as a result we found many cases of wood type labelled 'mixed', where incomplete cases had been combined. Modern digital technology has enabled laser cutting, 3D printing and CNC routing. In several

workshops we saw student and staff designed fonts and type blocks cut on end-grain wood as per historical manufacture and single designs mounted on type-high MDF in the manner of relief block printing, letterpress is not now exclusively defined by the use of moveable type.

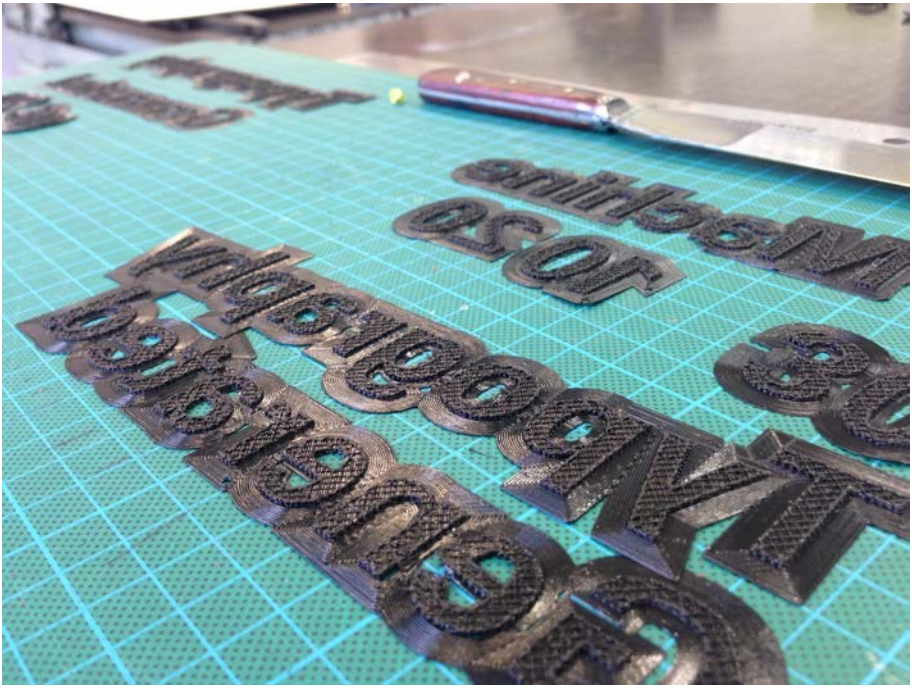

Figure 3. 3D printed type, in the process of being mounted to type height to print.

3.1 Workshop Initial Findings: Presses

The workshop survey only records the position on the measured drawings of presses which were used for letterpress printing. It does not record all the relief printing presses in each institution in a printmaking workshops which may be used for, lithography, etching or mezzotints *etc*, nor those unused presses displayed in entrance lobbies as artefacts. The range of equipment, and particularly presses, varied across the different workshops. The 41 workshops surveyed to date contain a total of 84 large presses located in fixed positions within the workshops.

Today each workshop contained galley and/or proofing presses, there advantage is that students can use them under supervision. As each pull relies on hand feeding the press it is

only possible to produce small volumes This has democratically opened up the possibilities of print production, students have authorship over each stage of the process of their work and are physically responsible for its execution. The student is in a position to produce multiple editions. By contrast, digital printing is often used by students to prototype, or produce a one off for a critique or review. Letterpress is not a facsimile of print, it is the actual print. It offers the student opportunity of working with: metallic inks, florescent colours, pastels and printing white over a colour. Students can emboss, deboss and foil block. Educationally, this promotes a freedom and a range of print that is not possible within digital production.

3.2 Workshop Initial Findings: Layouts and Patterns of Use

At each workshop visited, the space survey and the making of measured drawings provided an insight into how the workshops are used for teaching and experimentation. The set-up had significant influence over the teaching and use. There are workshops in which the type is stored separately from the presses which enable students to set type when technical or academic staff are not supervising but do not support independent printing. We identified workshops in which all the equipment the paper, type, presses and drying racks are contained within a lockable space supported by a dedicated letterpress technician in which students can compose, proof, print and diss type under supervision. There are workshops in which the letterpress equipment is contained within a larger general printmaking room which may also support, mono printing, etching, mezzotints, lithography, and screen-printing *etc* and is supported by several technical staff with a range of printmaking expertise. There were also studio spaces containing type cabinets and a hand proofing press, characteristically a *Farley*, which enables students to compose and print independently. Only two dedicated workshops that had escaped closure were largely unused and without technical staff.



Figure 4. The workshop at Birmingham City University, with type cabinets and a Farley proofing press.

4. Reinstating Letterpress

Many of the staff with responsibility for the workshops are more investment and influence on the type collections within the workshops. At *Arts University Bournemouth* Sally Hope Course Leader Visual Communication has built up a collection of wood and metal type, acquired cabinets and cases, a stone and a *Farley Press* through which she introduces students to the process. Designers and academics Barry Tullett and Philippa Wood at the *University of Lincoln* house *The Caseroom Press* within the undergraduate Graphic Design Department. Their collection of predominantly wood type and typewriters is closely connected to their practice led research (Tullett, 2014) and this, in turn, informs their teaching. Students across all three years are taught the process through workshops which respond to Tullett and Wood's own experiences as students.

The latest Letterpress workshop to be reinstated is at Kingston School of Art (KSA), *Kingston University London*, the *'**noble**press'* was founded in May 2017. *Kingston Polytechnic* had a letterpress workshop until 1992 (the same year it gained University status) when with the

retirement of the technician and an investment in new Macintosh Computers the workshop was dismantled and the presses sold.. The set-up costs of £67,000 to establish the workshop must be considered in relation to the durability and longevity of the equipment. If serviced regularly the presses could be rolling for well over 100 years, as is demonstrated by Camberwell's workshop which is the oldest in the same location since 1906. Letterpress equipment is rising in cost and so the presses and type are increasingly valuable assets.

5. Workshops and Curriculum Developments

The use of the letterpress process within each workshop varies according to the history and culture of the institution. The technical teaching of letterpress composition was phased out at all colleges by the late 1980's. Digital composition rendered print apprenticeships irrelevant. The impact, scale and speed of change on the print industry and its knock-on effect on technical education which supported it in the was colossal through the mid 1980's. Little more than a decade earlier, the print industry of 1970 employed 300,000 people in the UK. As late as 1985, 266 printers traded in the City of London, one of London's major print areas, 111 of these were letterpress workshops.

Today, the workshops are used by a broader community of art and design students. Groups of Graphic Design, Visual Communication and Illustrators and printmakers use the space. When open access policies are adopted photographers, fashion students, architects and product students are often working alongside each other. The mode of teaching delivery varies from institution to institution, but the majority of colleges have an induction process to the workshop area, which is delivered by technical staff. This enables students to work independently with access to specialist support and technical guidance. Students at the majority of colleges are encouraged to explore design briefs through a range of media which may include: interaction, film, publication, print and print processes including letterpress. Some, including *Cambridge, Glasgow*, *Kingston* and *Lincoln*, stipulate a letterpress outcome on workshop or project briefs and therefore ensure that all students gain an induction into the area. Others have attempted to further embed it within curriculum through assessment submission requirements. In a strategic move to protect the workshops, courses have explicitly mentioned the letterpress process within validation documents, ensuring the preservation of the workshop. This was achieved when the workshop at *London College of Communication* was under threat in the early 2000s after several years without a dedicated technician. Both of these approaches mean that each student on the course in question can gain experience of the process, and work on the assumption that the most engaged students will return to undertake longer projects throughout the duration of their course. The wider adoption of letterpress as a medium by students is therefore primarily through self-selection.

Following the survey visits we conducted a series of telephone interviews with the staff responsible for the workshops which provided an insight into the way they are used in relation to curriculum. Edwin Pickston at *Glasgow School of Art* (GSA) identifies the advantages of the *'Caseroom'* to *Visual Communication* students. For Pickstone the workshop presents the history of type. This is important as, *'The principals of metal type underpin the systems which controls what's going on digitally today.'* Letterpress provides the todays Graphic Design students with a direct link to the process of reproduction key to the historical dissemination of knowledge through the printed book. For students who are familiar with digital type through word processing the origins of, typeface, size, columns, alignment, kerning (horizontal spacing), leading (vertical spacing) and alignment are made real through metal. The letterforms of type can be traced back to calligraphy, notation and writing systems leading to the origins of the alphabet. The link with history was a common thread with staff responsible for workshops. Pickstone states *'In some ways "Graphic Design" has very short history, unlike architecture, the term "Graphic Design" was only really coined in the 20th Century',* the workshop prompts discussion about type development *'through history'.* Digital outputs are often used to present work for review and critique but these are presentations anticipating reproduction through lithography. Pickstone notes with letterpress *'the prototypes are the real thing'*. Students can make decisions about *'…paper stock and mix and test ink, experiment with over printing using the full range of pantone inks: metallics, fluorescents, and pastels and opaque whites.'* Pickstone describes the process as learning: *'discipline, explanation, endeavour and development'.* He recognises in both his own work and that of the students the workshop naturally supports collaborative practice. The disadvantages of letterpress are that the students have to be taught in small groups at GSA 8-10 at a time. The process is slow and there is a significant learning *'attrition rate'*, the number of students who complete inductions but don't return to the workshop. However, for those students who don't choose to use the process again they have acquired an understanding. Pickstone reflects, *'Perhaps not all knowledge gained through practical learning needs to be applied'*. He describes the letterpress workshop as integrated into the curriculum as all the third-year students in *Visual Communication* Illustrators, Designers and Photographers have to compete an assessed piece of work within the workshop.

6. People

As the function of the letterpress workshops have changed between 1967 and 2020 so the experience and the demographic of the those responsible for the workshops has changed. The interviews with staff responsible for the workshops have revealed a range of routes into letterpress and a variety of career journeys. The workshops within Trade Schools of 1960's where characteristically run by male technicians trained as a compositor or printers with commercial experience of working within the print trade. Through the early 1990's there was a period of transition, some technicians retired and others retrained transferring their analogue knowledge of type to digital composition. Today the gender balance is improving,

staff responsible for the 41 of the workshops surveyed to date include 21 female staff and 28 men.

Both *Manchester School of Art* (surveyed in November 2017) and *Plymouth University* (surveyed July 2017) have trained compositors. Paul Collier at Plymouth had begun work as apprentice printer and learnt to set type by hand in a *'jobbing printers'* in Plymouth. He then trained as a *Monotype* compositor before joining the University.

By contrast, Edwin Pickstone at *Glasgow School of Art* (surveyed 2017) has a full-time post which is made up of design lecturer/researcher, designer in residence, and letterpress technician. Pickstone was a student on the *BA Visual Communication Design* course at GSA. During his final year in 2004 Senior Tutor Steve Rigley set a project *'What is the value of letterpress?*'. Rigley's project was both a provocation and invitation. In 2005 he combined technical support with *'Designer in residence'* by a small grant from the *National Heritage Print Fund*. Fraser Ross, the technician who had trained as a compositor working at GSA since 1976 was considering retirement. A combination of wise succession planning and serendipitous opportunity enabled a period of handover and from September 2005 until April 2006 Pickstone worked with Ross. Pickstone recognises the importance of this generational handover, *'…though he didn't have six years to train me, I learnt rigour, and discipline from him…'*.

Chris Wilson at *Northumbria University* views the letterpress workshop as a research *'laboratory'* and has used it as a base his practice-based PhD. He was inspired by a week intensive workshop in the Netherlands with Thomas Gravemaker. Wilson's role is multifaceted: design tutor, researcher and technician. *'the workshop provides students with a historical context for typography'* and does not want *'the workshop to become a museum or window dressing for Open Days.'* It has to be *'a place where students actively make work'*. The *'physicality of type'* provides students who are '*…visually aware, with a way to learn through doing, by designing on the press.'* He identifies the constraints as a positive aspect of letterpress, students can *'Overcome the restrictions of limited number of typefaces and sizes.'* But also acknowledges that some students find it *'Difficult to adjust to both the restrictions and the slow and considered approach to design and composition'* as the cultural conditioning of *'the digital world provides instant gratification'*.

7. Conclusion

This research has surveyed all but three of the letterpress workshops. It has established the number of workshops active in 1967 was 104, this figure has dropped to 44 workshops in 43 Institutions in 2020 (there may be some vestiges of type workshops as yet undiscovered). The research has traced the multiple name changes of the institutions and revealed that only 7 of the 104 institutions have retained their original name from the 1967 listings. Of the 43

institutions with workshops 42 are in the Higher Education sector within post '92 Universities, only *Southport College* in the FE Sector has retained a small element of letterpress. None of the 104 institutions identified on our 1967 list offer any of the print apprenticeships. The 43 workshops located within post '92 Universities are providing courses within Art and Design Schools or Faculties offering BA or MA degrees in *Graphic Design*, *Visual Communication*, *Communication Design*, or *Illustration*, though the workshops in some institutions are used by students from many disciplines. We have established that 41 workshops surveyed to date contain a total of 490 cabinets or type frames, which hold a total of 9,272 cases of type. These consist of consisting of: 8,132 cases of lead type, 1,140, cases of wood type and 22 case of Acrylic type and 84 large presses and 17 table top presses.

The demographic of the staff responsible for the workshops has changed. There are two technical staff who have trained as compositors and printers and the remaining 47 members of staff have learnt to use letterpress equipment through a design education. The nature of the curriculum taught within the workshops has changed radically from the acquisition of technical skills interchangeable skills for the print trade, to a creative workspace which places the student designer at the heart of print design and production. The workshops are today are learning and teaching spaces, research spaces, production spaces, and experimental studios where students can play type letterform and image through the integration of analogue and digital technologies.

Looking to the future we will analyse all the material gathered through the survey, including the equipment survey for each workshop which has yet to be collated. We will continue to conduct phone interviews with staff responsible for the workshop spaces to gain greater insight into links with curriculum and workshops use. We aim to create a digital data base which is likely to list over 9,500 cases of type, and provide press and equipment details. This will provide a listing of typefaces and sizes available in each size per workshop and the catalogue of type held within Education.[2] It is our intention to make the catalogue of presses and equipment an interactive data base and web resource so that institutions can update new acquisitions.

[2] The research may be extended up to Universities outside Art and Design Education which have retained letterpress workshops. *Birmingham University* has moved the letterpress workshop *Winterbourne House and Botanical Gardens* as a working Museum run by volunteers. This workshop has already been surveyed but is not counted in the 44 workshops within Art and Design Education. *Oxford University* has a letterpress workshop in the ground floor of the Schola Musicae of the Quadrangle in the Bodleian Library, whilst *Leeds University* and the *University of Stirling* have workshops which have been revitalised.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Made by (Material) Frustration

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Abstract | This paper explores the concept of geometrical frustration as an alternative mode of form-making in design and manufacturing. While builders, craft makers and designers traditionally attempt to work with stress-free materials with predictable response and controlled outcome, nature often develops form and function through mechanisms of stress-informed materials. In biological systems such as flowers, geometrical frustration caused by internal stresses often leads to shape transformation. Although scientists have studied and understood this phenomena, material frustration has yet been introduced as a possibility for designers. In this paper, a frustrated materials approach is brought to the design process, through case studies in two different material systems. Both in ceramics and in latex, the material becomes an active partner in the design process, no longer controlled, predictable and "well behaved". Through close collaboration with the scientist, the material's behaviour is understood and analysed for further exploitation, enabling to reverse-engineer surprising new forms.

KEYWORDS | MATERIALITY, MATERIAL FRUSTRATION, MATERIAL RESEARCH, MANUFACTURING, TRANSDISCIPLINARY DESIGN

1. Introduction

Design and Production are control oriented. The history of design relies on the control over materials through manufacturing techniques such as casting and machining, making sure each chosen matter doesn't "misbehave" (Lefteri, 2012). Processing materials involves external tools and moulds, rules and patterns – all created to ensure order and make sure each material element is passive, thus acts according to plan. The need for control is accentuated by computation capabilities, deeply rooted by now in the design and architecture realm, leaving no room for randomness, aiming at minimal tolerance and maximal efficiency, affecting the whole making of a design project: conception, visualisation, simulation, and fabrication (Carpo, 2013).

The ability to generate practically any imaginable form with ease on the computer screen, with digital design tools and advanced visualisation capacities, has led to the ongoing rising challenge of its materialisation as built or manufactured artefacts; designers and manufactures alike face the challenge of fabrication of complex geometries (Kolarevic, 2005; Austern, et al., 2018); issues of cost, sustainability and geometrical limitations come into play, raising significant barriers. The realisation of complex shapes in large scale, typical to contemporary architecture, is furthermore challenging due to the extensive use of moulds in the fabrication process (Hickert, 2016); It is echoed by the large efforts of research and technological developments in the past decades, oriented towards the development of alternative fabrication methods (Sheil & Glynn, 2011; Menges, et al., 2017). While some concentrate on new technologies, such as 3D printing (Duballet, et al., 2017), other directions of development focus on the opportunities to be found in the material itself. Inspired by the philosophy of new-materialism (Miller, 2018) on one hand, and technological advancement in material research on the other, a rising awareness of matter's generative power is at the centre of design discourse in the past years, under the concept of 'Materiality' (DeLanda, 2015). Seeking innovation and alternative modes of form-making, material-systems are developed, where the inherent capacities of the material itself are enhanced and exploited to achieve performance (Menges, 2012). Such material-centred approach widens morphological expression, promotes efficiency and higher performance, and inherently introduces new design paradigms (Hensel, et al., 2010).

Alternative modes for achieving form and reaching required performance, introducing concepts such as self-organisation, growth, hierarchy, redundancy and resilience, inherently relate to the world of nature (Speck, et al., 2017). In the search for alternative modes of form materialisation, nature serves as a source of inspiration and bio-mimetic development processes. While builders, craft makers and designers traditionally attempt to work with stress-free materials with predictable response and controlled outcome, nature often develops form and function through mechanisms of stress-informed materials (Weinstock, 2010). Wishing to adopt alternative material formation processes from nature, requires a shift from the traditional engineering efforts of balancing and annealing residual stresses

within materials (Withers & Bhadeshia, 2001), to the study of the principles of stress-driven formation, for possible control.

A growing number of bio-inspired material systems are developed in recent years, mostly looking at biological models, extracting their principles of operation and translating those into a synthetic designed realm (Knippers, et al., 2012). This paper presents an ongoing transdisciplinary research that draws its theory and ideas from the world of non-linear physics into the world of design. From the physical formulation of complex form generation and motion mechanisms in nature, an analytical theory was generalised, applicable across scales and materials. This paper will present the application of the theory of incompatible shells on two very different material families, rubbers and ceramics.

2. Material frustration as shaping mechanism

2.1. Learning from Nature

Much of shape transformation in natural system is driven by internal stresses. For example, the opening of a flower, the swimming of a jellyfish and even the beating of our heart, are all driven by the build-up of internal stresses and their release via global shape transformations. The origin of these stresses is *geometrical frustration,* which can be described mathematically. An example that well demonstrates the principles underlying “forming via frustration” is that of the opening of a seed pod. In (Author, 2011) we studied the opening of a dry *Buhinia’s* seed pod. The pod's valves consist of two layers of fibrous tissue, a tissue that expands/shrinks perpendicularly to the fibre orientation upon hydration/dehydration. If the fibres orientation in the two layers would be identical, the entire flat valve would shrink/expand uniaxially, perpendicular to the fibres’ orientation, remaining flat. However, the fibres orientation in the two layers are perpendicular to each other - in $\pm 45^{o}$ to the long axis of the pod. Apparently, this simple micro-architecture of the tissue, is sufficient to drive the valves' twisting in opposite handedness upon drying – a process that "shoots" the seeds to large distances. To understand the twisting mechanism, we note that upon drying, each layer “tries” to shrink uniaxially. Uniaxial shrinkage of one layer with respect to the other, induces curvature aligned with the shrinkage: If the top layer shrinks along one direction, the composed sheet would bend upward along this direction, similarly to a bi-metal ribbon. Therefore, shrinkage in two orthogonal directions in the top and bottom layers, induces a saddle curvature. However, since separately, both layers are flat, their in-plane geometry does not match the saddle geometry (imagine trying to attach a large flat sheet of paper to a saddle). This incompatibility is the cause of geometrical frustration: the valve can either fulfil its natural (or “reference”) curvature (saddle), OR its natural (reference) in-plane (flat) geometry. It cannot be completely relaxed, thus must contain internal stresses. One immediately sees that the same type of frustration can be generated in different ways, in sheets made of different materials: for example, by gluing together two flexible sheets while

they are stretched in orthogonal directions. Like the seed pod, both layers want to shrink uniaxially, in orthogonal directions, i.e., a tendency to form a saddle. This frustrated structure is described in more details in section 3.

Though the tendencies of each separate part of the material are simple and clear, the behaviour of the combined sheet is much more complicated and unpredictable. In order to understand the geometrical and mechanical behaviour of such a frustrated sheet, one has to develop a suitable theoretical modelling.

2.2. Theory of incompatible sheets

Recent developments in the theory of elasticity introduce and develop a new way of thinking, designing and manipulating solids. Within the framework of *incompatible elasticity*, effective theories of rods, plates, and shells were formulated (Efrati, et al., 2009; Aharoni, et al., 2012). In this framework the local intrinsic geometry of a body is expressed with the reference metric and reference curvature. These express the *equilibrium distances* between the elements that compose a solid body. The reference metric and curvature can result from growth, irreversible deformation, or from the geometry and connectivity of the elements that compose the body. The theory expresses the energetic cost associated with deviation from the reference metric (stretching energy) and from the reference curvature (bending energy) (Efrati et al., 2009).

The formalism opened the way to a set of quantitative experimental and theoretical studies of self-shaping sheets (Gemmer & Venkataramani, 2011; Klein, et al., 2007; Santangelo*, 2009;* Author, 2010). Several important notions were determined, based on the new formulation, providing useful *guidelines for the design* of desired shape transforming sheets, often saving the very complex process of solving the nonlinear elastic problem. The theory was successfully applied to many specific structures, including frustrated ribbons with saddle curvature, such as the seed pod described above. Experimental and theoretical study (Author, 2011) demonstrated the ability of the theory to predict a wide range of twisted and helical configurations obtained at different ribbon widths and orientations.

An important notion related to the formalism is "geometrical frustration" (which was mentioned in the previous section). This occurs when the reference metric and curvatures are *incompatible* – they cannot be both realized by a configuration of the surface in 3D. This is manifested by *sharp mathematical constraints,* given by the violation of Gauss-Minardi-Codazzi (GMC) equations. Under such conditions the body will always contain residual stresses. Within the new formalism, the origin of internal stresses is clearly "visible" and the conflicting geometries are clearly expressed.

Frustrated bodies have unique properties. Any cut or change in the shape of their boundaries results in a change in their 3D shape. This is due to the fact that any configuration is a compromise, set by the competition between the reference metric (stretching energy) and reference curvature (bending energy). Any change in the boundaries

of the sheet changes the balance between the conflicting geometries, and a new equilibrium configuration is achieved. This responsiveness and shape variation of frustrated sheets is in a sharp contrast to ordinary stress-free sheets that stay as they are, when cut or curved. This property makes frustrated sheets much more interesting than ordinary ones. A non-trivial information is encoded within them, making them buckle and wrinkle into 3D shapes and to respond in a surprising way to cuts. To some extent such structures are unexpected, but with the theory of incompatible sheets, that holds the information about the reference geometry (in the form of the reference metric and curvature), we can "understand" the frustration of the materials and guess their response.

3. Making form by material frustration: case studies

In mirror of the new physical understanding of generation of complex curvatures in geometrically incompatible, or frustrated plates (Efrati, et al., 2009) and shells (Author, 2011), we developed two experimental design projects: 'Frustrated Materials' and 'Frustrated Ceramics'. These two case studies served as demonstrators of the physical theory, as well as a starting point for future design development. The case studies described in this section operate in two very different material realms, demonstrating the application of similar sets of principles, which rely on the generalised theoretical basis of incompatible shells. From surface design in latex, a soft and flexible material, to morphology in ceramics, a malleable material but brittle once fired, the two case studies will demonstrate the agency of material frustration.



Figure 1. Frustrated Material', 31 latex tiles. Bet Binyamini, September 2018. (photo: Shay Ben Efrayim).

3.1. Frustrated materials

Frustrated Materials' is a composition of 31 latex tiles (36x36cm each), forming an ornamental wall-piece (Figure 1). Latex is an elastomer, used here in the form of thin (cast) sheets. It is a continuous, homogeneous and isotropic material, with a typically high stretching capacity. Here, this capacity was used to introduce directionality in the material, stretching the latex sheet to one direction only. By the bonding of two sheets, stretched in perpendicular directions, we introduced geometrical incompatibility in the system, as described in section 2. The two stretched and connected latex sheets make a bi-layered material that is frustrated, each layer tending to shrink in opposite directions. Attached to a frame and geometrically incompatible, the bi-latex surface is charged with energy. Once incisions are introduced on the surface, the stored energy is released through the spontaneous generation of three-dimensional shapes. The articulated and ornate surfaces of the 'Frustrated Materials' tiles were made by laser-cutting of different patterns, of stretched bi-layered latex material. To accentuate the bi-layer effect, we chose a top layer of uniform cream colour, and a bottom layer of varying colours (Figure 2).



Figure 2. Surface design by material frustration. The bi-layer structure is accentuated by the choice of contrasting colours between the layers (photo: Shay Ben Efraim)

The case study explored the design potential of controlled shape generation in the bi-layered latex surfaces, through the variation of a few elements. The effect of three main parameters can be demonstrated through the work:

Radius of curvature of the surface - Three elements are related (Efrati, et al., 2009): curvature (K) of the surface (expressed as $1/r$), thickness (t) of the material, and the differential strain (ε) (unitless, $\frac{\Delta L}{L}$as the percentage of stretch of the material), expressed as

$$K \cong \varepsilon/t \text{ or } r \cong t/\varepsilon$$

This formulation indicates that the typical radius of curvature of the shapes that would form by the cutting of a frustrated surface, could be directly dictated by the thickness of the material used, and the amount of stretching applied (applicable as long as the material is considered 'thin surface' physically). Through a short series of samples, we identified a typical radius of curvature that would be expressive and enabling: significantly visible curvature, without reaching strongly curved forms. Based on a series of initial tests, we aimed for a typical curvature diameter of 8-10mm, being expressive, while not too curly. As we used a latex thickness of 0.4 mm, (the total thickness (t) being 0.8mm), we aimed for a differential stretching (ε) of around 15-20%, that would result in typical curved shapes of 8-10mm diameter, identified as our desired range (Figure 3). (A stronger stretch resulted in more curly or highly twisted shapes, a weaker stretch would result in less pronounced curvature, closer to flat surfaces).

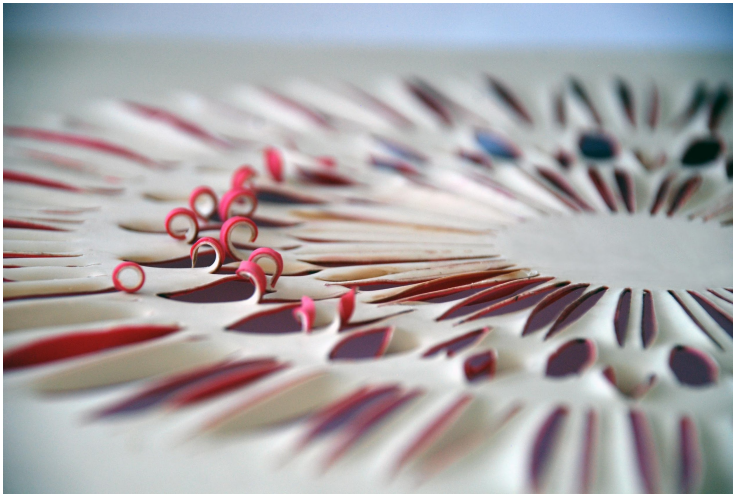

Figure 3 Selecting the radius of curvature by the amount of stretch applied over the material (according to given thickness).

Orientation over the surface - The scientific work of (Author, 2011) showed that the frustrated sheet tends to bend into a saddle-like configuration. The shape of strip cut strip out of this surface would vary according to its orientation over the surface (angle θ with one of the stretching directions), acting as a portion of a saddle-like curved surface, i.e. an identical cutting curve would generate different shapes, depending on its orientation over

the sheet (θ) (Figure 4). Following that principle, the 'Frustrate Material' tiles were designed with mandala-like patterns, all with radial organisation. The radial array of an identical cutting curve, was used to express the variety of shapes that form out of the same cutting curve, placed in different orientation: from cylinder-like shapes in either direction of the stretching (θ=0/90), to saddle-like or helical ones on the biais direction ((θ=45), with an identically repeating curve.

Geometry - (Armon, et al., 2011) have demonstrated both empirically and mathematically that strips cut on the biais orientation ((θ=45) demonstrate two different regimes: "narrow" strips that twist around a straight centreline, and "wide" strips that form helical configurations, as a cut out from a cylindrical envelope. The transition between narrow-strip and wide-strip behaviour was explored in the case study, through the variation of patterns in the tiles. Starting with a set of basic graphic elements that generated different shapes, we established a set of "building blocks", or "letters", with which an infinite variety of patterns could be composed.

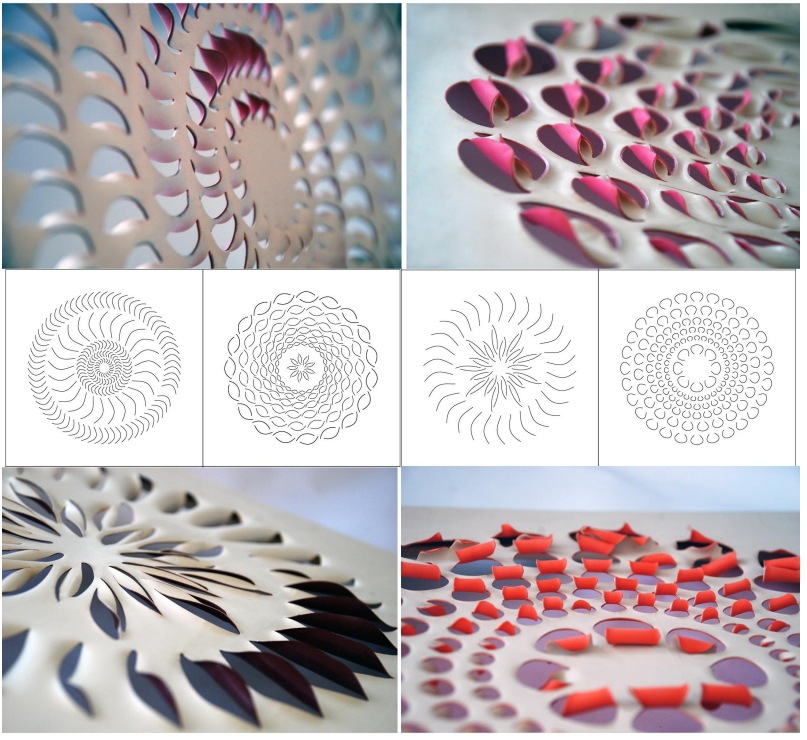

Figure 4 - Rotational patterns accentuating the effect of orientation on the surface over the resulting shape.

The rotational “mandalas”, along with the biological references of frustrated formation of leaves and petals, have led us to the theme of flowers as the visual concept for the tiles. The patterns were conceived with regards to a flower type (Dahlia, Sunflower, Carnation, Thorn, Chrysanthemum etc.) (Figure 6) planning its three-dimensional outcome by using the “building blocks” that we have established in earlier stages (Figure 5). ‘Frustrated Materials’ can be considered as one whole piece and at the same time as a series of tiles; it is a showcase for the scientific work, while being the seed for creative design exploration.

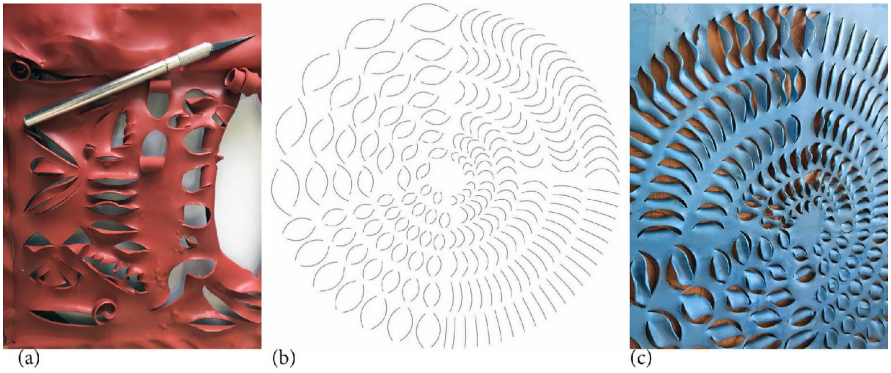

Figure 5. Developing patterns (a) manual cutting, creating a catalogue of ‘building blocks” (B) polar array of curves, developing rotational mandala, pattern (c) surface.

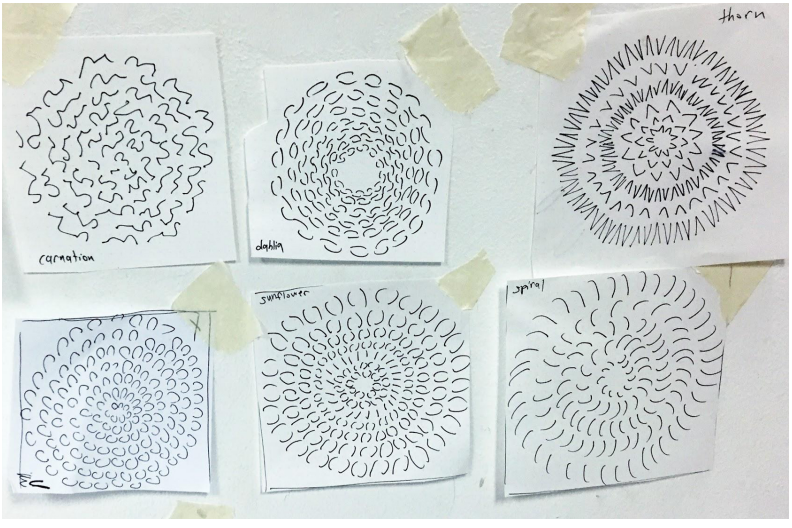

Figure 6. Drafting biologically inspired 'flower mandalas' as inspiration for digital design

3.2. Frustrated ceramics



Figure 7. Series of ceramic material exploration, seeking to accentuate displacement and curvature of the ceramic surface, observed as maximal Z value and minimum radius of curvature

'Frustrated Ceramics' is a series of material explorations that takes the case study of 'Frustrated Materials' as its starting point. Here too, frustration is induced in a bi-layer material, enhancing its natural properties. In the basic ceramic manufacturing process, from the humid chunk of matter (the 'ceramic body') to the accomplished, dry and brittle final stage of the artefact, firing and drying play an essential role. Gradually, water and humidity are released out of the ceramic body in the drying phase, to be then heated in a kiln to bring the clay-body to its full maturity. As moisture evaporates, clay particles come closer and closer together, and thus shrinkage occurs . Shrinkage is substantial in the firing process as well, as glass begins forming within the clay particles (platelets), filling cavities and voids, and reducing volume. The amount of shrinkage is affected by several factors such as type of clay, size clay particle, weight, proportions, size of piece exposure to air, and more. Radical differences in shrinkage within a single piece would lead to the build-up of internal stresses, and are therefore carefully avoided by ceramists, as these might lead to cracking (Reijnders & Centre, 2005).

Wishing to induce frustration in the ceramic material, we utilised the shrinkage phenomenon, inherent to the ceramic process. We combined two material types with

substantially different shrinkage rate, porcelain (Audrey 12.5% shrinkage) and stoneware (Terrazo Umbra, 7% shrinkage), bonded to act together as material of bi-layer architecture. The different shrinkage rates within the material introduce geometrical incompatibility (Figure 8) in the system, inducing residual stresses and resulting in large displacements. A flat bi-layered piece entering the kiln for drying and firing process, resulted in a three-dimensional ceramic form (Figure 8). While in the latex bilayer [see 3.1] the material was anisotropic, with directionality introduced by stretching, forming a surface of negative Gaussian curvature (anticlastic), the ceramic material is isotropic and incompatibility between the layers is uniform, forming a surface of positive Gaussian curvature (synclastic).



Figure 8. Flat rectangles of ceramic-body entering the kiln for drying and firing (b) resulting three-dimensional shape.

Aiming to achieve significant displacement to create morphology and maximum scale, series of samples were realised to identify the effect of different parameters over the resulting shape. Parameters related to the ceramic process, such as level of humidity of the ceramic body, positioning in the kiln and the drying-firing curve were examined for their effect over the resulting objects. Scientific principles were implemented through the exploration of geometric properties, such as thickness of the layers, width-length ratio of the element, curvature continuity of the two-dimensional contour and surface grooves, were varied to analyse their effect over the resulting form.

- **Minimal thickness -** similarly to the prior case study, here too the thickness directly affects the curvature obtained by the surface; the thicker the material, the shallower the curvature would be. However, compared to the latex, the wet clay is heavy and soft. This makes gravitation effects non-negligible. Gravity enters the scene, and should be taken into consideration, limiting the amount of curving of large samples. Therefore, we aimed at minimal thickness of the bilayer, within the possible range of the clay material (typically, 2-4 mm for each layer).
- '**Narrow ratio' - length to width -** In relation to the overall thickness and gravity, another geometrical consideration would be the ratio between the circumference and the surface area, i.e. the width to length ratio of the piece. The narrower the

piece, the smaller the frustration is; the conflict between lateral flatness and curvature is minimised. A more significant curvature in the long direction can take place, which is only weakly “resisted’ by the tendency to flatness of the in-plane geometry (the reference metric) (Figure 10). We therefore prioritized narrow and long geometries, to achieve significant morphologies.



Figure 9. From flat sheets to shaped ceramic, illustrating geometrical incompatibilities: the matching curves in the flat sheet transform to non-matching edges once frustration is in play.

- **Oscillating curvature** - A large number of shapes can correspond to the definition of long and narrow. We have noticed that the geometry of the contour of the shape affects the obtained curvature of the surface, and a clear preference was noted to outline curves that had oscillating curvature, forming a kind of S shape (Figure 11). While this behaviour was clearly observed in samples, its origin is still unclear from the theoretical point of view and is the subject of new mathematical and physical research at the lab these days.



Figure 10. Prioritising long and narrow shapes where lateral frustration is reduced, and significant curvature can take place in the long direction.

- **Introducing grooves** – Due to the isotropy of the ceramic material, the incompatibility within the ceramic surface is homogenous, hence restricting curving as mentioned above. In order to accentuate curving, we introduced directionality in the material through grooves in its stoneware layer, as this layer restricts the movement of the material (as a result of lower shrinkage rate) (Figure 11). Whether inspired by the mechanical reference of a hinge, or biological reference of fibres in the seed pod (see 2.1), the grooves enable movement on the perpendicular direction to the groove, and thus accentuate the curving on this direction.



Figure 11. Oscillating curvature of two-dimensional contour curve creates significant displacement in resulting surface. Grooves on the terrazzo layer enable additional displacement and curvature.

4. Discussion

This paper presents the implementation of frustrated materials as an alternative approach to design and fabrication, through two case studies, in ceramics and soft materials. Although the principle of materials frustration is common in biological systems, known and understood by scientists, it has not yet been introduced to designers as a possible means of creation. By working from the materials' properties, this proposed approach could come as an alternative to the efforts invested in shape generation, creating form becomes simple through a reverse engineering process, once leaning on scientific knowledge. This approach brings new players into the design process: the material becomes active and sometimes surprising and the designer, who works closely with the scientist, no longer forms it alone. Therefore, there is a need for mapping and reorganisation of the design process, which may lead to an alternative methodology and even a new role for designers.

Making by material frustration, suggests a new form of manufacturing. Rather than technological advances it enhances material inherent capacities. Free from moulds, manual labour or new technologies, it suggests an alternative forming process, offering freedom of shape and opening new morphological horizons as well as a detour to serial production. In ceramics, as explored in the second case study, material frustration suggests an alternative to traditional form-making of vessels and may lead to more sustainable possibilities of manufacturing by reducing excessive labour, large quantities and stock.

By reflecting on these two different projects, materials frustration for design may be analysed further in order to outline an alternative design methodology. Frustration may also offer new capabilities for traditional materials. In latex, for example, by generating frustration, structure was introduced to a flat, isotropic, structureless material, thus enabling the material autonomy. Further investigation in the potential of frustrated materials in design could open more possibilities for innovation in materials yet to be explored, such as glass, wood, metals and more.

For designers, utilising frustration in materials requires a shift of control: taking a step back from the drawing board or computer screen and enabling the material properties to lead the way. Following hands-on materials experimentation and research, the design potential of the materials' behaviour may be analysed and later translated for further development - as a bottom-up strategy for design. This strategy not only affects manufacturing methods but may also hold potential for creating original shapes and forms, difficult to foresee or plan in standard approaches. Here, the material is no longer a passive matter which reflects exactly the designer's ambitions. Therefore, this proposed method impacts the role of the designer who should embrace a flexible mindset and reflexive attitude while gaining knowledge of the frustrated material's behaviour, which is sometimes surprising, unexpected and even difficult to understand. A third party, the physicist, can be joined as someone who understands the materials' frustration (knows the principles of the theory of incompatible elastic sheets) and can help the designer with his/her interaction with the material. Once understanding the qualities of the material, the designer may strategically intervene in the process in order to exploit the frustration for the desired results. In the process described in these two case studies, the designer may be seen as an agent, connecting between different partners: expert, materials and tools, to explore innovative ways of making.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Material culture(s). Research paths in an evolving material design culture, and the connected future designer's attitudes

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Abstract | This contribution will investigate how material design culture is evolving: in fact, as designers, we can choose materials taking into account their variety during the design process, as well as design them. The article, through the analysis of a first exploration of just some of the most active and innovative academic case-study laboratories, in which tests and experiments on innovative materials for design are performed, will highlight the most recent research directions covered by designers in the new materials world: growing and living materials, DIY materials, active materials, materials in the circular economy, manufacturing processes applied to innovative fields and innovative ancient materials, rediscovered from the past and re-launched in the next future will be discussed. Those trends will be investigated to outline the directions of designer's and research group's activities and their new attitudes on the topic.

DESIGN BOUNDARIES; MATERIALS EXPERIENCE; MANUFACTURING PROCESSES; MATERIAL DRIVEN DESIGN; MATERIAL ACTIVISM

1. Expanding the horizon of the materials for design

Materials, as underlined by many authors (Ashby, Johnson 2009; Karana, Pedgley, Rognoli 2014; Karana et al. 2015; Miodownik 2014), are the essence of what matters just as the choices made by the designer when contriving conscious products. Expanding the horizon of research and experimentation activities that designers constantly perform, some emerging phenomena can be highlighted within the wide world of materials for contemporary design dictated by the hybridization between different disciplines, from the birth of a "scenario founded on the collaboration between design and science" (Ito 2016; Langella 2019) and also from the changes that the production processes have undergone, thanks to the evolution of some specific technologies: the researches on materials for design are as wide as ever and offer a broad spectrum of opportunities for achieving new material experiences in design (Karana et al. 2019). This contribution will investigate how material design culture is evolving: in fact, as designers, we can choose and feel materials taking into account their variety during the design process, as well as design themselves.

In recent years, the value of craftsmanship has grown significantly: this revaluation and re-flourishing of craftsmanship (Bardzell et al. 2012), or of those who have a deep connection with the material world and can "dominate a dialogue between knowledge abstract and practical", is parallel to the spread of the maker (and Fab Labs) phenomenon who, according to Richard Sennet (2013) responds to the need (of many designers) to regain possession of the surrounding world through an active experience, a material comparison with it (Miceli 2012).

Hard experimentations, biological methods and systems found in nature are applied to the study and design of engineering systems and modern technology: these are examples of how designers and other experts in different disciplines can collaborate to transform the matter and modify it at will: Synthetic Biology and Living Technologies are some of the disciplines in which man tries to produce “natural” materials and to face some of the key sustainable challenges of the 21st century.

On the other hand, the experiments in the families of DIY (Do It Yourself), cooked materials and open materials are characterized by subtle and labile boundaries: according to the principles of molecular gastronomy and alchemy (but also of botany and biology), today’s designers are able to produce new materials for the project through new or renewed processes starting from industrial production waste, materials from plant sources (plants and fungi), animal sources and bacteria, traditional materials, such as wood or stone, and many others.

3D printing latest interesting frontiers go beyond the traditional 3D printing process: experiments have been carried out with food, ceramic and stone materials, but also for architectural fabrication. Sugar, waste polymers, flexible elastomers, organic mixtures, stone or glass can all be 3D-printed, thanks to a consolidated and renewed technology, by the use of new materials for the production process. And thanks to this technology and other

production and design processes, defined and cared for by interventions and design, they give a new shape to traditional materials and ancient arts.

Materials from the past, from local and ancient traditions are becoming more and more new future materials: an archaic material library that is still not set, should instead be conceived in the next future in Politecnico di Torino, investigating the ancient natural resources, artefacts and everyday practices of a specific area. Materials and cultural heritage, the core essence of typical territories that are disappearing or that have been forgotten by time, could be oriented to innovative and speculative further design developments.

2. Today's places of experimentation: the laboratories

In a new, more blurred vision of disciplinary boundaries, known as “The Age of Entanglement” (Oxman, 2016), the point of view changes: the focus of the materials designers – including that of manufacturers – is no longer primarily oriented towards the final application, but is increasingly curiosity-driven, i.e. guided by the pure and simple curiosity of researching, experimenting and observing the material.

The gym in which designers increasingly test the crossroads of knowledge in the matter of materials for design is represented by experiences gained during graduation theses and PhDs or – in the case of in-house designers – during their continuing education outside the company, working in interdisciplinary laboratories within universities or experimenting during workshops and summer/winter schools in close contact with artists, scientists and professionals in various fields. The research tools change too: books and scientific journals are abandoned and ecomuseums, pots and pans and microscopes are rediscovered, along with waste deposits and blogs. The following overview represents a first exploration of just some of the most active and innovative academic case-study laboratories, in which tests and experiments on innovative materials for design are performed. A selection of the most up-to-date laboratories is presented with a brief description that leaves room for the original presentation words of the team, accompanying it with the university or research body that hosts it, the country of origin, the name of the laboratory coordinator and the website, for further investigations, and a short overview on the originality of each approach.

2.1 Hybrid Design Lab

Università degli Studi della Campania “Luigi Vanvitelli”, Naples (Italy) [Prof. Carla Langella]

> “Hybrid Design Lab is a research, design, and teaching laboratory geared towards testing the relationship between design and science. The lab is oriented to experience the opportunity to integrate advanced research, teaching and production through science-inspired design. One of the main objectives is to transfer the theoretical and experimental research in the areas of biological sciences, new materials and new technologies, to the design dimension of the sustainable

> innovation of products and services. The ability to spread through common products, and preferably daily, new knowledge and sensitivity on the environment, human health and on social equity, offers new prospects for real and tangible improvement of quality of life and growth of awareness, precisely because based on large numbers and, therefore, a large impact. The HDL is based on the integrated processes that underlie the life of biological systems and the balance of their ecosystems. Birth, life, death and re-integration in the natural cycles become references to proposal design production, process and strategies for the recovery of resources, innovative, yet environmentally and socially sustainable."
>
> (http://www.hybriddesignlab.org/, accessed on February 13th 2020)

In Hybrid Design Lab, the original approach arises from the new and unprecedented prospects of *intersection between scientific knowledge and design culture*.

2.2 MakeGrowLab

Puławy (Poland) [Dr. Roza Janusz and Dr. Josh Brito]

> "The project began with one question: What if we could grow materials instead of making them and at the end of their cycle, use it as fertilizer which would then be used to continue the cycle of a biological production system? The MakeGrowLab now consults, designs and produces bio-materials for mission-driven companies. The goal is to mimic the symbiotic processes of nature, to not pollute the environment but enrich it instead. They aim for The Biorevolution Movement - to fuse science with design, to create a fully circular production of local, sustainable materials and spread it around the world. The inspiration derives from the symbiotic processes of nature, specifically the life-cycle of plants, where there is no waste and everything is recycled. Since 2019 the team is growing with Future Farmers from different backgrounds but with the same goal: to spread The Biorevolution."
>
> (https://www.makegrowlab.com/, accessed on February 13th 2020)

The MakeGrowLab key-element of innovation is *thinking the material as a living element*, able to born, grow, live and die, exactly like any other living beings.

2.3 Design and Living Systems Lab

Central Saint Martins, University of the Arts London, London (United Kingdom) [Prof. Carole Collet]

> "The Design and Living Systems Lab is a pioneering research laboratory that explores the interface of biological sciences and design to challenge established paradigms and envision new sustainable materials and forms of production for the future. The Lab explores a new hierarchy of relationships with the 'living' where designers operate within a sliding scale of a 'natural nature' and a new 'programmable nature' in the quest for innovative ecological design and fabrication models. The main objective is to explore biological sciences through design to grow new design

> propositions that could facilitate the transition to the 'one planet living' horizon 2050. Not only we are beginning to explore the advantage of biological systems in terms of zero waste, minimum use of energy and materials, but with synthetic biology, scientists have developed means to bio fabricate like 'Nature' does. We can program and engineer living organisms to grow tailored materials. Such extraordinary tools can trigger a paradigm shift in terms of design and manufacture for the future."
>
> (http://www.designandlivingsystems.com, accessed on February 13th 2020)

In the Design and Living Systems Lab design is seen as a *proposer of innovative fabrication models*, able to set potential speculative scenarios.

2.4 Mediated Matter

MIT Media Lab, Boston (U.S.A.) [Prof. Neri Oxman]

> "The Mediated Matter group focuses on Nature-inspired Design and Design-inspired Nature. It conducts research at the intersection of computational design, digital fabrication, materials science and synthetic biology and apply that knowledge to design across scales from the micro scale to the building scale. They create biologically inspired and engineered design fabrication tools and technologies and structures aiming to enhance the relation between natural and man-made environments. The research area, entitled Material Ecology, integrates computational form-finding strategies with biologically inspired fabrication. This design approach enables the mediation between objects and environment; between humans and objects; and between humans and environment. The goal is to enhance the relation between natural and man-made environments by achieving high degrees of design customization and versatility, environmental performance integration and material efficiency. The group seeks to establish new forms of design and novel processes of material practice at the intersection of computer science, material engineering, design and ecology, with broad applications across multiple scales."
>
> (https://mediatedmattergroup.com/, accessed on February 13th 2020)

In the Mediated Matter group, a step back to *natural processes intertwined with current production processes* informs the new Material Ecology culture.

2.5 [MI] - Material Incubator

Centre of Applied Research for Art, Design and Technology (CARADT), 's-Hertogenbosch (The Netherlands) [Prof. Elvin Karana]

> "Material Incubator is a creative research lab that explores the potentials of materials from living organisms for an alternative notion of the everyday.
>
> Bringing together researchers and practitioners from different schools, Material Incubator [MI] encourages tangible interactions with the living organisms, such as

> algae, fungi, plants and bacteria, to explore and understand their unique qualities and constraints through diverse technical and creative methods taking artists, designers and scientists as equal and active partners in the material creation. The core research team of the MI includes artists and product designers specialised in bio-design, (digital) storytellers and micro-biologists.
>
> In exploring and designing for an alternative notion of the everyday from materials from living organisms, the [MI] researchers ground on the theory of Materials Experience, which suggests that whilst our experience with an artefact may originate from - or be moderated by - a wide variety of sources, one of the prominent sources is its physical reality, i.e., its material(s)."
>
> (https://www.materialincubator.com/about, accessed on February 13th 2020)

Material Incubator [MI] sets its original approach on a *co-creation process between different expertise*, within whom the design is a participant of the co-creation, and the new matter is the possible output.

2.6 Self-Assembly Lab

MIT's International Design Center, Boston (U.S.A.) [Prof. Skylar Tibbits]

> "The Self-Assembly Lab is a research lab at MIT inventing self-assembly and programmable material technologies. Self-Assembly is a process by which disordered parts build an ordered structure through only local interaction. In self-assembling systems, individual parts move towards a final state, whereas in self-organizing systems, components move between multiple states, oscillate and may never come to rest in a final configuration. The Self-Assembly Lab is located in MIT's International Design Center, a cross-disciplinary design research centre. The Singapore University of Technology and Design was established in collaboration with MIT to advance knowledge and nurture technically grounded leaders and innovators to serve societal needs. This will be accomplished, with a focus on Design, through an integrated multi-disciplinary curriculum and multi-disciplinary research."
>
> (https://selfassemblylab.mit.edu/about, accessed on February 13th 2020)

In the Self-Assembly Lab the *design process is informed by mathematics, physics, robotics and digital technologies*, following a "techno-creative" approach.

2.7 Material Experience Lab

Technische Universiteit Delft (TU Delft), Delft (The Netherlands) and Politecnico di Milano, Milan (Italy) [Prof. Elvin Karana and Prof. Valentina Rognoli]

> "Materials Experience Lab is a cross country research group bringing together researchers/practitioners who introduces unique ways of understanding and designing (with) materials to radically change and enhance the relationship people have with materials and artefacts. The lab introduces unique ways of understanding and designing (with) materials by combining research methods, techniques, and

> tools from product design, social sciences, materials science, and engineering. The term 'materials experience' describes the holistic view of materials in design, emphasising the role of materials as simultaneously technical and experiential. In most of the research activities, the Materials Experience Lab combines interpretive and empirical research techniques in a unique iterative manner, actively promoting a Do-It-Yourself (DIY) approach to materials that pushes the boundaries of material (driven) design. The DIY approach to materials brings people and materials closer in the making, promoting further consideration of contexts and time in designing, making, and use, greater awareness of the resources required, greater agency for working with materials, all of which leads to novel design outcomes."
>
> (http://materialsexperiencelab.com, accessed on February 13th 2020)

In the Materials Experience Lab, the *direct experience of the matter* is the key point of the new materials development, with a "creating-by-doing" approach.

2.8 Institute of Making

University College London (UCL), London (United Kingdom) [Prof. Zoe Laughlin and Prof. Mark Miodownik]

> "The Institute of Making is a multidisciplinary research club for those interested in the made world. The mission is to provide all makers with a creative home in which to innovate, contemplate and understand all aspects of materials and an inspiring place to explore their relationship to making. At the heart of the Institute of Making is the Materials Library – a growing repository of some of the most extraordinary materials on earth, gathered together for their ability to fire the imagination and advance conceptualisation. A place in which makers from all disciplines at UCL can see, touch, research and discuss, so that they can apply this knowledge and experience to their own practice. Alongside the collection is the Makespace – a workshop where members and guests can make, break, design and combine both advanced and traditional tools, techniques and materials. The facility brings together equipment, expertise and perspectives of making from a wide range of disciplines, encouraging users to engage in the craft, design, technology, history, philosophy, art and engineering of making."
>
> (https://www.instituteofmaking.org.uk/, accessed on February 13th 2020)

The original approach at the Institute of Making lies on a *makers community*, in which the exchange of knowledge between peers is fundamental for generating new know-hows.

2.9 Material Design Lab

KEA - Copenhagen School of Design and Technology, Copenhagen (Denmark)

> "Material Design Lab consists of The Box, The Lab and The Library. The Box is a walk-in expandable box that contains an exhibition of raw materials. It is the starting point to a basic understanding of the 'raw ingredients' before they are processed and

mixed. The Lab itself is the heart of Material Design Lab and resembles a hybrid between a design prototyping workshop, a scientific laboratory and an industrial kitchen. It is a space designed for materials to be tested, manipulated, refined and potentially, for new ones to be created. The library is the Material ConneXion Copenhagen collection containing 1500 material samples, as well as access to the online database providing detailed information on over 7500 materials. The library also holds a wide range of books on materials relating to design and architecture."

(http://materialdesignlab.dk/, accessed on February 13th 2020)

Understanding and knowing the raw materials that are at the basis of the materials that we experience every day is the original approach at the Material Design Lab.

2.10 LAMA - Ancient Materials Analysis Laboratory

IUAV University, Venice (Italy) [Prof. Fabrizio Antonelli]

"The Ancient Materials Analysis Laboratory was created in 1993, with the aim of carrying out didactic, research and service activities for third parties in the field of stone and lithic materials used in ancient times. The extraordinary technological development of the last few years has made science previously unthinkable progress, and therefore also the acquisition of a large mass of data on the historical-artistic materials of cultural heritage in general, data that are of significant interest for the characterization, dating and conservation of the cultural heritage itself. The institutionalization of the above teachings, as well as archeometry, geoarchaeology, and various other disciplines such as chemistry or physics applied to conservation science, as well as the creation of associations and specialized journals, among other things with specific tasks promotional, has finally positively changed the national panorama in this sector of applied sciences."

(http://www.iuav.it/SISTEMA-DE/Laboratori3/, accessed on February 13th 2020)

A reference to the *materials of the past to understand the materials of today* is the key point to the approach of the Ancient Materials Analysis Laboratory.

2.11 Wearable Technology Lab

University of Minnesota, St. Paul, MN (USA) [Prof. Lucy Dunne]

"The Wearable Technology Lab (WTL) is an interdisciplinary research laboratory founded in 2009. WTL research focuses on the intersection between apparel and new technology: for instance, in expanding garment functionality through dynamic geometry and new sensing functions; in improving the way we use, manage, and consume clothing; and in streamlining the design and manufacturing processes of smart clothing and e-textile products. New technology opens new frontiers in understanding the human body, mind, and capability through pervasive sensing, actuation, and interaction. Many projects deal with translating technological potential into the real, everyday world: understanding human physical and

> emotional comfort and balancing these variables with trade-offs of performance variables in a smart system design."
>
> (https://wtl.design.umn.edu/, accessed on February 14th 2020)

The *intersection between new materials, new technologies and the world of wearables* is the meeting point of the Wearable Technology Lab, where new intelligent and active "skins" are conceived.

2.12 Smart Textile Design Lab

Swedish School of Textiles, University of Borås, Borås (Sweden)

> "At the Swedish School of Textiles creativity and theory are combined with practical work in several machine parks and laboratories. The unique with the educational programmes is that students and researchers have the opportunity to work with the entire process, from hand knitting machines to advanced 3D techniques, from hand weaving to effective weaving machines. Students and researchers also have the opportunity to elaborate with colours and different types of coatings in the colour lab, to use pattern construction the traditional way or use the latest computer programmes. The well-equipped sewing room gives almost unlimited possibilities. The Smart Textile Design Lab turns textile traditions and materiality upside down; the researchers develop, explore, and experiment with new expressions for textiles through the use of various technologies and textile techniques."
>
> (https://stdl.se, accessed on February 14th 2020)

The process, from dyeing to knitting to sewing, is the main core of the Smart Textile Design Lab, where *innovation is the reinterpretation of traditional and well-established techniques and processes*.

As already introduced, this overview doesn't want to be exhaustive, it rather outlines how the matter of material design is evolving in new material design cultures, thanks to the collaboration with different disciplines and know-hows, and new approaches, producing heterogeneous materials belonging to some possible clustered trends.

3. The consequent new material design cultures

The article, through the analysis of substantial case studies of the most recent and academic laboratories, in which innovative materials for design are tested and developed, highlights the most recent occurrences and research directions covered by designers in the new materials world: materials in the circular economy (i.e. from circular materials to urban mining); growing and living materials; DIY (i.e. Do-It-Yourself) materials and material tinkering approach; manufacturing processes such as 3D printing applied to innovative fields

(e.g. food, stone, architecture, etc.); innovative ancient materials, rediscovered from the past and re-launched in the next future.

It should be pointed out how designers feel the need to "compose, modify, transform, and self-produce their own materials" (Rognoli, Ayala 2018), by using ancient materials and new technologies, by modifying traditional materials, waste materials, bacteria, vegetables (see Figure 1)(Karana et al. 2019; Ayala-Garcia, Rognoli, Karana 2017).



Figure 1. Biolace, Carole Collet.

For example, Blood Related (Figure 2) is a material that uses waste materials, a zero kilometre, for the production of new raw materials. Awarded at the Dutch Design Week in 2018, it is a compound material, printable like plastic, selected by dried and pressed cow blood: waste from the meat and livestock industry, they become raw materials and we are asked about the limits of what can be transformed and be matter. Moreover, as underlined in the introduction, designers, alchemists and cooks experiment the production of self-produced materials from vegetable sources: the principles of molecular gastronomy and methods, the techniques of self-production, individual or collective, are the tools for the creation of new democratic materials, accessible and with a low technological impact (Rognoli, Ayala 2018; Rognoli et al. 2015; Rognoli, Ayala, Parisi 2016a; 2016b; Parisi, Rognoli, Sonneveld 2017). On the other hand, the materials grow and transform themselves within laboratories (Figure 3): “we can grow all kinds of structures using living organisms, from foams that can replace plastics in footwear, to leather-like materials without animals. Furniture, flooring all are currently being prototyped. Fungi are able to grow materials that are naturally fire retardant, without any chemicals” (Lee 2019).



Figure 2. Blood Related, Basse Stittgen.



Figure 3. Packaging film from bacteria, MakeGrowLab.

While many of these activities are currently conducted on an experimental and extemporary basis, this does not mean that the approaches to research are not based on a solid scientific framework. Exploring the way that other professionals work and trying to "tune in" with their skills, sometimes borrowing their methods, helps not only material designers but also manufacturers to break free from prefabricated schemes, pursuing new currents and new avenues of research. The new figure of the materials designer is therefore more and more

outlined by ephemeral and blurred “boundaries”, coherently with the contemporary Design condition: in those laboratories, the designer turns himself into new professionals characterised by a hybrid knowledge, driven form different know-hows. We can therefore discover a “designer-maker”, a “designer-archaeologist”, a “designer-biologist”, a “designer-detective” and a “designer-alchemist”, following the latest materials culture trends (De Giorgi, Lerma, Dal Palù 2020). These and other emerging issues coming from the materials design culture are currently investigated by the authors of the present contribution.

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Acknowledgements: Special thanks go to those who have made an extensive contribution to the development of MATto, the Material library of Politecnico di Torino, and the advisory services provided to local businesses, as well as to all the companies and participants who have used the services and provided inspiration to further the research.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Mind-mapping in design culture: A tool for ideation in graphic design education?

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Abstract | This study focuses on mind-maps as an aspect of design culture – the conventions and practices adopted by a community of designers. The research aims to work towards establishing the effectiveness of mind-maps as a tool for ideation. It questions the extent to which mind-maps enable students to break away from the cultural frames evoked by design briefs in order for creative cross-space associations to occur. By comparing mind-map-like diagrams produced by nine undergraduate students with codes emerging from the analysis of the corresponding briefs, the study seeks to answer the question: What levels of cross-space mapping are evident in the knowledge representation diagrams produced as part of an undergraduate graphic design, practice-based project? The study found 301 cases of internal linking, as opposed to 23 instances of cross-space mapping, however it concludes that there is value in knowledge representation diagrams for ideation and makes recommendations for their use.

KEYWORDS | MIND MAPS, CREATIVITY, KNOWLEDGE REPRESENTATION, FRAME THEORY, CONCEPTUAL BLENDING

1. Context.

As lecturers, both researchers worked on the BA(Hons) Graphic Design course at the Arts University Bournemouth. The project grew out of a conversation in which we both expressed a scepticism with regard to the value of mind-mapping as a method for ideation. Despite our scepticism, it was noticeable that mind-mapping was a feature of many students' work. We questioned whether this practice had become part of a "project culture" or "la cultura di progetto" (Julier, 2004, p.6) instilled through prior educational experience. Conversely, there are claims for the facility of Mind Maps™ and concept maps in the literature. Novak and Gowin (1984, p.17) state that, "concept mapping may be a creative activity and may help to foster creativity". Whereas Buzan and Buzan (2010, p.93) include being "able to create new associations from existing ideas" as a key feature of Mind Maps™.

The students' use of mind-mapping, together with such claims above, raised questions: were we undervaluing the usefulness of mind-mapping? What value did students attribute to this method? Or more simply, "What's happening here?" (Glaser, 1978).

Our conversations occurred during the assessment of fifteen submissions that were later entered for the International Society of Typographic Designers Student Assessment Scheme. These provided the sample for the research, the ISTD briefs were also included as data. Prior (cited in Charmaz (2014, p.45), notes how researchers can address what documents *do* as well as what they *contain*. These mind-maps, as part of the unit submission, and in relation to the ISTD scheme, are assessed. We should therefore acknowledge that what the mind-maps might do is present a systematic and smooth process of development in order to acquire marks. Another possibility is that they do little but are used unthinkingly; replicating previously instilled behaviour (Martin, 2006, p.262). In contrast however, there are numerous possible explanations for what mind-maps might legitimately do within a design task, including:

1. To develop lines of enquiry.
2. To scope a field of study.
3. To capture what the student already knows about the topic.
4. To break down and categorize complex words and phrases.
5. To make creative leaps.

Although students referred to their knowledge representations as "mind-maps", they are not Mind Maps™ as described by Buzan (2010). The students' diagrams did not follow the procedures advocated by Buzan (2010) in relation to Mind Maps™, or by Novak and Cañas (2006) in relation to concept maps. This project therefore analyses practices of knowledge representation as presented by undergraduate students rather than ideal examples from the literature.

The research was initially motivated by a wish to understand the reason *why* students engage with mind-mapping. A Grounded Theory, data first approach therefore seemed appropriate where concepts could emerge from the data itself. The question slowly turned

however, through the open coding stage, to questions about *what* kinds of knowledge were being used and the nature of the links made. Did these links resemble creative leaps or a more mundane filling in of the territory defined by the project brief?

2. Open coding stage

The open coding strategy follows Corbin and Strauss (2008, p.160) who describe a three-stage process, involving breaking "data into manageable pieces"; "interpreting those data"; and giving the pieces of data names that stand for the ideas they contain.

Coding schemes in the literature, are frequently based on interview transcripts (Charmaz 2014). These are essentially monomodal; using character strings to capture vocalisations stripped of intonation, physical gestures, and expressions. In contrast, the mind-maps which in part comprise the data for this project, are multimodal: involving multiple kinds of communicative resources. In the open coding phase, three different issues arose out of the dissimilarity between the coding of interview transcripts and mind-maps.

2.1 Units of analysis

The first difference involves the breaking down of data into units of analysis. In relation to interview transcripts, Charmaz (2014, p.127) lists the following: "Word-by-word, line-by-line, segment-by-segment, and incident-with-incident". This repertoire of units is not sufficient to engage with mind-maps as data. Meanings attributed to mind-maps are also mediated by such things as placement, and scale, and depend on more dynamic spatial relationships with other network elements. Figure 1a is a schematic version of the first mind-map analysed, this is abstracted further in Figure 1b. A range of different supplementary structures are defined below:

- There are individual *elements.*
- Elements are connected by *paths*.
- Two elements connected by a path make a *binary construction*.
- *Branches* are built out of one or more binary constructions.
- There is an element in the centre of the mind-map from which branches radiate, this is the *central node*.
- Paths can have a *direction,* for example moving from the centre to the periphery of the mind-map (indicated by arrows in the data).
- Binary constructions have an *inner element* closer to the centre of the mind-map and an *outer element* further from it.
- All of the elements at the same remove from the central node are referred to as being on the same *orbital*.
- All of the elements connected to one radial element are referred to as a *radial sub-network*.

- Elements not connected by a path to any other element are referred to as *radical elements*.
- *Links* are paths that link an element in one branch to an element in a different branch.

Figure 1a

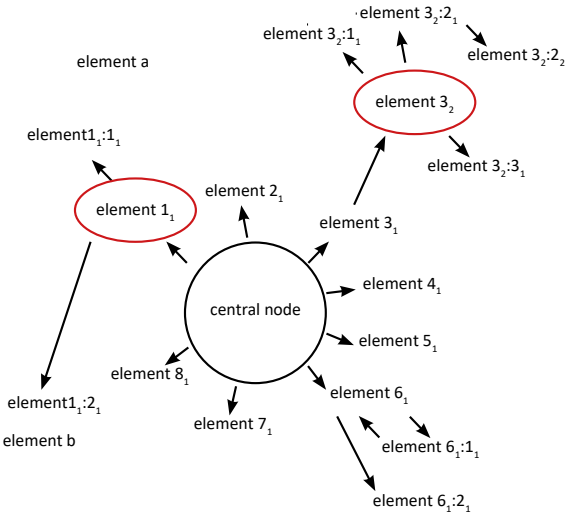

Figure1b

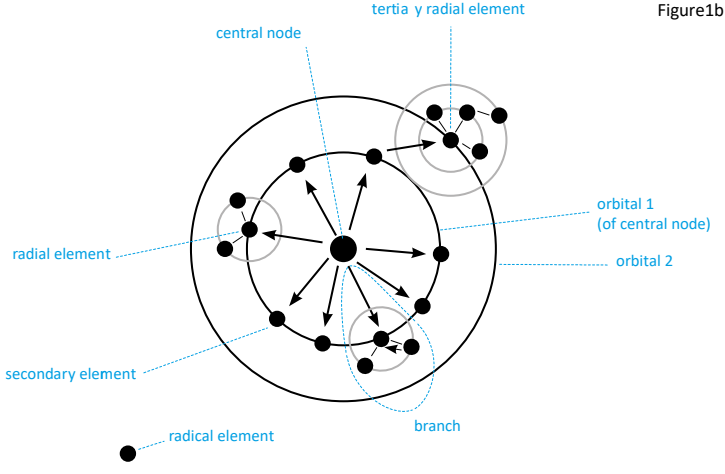

Figure 1.

In the open coding stage, it became apparent that patterns in the data are manifest in these additional units of analysis: different categories are often represented as branches for example. A focus emerged based on the links between elements. The binary construction provided the basic unit of analysis in the subsequent coding.

2.2 Reading paths

The second dissimilarity between data types arises from interview transcripts unfolding chronologically. This translates spatially into written text where each line reads from left to right, and each column from top to bottom. This same logic however does not apply to mind-maps which have any number of branches that can be read in any order.

2.3 Topics addressed by data

The topics explored in interviews are in many cases the focus of the researcher too. However, the topics explored by students in these mind-maps are not the primary focus, but rather, the relationships established by linking topics – whether the relationships are categorical or cause/effect for instance. It is at this more generalised level of analysis that we can begin to form inferences about the originality of the connections made between topics.

2.4 Coding Procedure

The coding procedure entailed starting at the central node and then moving out along one branch toward the periphery, this was then repeated for each branch. Branches included different kinds of links: chronological, categorical, etc. But these different connections frequently linked concepts directly related to the brief. This quality of the mind-maps – to remain categorically related to the central node – was emphasised when links were made to elements not circumscribed by the brief, and these appeared to be far fewer in number. This observation in the first round of coding led to the study focus, and two core concepts: *internal linking* and *cross-space mapping*.

3. Core categories: internal linking and cross-space mapping

As the first round of coding progressed it was noticeable that there were different levels of creativity in terms of the links made. One aspect of this concerned categorisation; if the outer-element was a sub-category of the inner-element this suggested a logical, straightforward association. If on the other hand, the outer-element belonged to a different category far removed from the inner-element, then this suggested a more creative association. The researchers were familiar with: conceptual blending theory (Fauconnier 1994; Fauconnier and Turner 2002), and frame semantics (Fillmore 2006), and recognised that these theories could provide useful conceptual tools for analysing the links between elements in mind-maps. Two concepts in particular were utilised: *mental spaces* and *frames*.

Mental spaces are constructed in the moment, as we think, for purposes of understanding. They are, "interconnected in working memory, can be modified dynamically as thought and discourse unfold" (Fauconnier and Turner, 2002, p.102). Many spaces can be active simultaneously enabling us to capture useful information from long-term memory and link them together in various ways.

The idea of a frame in Fillmore's theory is that words attain their meaning through the relationship they have to a structured conceptual setting. The often-cited example is the commercial event frame (Fillmore, 2006, p.378). Here a word such as "sell" is understood because of its relationship to other words such as "buy" and "seller" in the same conceptual setting.

Mental spaces can recruit elements from different frames, and whole spaces can be organised by a frame: whereby every element in the space is organised with reference to one conceptual setting.

The assumption in this article is that, within design culture, there is a familiar frame for a "brief" Although each brief is unique, there are recurring features in the way briefs are written. Analysis of the ISTD brief data yielded such recurring features (Figure 2a). Decisions about framing were not based on linguistic analysis, but on introspective reflection.

Each of these features – using the terminology of cognitive linguistics (Coulson 2001, p.19) – are *slots* that can be *filled* differently according to the brief concerned. Encountering a brief will prompt the construction of a mental space in which these slots are filled by elements. Though different elements can come from different conceptual frames they are still organised by the brief frame. We therefore think about them in terms of how they participate within the context of a brief.

An illustration is probably useful at this point. One generic feature of the brief frame listed in Figure 2a is *meanings to communicate* and such meanings can be tightly or loosely defined. The *Anniversaries* brief requires the communication of meanings about anniversaries and "Anniversaries" is therefore a filler for the slot *meanings to communicate.* Different students took this "anniversaries" filler and interpreted it at a more specific level. One, for example, focused on alcoholic spirits which introduces another frame (but this time not an organising frame): *making alcoholic spirits*. In this case, the alcoholic spirit is a cognac ready to drink on its 100th anniversary. This processing involves the construction of a mental space organised by the brief frame. The brief frame recruits those elements from the *making alcoholic spirits* frame that are relevant to the *Anniversaries* filler.

As the illustration below demonstrates there were different levels of generalisation amongst the codes emerging from the brief data. The mind-map data codes also showed different levels of generalisation, corresponding to those of the brief data (Figure 2b).

Figure 2a. Recurring codes from the brief data. All of these are potential fillers for the slot at level 3 of figure 2b.

Elements of brief frame
the product to be designed,
the audience or user,
the design problem,
the social and cultural context,
desired outcomes (deliverables),
technical and/or commercial constraints,
meanings to communicate (propositions),
tone of voice

Figure 2b. Hierarchy of different levels of frame components.

Level	Frame component	Potential instantiations of frame component	Level of generalisation
1	Frame:	Brief	High
2	Sub-frame of brief frame:	ISTD Anniversaries Brief	
3	Element of brief frame (slot): -part of frame	For example, meanings to communicate	
4	Type of meaning to communicate (filler): -part of sub-frame	For example, anniversary	
5 and below	Specific meaning to communicate: -student's response to Anniversaries Brief	For example, 100 year old cognac	Low

ISTD Brief	The 'potential meanings to communicate' element of the brief frame
Anniversaries	Anniversary, plants ('roots' used metaphorically to suggest the start of something), cyclical nature of the universe, typography.
Writing women into history	Recognising achievement, fields of endeavour, history, sexual equality, typography.
Mark my words	Abundance of language, language accretion, word history (including etymology), typography.
Food for thought	Analysing societies, distribution of dishes, history, food preparation, representation, typography.

Figure 2c. Different types of meaning to communicate as indicated by the ISTD briefs. All of these are potential fillers for the slot at level 4 of figure 2b.

Figure 2.

All of the codes in Figure 2a are potential fillers for the level 3 slot "Elements of the brief frame" in Figure 2b. The codes from the brief data related to level 4 of Figure 2b (the type of meaning to communicate) are listed in Figure 2c.

This conceptual framework of mental spaces, and frames, is used to distinguish between links that stay within the territory delineated by the brief, and those that connect to other outside elements. It is questionable as to whether it is desirable to be completely confined to the space delineated by a brief. While the brief's aims, and specifications cannot be ignored, designers often use other means such as metaphorical expressions to communicate which can involve two organising frames. Within mind-mapping this can be indicated by including two central nodes in the mind-map and by making links between these two networks.

The importance of making links to different domains is recognised by Novak and Cañas (2008) in relation to concept maps, and in "double-scope networks" described by conceptual blending theory (Fauconnier and Turner, 2002, p.340).

The idea of relating concepts from two separate and distinct domains unites the concept of *cross-space mapping* – that emerged in this study- – with: *transfer recall (*Guilford, 1967, p.214)*, bisociation* (Koestler, 1964, p.35) and *cross-domain transfer* (Pereira, 2007, p.3), described in theories of creativity. These are all forms of what Guilford (1967) termed *divergent production*. Furthermore, according to Pereira (2007, p.29) *convergent production* is also linked to creativity, if this is understood as the "creation of a *novel* and *useful* product" (emphasis in the original). Here, divergent processes provide novelty while convergent processes provide usefulness.

We should not be too dismissive of working entirely with the conceptual elements circumscribed by the brief. As we have said this mental space will contain elements from different conceptual domains and it is possible to make metaphorical or counterfactual links between these also. In mind-maps this can be represented by making links between the different branches of the mind-map.

Just as c*ross-space mapping* loosely corresponds to aspects of divergent production, *internal linking* – which concerns associations made within one mental space – suggests convergent production. The twin aspects of convergent and divergent production that are a prominent feature of theories of creativity are therefore supported by the codes emerging from the data.

4. Second stage coding

The central nodes in all the mind-map data refer to the ISTD briefs, although some more explicitly than others. The assumption is that the central node prompts for the construction of a mental space, thereby evoking an organising brief frame. Those elements of the mind-maps that form part of this mental space should therefore be coded as examples of internal linking; those on the other hand that fall outside of this mental space are candidates for cross-space mapping. This coding stage employed a two-track strategy.

This strategy involved working progressively outward through the binary constructions in each branch. If the inner and outer elements of each binary construction were deemed to be 1) in the same frame, and 2) related to the organising brief frame evoked by each brief; then the link between these elements was recorded as an internal link. If, on the other hand, one of these conditions was not met then this raised the possibility that the link was a cross-space mapping, requiring further scrutiny of the binary construction to determine which frames were involved.

At this point it is probably helpful to provide examples of different scenarios, emerging from the data.

Table 1. Internal linking using a single conceptual domain. ISTD brief, Anniversaries.

Elements from the data
Central node: "Anniversary"
Element 1_1: "Culture"
Element 1_2: "Thanksgiving"

Here the topic "anniversary" is provided by the brief's title. Of all the yearly events that take place, some are "cultural" and within those is a particular anniversary "thanksgiving". This involves a movement from the generic to the more specific within one frame – anniversary.

Table 2. Internal linking using two conceptual domains. ISTD brief, Writing women into history.

Elements from the data
Central node: "Writing women into history"
Element 1_1: "Hidden figures"
Element 1_2: "NASA"

In this example NASA is not an established sub-category of "hidden figures" in the same way that "thanksgiving" is in relation to "culture". The label "hidden figures" is part of the "recognising achievement" frame while "NASA" belongs to the "fields of endeavour" frame (Figure 2c). Consequently, this construction requires more work from the reader to determine which part of the "NASA" frame relates to the frame "hidden figures" (workers in NASA that are "hidden" from history). Also, we are not interested in all hidden figures, only those that are women (a focus handed down from the central node). This branch therefore results in a similar movement from the generic to the specific as in example 1 but one that requires more processing since two frames are more clearly involved. However, since both frames are part of the same organising frame evoked by the brief, this is still an example of internal linking, rather than cross-space mapping.

Table 3. Cross-space mapping using two conceptual domains (two organising frames – metaphorical). ISTD brief, Mark my Words.

Central node: "C word" and typography	
Branch 1	**Branch 2**
Element 1_1: "Sound	Element 2_1: "Punctuation -Bullets + Ammunition"
Element 1_2: "Short quick" ⟶	Element 2_2: "Gun shot"

In this example two elements are linked suggesting the metaphor expletive is gun shot. The "short quick" sound of the "c word" linking here to "gun-shot". This involves two different organising frames: that of words and typography (part of the brief frame), and the shooting of guns (external to the brief's organising frame). Interestingly the recruitment of this second frame seems to have happened in Element 2_1 where an association is made between a bullet point (a typographic glyph) and bullets/ammunition. The implicatures of this metaphor would seem to provide useful communicative potential so that swear words become *wounding* and are *fired off* in a hostile act.

Table 4. Cross-space mapping using two conceptual domains (two organising frames – counterfactual). ISTD brief, Mark my Words.

Elements from the data
Central node: "what if"
Element 1: "nice had a smell"

This central node here makes an indirect reference to an ISTD brief; the connection is only clear once the link is made between "what if" and "nice had a smell" since "nice" is explored in relation to the "Mark My Words" brief. The cognitive work involved in this "what if" processing is impressive. "Nice" is of course a word used to *describe* physical things or events and is therefore part of the language frame. But the "what if" – "nice had a smell" construction forces us to think of "nice" not as a word but as part of another frame, one of physical things. When combined with this second frame "nice" becomes itself an *object* that is available for scrutiny by our sensory organs - it has a smell. This objectified imagined manifestation of "nice" moves it outside of the language related elements listed in Figure 2c. It is an example of a counterfactual construction.

All of the data were coded on the same basis as these examples and were assessed as being a case of internal linking or cross-space mapping using the criteria discussed above. Codes were collected and analysed using NVivo 12 software.

5. Results

The sample consists of fifteen students who entered the 2018 ISTD Student Assessment Scheme. Of these entrants, ten produced mind-maps as part of their submissions and nine of these participated in the study. There were fourteen different mind-maps produced by these nine students, all of which were coded and analysed.

Database queries of the codes yielded 301 links that were assessed as being internal linking, as opposed to 23 links being assessed as cross-space mapping. Of the 23 cross-space links, twelve came from a single mind-map that labelled the central node "what-if". The other 11 cross-space mappings were distributed across two other mind-maps; of those one had a

central node providing a level 3 (see Figure 2b) reference to the brief, this provided nine cross-space mappings. The remaining one was a response to the *Anniversaries* brief and the central node was labelled “whiskey + distilleries + spirits”, this mind-map yielded two cross-space mappings. Overall there were 16 links which were either illegible or so vague or ambiguous that it was decided that their inclusion in the study would introduce unreliability.

With regard to examples of counterfactual thinking, there were two examples of counterfactual thinking as internal linking, and 12 cases in which it occurred across spaces.

6. Discussion

This study began with a degree of scepticism as to the efficacy of mind-mapping as a tool for idea generation. The coding results at first suggested that this scepticism was not misplaced, with comparatively few cross-space mappings in relation to the number of internal links established. The nature of the internal links is often rational, relevant but somewhat unsurprising, consisting – as many do – of categorical links stepping down from superordinate classes, to subordinate classes. Generally, the mind-maps tend not, to provide links to more distant conceptual domains suggestive of divergent thinking.

Yet there was one exception that generated twelve out of the total of 25 cross-space links. What differentiated this mind-map from the others was the placement of “what if” in the central node of the mind-map – rather than a more direct link to a brief. The “what if [x was …?]” statement prompted counterfactual scenarios to be imagined that often included concepts from domains distant from those organised by the brief in question. Further possibilities could be achieved by placing other questions at the centre of mind-maps “x as …?”, or “x is …?” for example, and this could be a source for further study.

The second most productive mind-map (nine cross-space mappings) has “c**t & typography” in its central node. This expression itself involves two conceptual domains; that of typography and the body. This may explain why the mind-map constructed around this node was so prolific in terms of cross-space mappings.

A further reflection on the mind-maps concerns the way that the central node potentially frames enquiry. By starting with a superordinate class in the central node there is the question of whether this primes the creator of the mind-map to think of other categories, rather than say attributes or abstract qualities. For example, in one of the mind-maps, “Anniversaries” is placed in the central node which links to another radial element “Cyclical nature of the universe”. This might have triggered an exploration of the abstract quality of cycles, building associations with domains not directly related to anniversaries such as bicycles, vinyl records, and so forth. Mapping a single revolution of a record to the year of a life, could result in surprising outcomes that highlight different aspects of anniversaries. For example, a revolution on the periphery of a record is longer than a revolution closer to the centre; which is reflective of the experience of time passing more quickly as we get older.

However, it would seem that the line of reasoning set up by the superordinate category of "anniversaries" led not to the abstract quality of *cycles* but to the category of *astronomical cycles* – which is a less creative leap, since the annual cycle of the Earth around the Sun links directly to the concept of "anniversary". The question arises therefore as to whether mind-mapping constrained thinking in this case.

Pereira's observation above is worth consideration here, where he notes that a creative product should be both novel and useful, and that these attributes arise from divergent and convergent production respectively. If "usefulness" in this context is translatable as "relevance", it appears that most of the internal links made in these mind-maps have quite a high degree of relevance to the idea placed within the central node. At first glance, the cross-space mappings perhaps less so. But according to Schilperoord's (2018: 14) summation of current accounts of metaphorical meaning, the incongruity resulting from the juxtaposition of "two objects stemming from disparate domains" is an important prompt for metaphorical association. It induces the viewer/reader to do cognitive work that finds the connection between two seemingly disparate things. The importance of these cross-space mappings should not therefore be undervalued.

If there are priming effects at work in mind-maps then this might account for the disproportionate number of internal links reported in the results, since one element in the mind-map would prime the creator of the mind-map to find another element closely associated with it in memory – and this suggests convergent production. Consequently, whatever appears in the central node would frame and to some extent determine, what appears in the branches that radiate from it. It could be argued that this is precisely the point of mind-maps. But if this is the case, is there less opportunity for the divergent, cross-space mapping of which the brain is capable? It is conceivable that this potential is even suppressed, in the creation of mind-maps.

From the admittedly small number of mind-maps analysed in this article, it would seem one way to open up mind-mapping to divergent, cross-space mapping is to put questions such as "what if x was …" in the central node of the mind-map rather than simply the name of a category.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

New scenarios for developing cooperative platforms for local manufacturing

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Abstract | This paper analytically connects the theme of collaboration, with an emphasis on the historical production structure of the Emilia-Romagna region and the increasing spread of cooperative platforms. This analysis gives rise to reflections on the characteristics and processes that distinguish the object systems from research. The multitude of instruments that appear in the research underlines the partial coverage of the area of the specific project, which is characterized by the complex process that relates raw materials to the logistics of distribution by the systems and the companies based on cooperative platforms. Within this research area, this contribution aims to elaborate some guidelines for the development of these systems on the subject of welfare, the relationship between collaborative and cooperative forms and the future application of artificial intelligence in the assessment processes that are crucial for the design of innovative models of cooperative platforms for processes of product creation and management.

KEYWORDS | COOPERATIVE PLATFORM, PLATFORM FOR DESIGN, DESIGN AND TERRITORY, DIGITAL MANUFACTURING, CREATIVE COMMUNITY

1. The state of the art of the cooperative system

The Italian context, particularly that of the Emilia-Romagna region, was characterized by different forms of consumption and production of goods and services that are jointly managed. In the course of time these development processes of the work have strongly shaped the area, which has always shown a particular preference for viewing these aspects as typical elements of a regional system, both socially and culturally. They promote socio-cultural growth through models in which the customer is at the center of the innovation process, and they themselves become actors of change and active figures in the creation of new forms as well as entrepreneurial and social processes (Villari, 2018). These are changes in goods, services and processes to meet the need for intelligent growth that is open to social responsibility and innovation, creating new market modalities and new relationships within the participants (Celaschi, 2016).

One modality is the collaborative economy, a model that redefines and updates the relationship between market, product / service, production processes and consumers while activating new avenues of production and consumption. A social and economic approach that is heading towards a dynamic of collaboration and co-creation between subjects and aims to create solid relationships between the offline and online attitudes. Vincenzo Cristallo (2018, p. 37) highlights how three actions emerge from the collaborative economy: the "collaborative consumption", the "collaborative market" and the "value of experience". The first activates three elements: the role of the community, mobile collaboration, and inexhaustible resources. The second relates to resource sharing and the third shows how the value of products and services is related to finding an experience. The goal is no longer the use and ownership, but the empirical value that enables access to this asset.

While it is clear that the phenomenon of the collaborative economy still has very broad and changing boundaries due to its growing diffusion and heterogeneity, the main features and differences within the most common collaborative models are examined. Starting with governance, this can either be centralized or widespread, geared towards profit or pursuing a social purpose, more capitalist with centralized control to more democratic and horizontal (Battistoni et al., 2015, p. 23; Kostakis & Bauwens, 2014)) it shows that the forms in which these models are implemented are mainly four: collaborative consumption, collaborative production, collaborative learning, and collaborative financing (Stokes et al., 2014). In these contexts, the element that most unites the different forms is the peer-to-peer dynamic and the contribution of digital technologies as a connecting tool between users.

As we proceed to analyze each of the models, some of them appear to use collaborative and exchange practices to respond to the material and social needs of the community. An approach that turns to some principles of the cooperative model to create alternative businesses to capitalist companies that combine the associative dimension with the entrepreneurial.

Historically, the cooperative model starts with the beginning of the industrial revolution and the first models emerged in Europe in the mid-19th century, focusing on consumption, work, agriculture and credit. An interesting case study is that of the labor cooperative, which was born in Paris in 1831. This was the first cooperative association of carpenters, which was later followed by others related to goldsmiths, furniture makers, bakers, stonemasons and all interesting forms of community experimentation (Zamagni & Zamagni, 2008). The members were also the workers themselves, and all equally enjoyed the principles of reciprocity, the founding feature of cooperatives, aimed to meet common economic, cultural and social needs. Italy was no stranger to these processes of job innovation and stood out for the development of models of cooperation in different areas, from consumption to production, from agriculture to credit, up to the social cooperative model.

The first evidence found from the sources is in Turin, 1854, with the first consumer cooperative, and always in the same period,1856, in Altare near Savona was registered the first cooperative production dedicated to glass art. The cultural and associative model was already existent in Italy, as it was in Europe from the mid-18 century thanks to the Mutual Relief Societies between workers, born to replace corporate structures, which for their formula dedicated to community support and mutuality were inspiration for the creation of Cooperatives (Zamagni & Zamagni, 2008, p.73).

By its definition, a "cooperative is an autonomous association of people who have come together voluntarily to meet common economic, social and cultural aspirations and needs through the creation of a common and democratically controlled corporation," as in the Declaration of Cooperative Identity displayed in Manchester in 1995. It is also defined by the following principles: free and voluntary membership, democratic control by its members, economic participation of its members, autonomy and independence, education, training and information, cooperation between cooperatives and interest in the community. Over time, market changes have contributed to the development of cooperative forms and the introduction of new legislation, which have also led to the creation of new forms of governance.

In this regard, the emphasis in determining some of the parameters in the tables below has been rather on the prevailing cooperative model of reciprocity, which keeps the intrinsic principles of the cooperative more intact. In addition, the fields of production and labor were further examined, a sector which, by its conformation, bases its actions on a continuous synergistic dialogue between the different actors in the supply chain and guarantees the identity values of what they produce. A distinguishing feature of cooperative production is the figure of the worker member who "pursues the good of the cooperative by lowering personal expectations of mutual exchange". (Legacoop, 2010, p. 67). If we compare this model with that of the collaborative production economy, we find connections that highlight how both are based on the idea of a common project of the community involved in it. It is plausible to argue that some rationale, such as equipment sharing and the collaborative manufacturing spirit, are common, especially when it comes to collaborative

manufacturing which is intended in the context of open manufacturing (Battistoni et al., 2015, p. 50). In Emilia-Romagna in particular, an analysis of the territory's entrepreneurial systems shows that the cooperative model is an entrepreneurial method of collaboration that is still relevant and has a strong connotation with social innovation processes. The UnionCamere dataset for 2018 confirms this with 80,765 cooperative companies on Italian territory, of which 5,006 are articulated in the Emilia-Romagna region and employing 12.5% of national employment related to cooperatives (Rapporto sulla Cooperazione, 2019, pp. 55-56).

Basing on the literature as early as the twentieth century, the development of the new cooperative business models of Emilia-Romagna distinguish itself at national level thanks to the historical ability of the regional territory to create a system, to its geographical conformation rich in small-medium enterprises well integrated in the productive regional setting, and to its aptitude to combine political culture, integration between public and private, entrepreneurial culture and social integration in a virtuous formula. All elements that in the second half of the twentieth century defined the "Emilian Model" (Menzani, 2007), which was one of the driving forces behind the transformations of the territorial cooperative model which differed from the others precisely because of one of its peculiarities: the social integration. Its widespread diffusion in the region, already after the war, allowed the regional economy to consolidate and renew itself, creating close ties with community and institutions.

Within this territorial ecosystem, the development of production and labor cooperatives is interesting as they find their best locations within the production districts and new resources both in the know-how of the local artisanal production tradition and in the training of high-level skilled professional (Menzani, 2007). The manufacturing cooperation was able to take advantage of the large training capacity and capillarity that had settled in the region, guaranteeing a high level of skills that contributed to the success of the manufacturing cooperatives in the ceramic, shoe, foundry and mechanical systems market.

The cooperative model is particularly interesting because it is still relevant today and, according to its principles, corresponds to the objectives of the European Community in matters of social innovation and inclusion as well as the development of new socio-economic sustainable models. A model that, when applied to the online world and contaminated with new trends in open design, can be an alternative approach and solution to the complex needs of the current and future market.

To understand this phenomenon and develop design-oriented processes, the different systems and types of contemporary entrepreneurship in the market are examined.

2. Contemporary digital models of collaboration and cooperation

The development and diffusion of ICT infrastructures, the reduction of transaction costs, the change of buying habits from a “own” to a “share” approach and the disappearance of the clear distinction between consumers and producers (prosumerism) are some of the conditions that have spread the sharing economy. There are misunderstandings and contradictions where some of the patterns of consumption that are commonly grouped under the term “sharing economy” do not reflect their principles. This can often be attributed to the habit of extending the metaphorical meaning of neologisms associated with the digital world to related concepts, tools, and practices. This phenomenon tends to dilute the specificity of the terms and introduce a number of umbrella terms that create ambiguity and semantic confusion (Ciracì, 2013). According to Giana M. Eckhardt and Fleura Bardhi (2015) the term “sharing economy” is not used properly on platforms such as Uber[1] and Air B & B[2]. In fact, the exchange of goods, services and information based on the Peer2Peer model is a phenomenon that occurs between individuals without any currency exchange taking place, but which is driven by a mutual and supportive approach. When there is a market broker between users who do not know each other, an economic exchange relationship is established by defining an access economy rather than a sharing model. This dynamic has a direct impact on how users of the platform use the service. It favors the return of economic value over social value and makes us wonder to what extent the peer relationship is perceived as an added value or a compromise to access the service.

The platforms that offer this type of service do not own the resources, nor are they responsible for the actions of the individuals. For example, Uber does not own the vehicles and has no obligations to any of the operators involved in providing the service. In the food delivery sector in particular, the use of bikers as the only resource without protection and recognition of their status as employees has a significant impact on the economic competitive dynamics of the dominant service companies. There are alarming social implications in this regard, and in response to these models, a debate has emerged in recent years about the role of platform cooperatism as a fairer and more sustainable economic model (Rifkin, 2014; Scholz, 2015).

The cooperative platforms are part of a panorama of typologically different online platforms on which the differences in the processes guide the structure and implementation of the actions they generate. Cooperative platforms are identified with four main characteristics (Scholtz, 2019): ownership that is extended to the members of the platform; democratic management of the same when a member's vote is worth one; the co-design processes that

[1] Uber, https://www.uber.com
[2] AirB&B, https://www.airbnb.com

guide the development of the platform; the obligation to support an open source development of its organizational instruments.

These features underline the similarity and diversity of the platforms that result from the collaborative economy. Two platforms enabling a transportation service could serve as examples, with the first, Uber, gathering self-employed workers under the same brand and app and asking for a percentage to pay for the service. The second platform, Eva[3], guarantees the same service, but structures the internal processes according to the scheme of the cooperative platforms. This choice, based on blockchain mechanisms, allows the members, through the development of the common platform, to generate a surplus of profit intended to transparently redistribute the value on the territory. The cooperative model generally guarantees higher profit margins for members, their participation in company decisions through voting, and better protection by hiding the verification data from the application interface.

The models are similar from the user's perspective, but different from the employee's perspective.

Cooperative platforms interweave multiple relationship models between members and the market by defining competitive, collaborative, algorithm-based forms with multiple stakeholders. For example, when using the American UP & GO[4] platform, the user does not have the option of selecting the operator responsible for cleaning based on the personal profiles of workers whose ranking or public rating does not exist. The user relies on the evaluation process carried out by the cooperative when selecting staff. This decision was guided in particular by tests carried out by the platform and studies that suggest that personal profiles could lead to harassment (Scholz, 2019).

Some models of cooperative platforms are characterized by the fact that several participants with different roles are accepted as members. These cooperatives are defined as multi-stakeholders and consider the involvement of workers and producers as members of the cooperative. For example, the Resonate[5] model expects content producers and users of the service to have the right to vote on the decisions that determine the development of the platform. In addition, the profits are shared among all stakeholders, who can choose to withdraw them as cash or use them as credit towards using the music streaming service on which the platform is based.

The mapping of active cooperative platforms is constantly updated (#PlatformCoop Directory - The Internet of Ownership, n.d.). In the past year, Scholtz (2019) divided the platform types into five categories:

[3] Eva, https://eva.coop
[4] UP&GO, https://www.upandgo.coop
[5] Resonate, https://resonate.is/why-were-a-cooperative/

- The production cooperatives are constructed as spaces where the members who create the content independently benefit from a single diffusion vehicle (i.e., Stocksy[6]), or as aggregation places of professionals developing joint projects (i.e., Enspiral[7]).
- Data platform cooperatives deal with user-driven social media;
- Cooperative platforms are based on blockchain protocols (i.e. Eva);
- Labor cooperatives aimed at providing services to their members (i.e. Up & Go);
- Collaboration platforms for common tasks aimed at bringing together non-group professional groups and helping them manage work activities. (i.e. Docservizi[8], Smart-it[9])

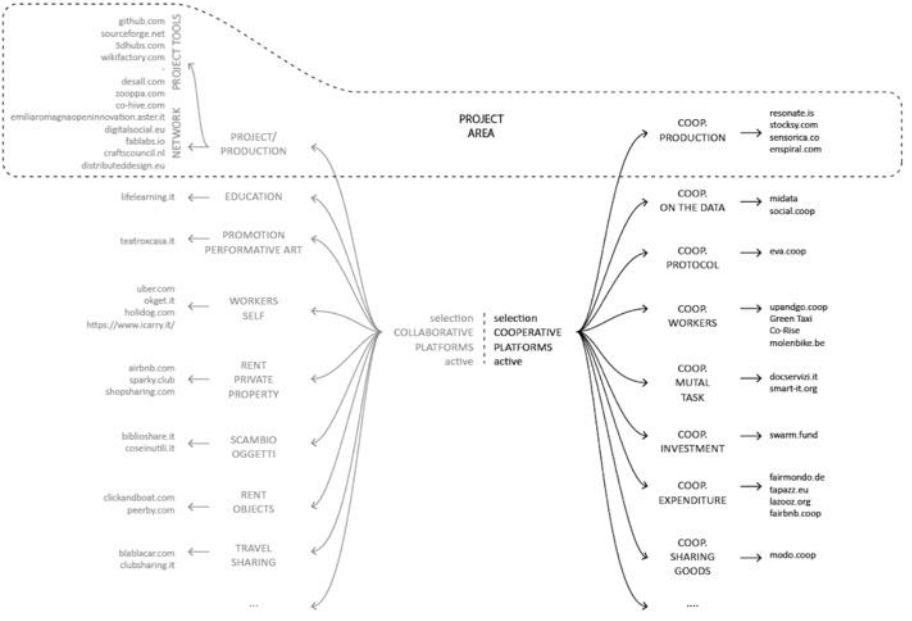

Figure 1. Collaborative and cooperative platforms.

Figure 1 shows how it is possible to insert other categories in relation to those already identified, with an emphasis on different aspects. Similar difficulties with categorization arise in connection with collaborative platforms, which, as mentioned above, often have a similar

[6] Stocksy, https://www.stocksy.com/
[7] Enspiral, https://enspiral.com/
[8] DocServizi, https://www.docservizi.it/
[9] Smart-it, https://smart-it.org/

user interface on the user side, but with specific internal procedures that sanction a profound ideological divergence.

The diagram shows how both branches represent platforms that are mapped to fields related to the project area. On the collaborative platform side, it can be stated that this area is essentially represented by two macro-categories: instrument supply platforms and network platforms. The former offers designers digital tools for their work like GitHub[10]; The latter connect the stakeholders of the design processes (i.e. co-hive[11]) and in some cases collect real orders that have been established between the company and the platform and which are then managed by the designers through working groups (Zooppa[12]) or competitions (Desall[13]).

By focusing the analysis of collaborative platforms on issues related to product design, it is found that the role of the platform is mainly limited to distributing the goods. The collaborative development processes seem to be mainly hosted on digital platforms that provide tools for coordinating workgroups like GitHub and Wikifactory[14]. Although these platforms are based on the active involvement of the participants in the development process, they do not contribute to build long-term collaborations, but create collaborations that are linked to individual projects. In this sense, the platform is only used as a collaborative tool and does not represent a common basis for the exchange of values and purposes, an element that characterizes cooperatives.

In order to be able to deepen the processes of the case studies of cooperative model platforms that intervene in the area of design, a descriptive matrix (Fig. 2) of internal processes was used where the case studies are analyzed through the characteristic coming from both the traditional cooperative model and the digital cooperative platforms. While two case studies declare themselves in their statute as cooperative platforms, the remaining take alternative forms in which the social aspect towards the members and the reinvestment of profits in the same area can be registered.

[10] Github, https://github.com/
[11] Co-Hive, http://co-hive.com/
[12] Zooppa, https://www.zooppa.com/
[13] Desall, https://www.desall.com/
[14] Wikifactory, https://wikifactory.com/

PIATTAFORME	resonate.is	stocksy.com	enspiral.com	sensorica.co
GOAL	MUSICAL SALE	PHOTO/VIDEO SALE	Design of budget control systems and decision making	opensource hardware development
COOPERATIVE MODEL	YES, multi-stakeholder cooperative	YES	limited liability company with a charitable constitution	Open Value Network
COLLABORATIVE MODEL	declared	YES	YES	YES
Individuals or companies	individual	individual	individual	individuals, associations, companies
Democratic control by members (one vote one head)	YES	YES	NO	NO
social purpose, Commitment to communities	enhancement of copyright and fair compensation	enhancement of art	NO	NO
Mutualistic purpose: a) revenues must come mainly from sales of goods and services to members	YES	NO	YES	YES
Mutualistic purpose: b) to make use mainly of the members' work performance	YES	YES	YES	YES
Mutualistic purpose: (c) the cost of goods or services provided by members must prevail	YES	YES	YES	YES
Freedom and autonomy (working members can manage their own work)	YES	YES	YES	YES
Principle of open door and undiscrimination in members entrance	YES	YES, open call with time limitations during the year	YES	YES
Competitive / Uncompetitive	competitive	competitive	uncompetitive	uncompetitive
Intellectual property projects	ownership of individual members	ownership of individual members	...	open source
Working members may have employment contracts as employees or self-employed	YES	YES	NO	NO
Limit on profit distribution	...	...	...	...
Management surplus: share that can be attributed to the members to further attribute the advantage that the members have enjoyed in the mutualistic exchange.	musicians 45%, listeners 35%, developers and managers 20%	redistribution of earnings based on surplus	...	...
Year of foundation	2015	2013	2010	2011
Registered office	Ireland	Canada	New Zealand	Canada
Cooperative fee	minimum 5 €/year	...	...	...
Deducted from profits	30% (from total) for management + 20% emergency fund + 10% interest for holders of Supporter Shares	25% on extended licences and 50% on standard licences	the funds are reinvested	...
Active/inactive	active	active	active	active

Figure 2. Cooperative platform analysis matrix.

3. Discussion

The policies implemented by the recent regional councils of Emilia-Romagna have, amongst their objectives, the regeneration and development of employment, in line with the demands of the European Community for a new social cohesion. Attention to the development of new business methods through the cooperative entrepreneurial system is seen as a tool for sustainable and strategic growth of the territory. The goal is to develop new forms in areas other than traditional, including through the creation of start-ups and measures that contribute to cross-sectoral contamination within the supply chains (Alberani, A., et al., 2018). Among the initiatives to support the regional development lines, mention should be made of the Social Hackathon[15], which was organized in Piacenza in 2017 by Confcooperative, a collective hacking action based on the open innovation model of Henry

[15] Social Hackathon, La prima maratona di Solution Making a Piacenza, http://www.confcooperativepiacenza.it/social-hackathon/

Chesbrough (2003) but more cooperative and the Coopstartup Bologna[16], a new co-op development program that offers winners an annual call, guide, and acceleration process.

As mentioned earlier, this research focuses on the interventions and development of digital and immaterial forms and tools in the specific area of the project. In the selection of the analyzed case studies there is a single example that does not belong to this classification: the Sensorica[17] community, whose goal is the development of open source hardware by its members. Together with the Enspiral project, this platform does not define itself as purely cooperative, but actually fulfills many of the requirements identified by Scholtz. The two platforms offer digital rooms in which working groups are created on specific project priorities. In the case studies analyzed, it is interesting to highlight the Stocksy and Resonate platforms, which are characterized by offering members a collaborative / competitive model that is integrated into associative management and allows them to participate in the decision-making processes of development and active cooperation in the EU to participate in the management and design of the platform. Their front-end model is configured as a wider audience digital space where preferred content can be purchased. The basis of these two online platforms is the clear desire to protect the copyright of individuals and to guarantee their members fair compensation. Transparency and clarity in managing retained earnings through both platforms is one of the most important added value values that enable it to attract members from competitors.

Taking into account the specific area of product design where there are currently no examples of structured collaborative platforms, a significant contribution to their development, particularly in the production and distribution phases, could come from the contexts that have evolved on the EU basis for open and shared philosophies such as Fablabs, Maker and Hacker Spaces.

In fact, the digitization of the design phase and the spread of the enabling technologies of Industry 4.0 offer the opportunity to imagine innovative and flexible production and sales processes. One analyzed case study based on these issues is the Distributed Design Market Platform project[18], which is funded by the European Union through the Creative Europe fund. This project promotes platforms and tools that support designers and makers not only in the design, but also in the manufacture and marketing of their products and support processes that are based on the exclusive handling of data and widespread production.

By digitizing the project, digital collaboration platforms can be used to simplify co-design processes. Many of these online tools were developed to facilitate software development, particularly in the open source area. They offer hosting services, version control, bug tracking systems, feature requirements, task management and wikis such as GitHub and

[16] Coopstartup Bologna, https://bologna.coopstartup.it

[17] Sensorica, https://www.sensorica.co

[18] Distributed Design Marekt Platform, https://distributeddesign.eu/about/

SurceForge[19].

Based on these models, additional platforms for the co-design of physical products were developed. On these platforms, the project management and tracking tools are flanked and integrated by tools that have been specially developed for product design, e.g. B. the online visualization of 3D models and the creation of a dynamic parts list that can be shared with external suppliers and manufacturers. Examples are Wikifactory, GrabCAD[20] and Thingiverse[21]. Although the tools described are not hosted on cooperative platforms, they represent technological solutions that correspond to the characteristics of cooperative models.

In addition to the technical support tools for design, there is one area of particular interest for design, namely the collaborative platforms for common tasks.

The analysis provided in this discussion summary shows that application models of the collaborative system cannot really be used to create platforms dedicated to the context of design. Hence, it seems necessary to create design scenarios that lead to the development of guidelines to ensure true compliance of these tools with the cooperative model.

4. Guidelines for design and productive cooperative platforms

The findings that emerge from this study of the cooperativism of Emilia-Romagna and the cooperative platforms in a broader and more general context, frame possible development of the cooperative platforms towards complex production realities characterized by the participation of several participants in the production processes.

Thanks to these developments, new cooperative models should take into account some aspects that deal with the field of production through digital mediation. In particular, three macro-themes emerge: the importance of the welfare system, the contrast between a competitive and collaborative approach, and the assessment processes that need to be developed to improve member evaluation.

One approach highlighted in the platform case studies is to improve community welfare. On the one hand, there are platforms to support freelancers by inserting them into networks and assisting them with the tax and organizational administration of customers. On the other hand, a regional system that has always been recognized for having pursued the aspect of social integration within regional and economic policy and which is still moving in this direction today through communal welfare projects involving institutions, citizens and communities work together to create systems that contribute to the economy of caring for

[19] SourceForge, https://sourceforge.net
[20] GrabCAD, https://grabcad.com
[21] Thingiverse, https://www.thingiverse.com

the common good (Symbola, 2018). Social relationships and quality of services are a combination that leads to a better quality of work and a more sustainable and conscious production, which is now also demanded by the end consumer.

The welfare instrument can also be inserted between the innovation and systems practices of cooperative platforms for both production and design in order to improve relationships in the network and in labor management.

From the analysis of the case studies it appears that the platforms that offer digital products are configured on the user side as places where one member's content and not the other's can be purchased, which of course creates a competitive aspect among members that is not possible is easy to evaluate.

Due to the number of participants involved in the process, the content distributed by these platforms is less complex than for material products, in which machines are used, raw materials are handled, stored and sold.

The cooperative model of Emilia-Romagna, closely linked to specific productions and combined with the concept of a cooperative platform, proposes what is necessary for the creation of aggregative digital places of the manufacturing vocation.

The cooperative networking of partners in synergy effects on a productive goal and not in the internal competition for the results could more closely adhere to the digital platform model intended for specific productions. Collaborative processes, managed through processes of transparency and equality between members, can lead to higher quality in the development of end products by improving the productivity of the platform.

Finally, the paper focuses on the processes of evaluating the work of shareholders. Comparison systems based on algorithms and artificial intelligence can lead to possible tools for managing the assignment of work activities to the platform operators. As in the Up & Go example above, the user relies on the selection criteria used by the platform and adapts to the system. At this level of interaction between the parties, the question arises of how fair and transparent the rules on which these algorithms are based are. Indeed, making machine learning and artificial intelligence (AI) mechanisms understandable is gaining political value in terms of equity, reliability, and transparency as these systems are increasingly used in managing sensitive data and decisions (Matsakis, 2018).

AI can also be used to create value for users within the platforms. Little by little, platforms are emerging that integrate processes based on neural networks to improve profiling systems. For example, Open Maker Digital Social Platform uses an AI-based value system to search for innovators on social channels, connect them based on common interests, and provide metrics to assess members' social impact and innovation. The application scenarios of technologies based on blockchain systems that help manage the transparency of the assessment processes are just a few of them that could lead to innovations in these decision-making tools in a short period of time. The crucial hub of the relationship system between

members is a fundamental element that will determine the future of collaborative platforms. The logic of the processes commanded on performance data must leave room for really comparable quality indicators.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Playing for change: designing a board game for the circular economy

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Abstract | There is a lack of public engagement in sustainability initiatives such as the circular economy (CE). This can be attributed to an absence of understanding and promotion of this new way of living and consuming. This lack of engagement is hindering the implementation of the CE. This paper aims to address this through an exploration of the role of games in explaining difficult concepts. There will be a particular focus on board games as tools for exploring aspects of sustainability, as they allow for a more discursive experience with other players and are a simple way to relate complex ideas. The paper will then detail the design and development of a serious board game *Circul8*. Designed by the authors to encourage engagement with complex systems, it aims to introduce ideas of the CE to the general public. The paper will explore the methodology of game creation and detail initial gameplay results.

KEYWORDS | GAME DESIGN, CIRCULAR ECONOMY, PLAY THEORY, LEARNING THROUGH PLAY, RAPID PROTOTYPING

1. Introduction

There is an urgent need to engage the public in the circular economy as part of the fight against climate change. The basic principles of the circular economy are simple enough; “design out waste and pollution; keep products and materials in use; regenerate natural systems” (Ellen MacArthur Foundation, 2017). However, understanding how these principles can work in reality is more complicated and there is a risk that people will switch off if they don’t understand. Research into the circular economy has revealed that public engagement is one of the most difficult aspects of circular economy implementation (Kirchherr et al., 2018). This paper will firstly explore the potential of the circular economy as a model to tackle some areas of the climate crisis, and the barriers around public engagement that are hindering its implementation. The paper will then go on to explore the potential of games to engage the public with complex ideas through a simple system, with a particular focus on board games. Finally, the paper will detail the designing of a serious board game, Circul8, by the authors, that will be used to engage audiences with circular economy ideas and provoke discussion around it.

2. Circular economy

The circular economy is gaining traction as an idea across business, governments and academia. It is seen as one of the ways to tackle the climate crisis by radically changing the way businesses operate and people consume (Ellen MacArthur Foundation, 2013; Ghisellini et al., 2016; Kirchherr et al., 2017; Mathews & Tan, 2016). The fundamental idea behind the circular economy is to move us from a linear economy of ‘take-make-dispose’ to one where resources are in constant use for their full usable life. There has been a variety of definitions for circular economy, ranging from product reuse and advanced recycling to eco-design and sustainable consumption (Gallaud & Laperche, 2016). Kirchherr, Reike and Hekkert (2017) analyse 144 definitions of the circular economy in order to consolidate and create transparency around current understandings. Their research concludes to define circular economy as “an economic system that replaces the ‘end-of-life’ concept with reducing, alternatively reusing, recycling and recovering materials in production/distribution and consumption processes.” (2017, p. 229). The Ellen MacArthur Foundation (2013) adds that systems should be restorative by design, focusing on nature-based systems as well as technical ones. The circular economy cycles are demonstrated by Figure 1, known as the butterfly diagram. This shows the inner cycles of reuse, repair, repurpose and remanufacture and the technical side, with the outer cycle and final process as recycling. The organic side focuses on extracting as much energy as possible, either directly through biomass or indirectly through calorie consumption, before the matter is returned to replenish the soil.

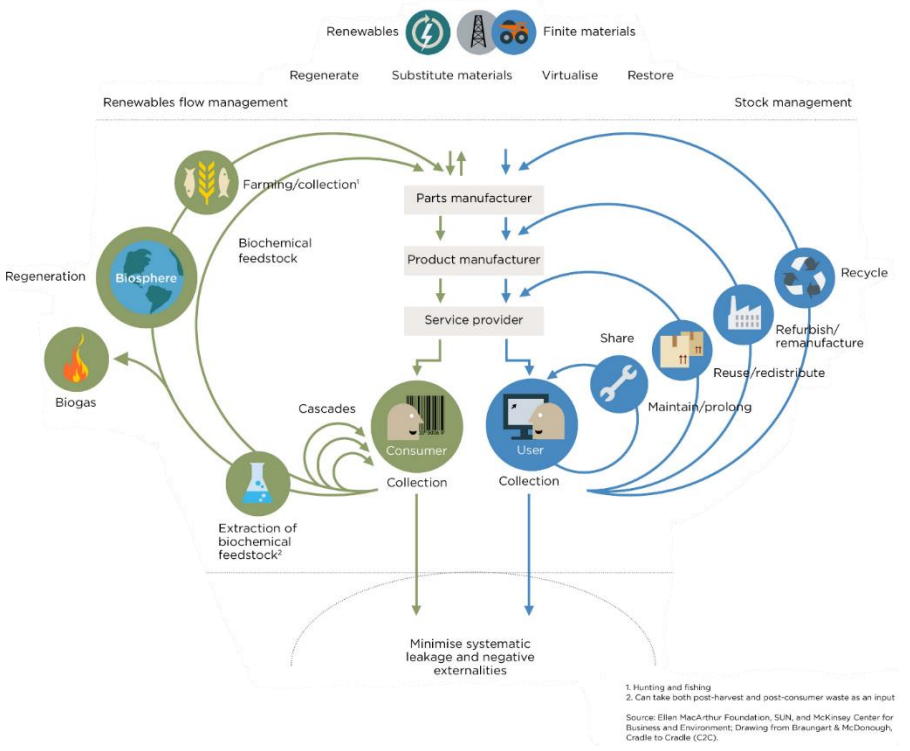

Figure 1. Circular economy butterfly diagram developed by the Ellen MacArthur Foundation (2013)

As well as working through different cyclical iterations, the circular economy works at different levels of implementation. *Micro*, at the product, company or consumer level (Elia et al., 2017; Kalmykova et al., 2018; Lewandowski, 2016), focusing on design for end of life (McDonough & Braungart, 2009) and product-as-service business models (Bressanelli et al., 2018; Spring & Araujo, 2017). *Meso* level implementation looks at eco-industrial parks like those being developed across China, where business are deliberately placed together to enable the waste from one business to be easily transferred to another that uses that waste as a resource (Mathews et al., 2018; Yuan et al., 2006). Thirdly *macro*, at national, regional or city level implementation, ensuring that the infrastructure is in place to support the effective sharing of resources and implementation of many small loops that feed into the overall circular system (Blomsma, 2018; Ellen MacArthur Foundation & ARUP, 2019; Kirchherr et al., 2017; Saidani et al., 2018).

2.1 Role of consumers

At every level of implementation and every stage of the circular economy cycles consumers play an important role. From product design consultation and uptake of subscription models of ownership, to actively seeking out second-hand goods and repairing what they own rather than throwing away, consumer involvement is vital for the success of the circular economy.

> "'Closing the loop' in the circular economy essentially requires much closer and more extended collaboration between participants. Consumers also become much more integrated because the value chain does not end at the consumption stage." (Ellen MacArthur Foundation, 2013).

Designers and engineers working in circular economy need to make sure that consumers are actively involved in each stage of the production process. For example, the purchaser could ultimately be one of many, so the resource recovery needs to be as painless for the consumer as possible (Lofthouse & Prendeville, 2018). City planners wanting to create circular urban systems must do so with the active involvement of their city's residents (Ellen MacArthur Foundation & ARUP, 2019). Not involving the people who will use the products and services being designed for them is likely to lead to costly vanity projects and products ultimately failing (Singh & Giacosa, 2019).

2.2 Barriers to adoption

Despite the importance of consumers and the public in general to the circular economy, they are one of the biggest barriers to its implementation. Research conducted by Kirchherr et al. of 208 businesses and policy-makers explores barriers to circular economy adoption in the EU and finds that "lacking consumer interest and awareness" is the most pressing issue preventing wide-scale adoption (2018). Since this research has been published there have been a few high profile circular economy media stories, such as IKEA's announcement to introduce take back schemes on their furniture (Inter IKEA Systems B.V., 2018), a focus on fast fashion (Britten, 2018; Farmer, 2020) and the business potential of circular economy (van Houten, 2019). As consumers are so vital to the success of the circular economy more needs to be done to engage them with the underlying principles of how the process should work. Preliminary research undertaken by the authors has found that often employees of companies engaged in the circular economy do not fully understand how and why their employer is engaging with the circular economy. It is prudent to point out here that, like everyone taking part in society, these employees are also consumers. To bring about this new model it is vital that we are all conscious of the roles we play, as designers and also as consumers. If we cannot take steps to become more circular in our work and daily lives, then how can we expect other people to engage.

3. Gamifying circularity

The question that needs to be asked is: how do we enable engagement with principles of the circular economy in a memorable, actionable and involving way? The authors have concluded that one of the ways to introduce ideas about the circular economy to people could be through a simple board game. Games can be important tools for educating audiences about wicked problems and are gaining more significance "as a way to bridge the communication gap between different stakeholders and support sustainability education" (Whalen et al., 2018, p. 336). They are useful devices to explain complex systems to audiences, demonstrating how different elements of these systems work together through non-linear access points that come about during gameplay, rather than linear speech. This allows audiences to come to an understanding through their own exploration instead of being told through written or verbal form. Games, "can be treated as small models of much more complex, much larger systems" (Castronova & Knowles, 2015, p. 41). Prominent game designer and theorist Jane McGonigal (2011) believes that games have the power to change by teaching ecosystems thinking, giving players the ability to think about complex ecological systems. "A good ecosystems thinker will study and learn how to anticipate the ways in which changes to one part of an ecosystem will impact other parts." (2011, pp. 297–298). Introducing ideas of circularity through a board game can provide a method to help the public understand their roles in the ecosystems necessary for successful circular economy implementation.

3.1 Serious games

A serious game is one that has a purpose beyond entertainment, their use is gaining prominence in sectors such as healthcare, education and workplace learning (Cannon-Bowers & Bowers, 2010). The majority are computer-based games, providing simulations for professionals such as firefighters or military. As they are generally designed with a specific, intended audience they are less commercially viable than video games designed solely for entertainment. They might not be practical for development in highly specialised areas, or areas where the use of computers is not permitted (Lamey & Bristow, 2015). Board games are an underused but useful avenue for the development of serious games. Serious board games offer a number of potential points over computer games: they can be developed without needing skills in programming, they can be cheap and quick to prototype, and most importantly, they involve interaction between players which can foster conversation during and after play about the subject (Castronova & Knowles, 2015; Illingworth & Wake, 2019).

3.2 Examples of serious board games

The potential for the use of serious board games is very broad reaching. For example, Bristow and Lamey (2015) developed an informal, homemade board game for use in mental health services to aid service users "in the design of their hospital environment. The advantage of a board game format is that it is familiar and unthreatening." (2015, p. 243).

This familiarity with the format allows for initial barriers to be broken down in a setting that can often be stressful and unfamiliar to patients.

To bring a serious issue to a wider audience Illingworth and Wake (2019) adapted the popular tile-based game Catan (Teuber, 1995) to introduce a global warming element as a way to generate dialogue around this complex topic.

> "Tabletop games, which offer high levels of sociability, adaptability, and tactility, create a shared space in which complex topics can be discussed and debated, and it is this capacity to foster dialogue that makes them such a productive means for discussion on the topic of global warming." (2019, p. 3).

There are a few other examples of games that tackle environmental issues. CO2 (Lacerda, 2012) is a commercial board game designed to raise awareness of the global pollution crisis. This game has been modified by Edward Castronova to explore "the difficulties that policy-makers face in dealing with the CO2 problem" (2015, p. 45). He chose CO2 as a base game as it already provided a simplification of a very complex system. By adding and removing parts of the game mechanics and adapting the rules, he was able to create a new game Climate Policy. This adaptation of the game was made using a pen and paper so can be used by anyone who owns the original game – the rules are freely available online in the International Journal of Serious Games.

Focusing on the circular economy, In the Loop Games design board games that help different groups explore areas of the circular economy specifically related to them. Katie Whalen et al. created the serious board game In the Loop to respond to the lack of understanding around complex circular economy implementation for engineering students (2015). Research had found that teaching the circular economy:

> "demands a departure from the current disciplinary and subject-focused teaching that predominates current educational paradigms, particularly in engineering education" (Whalen et al., 2018, p. 335).

The focus during gameplay is to teach students about systems thinking and material criticality through active involvement in a simulation of these systems as an addition to the traditional learning structure the students were part of. They found that "the students were able to reconnect the game to reality, think in systems, and utilize critical thinking" (2018, p. 342). The research also found that the game had implications beyond its initial intention with the potential for use with groups outside the target audience.

3.3 Serious games as boundary objects

When a game moves outside of its original intention, it becomes a boundary object. This is explained by van Pelt et al. (2015) as:

> "instruments used to facilitate the interactions between science and practice and function as the operating space between different 'social worlds' in which actors

> come together and share interpretations without the need for consensus" (2015, p. 42).

The potential for games as boundary objects when exploring complex subjects such as climate change can be investigated further when looking at the role of simulation games to bridge the boundary between climate change science and various groups. The game players do not need to have an extensive knowledge about the subject in order to understand the important concepts put forward in the game. The game play becomes a *magic circle* (Salen & Zimmerman, 2003), allowing players to experience the consequences of making different choices in the safe space of the game.

3.4 Research summary

As demonstrated in this section serious board games are an accessible way to introduce complex systems to non-expert audiences. The social dynamic allows for dialogue during and after gameplay, so players can discuss the issues around the theme of the game, potentially developing a deeper understanding of the subject. A serious game developed for a broad audience could have the potential to explain circular economy principles to different groups of people. By playing a game, audiences can experiment with a system and push the boundaries, allowing themselves to develop their own understanding of a concept.

4. Introducing 'Circul8'

This section will detail the development of a serious board game, 'Circul8', designed to explain the principles of the circular economy to a general audience. The game was initially conceived as a modification for the game Carcassonne (Wrede, 2000), a tile placing game where players can build cities, roads and farms claiming them with character tokens. The original idea was to allow players to build their towns and farms and be able to trade with one another, with a focus on the waste from one area being used by another area to create a new product. As mentioned previously, this is known as meso-level implementation (Kirchherr et al., 2017). The decision to focus on meso level implementation was taken to demonstrate the symbiotic nature of the circular economy – how one group will be reliant on another for resources. This also ties into research by one of the authors into the role of communities and networks in the circular economy.

4.1 Research and development

During the very first research and development session, the game designer trialled the game using a small selection of cards and a copy of Carcassonne (Figure 2). Trade elements were introduced through a series of cards that were selected randomly and detailed a raw material source, i.e. an oil refinery or forest, or a manufacturing base, i.e. electronics or furniture (Figure 3).



Figure 3: Initial Carcassonne gameplay



Figure 2: Carcassonne board and card modifications

The first playtest of Circul8 was held at a small doctoral conference which encouraged open and honest feedback of each workshop (CC). The feedback received followed some general questions that could be applied to any of the workshops being played but was useful. Some players mentioned aspects of game mechanics they would like to see added or improved, whereas others suggested applications for the game that had not been thought of. Table 1 shows a matrix of the initial research and development session's play testers feedback, their names are encoded for anonymity.

Table 1: First play test responses matrix

Reviewer	Key Takeaways What most interested you? What surprised you?	Key Opportunities + any suggestions for applications of this research beyond those suggested by presenter?	Key Challenges + approaches to overcome these challenges?	What Else? What gaps do you see in this research? What could your research add to these gaps?
CCR1	The interactivity and how it can relate to policy & planning for space.	Taking the game to policy makers/planners or communities for co-design	Incorporating all elements for a circular economy - but interesting approach, could see it working	Make an online version. Keep this one too but get it online if/when people are happy with the plan/ideas
CCR2	Idea of learning about circular economy through a game with a focus on local/regional places	Influence local/regional planning in northern powerhouse	Level of complexity – making it give the message without oversimplifying	Lego pieces for resources. V. interested in how in how waste fits into cir. econ
CCR3	How the game starts with random layouts and slowly they become more intentional with players planning their next move based on potential future relationships	Making game more strategic by giving out cards before setting out tiles	How would the exchange work between cities and farms?	Money? Is the purpose to create wellbeing? How do you win?
CCR4	It's really good way of thinking where resources come [from] and how they are used. The interaction at the beginning is good as you play, and then the second part makes you think about the strategy and resources	Opportunities to modify the cards in order to give different life	How to reduce the game to not open it up that much?	Really hard work to create a game
CCR5	Great idea to gamify a quite serious subject	Game used in industry, to raise awareness of the circular economy Also, education	Making sure industry see it as serious, perceptions. It's a great idea, as a way of bridging, but for industry to	Make it digital in the future?

	How realistic to life the game can actually be	A means of understanding for private to public or environmental to private A means of knowledge exchange	understand its seriousness. You'll need to play with [it]

The research and development session introduced the two authors of this paper. Tom Cockeram is a game designer and had designed a board to be used as a base for other games. He has expertise in game mechanics and was able to take the ideas of Jessica Robins and turn them into a serious game with engaging gameplay. The following illustrates the changes the game went through to its final iteration.



Figure 4: T. Cockeram's multi-use board displaying games previously designed with school groups.



Figure 5: (on the left) First planning meeting using the pre-designed board by T. Cockeram and resource cards from the R&D session. (on the right) Development of the resource cards and gameplay logistics.



Figure 6: The green and pollution tokens, introduced as the mechanics needed to win the game.



Figure 7: Circul8 board designed and developed by T. Cockeram and J. Robins with rough draft of circular economy game elements.

4.2 Gameplay

Circul8 will focus on meso level implementation, looking at how waste streams flow in, around and out of an area. By focusing on this level of implementation the game could have a broad appeal. It doesn't use specialist terminology or concepts, simplifying the manufacture of products to 5 components: organic (plant-based materials), natural textiles (i.e. wool, cotton, leather), metals, minerals and petrochemicals. Players control a number of material processing plants and/or product manufacturing factories, they are able to choose what proportion of each they own, selecting cards randomly from a deck. Players are able to change their manufacturing factories after every turn, but they cannot change what types of material processing plants they own. The material processing plants process raw materials and also recycle or remanufacture materials once they have been used to create a product. Players earn green tokens for using second-hand materials to create their products but gain pollution tokens for creating products or making decisions about their products that are seen as detrimental to the environment, most products can be broken down into their component materials, however, some cannot and must go to landfill. The game is won overall when a player has 10 green tokens.

4.3 Methodology

Once the rules and game mechanics are finalised the game will be tested with a variety of people to gather a cross section of responses. There will be a rage of ages, including a teenage test group; testing with boardgame hobbyists, design students, and people working

in the circular economy. The players will be asked to fill out feedback forms immediately after playing and their discussions will be recorded. From the research and development session the game designers know that the game provokes a lot of conversation and that the feedback given was timely and specific, even if the questions were not. The play testers will be asked more specific questions about the game mechanics, thoughts about the systems contained within the game and overall impressions. By playtesting with a range of audiences the researchers will be able to assess what ability the game is best pitched at, and whether it is suitable for an expert and general audience. They want to be able to assess whether the messages about circular systems come across to the different groups and what changes could be made to improve the game. There is always a risk that in making something to please everyone they will create something that pleases no-one, but this is why it is important to gather a range of feedback and to be able to assess whether one or two of the test groups can be side-lined to create a wider appeal.

The intention is to make the schematics for the game and playing cards freely available so they can be printed off using a standard printer and laser cutter (or scissors, if players don't have access to a laser cutter). This way anyone will be able to play the game, regardless of finances. To keep the game as sustainable and circular as possible we will encourage players to use second-hand cardboard (from old packaging) to create their board and pieces. By keeping the game accessible to many groups the intention is to create conversations about consumption habits and how open source access could be a valuable tool in moving to a circular economy.

5. Conclusion and next steps

Through this paper we have argued for the importance of board games in disseminating ideas of circular economy. By using board games as tools, we can start to bridge the gap between a prominent model being worked towards in business and academia, and the uptake and acceptance of a new way of consuming by the public. Through the board game Circul8 we hope to develop something engaging and timely that can help audiences understand the importance of the circular economy in the fight against climate change.

The next steps for Circul8 is to be play tested with a wide variety of demographics; refining the rules and gameplay to make it accessible and enjoyable for a general audience. The authors would like to see the game printed, played and enjoyed by others, this will involve online promotion through game communities and general social media. One of the authors is looking to incorporate Circul8 into their PhD thesis, though inviting interview subjects to participate in a game with their colleagues and supply written feedback on the messages and gameplay. As the game is a microcosm of one part of the circular economy system it will be important for the authors to receive feedback from experts working within the field. This will allow the authors to assess how useful the game will be to explain circular economy concepts to a general audience.

Lastly, this paper makes a contribution to the fields of design for the circular economy, specifically design for public engagement in the circular economy, and provides another valuable example of the use of serious board games for public education. It positions Circul8 within a developing field of serious board games that focus on sustainability, and the smaller area of circular economy board games. Drawing particular attention to the importance of board games as affordable tools, their ease of creation or modification, and how they can be disseminated openly. By focusing on the circular economy as an underlying concept we have positioned the paper at an important cross-section of research: design, game theory, and sustainability.

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Acknowledgements: The authors would like to thank the team at Corridor Conversations whose mini conference was the reason they met and embarked on this project. They would also like to thank all the participants who have played the game in its various forms and given feedback.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Progetto Glume: from milling waste to resource for new materials.

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Abstract | The article discusses the results of experimental research concerning the enhancement of waste from wheat milling. It focuses on the analysis of Mulino Marino's production system, a leader cereals' milling company in the Cuneo province (Italy). The analysis of material flows identifies wheat husks and organic sand (about 30% of total wheat grains in weight) as processing residues not classified as by-products that must be discarded as waste, following current regulations. Chemical-physical characterization certifies that they present qualities that are not optimized in their current end-of-life management. Looking at the main purposes of the circular bio-economy and the SDG12, the study focuses on defining a craft protocol for testing potential uses of company's organic waste through a set of basic experimental tests to investigate performances of wheat husks as a biopolymer, similar to thermoplastics, and as a compound for a bio-based material to replace to disposable plastics (e.g. for packaging).

KEYWORDS | ORGANIC WASTE, BIO-BASED MATERIALS, MICROBIAL PROCESSING, CRAFT-MAKING, CRADLE-TO-CRADLE

1. Introduction

Nowadays, one of the most important global challenges is to undertake tangible actions toward zero-waste production processes. The SDG 12 promotes resources and energy efficiency to ensure a better quality of life and to avoid the increasing degradation of the natural environment. The improvement of natural resources management is necessary to face the trend of increasing global population that could reach 9,7 billion people in 2050 (Department of Social and Economic Affairs, 2015). K.E. Boulding (1966) suggested that humans should move towards a "spaceman economy", considering the Earth as a single spaceship, with strict limits for extraction and pollution. An effective proposal is to move from a linear approach to the production system towards a circular or systemic one (Bonaccorso et al., 2019), increasing waste recovery and creating industrial symbiosis between complementary supply chains (Ellen McArthur Foundation, 2015).

Agriculture and food production systems present a lot of environmental issues, in terms of land use changing, soil degradation and resource depletion. It also presents critical issues in waste management like all mining processes that exploit ecosystems (Thackara, 2015). The cereals supply chain is an essential part of the food system because it is the basic diet of millions of people. In Italy, wheat cultivation is the core for the production of many basic foodstuffs. It occupies almost 1.8 million ha (Faostat, 2017) and it represents an important productive sector for the Italian economy. The Italian milling industry has more than 350 companies spread over the territory and it produces almost 7,8 million tonnes per year of wheat flour (Italmopa, 2017). On the other side, the milling industry produces also almost 3,3 million tonnes of residues not for human consumption. A part of them are used as feed in the livestock industry, but a huge amount of residues are treated as waste. In some cases, these residues present chemical-physical and mechanical properties useful for the development of bio-based materials (Genovesi & Pellizzari, 2017).

This article investigates the opportunity to enhance the milling process's residues from waste to resource for the production of new bio-based materials. The research is based on a collaboration with a company in Piedmont Region, the two residues are tested to evaluate possible applications in the design practice. The article discusses the strengths and constraints of materials obtained in terms of environmental, economic and social aspects. It also promotes the change of *mind of making* towards a systemic approach.

2. Design considering products' origin and end of life

Considering that the most environmental issues should be addressed to decisions making during the design stage (Thackara, 2005), the design culture of making products, processes and services plays an important role in promoting sustainability. Systemic Design (Bistagnino, 2011; Peruccio, 2017) proposes to adopt a systems thinking-based approach to design practice in order to reduce the ecological footprint of production processes. The

systemic approach considers products' end of life during design stages and it is inspired by nature's design principles that don't support the concept of waste (Pauli, 2015). Following the principle that “the output of a process is the resource of another one”, the concept of waste should be reconsidered. Residues obtained as results of manufacturing processes can be classified as by-products only if they respond to all requirements shown in Figure 1 (MATTM, 2017). Otherwise, they should be treated as waste. This standard is both an opportunity and a limit for alternative applications of manufacturing residues.



Figure 1. Conditions for classifying a residual substance as a by-product.

The opportunity to use them as by-products is essential to undertake tangible action towards circular supply chains. Materials and resources become strategically important in the design of production and consumption systems. Especially, the improvement of bio-based materials, composed of plant or bacterial resources, could produce a considerable effect on preventing environmental depletion. Bio-based materials are obtained by processes and technologies that allow their use in new fields of application (Genovesi & Pellizzari, 2017). Supply chains should respond to three main requirements to implement the circular approach:

1. improve the reuse of manufacturing residues looking at the “zero-waste” production;
2. promote the industrial symbiosis approach between manufacturing processes;
3. reinforce local supply chains.

The agri-food sector produces a huge amount of by-products and residues that could be used to create new valuable production processes and products (Bistagnino, 2011). Considering cereal processing inside mills, the most of residues are obtained during cleaning (mixture of dust, chaff, weed, seeds, broken and unprocessable grains) and milling processes (bran and wheat germ). The mixture of residues is not considered as by-product due to the complexity of characterization. While, bran, with high content of fibers and proteins, and wheat germ, rich in vitamins, proteins and oils, are classified as by-products suitable for human consumption and pharmaceutical usage (Grundas, 2003). Recent studies are

evaluating the opportunity to use these by-products for other applications (Kwiatkowski, 2006; Galanakis, 2018; Dietrich et al., 2018). These studies highlight by-products' properties increasing also their economic value. Significant examples can be found also in the field of products, packaging and bio-based materials, but they could present some critical aspects linked to the land-use for cultivating plants for non-food purposes. The attention should be focused on highlighting the value of agri-food waste to overtake these environmental issues.

3. Progetto Glume: from waste to resource

Progetto Glume evaluates the opportunity to test new applications of organic residues for foodservice items and food packaging that present the urgency to replace plastics from fossil resources. The concept of “Glume” refers to the leaves of graminaceous plants that protect the caryopsis until it reaches maturity and they are separated from plants and collected during the cropping and cleaning process. The study was carried out in collaboration with the “Mulino Marino”, that since 1956 is a leading milling company located in Cuneo province (Piedmont Region, Italy). The province of Cuneo is mainly characterized by agriculture and farming economy of small and medium enterprises and in 2017 cereal cultivation reached 26% of the total agricultural area under cultivation. Annually, the company produces almost 420 tons of flours and it excels in the Italian scenario for the attention to environmental sustainability and process innovation.

In the first part of the study, the Systemic Design approach, in particular the Holistic Diagnosis (Battistoni et al., 2020), was applied to analyse the company’s materials flows (raw cereal grains, by-products, final products and waste) and to identify the main critical issues linked to organic waste. While the second part focuses on lab tests to evaluate the potentials of organic residues to create alternative food service items and food packaging, following a conceptual map of testing (Figure 2).

3.1 Material flow analysis

After the grain acceptance at the mill, it undergoes some pre-cleaning processes in order to separate the non-milling parts. Foreign matter, such as weeds, straw, stones and metallic foreign elements, are collected by compressed air machinery and sieves. *Organic sand*, composed of dust, non-regular grains and vetches, is obtained as the output of other consecutive cleaning processes that are carried out on grains. Before milling, cereal grains must be brushed and filtered by a vertical peeler, following the ATEX Directive (Atmosphere Explosive, ATEX 2014/34/UE) in order to reduce the risk of explosive dusts and ashes in the milling plant. This step is compulsory to maintain high standard levels of safety inside the plant that works at high concentration of dusts and using electrical machinery which could cause the trigger. *Wheat husk* [*WH*] is obtained as residue at the end of the peeling process and it cannot be classified as a by-product following current regulations (MATTM, 2017). Unsuitable grains for milling are separated by an optical sorting machine, while the suitable

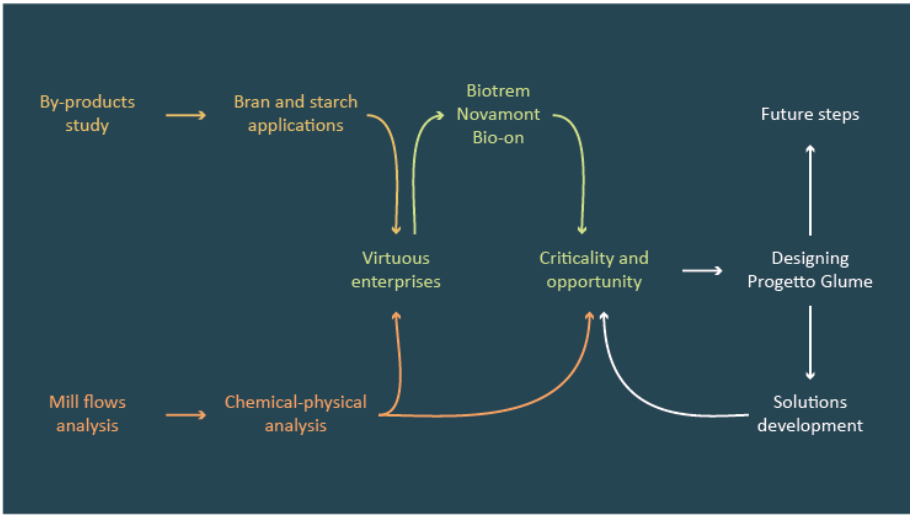

Figure 2. Design path.

part is conditioned and prepared for cylinder or stone milling. Flour, as the core product, and bran, as a by-product, are obtained at the end of the process. In 2018 the Mulino Marino has processed about 680 tons of grain obtaining 420 tons of flour. About 30% of raw cereal grain is lost as processing residues (Figure 3). Wheat flour and the first selection of bran is sold in HDPE package for human food consumption, while the other part of bran are sold as feed for the livestock industry (about 0,30 Euro/kg). On the other hand, *organic sand* and *WH* are not classified as by-products and they must be managed as organic waste, defining a critical issue for the mill. Considering the high quality of raw cereal grain processed by the mill, these residues could present properties that should be enhanced.

3.2 Qualitative analysis of organic residues

The characterization of these residues is the second step to evaluate the opportunity to reuse them for alternative uses. After processes wheat bran is stored following food management standards, minimizing risks of product contamination and alteration, while *WH* are collected in 25 kg bags and kept in an uncontrolled environment. Chemical analyses are carried out to assess their chemical composition, toxicological values, starches and protein values (data are available on request). Results assert that *WH* do not present any harmful toxicological value and they content noticeable values of proteins and fiber and about 20% of starch. The starch content is particularly important for the production of bioplastics as it is responsible for the phenomenon of gelatinisation (Lubis et al., 2018). However, the amount of starch should be increased to allow proper *WH* processing as a bio-based polymer, increasing cohesive property.



Figure 3. The analysis of raw cereal grain and output flows. Processes that generate residues: Roughing (a), Cleaning (b), Milling (c).

3.3.1 Vegetable polymer

This experiment is based on previous studies carried out by Jiang et al. (2016) and by the designer Pontus Törnqvist (The James Dyson Award, 2018). Looking at the Circular Economy and sustainability purposes, the starch used for tests, for increasing cohesive properties, is extracted exclusively from potato peels. The first step consists of the assessment of the percentages of amylose and amylopectin present in matrices of wheat and potato starch. Both of them present a range of 21-25% of amylose and 75-79% of amylopectin (Thakur et al., 2019).

The process to obtain the proper composition of the basic mixture is reached by gradually adding *WH* to a pure starch-based mixture for bio-polymer. This step is essential to assess if the addition of *WH*, as fiber, can cause adversities. Water is the solvent essential to dissolve starch crystals and moisturize *WH* fibers. The vinegar and lemon solution acts as an acid and it helps the ionization process in order to make the compound homogeneous. Glycerine gives more flexibility to the compound being a natural plasticizer. After gelatinisation, the samples are flexible and viscous, suitable for processing.

These proportions were indicated as Base Formula [*BF*], on which the following tests have been carried out to reach a Vegetable Polymer [*VP*] (Figure 4).

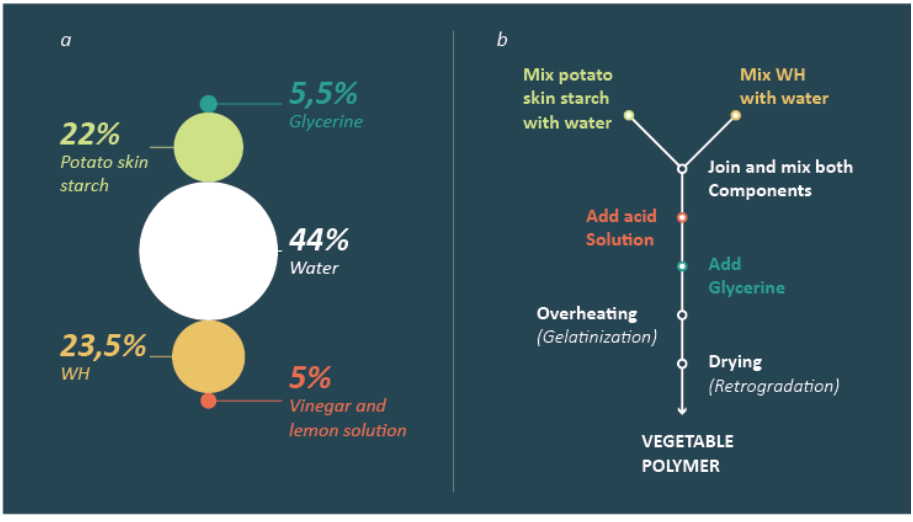

Figure 4. Optimal proportions with maximum use of WH for the basic mixture composed by WH, starch from potato skin, water, glycerine and acid solution of vinegar and lemon (a). Making processes of the Base Formula (b).

3.3.2 Manufacturing process

The BF is used to process the VP samples at room temperature, while the starch gelatinisation is done directly on the overheating phase. Preliminary tests are carried out to assess the performances of VP samples using wooden moulds under different compression times and at different drying conditions. Results of these tests are considered to improve the moulding process and the drying step.

First of all, VP samples are coated with waterproof and non-stick paper to allow a homogeneous gelatinisation process during overheating. This procedure limits the risk of dehydration of the samples surfaces exposed to contact with hot air. Furthermore, the coating avoids the adhesion of the sample surfaces to the mould surfaces during the moulding phase. The moulding process of VP sample is carried out by 3D printed moulds and counter moulds (Figure 5). Digital modelling and 3D print file generation are performed by Blender and Cura software, while printed moulds are obtained using the Anet A8 printer and Sunlu filament (PLA). Moulds shapes have sharp edges and inclined surfaces to improve the mechanical properties of VP samples.

Variables taken into account during tests concern the time of exposure to heat, the temperature reached on overheating and the drying temperatures. Drying conditions are decisive for limiting and controlling the retrogradation process of the material. *VP* samples are tested under different processing and drying conditions (Table 1).



Figure 5. Set of PLA moulds used to give shape to the vegetable polymer.

	T1(DC)	T2(DC)	T3(DC)	T4(DC)	T5(DC)	T6(DC)
Overheating						
Temperature	187°C	248°C	>250°C	175°C	235	>250°C
Timing	3’	5’	7’	3’	5’	7’
Weight						
Inbound	19 gr	19 gr	19 gr	19 gr	19 gr	19 gr
Outgoing	10,2 gr	9,7 gr	8,8 gr	10,4 gr	9,5 gr	9,2 gr
Drying						
Temperature	25°C	25°C	25°C	7°C	7°C	7°C
Timing	48 h	48 h	48 h	48 h	48 h	48 h

Table 1. Processing conditions test to find the basic formula.

The *BF* used to process the T5(DC) sample is taken as reference for subsequent tests, to assess which mechanical process is the most suitable for *VP* material. Base Formula has been exposed to lamination, compression at high contact temperatures and extrusion.

Simultaneously, experiments on the moulding of tableware were carried out in order to investigate the samples' deformation using different PLA mould and countermould. The texture of their internal surfaces is accentuated in order to fragment the surfaces and reduce tension during the drying phase. Mould's internal surface mesh allows the samples to lose humidity uniformly without temperature changes. Moreover, a dehydrating machine is used in order to limit retrogradation and to better control the drying process (Figure 6). Scraps obtained by pressure mouldings are collected and left to dry without specific constraints. After retrogradation, they are crushed and placed under pressure at high contact temperature (160°C), obtaining the melting of all fractions. This result highlights that *VP* samples present properties similar to thermoplastics. Furthermore, the hydration of the fragments improves the (re)gelatinisation process.

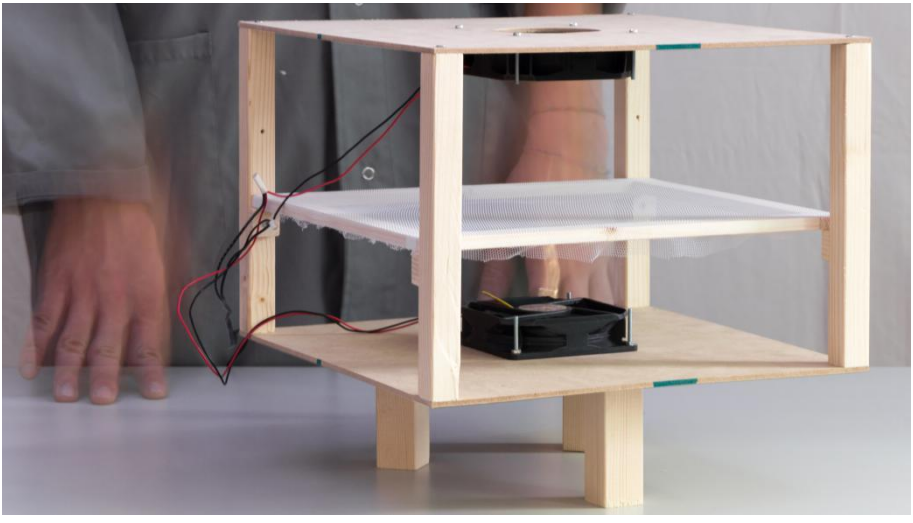

Figure 6. Self-built dehydration machine.

3.4.1 Microbial cellulose

According to From Peel to Peel project (FPTP) (Sicher, n.d.), the interaction between food-waste and microorganism can generate potential new materials. "*SCOBY*", the acronym for the Symbiotic Colony of Bacteria and Yeasts, is usually used to produce fermented foods, such as vinegar or Kombucha. This bacterial culture presents distinctive chemical-physical properties to be used as a starter to grow microbial cellulose through sugars fermentation: an extracellular polysaccharide produced by some bacterial strains such as Acetobacter,

Agrobacterium, Gluconacetobacter (Rangaswamy et al., 2015). It represents an alternative to vegetable cellulose and it is already applied in medical and food sectors. Environmental conditions of microbial cellulose growth are essential to define the final result. Parameters such as carbon source, nitrogen source, temperature, pH and type of sugars influence the generation process. The key qualities that lead to testing the *WH* potential through microbiological transformation are:

- Specific surface area;
- high water retention;
- excellent mouldability;
- tensile strength.

Tests are carried out to validate whether wheat husk could feed this bacterial culture, since *WH* is composed of starches. Moreover, *WH* contains residues of graminaceous plants and its values are similar to straw, already used in unconventional fermentation to produce bacterial nano cellulose (Corujo et al., 2016).

3.4.2 Manufacturing process

According to FPTP experiments and the results obtained by the Production of Microbial Cellulose by Tea Fungus (Shehata et al., 2007), the *WH* experiment was set up using the *SCOBY* from Fermantaholics.com and 3 tempered-glass tanks for culture growing. The percentages of elements for bacterial culture growing are calculated starting from 1 l of water (Table 2). *SCOBY* is placed into emulsion after mixing all elements. Tanks are covered with fabric to allow the respiration process and to avoid dust contamination. The temperature is set between 22-25°C.

After 3 weeks, the layers of bacterial cellulose are extracted from the emulsions. Results of the tests showed that tank 3, containing *WH* as a nutrient for bacterial culture, is the best in terms of microbial cellulose growth. The Microcial Cellulose [*MC*] layer is grown over the entire area of the emulsion and it reaches the maximum of 1.8 cm of thickness. The layer is left to dehydrate upon a grid frame to promote ventilation. Once dehydrated, mechanical tests are carried out on the *MC* to evaluate its properties. The *MC* layer is rehydrated and stretched between two transpiring surfaces in order to obtain a thin film. Both two layer's sides are clamped to prevent deformation during the second drying phase. Fans are used to maintain ventilation and to avoid mould contamination. After this step, the *MC* is pulled out from frames and it looks like a thin and tough film.

	T4(DC)	T5(DC)	T6(DC)
Wheat husk	-		5%

Water	1	1	1
Vinegar	10%	10%	10%
Sugar	5%	5%	5%
Green tea	5%	5%	-

Table 2. Percentage of the elements for bacterial culture medium.

Before dehydration, the *MC* shows excellent tensile strength and high malleability. These characteristics suggest to test it as a bio-based material for packaging. A moulding test is performed to transform the film into flour packaging. The test foresees three steps of transformation: three-dimensional forming of the film and sealing of the flaps; folding and closing of one end; fill the pack with flour and close it by sealing. Firstly, the sample is slightly hydrated and wrapped on mould; two edges are joined, folded and pressed to be welded by compression. Secondly, the bottom of the sample is made by folding and compression of the lower end. Finally, after pouring the flour, the upper ends of the sample are sealed by moisturizing the surfaces that are bent and compressed. The result is a prototype pack (Figure 7).



Figure 7. Detail of the sample manufactured by artisanal process.

Scraps of *MC* layer are hydrated to reduce their stiffness due to natural moisture loss and to make them highly malleable. Two moulds (hemisphere and truncated cone) are used as a three-dimensional shape on which the *MC* residues are manually laid and compressed. The presence of water makes the residues adhere to the moulds and single fragments blend together without being more recognizable. The detachment from the moulds does not present problems of adhesion between their surfaces and *MC* samples easily take the same shape of moulds.

4. Discussions: critical issues and positive aspects

Main issues are related to material deformations during the drying processes: water loss leads to results that are difficult to control. In the case of *VP*, samples shrink by about 1 cm and the thickness decreases from 2 to 1 mm once dried. The same phenomenon is observed for the *MC* which drastically reduces the thickness from 1.4 cm to 0.007 cm. The *VP* samples with less post-drying deformation are those processed with compression at high contact temperatures (160°C): however, this process requires high energy consumption. The drying process has a significant effect on the mechanical properties of samples. Therefore, it is necessary to perform tests in a controlled environment monitoring the below parameters:

- Air circulation;
- Temperature and pressure changes;
- Influence of external light (especially for *MC* processing).

The VP experiment shows that the temperature between 60° and 70°C is the optimal condition to promote a low viscosity fluid state. Once the 90°C threshold has been exceeded, starch processing is not possible, compromising the final result.

MC tests present the processing timing as the main critical issue, especially compared to other industrial materials. 3 weeks are necessary to obtain an area of 0.28 m² with a thickness ranging from 0.8 to 1.8 cm. Another negative issue concerns the control of acetic fermentation during MC formation: only a part of the film is cohesive and compact. Temperature changes can generate spontaneous contamination by other bacteria strains that compromise the uniformity of the surface layer. The well-formed portion of MC is generated close to the bacterial culture starter (SCOBY). Therefore, the amount and placement of SCOBY used as a starter affect the final result. Nevertheless, positive aspects are related to the possibility of generating bio-based material using a low amount of energy and without fossil-fuel components. Materials obtained don't present any physical or chemical constraints to deny their reintroduction into different production chains, nor do they contain elements harmful to the composting phases.

Positive aspects of VP processing concerns the preparation of the mixture before gelatinisation that can be carried out at room temperature (20°-25°C). VP samples reach a

volumetric detail of 1 mm thanks to compression processing, while the most performing manufacturing processes are lamination (minimum thickness reached 0.5 mm) and compression at high contact temperatures, because the sample gelatinizes and takes shape simultaneously. VP can be compared with thermoplastics because VP scraps can be easily re-processed.

Microbiological processes to obtain the MC don't require energy: the cellulose layer naturally grows on the whole surface in contact with oxygen. This process presents innovative aspects that look at the hybrid frontier of biodesign. Biodesign approach incorporates living organisms (bacteria and yeasts) into design processes as essential components (Myers, 2018). This property allows designing custom two-dimensional configurations, eliminating the production of waste from any shaping or cutting. The culture of bacteria and yeasts regenerates itself by "new" fermentation. Unlike traditional material processing, it has the ability to generate new microbial cellulose as a starter for subsequent production. MC generates two residues: solid and liquid. The solid part is composed of fermented WH that can be gelatinized following the VP procedures. While properties of the liquid fraction have not yet been characterized. These two residues are biological matrices that should be optimized.

5. Conclusion

The goal of Progetto Glume is to explore new strategies to optimize and validate the transformation of milling waste into by-products and bio-based materials through the application of an experimental approach. The study highlights many positive aspects and some constraints that should be considered as challenges for future steps. Critical issues should be taken into consideration as an opportunity for the development of *WH*'s validation tests and to define possible future scenarios. Future challenges can be organized into two main areas: the first one focuses on translating the handcraft approach to industrial one considering *VP*'s and *MC*'s mechanical performances, while the second one designing the system of local supplier (mill companies) and product processors. The research project promotes sustainable development strategies that acts locally. Indeed, future challenges include the involvement of small and medium-sized enterprises in cereals transformation sector that are able to exploit their residues reducing the environmental footprint, the exploitation of natural resources and economic costs for waste management. Project improvement should focus on design engineering, on testing *VP*'s and *MC*'s sustainability, compostability and their compliance with current regulations. The handcrafted approach adopted in the experimental research highlights that both proposals present a high potential for improvement and application in an industrial way. The abundance of locally ground cereal and the low energy requirements for waste transformation processes are the key aspects of the project. For effective development, Progetto Glume needs to create a multidisciplinary research team composed of professional figures from different fields such as biotechnology, engineering mechanics and materials science. Mill industries, feed mills

and malting plants are playing a key role in the project because they provide waste/resources for the project development. Progetto Glume is inspired by many people working in the cereal sector, agriculture and design with the aim to involve and connect people of different work and research fields. This study suggests a joint-venture of design manufacturing for sustainable and strategic development in relation to the territory and its resources.

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Acknowledgements: We would like to thank Mulino Marino, in particular to Fausto, Flavio and Ferdinando Marino, for their collaboration to the research project.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Re-distributed manufacturing in makerspaces. Towards a model of sustainable production.

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Abstract | This paper examines the current trends within the «making» landscape and brings forth a vision for the future evolution of the role and status of makerspaces in local communities. It does so by bringing together observations from several Danish makerspaces and the insights collected during a subsequent design experiment. This tangible, empirical and design-influenced data is contrasted and analysed throughout the process using a range of relevant literature, touching on the topics of Maker culture, distributed manufacturing, and their sustainable implications. The outcomes of this research process describe the ongoing transition taking place within the Maker movement. They also give a sense of how it is perceived from a design perspective. The paper sets out the potential that makerspaces represent in terms of local manufacturing, circular economy, and collaborative work, while highlighting the difficulties and challenges that such a vision will have to overcome in order to be achieved.

KEYWORDS | MAKERSPACE, RE-DISTRIBUTED MANUFACTURING, ENVIRONMENTAL SUSTAINABILITY, FUTURE MODEL OF PRODUCTION, DESIGN-BASED RESEARCH

1. Introduction

This paper takes its start point in the identification of a literature gap concerning productive aspects of makerspaces by Hennelly et al. (2019). They point out a “distinct lack of in-depth case study work”, as well as missing analysis of makerspaces’ “role in building local productive capacity”. Therefore, the present research, through the use of case studies and design methods, aims to contribute to the exploration of this field by investigating the possibilities that are opened up by a makerspace-based decentralized model in terms of re-distributed manufacturing.

The first makerspaces, Fablabs, demonstrated at the beginning of the 21st century the transition from virtual to physical, from bits to atoms, with the promise to allow everyone to build everything (Anderson, 2012; Gershenfeld, 2012). As they spread, the original layer of tinkering was supplemented with a layer of education and empowerment. This is now leading Fablabs to be more and more integrated within public spaces and educational institutions, as they are seen to elicit creativity and provide a culture of technology and hands-on experiments (Barrett et al., 2015).

Nevertheless, the evolution of original Fablabs also led to the emergence of other typologies of makerspaces. Hennelly et al. (2019) categorize them in three types: «Type 1 - educational and concept design; Type 2 - design and prototyping and Type 3 - prototyping and production», categories which will be used as a theoretical frame in this research.

In light of the current environmental and societal pressure, this paper premises that the conscious development of more production-centred makerspaces – above-mentioned Type 3 – could greatly disrupt our present manufacturing and consumption patterns, enabling more collaborative, reflective and sustainable behaviours (Kohtala & Hyysalo, 2015; Kostakis et al., 2016; Millard et al., 2018). The possibility presented here is that that Type 2 makerspaces will fade and make way to a bipolarization of makerspaces offer, and that the remaining poles will nurture each other in a symbiotic relationship.

These conjectures, beside taking their roots in a review of contemporary theory, are the result of an investigation consisting in two loops of Design-Based Research. The first step is based on the observation of four case studies from the region of Copenhagen, Denmark. The results from this phase were subsequently used in the elaboration of a design experiment – the second loop.

2. The case studies

The ethnographic inquiry at the base of this paper started off with the setting up of four case studies. Yin (2003) was used along this process as a framework to assess both the design and the conduct of the studies. Yin provides the current matter with an interesting definition when he writes that a case study “investigates a contemporary phenomenon within its real-

life context, especially when the boundaries between phenomenon and context are not clearly evident" (Yin, 2003, p.13). Within each case, Pink's (2015) precepts for sensory experiences of places and people also guided the initial passive understanding. More active methods, mainly semi-structured interviews, were subsequently used.

The choice of the cases was motivated by the will to collect contrasting observations to provide empirical backup to Hennelly et al.'s (2019) above mentioned classification. The Copenhagen area was targeted for its relatively wide range of makerspaces, some of them organized in emerging structured networks. Four cases and therefore four sets of observations were conducted during the time of the study.

2.1. The cases

The first case was conducted at FabLab Copenhagen. This observation holds a specific role in the study since the FabLab network has for long been communicating a clear focus on technology education, sharing and non-profit, volunteer-based business model (Massachusetts Institute of Technology, 2012). These characteristics undoubtedly place it within the scope of Type 1 makerspaces (Hennelly et al., 2019), directing its efforts towards openness, knowledge sharing, and hands-on experimentation. Therefore, it became a sort of benchmark for ensuing cases, mainly regarding the assessment of their typology.

FabLab Copenhagen's premises are certainly the first evidence of the institution's practicality, as it is hosted in former sport facilities, made available by the municipality. It therefore consists in a succession of changing rooms, repurposed as different workshops corresponding to different technologies. These latter range from desktop 3D printers to laser cutters, vinyl plotters and more traditional power and hand tools. During the observation, several people coming and going hinted at the openness and informal aspect of the place. However, one of the interviewed superusers specified that since the recent acquisition of bigger, expensive machines that the FabLab «can't afford to lose», the presence of a supervisor was required to control the access.

The second observation took place in Helsingør, at the open workshops of the recently opened Centre for Art, Design and Technology (CATCH). The makerspace is part of a cultural and leisure offer comprising a library, an exhibition hall and a food court, hosted in a mix of newly built facilities and repurposed shipyard warehouses. Beside the small 3D printers and electronic tooling found in the main building, bigger machines – CNC milling, laser cutting and power tools – as well as workbenches are available in the warehouses. The location of this makerspace as well as its short existence are plausible explanations to the very low attendance experienced there, later confirmed by an interview with the workshop manager.

The third case was conducted at Underbroen, at the heart of Copenhagen. The workshops – displaying similar technologies as in Helsingør – as well as the several working or meeting areas accessible there are placed in a succession of decreasingly sized rooms, making the most of this unique space (it is part of a bridge pier). The institution benefits from a robust

community, that was described by one of the founders as an “even mix between businesses and individuals”. This distinction is reflected in the available memberships, full-time or evening access, from which Underbroen is mainly financed. This mix of audiences was confirmed during the main observation: from the relatively large amount of people using the space that day (mainly occupied doing computer work in groups or operating the laser cutter and 3D printers), short informal interviews allowed to determine that both start-ups and non-professionals were present. A second visit on a different day gave evidence of lower attendance periods, demonstrating the difficulty to establish presence patterns (Klemichen et al., 2018)

The fourth case was organized at the Beta Factory, in the district of Sydhavn. This makerspace, hosted in large industrial facilities, features two distinct workshops with heavy-duty wood machinery. The first one comprises large wood-oriented digital tools (CNC milling, laser cutting) as well as fixed power tools, while the second offers different metal-oriented machinery. Besides that, an industrial-grade CNC sheet processing machine was being installed during the observation. Members are also provided with workbenches, material storages and dust-free areas. Despite offering the same membership plans as Underbroen, Beta Factory is much more business-oriented, both towards craftsmen and start-ups. Members, besides their own activity, also work together on collaborative projects whenever Beta Lab – the umbrella organization – receives projects requiring different skills. Different informal talks with the craftsmen highlighted the permeability between fields of competencies, as well as the exchange of skills and knowledge. A meeting gathering all the members present that day to discuss the optimization of the workshop areas confirmed the communal aspect in the management of the space (Figure 1).



Figure 1: An example of members-based decision-making at Beta Factory.

2.2. Report

The cases, selected to provide this study with contrasting data, proved to be very different examples of makerspaces. However, despite the obvious distinctions, they also showed some interesting converging trends.

The observation of the FabLab confirmed the expectations regarding Type 1 makerspaces and helped setting the benchmark standards. The openness as well as the “system D” approach were palpable. Nevertheless, it is tempting to see dynamics of expansion in the acquisition of bigger machinery. Dynamics which were interestingly also visible in Beta Factory, although in a dissimilar context.

In Helsingør bigger tooling was also observed. However, this part of the workshop really appeared under exploited, and the offer found in the main premises proved to be similar to the one at the FabLab. In addition, the overall cultural supply displayed by the CATCH and the obvious wish from the municipality to use this space as a technology-centred mediation tool makes it a good example of Type 1 makerspace. Yet it will be interesting to observe its future developments, as interviews raised evidence of a nascent networking with artists and businesses.

This business perspective is already omnipresent at Underbroen. Strong insights were provided in that sense, by the interviews with professionals as well as by the observation of a meeting held with a delegation from a big furniture company. However, these insights also revealed that what professionals found in that place is an experimental ground, at best a prototyping one, this being explained both by the location – close to other businesses – and by the limited available space. Underbroen was therefore deemed to be a Type 2.

The space constraint did not exist at Beta Factory, and the business aspect was also particularly tangible. Moreover, it displayed noteworthy dynamics in terms of internal organization, translating the FabLab’s mutual aid and sharing philosophy in a professional context. In that sense, the occasional formation of skill-based “taskforces” to answer productive challenges was also decisive in assessing Beta Factory as a developing Type 3 makerspace. Although its current activity is not so much an example of re-distributed manufacturing – most of the craftsmen are working on one-offs, for example for the event sector –, it undoubtedly displayed a great potential to one day host such local, crafts-based production.

The presented case-studies undoubtedly brought empirical evidence in favour of a makerspaces categorization such as the one proposed by Hennelly et al. (2019). Even though it has to be acknowledged that makerspaces represent an eclectic group of entities, with different focuses, approaches or social implications (Klemichen et al., 2018; Barrett, 2015; Kohtala & Hyysalo, 2015), their level of professionalization and involvement in productive activities seems to provide a convenient measure in defining overarching typologies. This classification is important since it should inform and guide the adoption of conscious

strategies and policies for the future development of makerspaces, and hopefully towards the development of a viable decentralized manufacturing network.

3. The design experiment

Capitalising on the results of the case studies, a design experiment was constructed to explore further and contrast some of the collected data. The goal was to find out significant commonalities and differences between current typologies of makerspaces, to build upon in order to envision a plausible model of decentralized, community-based production system. Designers composed the experiment panel, as it was deemed their approach could help to identify both the potential and the flaws, both the commonalities and singularities, of the exposed cases, in pragmatic and forward-looking manners (Kimbell, 2012).

The experiment was crafted on the base of two methods used in design thinking (Friis, 2016). The first one, sometimes referred to as Investigate Opposites, is a data analysis exercise aiming at comparing two radically different entities within one field or group, to explore the gap left in between and the opportunities lying there. In this case, participants were introduced to two of the aforementioned case studies, the Fablab and Beta Factory, deemed to be situated at both ends of the makerspace's spectrum – Type 1 and Type 3, from Hennelly et al.'s categorization (2019). The second method involved, Future Scenarios, is a speculating exercise where participants build on contemporary phenomena to imagine possible future evolutions for these phenomena. To ease the transition from one method to the other, the overall experiment was divided into three phases: Reaction, Confrontation and Projection. Figure 2 was produced to visually support the conduct of the workshop.

3.1. The phases

For the first phase of the experiment – Reaction –, the designers were split into two groups. Each group was assigned a case and given a time to familiarize themselves with it through a video montage of the actual space complemented with an audio record of a member from each makerspace describing the institution. An access to the websites was also granted, both to enrich the informative aspect and to inform about the communication strategies.

Then, the participants were asked to express their reactions and feelings on sticky notes that were then sorted according to four pre-established tracks: Institution, Technology, Social aspects, and Sustainability. Each track was defined using a list of keywords to make sure participants would reach equal understandings. It could be argued that the sustainability aspect is implied in the first three tracks, but it was decided to emphasize it as it has been proven to be often overlooked in similar contexts (Klemichen et al., 2018; Kohtala & Hyysalo, 2015; Millard et al., 2018).

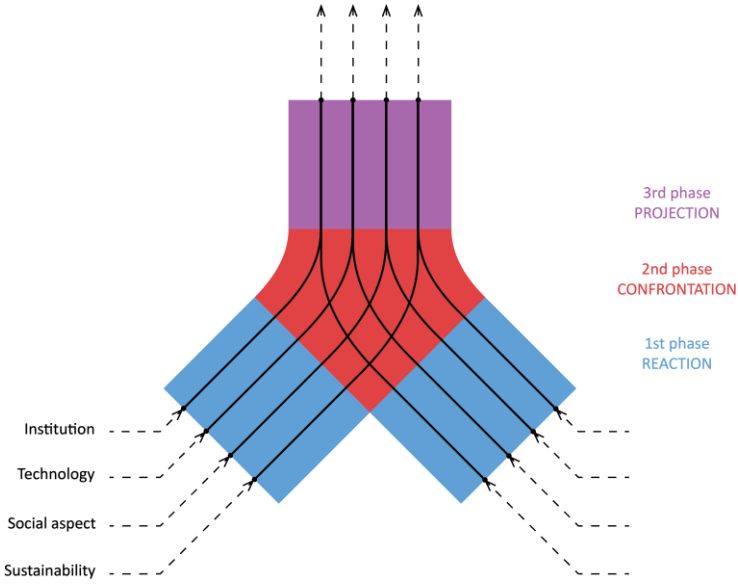

Figure 2: This graphic was showed to the participants in order to facilitate the conduct of the experiment.

For the second phase - Confrontation -, both teams gathered to briefly introduce the institutions they had been working with, before moving on to the presentation of their reactions, track by track. Along the subsequent discussion, the participants were prompted to start small debates around the different commonalities or singularities between the two models. All this second phase, as well as the third one, was audio-recorded and photographed for further analysis.

Thanks to the designers' natural propensity to envision future potential developments, the conversation was easily conducted towards building future visions for makerspaces, the goal of the third and last phase - Projection.

Participants were thorough in reading current trends in the evolution of both types of makerspaces, then translating these trends in potential future scenarios and evoking both their strengths and flaws. They even touched upon how such models could be economically sustained. Some of the points raised during this phase played an important role in the elaboration of the conjectures presented in section 4.

3.2. Report

The results of the experiment will be broken down into the four tracks given to the participants: institutions, technology, social aspects and sustainable aspects. More cross-

category analysis and discussion will take place in Section 4. (Note that from this point and until the end of the present subsection, quotations marks were used to quote contributions from the participants, either oral or written.)

The Institution track was introduced with notions such as business model, membership system, philosophy, rules or codex, etc… Within this discussion, some points were made about the «functional» and «professional» aspects of Beta Factory's set up, in opposition to the more «after-work club» look of the Fablab. If both were in turn described as «messy» and «chaotic», the aesthetic of the website and the work produced at Beta Factory were considered «design-oriented», while the free access to the Fablab and its non-commercial aspect raised questions about its business model.

Technology was the least discussed topic through the experiment, probably due to the fact that the Institution track had already absorbed some of the discussion related to the level of tooling. As for craft-related discussions, they rather took place within the Social track. In the end, beside the scale of the machinery, participants did not observe a clear difference between the two case studies. A consensus emerged around the mix of low and high tech in both spaces.

The Social track, together with the Institution, gathered most of the reactions, which could be explained by the intrinsic collaborative characteristics of both places, as well as by the human-centred approach of most designers. Observations mostly orbited around the sociality of making found in makerspaces. For Beta Factory, it was seen as the possibility for «like-minded people» to work in a «community hub» that allows them to «interact with their immediate neighbourhood». In the case of the Fablab, it is more the «focus on sharing» and more widely the social inclusion and low skill threshold which caught participants' attention.

Even though it seemed clear to the participants that sustainability was not at the heart of makerspaces preoccupations, they identified shared trends of both conscious and unconscious sustainable behaviours. The local «reuse of materials» and «sharing/donating» were among the conscious ones, while the Fablab's initiatives to build product from discarded material, and Beta Factory's shared entrepreneurial facilities were cited as unconscious sustainable features, both environmentally and socially.

4. Analysis and Discussion

From the results of the ethnographic inquiries displayed above, this section aims to identify patterns that could be further explored and harnessed in the perspective of a transition towards a productive makerspaces landscape.

Beyond the useful but static classification of the case studies, it is essential to consider the transformations at stake. In the context of this research, the main identified pattern is a bipolarization of the makerspace's spectrum.

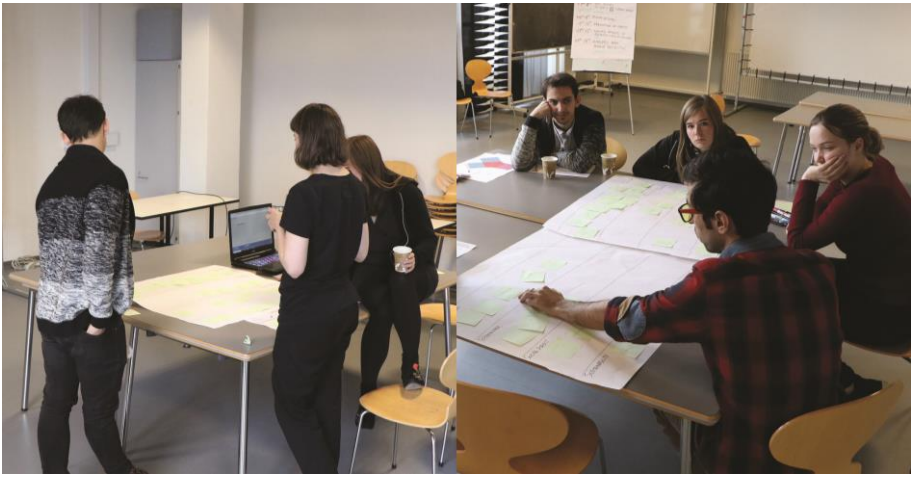

Figure 3: The participants first familiarized with their given case in groups, before sharing their insights and observations in plenary. The contrasting between cases led to the exploration of possible future scenarios regarding the development of makerspaces.

4.1. Towards Two Complementary Poles

The first premise of this paper, building on Hennelly et al.'s work (2019), is that Type 2 makerspaces will progressively disappear and be absorbed by the two other types.

This will firstly stem from the emergence and enhancement of more makerspaces embracing the productive aspect of digital fabrication – Type 3 –, invigorating short supply chains and local economies. Beta Factory gives a good example of this transition, originating in the impossibility for Underbroen to accommodate the productive ambitions of both its founders and some of its members.

This evolution was perceived, during the experiment, as a way to add to the Maker movement a higher level of craft and expertise, as well as to sustain «craftsmanship and make sure that craftsmen will persist in the future». This combination of craftsmanship values, sometimes compared to the original hacker ethic (Himanen, 2001), and digital tools of communication, conception and fabrication, represent a real disruption potential (Micelli, 2015). Incidentally, an increasing number of frameworks now advocate for "globally connected, locally productive" models (Fab City Global Initiative, n.d.)

Nevertheless, there is a risk for Type 3 makerspaces to be taken too far away from their Maker-based roots, following the same path as the "sharing" economy with examples such as Uber and Airbnb. The Maker movement being absorbed back into business-as-usual is in fact one of the three potential scenarios derived from the two years long European Make-it program (Sbeih, 2017). In the Copenhagen context studied here, the yellow line might be

quite close. With the high running costs induced by the rent and the energy consumption, Beta Lab is in need of big projects and partners coming from the outside, which could eventually divert them from the forward-looking decentralized model they started setting up (Javelle & Péché, 2013).

This concern is obviously not a plea to slow down the move towards productive makerspaces but more an invitation to operate this move reflectively, in order to avoid these shifts to generate «negative patterns with unfortunate consequences» (Stewart & Tooze, 2015).

The second expected dynamics of this bipolarization process are the strengthening of existing educational poles. Through their accelerating implementation in diverse public spaces and educational institutions (Barrett, 2015), and with the increased awareness about the culture of making, it is believed that these spaces will gain agency as well as more design sensitivity.

This drift could be matched with the observed expansion of Fablab Copenhagen. This topic was also raised by the designers during the experiment, questioning what could be the consequences of such a scaling up.

4.2. Two Poles, One Hub

The second premise internalizes, while pushing further, some of Stewart and Tooze vision (2015) of the potential for educational makerspaces to prepare «a future generation of 'employees'» for their productive counterparts.

This vision is the core contribution of the design experiment to this paper, and perhaps the core postulate of the paper itself. The anticipated bipolarization, instead of creating two very discrete entities, could rather give birth to a duo, or Hub. Considering simultaneously the role of super users in the Fablab organisation and the sharing of skills and knowledge already taking place at Beta Factory, the experiment participants quickly visualized the potential of bridging these two into a single loop. Instead of paying for their membership, willing craftsmen could facilitate introductions to certain skills, as superusers do, therefore substituting money flows with knowledge ones and reviving a commons-based economy (Kostakis et al., 2016). Hobbyists would benefit from experts' supervisions and have the choice to keep their activity as hobbies or to scale it up in the adjoining facilities.

This theorized Hub would provide communities with locally produced goods and services, as well as with a pool of locally shared skills and competences. Municipalities and regional political bodies, in return, could provide support through subventions and public sector partnerships. It is believed that making this fabrication culture more visible and desirable will ease the shift of current consumption habits towards more conscious, sustainable and local behaviours (Clune, 2010; Shove, 2003). The Hub could also become a favourable platform for the emergence of "local discontinuities", easing the generation of sustainability through social innovation (Manzini, 2015).

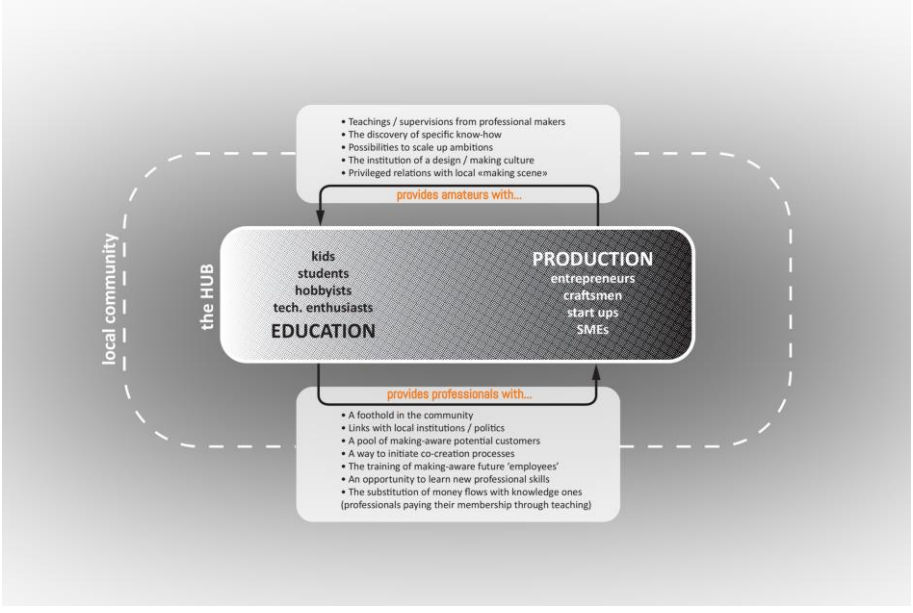

Figure 1. The theorized education/production Hub

4.3. Towards a Sustainable Model of Production

By drastically shortening supply chains and reorganising the economy around distributed Hubs; by empowering people and communities through a culture of making and a strong local alternative to global-market goods; by establishing tight connections with both local political bodies and SMEs; it is strongly anticipated that the above-described shifts could deeply impact the current societal model. The focus would then be moved away from profit-making only, allowing a true path towards sustainable development, or, in a more utopian but enviable vision, a path towards the true «roots of sustainability» (Erhenfeld, 2005).

It is shown that, at the moment, environmental sustainability is not at the core of Makers preoccupations (Klemichen et al., 2018; Kohtala & Hyysalo, 2015; Millard et al., 2018). However, the case studies and the design experiment indicated that, despite this lack of attention, local making and manufacturing practices are already embedded with a number of unconscious sustainable behaviours. This is inherent to the nature of the Makers and Hackers movements (Kohtala, 2015; Himanen, 2001).

Besides the environmental aspect, there are signs that the Makers movement is already generating great social sustainability (Kostakis et al., 2016). Furthermore, the experiment laid the foundations for an economically sustainable re-distributed model of production.

These existing patterns only need to be fostered and, in certain cases, guided to meet their full potential (Klemichen et al., 2018). Progressively integrating more links of the design chain within makerspaces will give them more agency and, it is hoped, generate a bigger impact. Finally, moving away from Type 2 makerspaces will help establishing them more as truly local institutions and less as incubators for ideas to enter back the globalized market afterwards.

5. Conclusion

In an attempt to open new perspectives towards more preferable futures, this paper advocates the implementation of a strong decentralized, re-distributed manufacturing model. Its main postulate is that this vision could be met by guiding more makerspaces towards productive purposes, and by operating them in parallel with existing education-oriented spaces. It is expected that the newly created Hubs will play a big role in diffusing a «making culture» within local communities or, at least, in raising the awareness of these communities about their disruptive power.

It would of course be incorrect to consider the case studies presented in this paper as the sole and entirely representative reflections of the current makerspaces landscape, mainly because of its heterogeneous nature. However, they give real-life examples of a possible model of development for these spaces.

The future of makerspaces as well as the path to decentralized production in general are highly uncertain, and subject to a number of threats that could spoil their original discourse and ethos. But this paper aims, building on the visions of numerous other authors, to look beyond the inevitable and apparently inexorable. It urges the concerned stakeholders – makers, designers, educational institutions, politics and potentially everyone – to join forces towards preferable futures that could sustain and gather communities around values such as respect, collaboration and sustainability.

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Acknowledgements: I would like to thank Ulla Ræbild for insisting that I should bring this paper to the world, as well as Richard Herriot and María Vitaller del Olmo for providing precious feedback on the way to the final form of this paper.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Research on the Application of Lacquer Craft in Modern Accessories

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Abstract | From the perspective of the environment, mood, behavior and significance, the present study analyzes why and how Chinese lacquer is applied in modern accessories. A bodiless rapid prototyping method is proposed in the study for accessories coated with Chinese lacquer, and a drying method is put forward for 3D-printed metal materials coated with Chinese lacquer. The feasibility of the two technical solutions is verified by experiments. Finally, from the perspective of future opportunities and challenges, the study analyzes the environmentally sustainable value of lacquer and people's demand for lacquer accessories, and looks forward to the lacquer craft assisting Chinese accessories manufacturing industry to upgrade and transform.

KEYWORDS | LACQUER CRAFT, ACCESSORIES DESIGN, TRADITIONAL TECHNOLOGY, RAPID PROTOTYPING

1. Research Background

"The Inheritance and Innovation of Chinese lacquer" has been a hot subject in the design and craft research field of East Asia (especially China, Japan and South Korea) in recent years. To apply traditional craft elements in modern design has become a consensus within the academic circles and a hotspot of attention of today's craft artists and designers. Throughout the history of craft development, craft has been corresponding to art all the time. "Art is created for appreciation while craft is born for a practical purpose"[1]. Inheriting the traditional craft in the modern society does not mean documenting and reviewing the craft only, but also means returning it to the original concept of "craftsmanship" to primarily meet living needs. "Usage" values are more important than "ornament" values. For this reason, "usage" must be blended with "ornament" to make the traditional craft adapt to the modern society.

Lacquerware used to be indispensable articles in the Oriental society and infiltrated in many sectors such as food utensils, furniture, ornaments and architecture. Unlike royal ornamental lacquerware and modern lacquer artworks, long-standing lacquerware for daily use does not provide an amazing visual effect, but it can meet our needs for production and living. The same is true for accessories. An exquisite crown stands for the status and power like a piece of royal lacquerware, displayed in museums to be appreciated by visitors; however, most accessories (e.g., bags, footwear, hats, cuffs and brooches) are nothing more than articles requisite for common people like lacquerware for daily use. Not only are they used in everyday life, but they make us move with ease. On the other hand, lacquerware for daily use is slowly disappearing from life for the reason that the traditional lacquerware prototyping method is time-consuming, costly and complicated, and that many new materials have come into being along with the development of modern technology. Will Chinese lacquer remain useful? In the present study, the author tries to review material performance from the perspective of an accessories designer and then points out the application values and methods of Chinese lacquer in modern life from the angle of accessories design by combining people's needs for accessories with their aesthetic demand in modern society. Then, the author compares the traditional technologies by which lacquerware is made out of different materials, including wood, bamboo, cloth, paper and earthenware, from a Chinese lacquerer's perspective, and conducts experiments on bodiless lacquerware using a new method and metal lacquering based on the modern prototyping technology, effectively shortening the production time and lowering the manufacturing costs of lacquered accessories.

[1] Sooetsu Yanagi. Trans.: Xu Yiyi. Craft Culture[M]. Guangxi: Guangxi Normal University Press. 2011. p25

2. Chinese lacquer performance and accessories design

2.1 The Application and Conflict of lacquer craft in Modern Life

Chinese lacquer, made from lacquer tree sap, is referred to as the "blood of the Orient". It is a material that becomes increasingly bright-colored as time goes on, and has been used as paint in China for more than 7,000 years. In Asian countries such as China, Japan, South Korea and Vietnam, it can often be found that artists use lacquering technology to convey ideas. They have created lots of world-renowned works. Application of Chinese lacquer can also be seen in the works of art created by western countries such as France, Germany, the USA and Belgium. There is a Chinese idiom which goes, "cleave together as firmly and inseparably as glue and lacquer". It suggests that in the Oriental history of technology, Chinese lacquer is an important binder. Mother-of-pearl inlay, gold foil, jade, crystal, pearl, coral, agate, tortoiseshell, lapis lazuli, turquoise, beeswax, agilawood……whether it is a rare gem or a precious metal or other common materials for accessories manufacturing, it can be inlaid on the surface of an object through Chinese lacquer, producing a magnificent and colorful visual effect. With high impact resistance, Chinese lacquer is used as a surface coating for lots of industrial products (e.g., fountain pen, camera, automobile and mobile phone) to enhance product performance. With a certain antibacterial activity, Chinese lacquer plays an important role in food preservation. Therefore, most of sushi plates are coated with Chinese lacquer. In addition, the physiological activity of laccase was tested in Japan, confirming that laccase has an antitumor activity and can inhibit platelet coagulation[2].

Although Chinese lacquer has many excellent characteristics, with the development of technology, lots of new compounds have been created as adhesives and coatings, which have basically replaced Chinese lacquer. Although the new substances do not have so gorgeous color or ultra-strong stickiness, and neither can they inhibit bacteria, prevent corrosion, resist acid or suppress shock, they can fully meet common people's daily needs. Moreover, the cost is very low, and the molding or production process is very easy to operate. Therefore, almost none of Chinese lacquer is applied for the articles of everyday use. Tableware is primarily made of porcelain, glass and plastics while furniture and building coatings are made from chemical composed materials and clothes are decorated with synthetic metals and plastic gems……In the Chu and Han Dynasties of China, lacquer could be applied for everything, including clothing, dinnerware, housing and vehicles, but it is rarely seen in modern daily life. In the face of wide varieties of new materials, Chinese lacquer becomes increasingly substitutable. Compared with efficient and convenient new production methods, the complicated lacquer craft is to be lost. The splendor of daily lacquerware has disappeared. Except the exquisite lacquer artworks displayed in museums and galleries, we can only find its trace in luxuries, whose "ornament" values are more important than their "usage" values. The applicability of Chinese lacquer may be found out from the perspective of the "usage" of luxuries. Expensive lacquer products can be used as "components" and combined with rapidly

[2] Tetsuo Miyakoshi. Chapter 7: Minutes of Lacquer Science Conferences, 1993

producible parts; then, the production efficiency of “lacquer components”can be improved for mass production; finally, products with more “usage” values than “ornament” values may be created.

2.2 Lacquer’s performance and accessories design

In luxury goods, accessories (such as jewelry, glasses, watches, bags, shoes and so on) account for a large proportion, so that people pay attention to whether it can properly display taste and shape personal image in key occasions. They should not only be suitable for daily use, but also match clothes in a specific environment. What matters more is whether they can demonstrate personal taste and build a personal image on an important occasion. In the present study, a long-lived daily-use accessories design scheme with an aesthetic additional value is proposed based on the attributes and visual effect of Chinese lacquer. Taking presbyopia glasses for middle-aged and elderly people (figure 1.) for example, sandalwood beads, which can calm the mind, are inlaid at the root of the temple according to the health habits of Chinese middle-aged and elderly people. After reading a book or newspaper or playing with a mobile phone, they can take off the glasses and use the temple to massage their periocular acupuncture points to relieve eyestrain; the frame is composed of redwood, Chinese lacquer and mother-of-pearl inlay. Its color and texture tone in with middle-aged and elderly people’s dressing style, making wearers look simple, natural, quiet and easy-going. Taking a small bag suitable for a dinner party (Figure 2.) as an example, its volume and opening-closing pattern are clearly designed based on the quantity and size of contents taken to a dinner party in the bag; in consideration of the requirements for the user’s image at the party, the exquisite handicraft art is used to convey the Oriental taste and traditional culture. As for a brooch and handbag for daily use (Figure 3.), they are designed in line with a quiet, elegant, cordial and simple dressing style. The thick color of Chinese lacquer is blended with folding and cutting marks, giving office ladies a clean-cut look in daily life and the workplace.



Figure 1. presbyopia glasses



Figure 2. Figure 3. handbags for daily use

3. Feasibility study of bodiless rapid prototyping for accessories lacquering

3.1 Traditional bodiless lacquer prototyping technology

The bodiless prototyping technology came into being in China during the Warring States Period. It was widely used for the construction or production of Buddhist statues, architecture and daily necessities. Bodiless lacquerware is light and durable. Taking the lacquered plate with phoenix pattern painted on (as shown in the figure 4) unearthed in the Mashan 1st Tombs of Jiangling as an example,its shape changed a little, but the color is still bright and the surface is still flat although more than 2,000 years has passed. As for the traditional bodiless prototyping craft, the inner body is made in the manner of clay sculpturing, wood carving and throwing. It takes about 1 week to make a body only. After the end of body-making, the 3D surface layer is wrapped in ramie fabric. In case of morphological protuberance or shrinkage, the fabric is folded in the form of tailoring with the redundant plane cut away so that the ramie covers the 3D surface up. In this process, Chinese lacquer is used as a curing agent to harden the ramie and as a binder to make fibers adhere to the 3D surface. The redundant plane is often cut away unevenly, causing the formation of holes or humps on the surface of the ramie. In this case, Chinese lacquer needs to be mixed with plaster for filling. If Chinese lacquer is still not dried when used as a binder, surface fibers may easily be dislocated during filling, ruffling and deforming the ramie, making the surface rougher. To be dried, Chinese

lacquer needs to be placed in a shady room[3] for over 12h. It cannot be mixed with plaster until the next day. In order to make the surface smooth, the plaster needs to be ground and filling needs to be repeated after drying. In this way, it usually takes about 1 week to smoothen the surface by covering the surface with a single layer of fibers and plaster. This process has very high requirements for the craftsman's craftsmanship, and carelessness is bound to make fibers fail to be tight against the surface, further roughening the surface. The above steps often have to be repeated 3 to 5 times before the shell is strong enough to have the inner body removed. Even a skilled craftsman must spend about 1 month finishing the work. Costing high, this prototyping method is unsuitable for modern fast-paced production. So, it is rarely used for the production of accessories and daily necessities at the present time.



Figure 4. lacquered plate with phoenix pattern painted on unearthed in the Mashan 1st Tombs of Jiangling

3.2 Quick bodiless prototyping experiment based on accessories application

The use of modern technology to improve the prototyping efficiency brings about a total difference in every aspect, including inner body making. 3D modeling and printing was performed in the experiment, with only 2~3 hours spent in making a complex inner body. The ramie was not cut when used to wrap the body up. Instead, the multilayer sinamay prototyping method used for traditional European hat accessory-making was adopted. Since the coarse ramie fabric is woven both longitudinally and latitudinally, when it is pulled at a

[3] A shady room is a device essential for lacquering and an enclosed space at temperature of 20-28°C and relative humidity of 70%-80%. Under the above environment, the urushiol in Chinese lacquer must fully absorb water molecules before a lacquer film forms and the liquid lacquer is solidified. The more humid the environment is, the faster the Chinese lacquer dries. When the relative humidity exceeds 80%, colored lacquer tends to turn brown with the lacquer film darkened and unable to be reduced. Excessive relative humidity has great effects on the color and glossiness of lacquer only, and has little effect on the form and hardness of the body.

certain angle, the density at the junction of the longitudinal and latitudinal lines can be changed to generate deformation. With a hollow structure, the ramie yarn becomes very resilient in water. So, after wetted, the ramie fabric was attached to the body with fibers straightened out by hand to adjust the density of the junction of the longitudinal and latitudinal lines in accordance with the body form until the fabric was deformed and tight against the body surface. After the 5 layers of ramie were basically prototyped in this way, it was removed layer by layer and coated with Chinese lacquer from inside out. Then, the ramie was attached to the body again and placed in a shady room until it was dried. When the outer layer was basically dried the next day, the inner body was taken off with the rest continuing to be dried in the shady room (as shown in figure 5.). On the third day, the inner and outer layers of the ramie shell became dry, but the Chinese lacquer on the middle layer was still liquid. Without the support of the body, the shell was severely deformed, so the inner body was stuffed into the shell gain so that the shell would be further dried. On the fifth day or so, the 5 layers of ramie were completely dry. With the body removed, the shell was placed in the daily environment for several months but was not deformed.



Figure 5. Quick bodiless prototyping experiment based on accessories application

For the use of this method, it takes only 3 days to do the work and only 5 days to have the shell fully dried. It takes a long time to make a body on the first day, but a much shorter time needs to be spent adjusting the body on the remaining 2 days. Compared with the traditional method, by which the prototyping process takes one month, the new method greatly reduces the time costs. In addition, this method is so easy that even an inexperienced primary or middle school student can do the work without difficulty. Compared with the traditional method, which requires a well trained craftsman to work meticulously with great care, the new method is easier to be promoted in the society. For a ramie shell made by the new

method, its hardness and impact resistance are obviously lower than that of the traditional ramie-assisted bodily lacquerware for lack of plaster support, but significantly higher than that of sinamay hat accessories and headwear. In addition, a body made by the new method has high water resistance, wear resistance, folding resistance and corrosion resistance. Dust in and around it can be washed away with water and daily detergent. From the perspective of accessories, a body made by this method can fully meet the requirements of daily use.

4. Research on the Application of Metal Forming Methods in Lacquer Accessories

4.1 Traditional forming methods and lacquer accessories

In addition to bodiless prototyping, the common bodies of traditional lacquerware are divided into the wooden body, bamboo body and ceramic body. The wooden body and bamboo body are made of wood and bamboo by the gouging method[4], turning method[5], rolling method[6] and weaving method. The surface is coated with Japanese lacquer evenly. Because there are tiny holes on it, the plant surface needs to be coated with cloth and puttied (the same as the way single layers of ramie are wrapped and puttied in the step of body removal) to prevent the body from being wetted and deformed and the lacquer surface from being broken. The prototyping process usually takes 2~3 weeks. This type of body cannot be used for modern fast-paced production. Neither can it be used for production of light accessories such as bags and hats, owing to its large mass.

Ceramic forming takes a short time and is easy to operate. Some process steps, such as blank making, drying and firing, are the same as that of ceramic ware making. After it is made, the prime ceramic body just needs to be coated with lacquer. However, the ceramic body has poor impact resistance with high fragility. “Without the skin, where can hair rest itself?” After the body is broken, the lacquer
on the ceramic surface will be no longer in existence. That’s why lacquerware with a ceramic or vitreous body is relatively rare. In addition, the sharp shards of a broken body are likely to

[4] The gouging method is a wooden body manufacturing technique, by which a sharp tool is used to gouge a solid log until the columnar wood is shaped like a bowl.
[5] The turning method is a wooden body manufacturing technique, by which a solid log is cut with a sharp tool when it is rotating on a turning lathe until the columnar wood is shaped like a bowl or a morphological change takes place with the log turned into something like a vase, kettle or basin.
[6] The rolling method is a wooden body manufacturing technique, by which a wood veneer or thin batten is soaked in water for a number of days until it is softened and then shaped like a barrel in a mold. After drying, the mold is removed and the barrel-shaped veneer or batten is lacquered.

cause damage to the human, so it is not a suitable body for accessories. 3D printing is one of the currently common rapid prototyping methods, and common printing materials include engineering plastics, photosensitive resin, rubber and metals. Although the above materials are light and durable, a lacquer film can hardly be attached to them owing to their smooth surface. If lacquer are dried in a shady room in an ordinary way, lacquer finish will scale off their surface, so the lacquer craft cannot be applied. According to a traditional lacquering technique, Chinese lacquer is baked for better coating ironware in order to protect it from rusting. So, for the combination of a 3D printed body with lacquer, the lacquer is baked when being applied to the surface of metals.

4.2 Experiment on lacquering a 3D printed metal body

Silver alloy and aluminum alloy, metals commonly used for 3D printing, are selected in the present study. First, a blow torch is used to burn the back of the two lacquered metals, according to the traditional metal lacquering method. Although the lacquer film is dried quickly, the lacquer finish may be ignited carelessly, causing failure because of carbonation. Chinese lacquer comes to the boiling point at about 200°C and to the ignition point at 450°C. The temperature of the blow torch is hard to control. In addition, if high temperature lasts too long, the hardness of the lacquer film will be affected, reducing the wear resistance of the coating.

As the experiment went on, a constant-temperature oven was used, and the hardness of the dried lacquer film was recorded. After lacquered, the silver alloy and aluminum alloy were baked at 150°C for 15min. The lacquer film surface was obviously viscous while the Chinese lacquer was brown but not so transparent. 30min later, lacquer film surface was slightly viscous, and the texture of the metal materials could be seen on the lacquer surface. 45min later, the lacquer film surface became dry, but an obvious mark could be left on the surface by fingernail pressure. 60min later, no mark was left by fingernail pressure, and the lacquer surface became more transparent; however, the hardness was not so high that the lacquer surface was damaged and metal body was exposed after it was ground slightly with 2000# fine sandpaper. There was no significant change taking place 75 and 90min later compared with 60min later. When baking lasted for 120min, the hardness of the lacquer surface was obviously enhanced and became resistant to the 2000# fine sandpaper. 150min later, the lacquer surface became resistant to the 600# moderately coarse sandpaper, and it felt hard in the grinding process. An experiment was performed at a constant temperature of 170°C in the same way. 45min later, the lacquer film became very strong, and felt harder in the grinding process than it did at 150°C 150min later. At a constant temperature of 190°C, there appeared speckles on the thin lacquer surface in the drying process while the thick lacquer surface was crinkled, but the surface became fully dry 15min later and the hardness became resistant to grinding treatment. The speckles might be due to an actual temperature approximately equal to the boiling temperature of Chinese lacquer while crinkling might be caused by excessively quick surface drying. There was basically no difference in lacquer surface between the silver alloy and aluminum alloy. As can be seen from experimental results, under the condition of

170°C and 45min, the lacquer surface was flat, hard and wear-resistant and rarely peeled off. This condition is more suitable for lacquering the surface of a 3D-printed metal material. A metal body wrapped in lacquer was barely visible and lighter than one made of the lower-cost aluminum alloy. The 3D printing method, which could also shorten the time of body-making, is better for the production of accessories such as headwear, jewelry and brooches as well as the hard parts of bags and belts. (As shown in Fig.6)



Figure 6. Daily accessories of Lacquer Craft such as brooches, headwear, jewelry

5. Research on the Application of Japanese Lacquer to Accessories Manufacturing

5.1 Sustainable value of Chinese lacquer for the environment

With current development of information technology and intelligent manufacturing, traditional lacquering craft can be combined into modern design and modern industry. In addition to solving the complicated and time-consuming production mode, we should also think about the sustainable value of Chinese lacquer for the environment so as to guide consumers to discover a new lifestyle, thus helping them form an environment-friendly and energy-saving consumption concept. Originating from nature, Chinese lacquer is a pure plant material. Chemical synthesis is not required for its refinement or deep processing. Lacquerware production is mainly in manual mode, with low energy consumed, suggesting that it is a process technology in harmony with the natural environment. After dried, Chinese lacquer is highly stable, acid-resistant, corrosion-resistant, waterproof and difficult to degrade naturally. The body is sturdy, highly impact-resistant and hard to break. Lacquerware is very difficult to damage fatally, and longtime use may just leave scratches on its surface, but it will be made new again as long as its surface is re-lacquered and polished in a simple way. Even

cracks can be repaired by the simple Kintsukuroi technique (a lacquering technique commonly used for restoration of historical relics). If you are visually tired of lacquerware that has been used for a long time, you just need to polish its surface finish rough and then redecorate its surface in another way to "change" it into a new object. Thus, the durability and variability of Chinese lacquer make it possible to effectively prevent people from discarding lacquerware at will after purchasing.

5.2 Continuous demand for lacquer accessories and its future application

Lacquer accessories are durable and can be handed down from the older generations of a family. Looking calm and quiet, Chinese lacquer boasts the Oriental elegance and simplicity, which enable it to match clothes for an impressing appearance on different occasions. Different demountable and easy-to-install lacquer components can even be applied to accessories made of different materials to meet many practical and aesthetic requirements. For example, these lacquer components can replace the metal accessories and ornaments on bags and shoes to form a wide range of accessories by combining with different materials, patterns and colors. It can also be made into modular multi-purpose accessories, such as used on scarves and cuffs to decorate formal wear or as earrings and key chains to match casual clothes. It can even be made into accessories used on mobile phones, computers, stationery and other products to decorate not only the body, but also a space. The emergence of universal and modular lacquer accessories can set a consumption trend, thus making it possible to provide the pubic with technical services including lacquerware maintenance, repairing and customization. If so, jobs can be created for lots of lacquerers to continue this traditional craft.

In the present study, the traditional lacquering technology is applied to the design of accessories not to change the traditional manufacturing technology, but to propose a futuristic lacquer craft's survival mode as well as a kind of accessories production mode based on profound insights into scenes of life and manufacturing techniques. Although the daily necessities created by industrial technologies have greatly met our material needs, overcapacity has been caused, followed by waste of resources and environmental degradation. The fashion industry, to which accessories manufacturing belongs, is one of the typical industries troubled by overcapacity in China. In today's China there are a large number of OEM of accessories, which have poorly-educated workers and thus can hardly make independent innovations in technology and design; for lack of advanced equipment, they can only produce low-quality products with a low added value. In the fast-paced and high-stress modern society, people have a preference for individualized and differentiated high-end accessories. Thus, for Chinese accessories manufacturers, they must transform their low-end traditional sub-contract manufacturing mode into creation of high-end brands with independent intellectual property rights. "The traditional technology is not merely a culture, but a productive force."[7]

[7] Yang Bin. Handicraft is a Culture and more of Productivity [J]. Art Observation, 2010 (04): p8-10.

Cultural integration is one of the important ways to increase the high value of the fashion industry chain more quickly. As the "all-round renaissance of the traditional culture" is promoted as a mainstream ideological trend in the Chinese society, the Oriental humanistic factors, including cultural accumulation and traditional crafts, make an increasingly significant value contribution to accessories manufacturing. By applying Chinese lacquer to modern accessories, "China fashion" can endow "Made in China" with a cultural connotation to set a new consumption trend and accelerate the transformation and upgrading of some accessories manufacturers from low-end production to high-end customization so as to further resolve the problem of overcapacity.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Emerging Fashion-Tech Paradigm in the Contemporary European Landscape.

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Abstract | Fashion-Tech is an emerging sector resulting from the intersection of design, natural sciences, engineering and business. The paper is aimed at exploring innovation trajectories of the emerging fashion-tech phenomenon in Europe. The work is structured in five sections aimed at giving a systematic overview of historical references and current experimentations. The first paragraph retraces the three industrial revolutions to pinpoint the interdependence of fashion and technology. The second introduces the 4.0 paradigm origin, technologies and configurations, offering preliminary insights on potentials deriving from its adoption in the Fashion-Tech industry. The third section illustrates the main challenges of emerging and established fashion-tech businesses. The forth section offers insights on possible trajectories for the long-term competitive advantage of the European Fashion-Tech industry, starting from the observation of the ongoing research agenda. The insights emerge from a multiple case study analysis of four fashion-tech design-driven innovation projects funded by the European Commission. Finally, the paper concludes identifying trans-disciplinary and cross-sectoral strategic partnerships as the key factors to effectively support the growth and development of the sector, leveraging on the European emerging ecosystems.

KEYWORDS | FASHION-TECH, ENTERPRISE 4.0, DIGITAL TECHNOLOGIES, PROCESS INNOVATION

1. Fashion and Technology: A History of Interdependence

Fashion and technology have always had a symbiotic relationship, interwoven paths, and mutual influences on both cultural and material level (Tomico, et al, 2017). Technological developments have always fostered process and product innovation in fashion and, at the same time, "fashion has always been a wearable expression of the technological state of society" (Scaturro, 2008, p.473). Evidence of this relationship can be demonstrated by retracing the evolution of industrial revolutions from the textile and clothing sector's perspective, pinpointing their key role in shaping and disrupting both production and consumption patterns of fashion products, processes, and services (Duarte, et al, 2018; Bertola and Teunissen, 2018). This preliminary overview will lay the foundation to state that the emergent Forth Industrial Revolution, also referable as 4.0 paradigm, is going to influence and bring together actors from inside and outside the traditional sphere of the fashion system, involving existing and new stakeholders throughout all the stages of the value chain, challenging traditional dynamics, and introducing new consumption, production, and entrepreneurial patterns.

The First Industrial Revolution, historically located between 1760 and 1830, led to a general mechanization of manufacturing industries powered by water and steam technologies. One of the key and exemplar inventions fostering improvements in the textile industry was the Spinning Jenny, developed in Britain by James Hargreaves in 1764. It consisted in a spinning system that allowed to turn raw materials (i.e. cotton and wool) into thread processing at the same time from 8 to 16, 24, 80 and eventually 120 spindles (Bellis, 2010). Prior, weaving was performed at home by farmers who alternated spinning and weaving with work in the fields (cottage industry) or manufactured raw materials provided by merchant entrepreneurs (putting-out system). In both cases, workers could not fulfil the market demand for textiles, as the production of yarn and fabrics was time demanding and economically not sustainable. With the introduction of the Spinning Jenny and further improved models, as well as the development of fully mechanized looms, the domestic and artisanal handmade production was replaced with mass manufacturing of consumer goods coming from factories and textile industries. High production volumes and manufacturing speed led to the decrease of yarn and fabric costs, generating a greater availability of textiles for a wider audience at more affordable prices (Bellis, 2010; Duarte, et al, 2018).

The Second Industrial Revolution, occurred between 1850 and 1914, was characterized by an intense micro-invention activity in energy, manufacture, chemical, steel, and railway industries. Such clusters of novel inventions entered as never before into workers' and middle classes' daily lives increasing their living standards and their purchasing power, as consumers. Defined by Homburg et al. (1998) "science-based industrial capitalism", this period presented an acceleration of connection and mutual feedback between science and technology, the emergence of large scale corporations gaining economic benefit from it and the spread of First Industrial Revolution technological systems, previously limited and localized, towards other European countries. Improvements in the manufacture industry

concerned the adoption of electricity as power source, the set-up of continuous-flow production process, the scientific organisation of labour and the mass production of interchangeable parts. Breakthrough developments in chemistry laid the ground for research, development and supply of new artificial materials and synthetic dyestuff. In textiles, progresses occurred gradually. The major innovation was the introduction of the sewing machine – perfected and patented in America in 1851 by Isaac Bashevis Singer – a machine able to replace hand-stitching, greatly speeding up the apparel making process. The annual production of sewing machines went from few thousands in 1853 to half a million units in 1870 (Mokyr and Stortz, 1998), becoming a mass-manufactured and mass-marketed consumer good, mainly intended for a domestic environment (Duarte, et al, 2018). On the other hand, mechanized machines for wool combing, spinning and weaving, mainly perfected in the US, started to be adopted and slowly spread only towards the end of the XIX century, due to the reluctance of adoption by European industries (Mokyr and Stortz, 1998).

The Third Industrial Revolution, also called the Digital Revolution, started in the 1970s and has been historically paired with the invention and development of microprocessors, integrated circuits and advanced electronics with computational capacity, and the spread of Information Communication Technologies (ICT). The integration of such technologies within the Textile and Clothing Industry led to a further automation of manufacturing activities (Bertola and Teunissen, 2018; Duarte, et al, 2018; Hermann, et al, 2015) increasing again production volumes, lowering prices, and fostering over-consumption patterns, leading to manufacturing delocalization to further reduce costs. From the industry perspective, since the 1990s, the combination of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) software with ICT strongly influenced the evolution of design and production processes in the fashion system (Rose Sinclair, 2014). They enhanced connections among stakeholders operating along the supply chain, helping them managing the entire process in more seamless ways. In particular, the former sped the creative design process, making it easier to communicate it at different stages, the latter made the prototyping and testing process better connected and allowed a greater management of the different manufacturing phases. Moreover, from 2000s on, the emergence of Internet and the Web 2.0 led to a radical change in the user's perspective and involvement. Digitally-mediated interactions disrupted the relationship between producers and consumers (Crewe, 2013), fostering Business to Consumer (B2C) and Consumer to Consumer (C2C) exchanges, giving rise to experiences of co-creation of fashion products and values (Prahalad and Ramaswamy, 2004).

In the last decade, an emerging Forth Industrial Revolution has been introducing a set of disruptive technologies and approaches, once again, promising to impact and challenge traditional industries and established systems, including fashion (Bertola and Teunissen, 2018). A key differentiation factor of the 4.0 concept, stressed by Herman et al. (2015), is that for the first time an industrial revolution is illustrated a-priori, not interpreted ex-post. This leads to multiple opportunities for different stakeholders, from research centers and

academic institutions to entrepreneurs and businesses, to dynamically shape the future (Herman, et al, 2015).

The present paper aims at exploring how the 4.0 paradigm could be implemented supporting emerging fashion-tech realities to grow and foster product, process and business model innovation. The reflection is limited to the European landscape, mostly including SMEs, start-ups, self-employed, micro-companies, and individual craftsmen (EC, 2012).

2. The Potentials of 4.0 Paradigm in the Fashion-Tech Industry

The Industry 4.0 (I4.0) concept was formalized in 2011, during the Hannover Fair in Germany, where representatives of politics, business, and academic institutions presented a future project aimed at implementing and strengthening the competitiveness of the German industrial sector leveraging on the possibilities offered by upcoming technologies (Hermann, et al, 2015). The support from German Government followed by integrating it within national strategic plans and, in 2013, Acatech—the German Academy of Engineering Sciences—shared a research agenda illustrating development recommendations for the Industry as well as the vision behind this model (BMBF, 2015). I4.0 aimed at the introduction of digitization at all stages of the supply chain, based on the development of cyber-physical systems/environments, on the integration of digital-mediated interconnected networks thanks to cutting-edge technologies enabled by the Internet of Things. Brunelli et al. (2017), from the Boston Consulting Group, listed nine I4.0 digital enabling technologies: Advanced Robots, Additive Manufacturing, Augmented Reality, Simulation, Horizontal&Vertical Integration, Industrial Internet of Things, Cloud Computing, Cybersecurity, Big Data and Analytics. From 2010s on, further initiatives spread all over Europe, and similar ones were being performed in the US and China (Hermann et al., 2015). Leveraging on multiple investigations involving both large scale businesses and start-ups, Brunelli et al. (2017) extract key learnings to support businesses in the set-up of an I4.0 implementation strategy. The findings are clustered in the following five lessons learned:

- Use Industry 4.0 to accelerate operational improvements,
- Integrate new and existing capabilities and technologies,
- Manage information architecture as a critical enabler,
- Thoughtfully design the transformation roadmap,
- Approach 4.0 as a change of managerial project.

In 2015, contemporary to the acknowledgement around I4.0, Klaus Schwab - the executive chairman of the World Economic Forum - introduced the expression “Forth Industrial Revolution” extending the conceptual paradigm shift to all disciplines, economies and industries, as well as people’s way of living. This revolution, built on the previous digital one, is characterized by the fusion and combination of different technologies blurring the lines among physical, digital, and biological worlds (Schwab, 2016).

Being an international and cross-sectoral phenomenon impacting all industries, also fashion system stakeholders are starting to contextualize the 4.0 paradigm. Among the scholars investigating such scenarios, Bertola and Teunissen (2018) offer a comprehensive overview of the overall impact the 4.0 paradigm could have in the Fashion-Tech industry evolution:

> "Digital networks and interaction can create an integrated system of actors, assets and stakeholders where not only supply-chains can be real-time tuned with the factory, but also retail channels and even products and final customers can communicate and exchange data within the system. […] Therefore, decision making processes can be better informed by market and users demands, making of the factory a knot of a complex networked eco-system. […] Consequently, all upstream manufacturing process (such as R&D, sourcing, inbound logistics etc.) and downstream functions (such as outbound logistic, retail, customer services etc.) should be included within the 4.0 architectural model." (Bertola and Teunissen, 2018: p.353)

The scholars' contribution suggests an interesting twofold reflection. On one side, it is argued that the introduction of disruptive technologies in the "smart factory" is by definition linked to the other actors and phases of the value chain, because they are integral part of the cyber-physical interconnected environment enabled by the 4.0 architectural model. On the other side, it implies that consumers and prosumers—producer + consumer—perform an active role, both conscious and unconscious, in the decision making process. As a matter of fact, the exchange of data is the basis of 4.0 concept. The efficient analysis and integration of such data generated by all interested parties could inform the product development process, if properly implemented (Duarte et. al, 2018).

Further potentials deal with trans-disciplinary approaches, at the crossroad of engineering, computer science, design, and business management, constantly and iteratively explored beyond the boundaries of the factory. The cross-fertilization of fashion with engineering and computer science is evolving the creative process, fostering experimental projects and paths (Musto, 2017) stimulating the development of wearable technologies, smart textiles, and systems as instruments to augment the self. Software developments and digital fabrication tools are giving rise to new industrial models where start-ups and digital craftsmen are able to deliver on-demand and tailor-made products (Mazzucotelli and Lunghi 2015), as well as promote locally designed and globally manufactured fashion products. At the same time, the democratization of such technologies is enabling figures like the Designer = Entreprise (Arquilla, Bianchini and Maffei, 2011) to grow and approach the market. The opportunities offered by the integration of Augmented and Virtual Reality technologies and processes in the downstream of the supply chain are trying to disrupt the retail customer experience, developing more and more sophisticated phygital—physical and digital—spaces (Chastel et al. 2019). 3D modelling and simulation technologies are redesigning the way apparel and accessories are experienced, from digital fitting towards products designed to live in the digital domain only. Big Data and analytics as integral elements of the infrastructure could nurture the whole system, from production processes optimisation to consumer demand anticipation. While existing technologies such as RFID (Radio Frequency Identification) and

NFC (Near Field Communication) embedded in textiles and accessories, are starting to be adopted not only to improve supply chain management, security, monitoring and tracking of resources (Nayak, Singh, Padhye and Wang, 2015; Garrido Azevedo and Carvalho, 2012), but also to improve in-store shopping, promote events (Ryan, 2017) and improve the customer-brand relationship (O'Neil, 2019) based on transparency and co-creation of value.

Key reflections emerging from the described scenarios suggest the need to formalize and extend the conceptual remit of this revolution from the industrial context only to a wider and more inclusive entrepreneurial one. This is possible also by exploring supportive governmental actions set-up by individual European countries, i.e. Italian National Plan called "Impresa 4.0" (Enterprise 4.0), introduced by the Ministry of Economic Development in 2016. Its aim is to promote training activities for new skills development and access to investments, in order to support innovation and competitiveness of national enterprises regardless of their legal nature, economic sector, size and accounting regime adopted (mise.gov.it, 2019). From this standpoint, "Enterprise 4.0" could be considered as a wider scenario in which "Industry 4.0" factory automation concept co-exists with "entrepreneurial-led augmented experiences", addressing micro, small, medium enterprises, as well as start-ups and artisans as potential adopters and implementers.

3. Challenges of Emerging Fashion-Tech Businesses

This section intends to collect main challenges emerging fashion-tech start-ups and SMEs need to tackle when embracing the Enterprise 4.0 paradigm. The phenomenon is illustrated clustering the challenges identified by Bertola and Teunissen (2018), CBInsights (2019) and Fashion Technology Accelerator (Filocamo, 2020), under the ones codified by Salamzadeh and Kawamorita Kesim in the paper "Startup Companies: Life Cycle and Challenges"(2015): support mechanism, human resources, financial challenges and environmental elements.

- **Support mechanism.** The lack of access to support players as incubators and accelerators, investors, and technology parks could increase the companies risk to fail. Many traditional incubators and other support organisations does not incorporate the specific know-how necessary to offer tailored support for fashion-tech innovative businesses. Furthermore, lack of financier networks focused on fashion-tech could lead to underestimation of the sector investment potentials and growth.

- **Human resources.** If the team lacks adequate knowledge of the sector the company risks to fail due to unsuitable management of human resources. The lack of awareness about contingent and future skills that in-house professionals will need to embody in order to support the company evolution and the lack of knowledge on domain specific issues (Bertola & Teunissen, 2018) could hinder the business success. Building the right team of professionals with different backgrounds, expertise and skill set corresponding to the company key activities,

and evaluating internalization of professionals vs resources externalization, are fundamental actions to consider (CBInsights, 2019; Filocamo, 2020).

- **Financial challenges.** Running out of cash, choosing the wrong time for fundraising, and underestimating the importance of pricing and costs (CBInsight, 2019; Filocamo, 2020) are some of the ingredients bringing start-ups to failure. For established companies, substantial re-engineering of existing assets as well as a profound reorganization of managerial processes (Bertola & Teunissen, 2018) could be difficult to achieve due to low system flexibility and high costs. Moreover, fashion-tech businesses are not aware of where to access funding or how to present themselves to attract investment.
- **Environmental elements.** Start-ups can encounter many difficulties in surviving if they lack attention to relevant external elements. The challenges related to the environment could deal with unawareness of existing trends, markets limitations, consumers' negative feedback, market competition (CBInsight, 2019; Filocamo, 2020), legal issues, and vendor inertia in B2B context (Betts, 2015). Such underestimation, along with the absence of a real product market need, the lack a clear business model and solid market strategy, could greatly contribute to the company fail.

The European Commission's "Action Plan for Fashion and High-end Industries", published in 2014, suggests a roadmap to address many of the challenges previously identified. Among the policies and activities to be performed, the following key actions are pointed out (EC, 2014):

- Anticipating skills needs and promoting cooperation between industry, governmental and educational institutions.
- Supporting innovation by integrating ICT innovative solutions in traditional businesses.
- Stimulating transdisciplinary partnership to enhance creativity towards product, process and business model innovation.
- Stimulating cross-sectoral cooperation boosting to new industrial value chains and business models to support and implement the innovation potential of SMEs.
- Improving access to finance.

The document prepared the ground and set the guidelines to support the growth of the European Fashion-Tech Industry leveraging on collaborative networks. As a matter of fact, in the last ten years, the birth of a great number of start-ups has stimulated the funding of European projects aimed at supporting their competitiveness and the diffusion of alternative support systems inspired by the culture of innovation of high-tech Silicon Valley hubs (Engel, 2015).

4. Addressing Fashion-Tech Challenges Through Strategic Partnerships: a European Perspective

This paragraph contextualizes how the fashion-tech ecosystem could be supported at a European level. A multiple case study analysis on four pan European fashion-tech design-driven innovation projects, currently funded by EASME COSME[1] and Erasmus+[2] programmes, is illustrated. The aim is to distill insights on possible trajectories for the long-term competitive advantage of the European fashion-tech industry starting from the observation of the ongoing research agenda.

The projects illustrated hereafter are represented by consortiums of trans-disciplinary and cross-sectoral professionals, in which fashion and design, engineering and business management academic and research institutions are joining forces with tech-driven and design-driven entrepreneurs and businesses, network of business support organisation (accelerators, incubators and hubs), trade associations and/or investors. According to the Boston Consulting Group (2017), such strategic partnerships are key for entrepreneurial realities to "gain an insider's perspective on the development of breakthrough innovations" (Brunelli, et al, 2017, p.7).

The case study analysis that follows combines the four challenges clusters identified in the previous section with a detailed breakdown of the actions performed to tackle them, foreseen by the European projects selected for the analysis: DeFINE, WORTH Project, Education4FashionTech, and FTAlliance.

DeFINE – Developing a Fashion-Tech Innovation Network for Europe is a 3-year project co-funded by the COSME Programme, aimed at building a Pan-European network of fashion-tech start-ups and SMEs, incubators and accelerators, and investors. The project delivers a series of inter-related events, training sessions and mentoring programme for selected companies, as well as knowledge sharing initiatives for the fashion-tech community at large.

The project aims to provide insights to face the following challenges: supporting mechanism, human resources, environmental elements and financial challenges.

- **Supporting mechanism**

Mapping, establishing, and moderating networks of financiers and investors, incubators and accelerators already active and/or interested in supporting fashion-tech businesses.

[1] The EU programme for the Competitiveness of Small and Medium-Sized Enterprises (SMEs). It aims to support better access to finance for SMEs, access to markets for SMEs, entrepreneurship, more favourable conditions for business creation and growth.
[2] Erasmus+ is the EU's programme to support education, training, youth and sport in Europe. It offers opportunities for a wide range of organisations, including universities, education and training providers, think-tanks, research organisations, and private businesses.

Connecting ecosystem stakeholders and nurturing cross-sectoral and transnational collaboration, through a series of informational and networking events, bootcamps, entrepreneurial and financiers workshops, and dedicated digital channels.

Supporting a selected number of fashion-tech businesses through bespoke technical, business and investment readiness mentoring programme. Mentorship is mainly aimed at better understanding specific challenges and tailored support needed by fashion-tech companies, in order extract exploitable learnings and best practices for replication and transferability purposes.

- **Human resources**

Stimulating the the ecosystem awareness around missing key competences and resources, valuable connections and partnership, through dedicated encounters with industry experts along the mentoring programme, bootcamps and investment readiness workshops.

- **Environmental element**

Guiding selected start-ups to develop a consistent product-market-fit and competitors research, to discover novel technological and innovative solutions for their products/services, to target the right consumer and structure sustainable marketing strategies accordingly.

Setting-up dedicated channels aimed at fostering knowledge sharing initiatives leveraging on the consortium partners and the fashion-tech community at large. Relevant events, incubation, acceleration and funding opportunities, as well as webinars, podcasts and asrticle on the sector trends, enabling technologies, business insights, investment strategy tips, success stories and best practices are publicly shared for the benefits of the whole community.

- **Financial challenges**

Supporting fashion-tech companies in getting investment ready through insights on the investors' perspective, investment strategy development, pitching mentoring and investors profile identification.

Helping expert and 'novice' financiers in identifying investment targets in fashion-tech and in (co)investment opportunities.

Organising pitching sessions and investment forums where selected fashion-tech companies can connect with potential financiers, in order to facilitate matching and foster investment opportunities.

WORTH Partnership Project is a 4-year project funded by the COSME Programme, designed to foster transnational, cross-sectoral collaboration connecting fashion designers, creatives, manufacturing SMEs and technology providers. It is aimed at boosting the creation of

innovative and design-driven products through the codification of cross-disciplinary partnerships supported by an incubation programme, mentoring and access to funding.

The project tackles the following challenges: human resources, supporting mechanism, environmental elements and financial challenges.

- **Supporting mechanism**

Organising networking events and activities to encourage entrepreneurial collaboration and market up-scale.

Establishing tailor-made coaching and mentoring process for selected partnerships, to improve knowledge and skills linked to design, technology, manufacturing processes, business strategy, legal support and IPR management.

- **Human resources**

Matching complementary SME/start-up designers and manufacturers with technology providers from the fashion and consumer goods industry.

Promoting creative partnerships as a model to sustain the development of cross-sectoral innovative projects.

- **Environmental elements**

Raising awareness and sharing knowledge on Fashion-Tech industry key topics through webinars, interviews and lectures on innovative partnerships creation, entrepreneurship, internationalisation, marketing&communication, IPR, pitching, business strategy, fashion and technology trends, incubation support opportunities, success stories and best practices.

- **Financial challenges**

Providing direct access to financial support to selected partnerships going across the incubation process, so as to bring their projects and ideas to life.

E4FT - Education4Fashion-Tech: Interdisciplinary Curriculum for Fashion in the Digital Era is a 3-year project co-funded by Erasmus+ Programme - Strategic Partnerships for higher education. Its purpose is to answer the market need shaping hybrid professionals able to manage fashion, technology and entrepreneurial domains. One of the project's output is an innovative fashion-tech higher education curricula to build up and progress skills and knowledge concerning smart textiles, wearables and digital manufacturing.

The project presents piloting experiences aimed at enhancing the awareness mainly on: supporting mechanism and human resources.

- **Supporting mechanism**

Mapping and sharing the state of the art of Higher Education programmes and other high-qualitative fashion-tech training experiences provided by public and private organisation.

- **Human resources**

Mapping subject specific fashion-tech skills at the intersection of design and multimedia communication; technology and engineering; and human, social, psychological, and economic context.

Developing teacher's toolkits and flexible MA programmes as resources to support the implementation of fashion-tech interdisciplinary teaching and learning activities, validated and continuously updated thanks to short term educational pilots (hackathons and workshops) promoted in collaboration with research and development centers and fashion-tech companies.

Collecting and sharing course material, edited lectures and other contents developed from educational activities as MOOC-type materials to allow future engagement by a European-wide creative community.

FTalliance - Weaving Universities and Companies to Co-create Fashion-Tech Future Talents is a 3-year academia-industries partnership co-funded by Erasmus+ Programme - Knowledge Alliance. Its goal is to enable and facilitate the exchange, flow of knowledge and co-creation paths between universities and companies operating in the Fashion-Tech sector. The partnership aims to boost a twofold impact. From one side, enhancing students' employability and innovation potential, equipping fashion and textile, design and engineer with updated fashion-tech competences. From the other side, supporting the competitiveness of and growth of the EU Fashion-Tech sector.

The project aims to mainly address the human resources challenge.

- **Human resources**

Designing and piloting a series of challenge-based design educational activities to boost creative encounters within the framework of a number of industry briefs, allowing beneficial and reciprocal exchanges between the student participants and companies.

Fine tuning a multidisciplinary fashion-tech curriculum integrating fashion, design and engineering with industry relevant challenges through open innovation and project-based learning methodologies.

Developing fashion-tech residency programme and co-creation opportunities to foster innovative concept development and products prototypes. Students are involved in hands-on innovation activities within fashion-tech companies, in order to let them benefit from the know-how, expertise, tools and channels of the host organization.

7. Conclusions

The necessity to embrace strategic partnerships and build networked ecosystem in constant dialogue seems to emerge as a valuable resource to tackle the novel challenges of the Fashion-Tech sector. The key activities when dealing with collaborative and distributed networks should be: understand the stakeholders needs, codify a common language, connect and match key players, and iteratively feed these relationships. As in the cases presented, universities and research centres should formalize long lasting parterships to align educational curricula with the future needs of the job market. The vision should not be limited to contingencies, but it has to look at the impact of disruptive technologies in the medium and long term. Given the novelty of the phenomena, the evolutionary and dynamic nature of this emerging paradigm lead to the fact that new approaches to create value from 4.0 model are still in progress, and that value will spread as best practices are shared, laying the foundation for further adoption. In this regard, fashion-tech dedicated ecosystems of innovative enterprises, business support organisations, academic institutions and financiers network should grow and drive innovative paths, fostering networked and capillary cross-disciplinary knowledge sharing initiatives and creating awareness and common literacy on key challenges and successful approaches.

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Acknowledgements: This paper is the result of common discussion and framework, nevertheless, section 1 was edited by Chiara Colombi, and sections 2, 3, 4, 5 were edited by Chiara Di Lodovico.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The evolving role of prototypes in design research: a discussion on terms and meanings.

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Abstract | In this paper, we present the preliminary findings of an ongoing research project addressing the role of advanced prototypes in design research. The project aims at investigating the evolution of the role of the prototype in design research, given the recent advances in prototyping techniques and processes. In the first phase, we collected a diversity of definitions from literature, outlining both traditional and emerging traits of the use of prototypes. We observed that researchers tend to classify prototypes based on a variety of different purposes, which are tightly bound to the type of enquiry being carried out and the specific area of research in which they work. The emergent heterogeneity of terms and meanings shows that the definition of prototype is anything but univocal. This multiplicity of definitions led us to develop an overview of the assortment of terminologies and purposes that researchers use to describe the role(s) of the prototype.

KEYWORDS | PROTOTYPE, RESEARCH ARTIFACT, DESIGN RESEARCH

1. Introduction

1.1 The changing role of prototypes

Design is deeply rooted in the culture of making, being traditionally devoted to transforming ideas into tangible outcomes. This hallmark of design is currently undergoing a radical change due to a twofold countertrend phenomenon. On the one hand, a profound process of dematerialization, which largely affects the world we live in (Moles & Jacobus, 1988). This process entails everyday objects losing their physical attributes and turning into either purely digital artefacts (e.g., bitcoins) or new types of product merging physical and digital features (e.g., smart objects, IoT, etc.). On the other hand, the emerging role of speculation – meant both as a means and as an end of the enquiry – in some areas of design research (e.g., design fiction (Bleecker, 2009; Dunne, 2013)). This shift makes tangible artefacts no longer an imperative stage of the design process, paving the way for a wider notion of both prototype and prototyping.

In other words, designers are still in charge of making things come into being, but regardless of their physicality. In the context of this paradigm shift, prototypes (both tangible and intangible) have come to acquire a crucial role in the process of knowledge production – mainly at the academic level – as they are considered carriers of meaning and, as such, *means* to conduct research. The terms of this new role are reflected in the preliminary findings we report on in this paper. Indeed, the proliferation of new jargons and terminologies in some areas of design research signals the attempt of giving a status to a *changed role* of the prototype.

1.2 “Advanced prototypes”: scope and limitations

As part of an ongoing research project addressing the “role of advanced prototypes in design research”, our findings shed light on the plurality of perspectives regarding the notion of prototype. From this plurality of views, besides the traditional understanding of what a prototype is (i.e., first unit of a product to be mass-produced), new conceptions emerge clearly, emphasising the theoretical and generative contribution that prototypes give to the research process. As an example, in the field of interaction design, prototypes are often employed to test the experience of users systematically, with the aim of producing knowledge to be shared with other researchers. In this field, prototypes are made mixing physical and digital features, sometimes relying on advanced manufacturing processes (e.g., PCB laser-cutting or milling). This peculiarity led us to term these types of prototype “advanced”. Because this way of prototyping, we believe, marks a significant shift in the way present-day design research contributes to the development of products, our project was named after this term. That being said, the true novelty in this field is that prototypes are conceived of as *means of knowledge production*, whether or not they are made by using advanced manufacturing processes. Indeed, this new role is played by other types of

prototype (and prototyping) as well – substantially intangible – which are gaining significance in design research (e.g., storytelling in design fiction – see section 4.1).

1.3 Focusing on the emerging role(s) of prototypes

Based on literature review, we found that prototypes in design research are used nowadays as means to produce knowledge (i.e., theory), throughout the research process. This innovation, we believe, is of great relevance for the understanding of the emerging role(s) of the prototype in design research. Indeed, the new role of prototypes as *means of knowledge production* extends beyond our notion of "advanced prototypes", including intangible artefacts that are often unrelated to manufacturing processes. Therefore, the focus of our project shifted towards the *evolution* of the role of prototypes in design research, which is not limited to those artefacts made by means of advance manufacturing techniques.

This project is funded by the Department of Design of Politecnico di Milano and developed by nine affiliated researchers, working in different areas of design research. The research group brings together a wide spectrum of expertise ranging from product design to interaction design, fashion design and materials in design. In this plurality of specialisations, the joint interest is the design of products and its evolution. Indeed, the proposal at the base of this research project originated from directly observing the emerging role(s) of the prototype in our daily academic work.

2. Literature review

2.1 Phase 1: "Defining and Understanding"

As a first stage of the project, we collected a wide range of definitions of prototype circulating in different areas of design research.

Analysing the literature, we found that there is no consensus among authors regarding the meaning of the term *prototype*, even when referring to the context of design practice. Some authors use the traditional notion, which understands prototypes as refined artefacts ready for production (Pei, E., Campbell, I. & Evans, M., 2011). Others, in contrast, ascribe a wider role to prototypes, viewed as "design-thinking enablers deeply embedded and immersed in design practice and not just tools for evaluating or proving successes or failures of design outcomes" (Lim, Y., Stolterman, E., & Tenenberg, J., 2008; McElroy, K., 2016).

Despite this lack of consensus, recent studies address specifically the context of design research (mainly academic), where "prototypes are made for operationalization, validation and exploration, and these uses seem to fit in different research approaches. They can be done to test preconceived hypothesis or to reflect on open-ended exploration. Roles prototypes can play in research projects are to confront theories; to confront the world; to evoke discussion and reflection; to changing the world; to test a theory" (Stappers, P. J. ,

2013). This idea of prototypes as means to carry out research extends to areas such as service design and design fiction, where they often consist of intangible artefacts (Kimbell, L., & Bailey, J., 2017; Kymäläinen, T., 2016).

The initial purpose leading the data collection was that of reaching a shared definition of the emerging role of prototypes in design research. Nevertheless, the heterogeneity of definitions that we found in literature led us to rethink the purpose of this stage, directing our efforts towards a mapping of the *diversity* emerged (section 4.2). Giving an account of this diversity, we thought, better responds to the underlying aim of the research project, i.e., *understanding* the emerging role of the prototype in design research.

3. Method

3.1 Selection and review of relevant sources

The term *prototype* is largely used nowadays in several areas of design research to describe unfinished and instrumental artefacts (McElroy, K., 2016; Wakkary, et al., 2015). This connotation revises and overcomes the long-established difference between *model* and *prototype* in the field of industrial design (see section 5.2). Furthermore, the notion of prototype currently used in design research (i.e., academic context) comprises a larger spectrum of categories of artefacts than the traditional one. For this reason, we decided to search for terms such as *model* and *artefact*, which the current notion of prototype seems to have gathered under the same umbrella-term (i.e., *prototype*).

Overall, the role of prototypes, their understanding and the terminology used to differentiate their purposes vary across the wide spectrum of design research, from engineering-based design studies to arts and crafts design research. Therefore, besides the terms *model* and *artefact*, we searched for definitions under the term *demonstrator*, mainly used in engineering-oriented design research.

3.2 Literature review process

Source finding
We started the literature review by collecting relevant sources, using keywords according to terminology (e.g., prototype and design), disciplinary areas (e.g., interaction design, product design, design research, etc.) and research areas (e.g., manufacturing techniques, product development, etc.). We made use of search engines and sharing platforms, such as Google Scholar, ResearchGate, Academia.edu, Mendeley, Online databases (library of Politecnico di Milano, ACM Digital Library).

Collection

We selected and sorted 95 publications among books, journal articles, papers, web articles and definitions from encyclopaedias. Hence, we extracted relevant content, consistently with the key topic of our research. Thereupon, we clustered the excerpts according to terminology, disciplinary area, and role played in the (design) research process. We identified eight clusters: prototype (49 publications); artefact (11 publications); culture and artefact (8 publications); design (encyclopaedia) (5 publications); model (5 publications); fashion (4 publications); product (design) (8 publications) and systems (design) (5 publications).

Document analysis using the Data Grid

We developed a grid to organise and review the excerpts systematically (Tab.1).

DATA GRID					
reference	**general definition**	**extensive definition**	**synthesis**	**interesting aspects**	**comment**
publication data	overall description of prototype and its meaning	extended description of prototype and its meaning	sum up of the publication	highlight of the relevant parts of the publication	reader's annotation
"Artifact"					
Design Dictionary: Perspectives on Design Terminology Michael Erlhoff, Tim Marshall (Eds.) Birkhauser, Berlin (2008)	"Quite literally, an artifact is an object that is the product of human skill and ingenuity. The term derives from the Latin ars (art or skill) and factum (made or done), and thus is a pivotal term to describe almost any designed entity." p.27	"All products of design are artifacts of one kind or another, and a common definition of design is the organization of the interface between humans and the "made world," that is, the interaction between people and our artifacts" p.27 "Although usually understood to refer to a material object, artifact can also refer to designed spaces, images, [...].	The term refers to anything is produced by humankind: the "made/designed world". Thus, the notion of artefact is not limited to tangible objects; rather, it includes non-tangible things such as software and environments.	The meaning of the term "artefact" is much wider than that of "prototype", though sometimes they are used interchangeably in some studies.	Artefacts is often another word for prototype; the fact that the term may refer to a diversity of things, much different from each other, raises the problem of the limitedness of the notion of prototype based on materiality. In other words, understandably and rightly enough, the term prototype can be applied to non-tangible things.

Table 1. Data Grid for literature synthesis and analysis – example of the term "artifact" in the Design Dictionary (Erlhoff M. & Marshall T. Eds., 2008).

Organizing literature

The literature review was carried out over a four-month period. During this process, unfitting publications were discarded. On the other hand, new ones were included, relying on the references of those we had already collected. The number of publications collected was considered enough to gain a general understanding of what a prototype is and what roles the latter plays in today's design research.

4. Results

4.1 Preliminary findings

The literature review carried out using the Data Grid (Tab.1) allowed us to gain a first understanding of the evolving role of prototypes in design research. We collected a wide range of definitions that describe what prototypes in research are meant by, under terms such as “demonstrator”, “proof of concept”, “sample” – just to mention a few. Such terms constitute a specialised lexicon used in specific areas of design research. Over the last ten years, a variety of new terms have been introduced, with the aim of defining some emergent types and uses of prototypes. One example is the notion of *counterfactual artefact*, developed by Wakkary et al. (2015), which encompasses critical design, HCI, interaction design and philosophy. Another example is the notion of *diegetic prototypes* by Kirby (2010), who investigates the narrative role of those prototypes that are used to influence cinema audiences. These neologisms signal the need to fill an ontological gap related to prototypes in today’s design research, beyond terminology. In other words, the proliferation of new terms used to describe the role of prototypes testifies a change of perspective in the field of design, where research has expanded its horizons. In particular, various strands of research in design have been turning their attention to theory and social phenomena, besides the development of products. In these strands, prototypes are used as means to conduct research and generate knowledge, which does not pertain to one or more specific products. In fact, the knowledge generated may be used at a later time by other researchers either to develop a product or to investigate relevant theoretical matters further. This understanding of the role of prototypes sets apart from the traditional view spread in industry, showing the occurrence of a shift in the way the very research in design is understood.

4.2 Prototype: from *definition* to *role*

Overall, we observed that the diversity of terms currently circulating are part of a jargon that design researchers use to classify prototypes, according to a variety of purposes deemed as most relevant to their specific research areas. As a result, terms and definitions vary according to the specific research contexts, questions and, sometimes, stages of the process. In this respect, the classifications are often based on the specific *objectives* or *purposes* to which the single prototype aims. Therefore, terminology is tightly bound to both the specific aim and the general purpose (i.e., *role*) that the prototype is expected to help achieve. Such a functionalist approach to taxonomy is widespread among researchers and led us to move our focus from the *definition* to the *role* of prototypes. We therefore reframed the Data Grid, highlighting the diverse *roles* and *aims* ascribed to prototypes (Tab. 2). Moreover, we revised the data collected according to the changes made.

DATA GRID II			
Reference	**Role of the prototype in the interpretation of the author**	**Categorisation criteria:** **Aim** **Discipline** **Terminology** **Context (academia, practice…)** **Fidelity (low, medium, high)**	**Author's specific distinction(s) (to be highlighted)**
publication data in APA style	description of the authors' intepretation of the role of prototype	collection of information based on a set of criteria of categorisation	notes about any author's specific distinctions about the role of prototypes
"Prototype"			
Blackwell, A. H. (2015). Prototype. In UXL Encyclopedia of Science (3rd ed.). UXL.	The role of prototype is to perfect items and processes of a design before implementing them on a large scale.	Aim: Allowing designers to see their design in action; Persuading marketers. Discipline: Design and Engineering. Terminology: Prototype (prototype for testing); Fully working prototype (first type of a series). Context: Industry (R&D); design practice (studio). Fidelity: No reference to the concept of fidelity. However, it is implicit in the definition of prototype (plain one) – "[...] a prototype is not exactly what the final design will contain, but that is close enough to let the designers see if it will work or not." Phase (process): Not specified but implicitly it should be throughout the process.	Prototype vs Fully working prototype (clear distinction).

Table 2. Data Grid II (revised version) for literature synthesis and analysis – example of the term "prototype" from Encyclopaedia of Science (Blackwell, A. H., 2015).

The new grid for analysing the literature allowed us to identify two main roles that prototypes have in design research. These roles differ substantially from each other. One, more traditional, consists of giving researchers the chance of gaining useful insights about the prototype itself, as part of the product development process. The other, unusual compared to the long-established role in industrial design, consists of enabling researchers to gain knowledge regarding phenomena that lie outside of the domain of design. In the latter case, prototypes work as instances, embodying ideas and theoretical concepts. In this regard, they can be used to generate new hypotheses, answering research questions, and envisioning new design propositions. This is the major innovation, we observed, regarding the *role* played by prototypes in current design research.

Regarding the specific aims of prototypes, we collected over 140 statements. After a process of review, we made a list of 34 primary aims and clustered them into 9 categories: *Develop*, *Assess*, *Communicate*, *Represent*, *Comprehend*, *Research*, *Explore*, *Provoke* and *Envision* (Fig.1). These clusters well represent the range of purposes for which prototypes are made in design research.

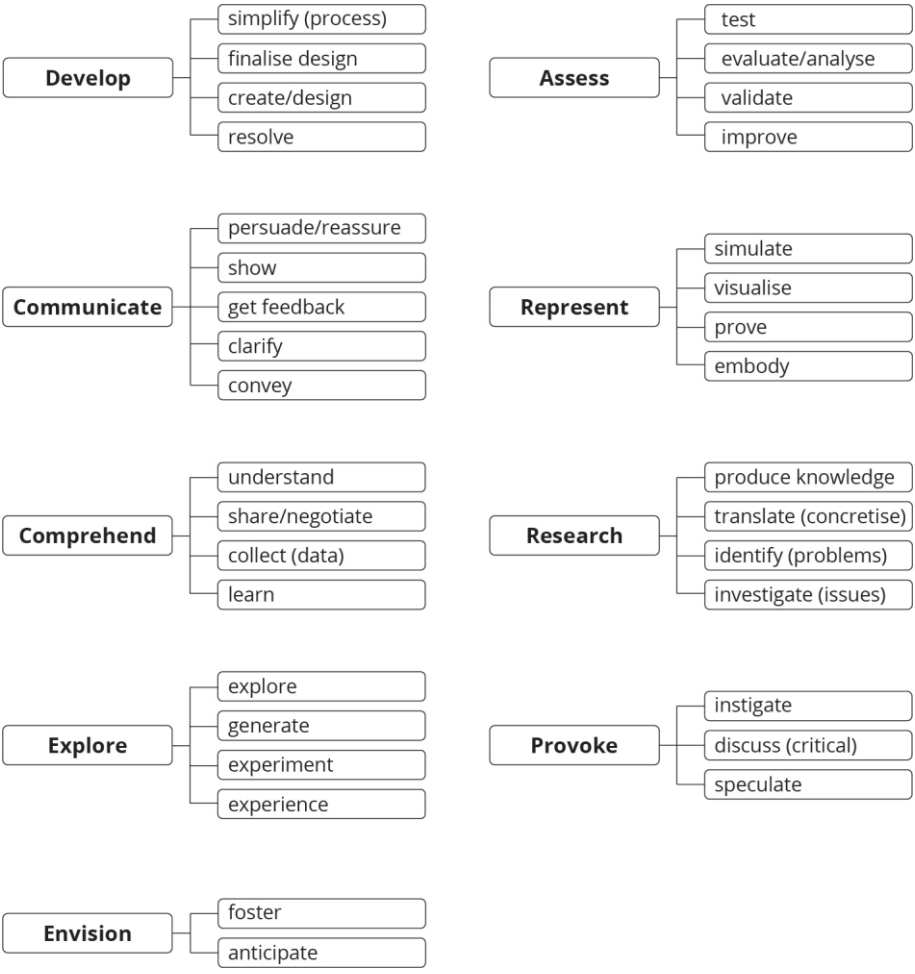

Figure 1. Aims of prototypes: categories and sub-categories

Later, we used this outline as a starting point to proceed with the next stages of our research. In this article, however, we focus on the insights gained by analysing the terminology and the definitions of prototypes currently spread in various areas of design research.

5. Discussion

5.1 The role of prototypes through terminology

Our shift of focus from *definitions* to *roles* of prototypes allowed us to pinpoint a major change of perspective in the field of design research, which has expanded its scope of interests, including theory and social phenomena related to material culture. In particular, our preliminary results show that prototypes have acquired the role of means for the production of theoretical knowledge, which complements the traditional role of testing aesthetic and technical aspects of the to-be-product. Moreover, drawing on literature, we were able to develop an overview of 34 primary aims for which prototypes are used, both in practice and research, defining 9 main categories.

It must be clarified, however, that the emerging role of prototypes – i.e., its evolution – in design research is tightly bound to the terminology used to describe them. That is to say, terminology defines the role of prototypes, highlighting the nuances related to their specific purposes. Indeed, through their discourses – i.e., fine-tuning terms and ascribing new meanings – the actors of research have constructed, conceptually, a new role to be played by prototypes, so influencing the practical dimension of the very research.

The classification of aims that we developed (fig.1) well shows the importance of terminology in the emergence of a new role of prototypes. Take, e.g., the two categories *Develop* and *Research*. It is clear that the aims that these categories gather refer to quite different paradigms, hinting at two distinct roles. Interestingly, other categories – such as *Comprehend* and *Represent* – gather aims that refer to both roles, traditional and emerging, reinforcing the idea that such roles often coexist in design research.

What is relevant about these examples is that the terms that we used to define the sub-categories (i.e., aims) are faithful to the claims made by various authors active in the field. That is why the lexicon used in design research to describe and frame prototypes is relevant to an enquiry into their emerging role in the field (see next sections).

5.2 Semantic overlaps

By mapping the definitions of prototype, we collected over 80 terms and related meanings. In this respect, we noticed that in some cases different meanings are ascribed to the same term (e.g., the term “prototype” is used to address both the provisional draft object that represents the concept of a product and a detailed object that represents the final product before production). In some other cases, the same meaning is described with different terms (e.g., the provisional draft object that represents the concept of a product in an early stage of development might be termed “model”, “mock-up”, “sketch”, “prototype” or otherwise). Therefore, the literature is riddled with semantic overlaps, which show a lack of a shared understanding among researchers of what a prototype is meant by.

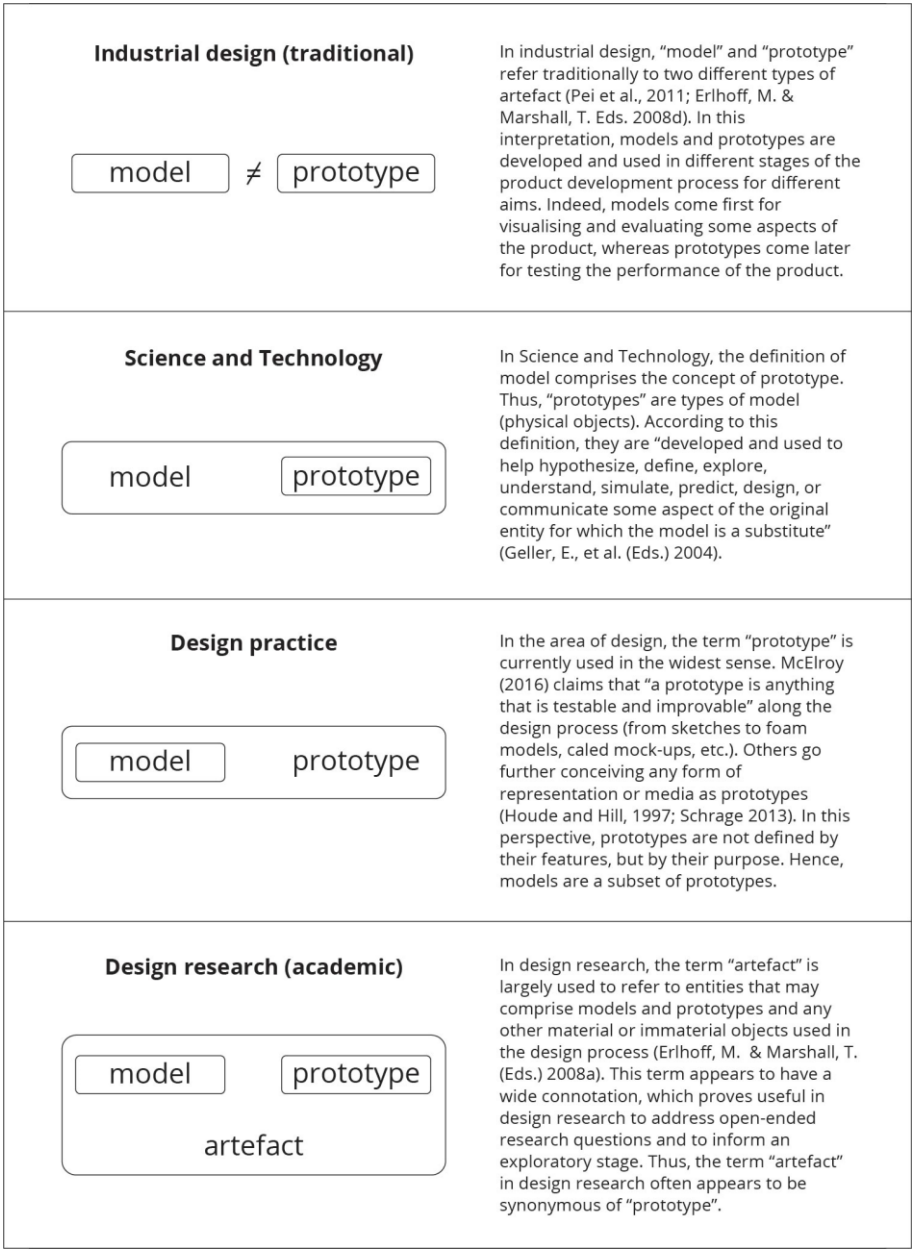

Figure 2. Interpretations of three widely used terms (i.e., artefact, model, prototype) in different areas of design research.

To bring some clarity, we give an overview of the way three widely used terms (i.e., *artefact, model, prototype*) are interpreted in different areas of design research (Fig.2). In addition, we elaborate upon a further term coming from the field of engineering (i.e., *demonstrator*), also adopted in some areas of design research (see section 5.3). Finally, we discuss the interpretation of the term prototype in the field of design research (see section 5.5) and in fields other than design (see section 5.4).

5.3 “Demonstrator” in Engineering

In the process of selecting relevant publications, we extended our scope of enquiry to engineering-oriented areas of design research. In these areas, we found that the term “demonstrator” is often used as a synonym of prototype. Moultrie (2015) points out that “[usually] demonstrators are viewed as technological prototypes which are close to market”. In this respect, Moultry proposes a new conception, arguing that “by considering the broader development space, it is possible to explore the potential for other types of demonstrators”. This point of view assimilates the term “demonstrators” to many of the interpretations of the term “prototypes" used in design research.

5.4 “Prototype” in disciplinary areas other than design

It is worth noticing that the term “prototype” can refer to a diversity of artefacts, depending on the specific disciplinary area. This semantic dissimilarity may lead to misunderstanding, especially in the context of multidisciplinary teamwork, where designers collaborate with researchers coming from different fields. Therefore, as Hallgrimsson puts it:

> “Product designers have to work with professionals from other disciplines where the term prototype could be used to describe many things that are not three-dimensional. Software designers use the term prototype in the context of code. Electronics engineers speak about prototyping printed circuit boards. […] It is worthwhile becoming more aware of these semantic differences since product design has become inherently interdisciplinary.” (Hallgrimsson, B., 2012).

5.5 “Prototype” in Design research

In the field of design research, as in that of design practice, prototypes are understood generally as means to represent ideas, namely, give an intelligible form to undetermined and abstract concepts pertaining to design solutions. In other words, prototypes are deemed as practical instruments to advance the design process, moving from the typical vagueness that characterises the concept phase to the clarity that implementation and experimentation usually require.

This general conception is common to all views on the role of prototypes that dot the diverse landscape of design research. Whether practice-oriented research (e.g., R&D context) or academic research, prototypes in the field of design serve the fundamental need to make magmatic and conceptually embryonic ideas manifest through fathomable forms of representation. Unlike in the professional world, however, in design research, the guiding

principle is that of gaining and/or producing knowledge, often regardless and outside of market requirements. That is to say, the kind of ideas and concepts that research prototypes embody are part of a process of knowledge production, which is not directly related to manufacturing and marketability.

Although in all areas of design research prototypes are used to produce knowledge, their (claimed) role differs widely depending on both the scope of research and the approach adopted, leading to a diversity of terms and definitions. Notably, Wensveen & Matthews (2015) identify four main roles, highlighting different ways in which prototypes and prototyping contribute to generating design-relevant knowledge. Prototypes can be used either to "test specific hypotheses" (*experimental components*) or to conduct "open-ended explorations" (*means of inquiry*) or to embody/show concepts and arguments (*research archetypes*) (p.272). Moreover, the very process of prototyping can be "a means of enquiry, akin to a research method" (p.269). Each role is bound to a specific methodological approach that proves consistent with the kind of knowledge sought, and yet a single research project may include all of them, relying on several prototypes having different purposes throughout the process (p.271). Thus, not only is the role of prototypes in design research multifarious, but also its variations can be combined in the same project, if needed.

As Wensveen & Matthews (2015) clarify, besides contributing to the discussion on the use of prototypes in design research, their categorisation aims to show that the approach commonly referred to as *Research-through-Design* (RtD) brings together "a multitude of legitimate intersections between design research and practice" (p.263). In other words, making prototypes, as a distinct practice of design put to the service of research, can contribute to producing knowledge relevant for design in many different ways. This open-minded view, which embraces the heterogeneity that characterises the field of design research, leaves room for new conceptions of prototype and prototyping in emerging areas such as that of design for social innovation (e.g., Kimbell & Bailey, 2017; Blomkvist, 2014). In this regard, the attempt of settling an inclusive epistemology for design research, beyond typologies and segmentations around the definition of RtD, is openly expressed by several researchers who proposed the term *Constructive Design Research* (CDR) (Wensveen & Matthews 2015; Krogh et al., 2015).

Notwithstanding someone's attempts of agreeing upon an inclusive epistemology, researchers active in different areas of design tend to emphasise their peculiar way of doing research, coining terms that aim to distinguish their conception from that of others. This need to stand out is also reflected in the understanding of the role of prototypes. To give an example, while Wensveen & Matthews (2015) discuss prototypes and prototyping, Frens & Hengeveld (2013), who share a similar background, prefer to use the term *making* (instead of *prototyping*). Krogh et al. (2015), who present a typology of methods used to produce knowledge in RtD, on the other hand, emphasise the activity of *sketching* (p.5). These few examples show how even strands of research that share the same methodology attribute

different roles to prototypes and prototyping in design research. Interestingly, they claim differences of substance by emphasising semantic nuances and using distinct lexicons.

All things considered, the plurality of views on the role(s) that prototypes and prototyping play in design research – included their terminological inventory – are held together by the common aim of producing knowledge relevant for the design field, besides developing products for the market. This common trait, we believe, is what can be generally viewed as the emerging role of prototypes and prototyping in design research, without detracting from the significance that the diversity of views on such role (i.e., its nuances) offers.

6. Conclusions

In today's design research, a variety of terms are used to describe tangible and intangible artefacts playing the *role* of prototypes. The reason behind this diversity is that the notion of prototype is highly context and purpose dependent, i.e., varies depending on both the specific disciplinary area in which is developed and its use in the research process as it is performed in that very area. Our preliminary findings show that prototypes are best defined by both their general purpose (role) and their specific aims. Furthermore, we found that the role of prototypes in design research has evolved from a traditional conception (i.e., the first unit of a product series to be manufactured) to a new and wider notion, which views them as means to investigate phenomena outside of the domain of design. This evolution reflects a widespread and influential perspective into vogue in various areas of design research today. According to this view, prototypes are no longer aimed exclusively at developing products, also serving the process of knowledge production in the context of academic research.

The contribution of this paper is threefold. First, we provide a classification of prototypes by aims (fig.1), based on the claims made by various authors active in the field of design, both research and practice. Second, we discuss the emerging role of prototypes in current design research, highlighting a change of paradigm regarding the way research is conducted. This change follows an expansion of the scope of investigation, which includes theory and social phenomena. Third, we show that the emergence of a new role of the prototype in design research depends largely on the definitions and discourses that are developed over this topic. In such discourses, terminology plays an important role, influencing the very practice of research.

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Acknowledgements: the authors would like to thank the team members: Alba Cappellieri, Manuela Celi, Venere Ferraro, Margherita Pillan, Lucia Rampino, Valentina Rognoli, Susanna Testa.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Making of a Dress: Explicating the Implicit Processes

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Abstract | This case study aims to provide fresh perspectives on design culture through the examination of the (usually overlooked) human decisions, interactions and processes involved in the design and making of an occasion dress. Four areas - actors and networks, project and praxis, benefits and limitations of technology, and artefact and meaning - were explored to address the questions, "What were the requirements for this dress to be made?" and "What is the cultural significance of this dress?" Interviews and observations revealed the motivations, co-design, risk-management, negotiations, relational capital, tacit knowledge, resources, technology and processes required in the making of the dress. The imagery referenced in the design of the dress gave it symbolic meaning. The making of the dress represents cultural cross-pollination through networks, artefact, and craft. The findings suggest that aside from brand storytelling, post-industrial designers should consider how they are helping clients craft their stories.

KEYWORDS | DRESS-MAKING, HAND-EMBROIDERY, IMPLICIT PROCESSES, CULTURAL HERITAGE, CO-DESIGN

1. Introduction

What can the making of a dress, commissioned in Singapore, inspired by Mexican Tehuana traje, and hand-embroidered in India, teach us about design culture in this post-industrial age? In the 20th century, shopping was a means of warding off the unhappiness created by a loss of self and identity (Bocock, 1992, cited in Press and Cuswoth, 1997). In the 21st century, everyday people are increasingly dissatisfied with simply being "consumers" and want to be "creators" as well (Sanders, 2006). Sanders (2006) identifies four levels of creativity that people seek. These include, from the most basic to the most advanced – doing, adapting, making and creating. Hur and Beverly (2013) cite the construction of IKEA flat-pack furniture as an example of 'doing'; the mass-customization of predetermined shoe styles by Nike as 'adapting'; and the growing number of DIY craft and fashion micro-producers embracing co-design activities as 'making'. The ground-up co-design of the dress in this study is presented as an example of 'creating'.

Numerous studies, including Jha and Narang (2014), examine the symbiotic relationship between contemporary fashion designers and craft communities in India. However, the end user (customer) is rarely, if ever, in the picture. The implicit human decisions, interactions and processes so critical to the culture of making are, likewise, rarely explicated. The author, having connected the client and the designer, had the opportunity to witness this design project as both an insider and a neutral observer. Considering the investment of time, effort and money involved in the creation of this artefact, gave rise to two questions: "What were the requirements for this dress to be made?" and "What is the cultural significance of this dress?" Four key areas were explored to address these questions – actors and networks, project and praxis, benefits and limitations of technology, and artefact and meaning.

2. Method

This case study involved detailed, in-depth qualitative and relevant quantitative data collection from multiple sources of information (Cresswell, 2013; Yin, 2009). Research tools included observation, interviews, and analysis of relevant data, such as WhatsApp chat proceedings between involved persons. Some of the key people involved in the making of the dress were interviewed, including the client, the designer, and embroiderers.

3. Actors and networks

Culture is created and defined by people. This section identifies the actors connected to the making of the dress. The client, Circe Henestrosa, is a fashion curator and heads the School of Fashion at LASALLE College of the Arts, Singapore. The idea for the dress came about when she was contemplating what to wear for the opening of Frida: Making Herself Up at the V&A Museum scheduled for June, 13, 2018. Circe considered two options, "My debate

was whether I should wear the traditional (Tehuana) dress or a more modernized version of it." Eventually, Circe had both versions made. She commissioned a Mexican designer to make a more traditional two-piece outfit and a Singapore-based LASALLE alumnus to produce a contemporary version.

The Singapore-based designer, Vikas Dayal, was born in India, but currently works and resides in Singapore as a permanent resident. His 2012 graduation collection stood out from his peers for his use of detailed embroidery and beadwork. A key advantage he possesses over other Singapore-based designers and arguably the main reason for his selection, was that he has his own embroidery workshop in India.

In New Delhi, Taufir and Mamu are Vikas' "main sampling guys" for machine-aided embroidery and hand embroidery respectively. Having previously worked for a renowned Indian fashion designer, Taufir chose to work for Vikas' workshop due to proximity to his home and higher wages. He was responsible for producing the first embroidery sample for this project. Together with five other embroiderers, Mamu was responsible for the hand embroidery used in the final dress.



Figure 1. The silk embroidery thread seller.

There is a group of supporting actors, largely overlooked in the literature, who enable the continuation of the craft of embroidery – merchants who supply the essential materials, tools and equipment used in the craft. A representative of this supporting network is an elderly embroidery silk thread seller who operates a hole-in-the-wall shop close to Vikas' workshop (Figure 1). Vikas prefers to patronize this particular thread seller because he provides the special service of color matching. The different colors of threads are stored in cardboard boxes with only numerical indications. Customers simply hand him color swatches and he will find the matching threads from memory.

Vikas has only one staff back in Singapore due to the country's restrictions on foreign manpower. His sample-maker, Chote, who is skilled in both pattern-cutting and sewing. Chote was responsible for making and altering the dress toile (prototype) for the fittings and assembling the final dress. Although Circe knew Vikas personally, she first sought the author of this paper, Adrian, for his opinion as to whether Vikas would be able to produce the dress she had in mind. Adrian was one of Vikas' lecturers at LASALLE and they had remained in contact since the designer graduated. Having previously worked together on a number of custom-orders, Adrian could attest to Vikas' dressmaking and embroidery capabilities. Circe also enlisted the help of another LASALLE colleague, Dinu Bodiciu, a fashion design lecturer, to plan the embroidery placement for the dress.

4. Project and praxis

The making of the dress took place between March and May 2018. On March, 28, Vikas had the first meeting with Circe and Adrian to discuss the design of the dress. He accepted the commission on Adrian's recommendation and because it aligned with his schedule. Vikas usually returns to India two to three times a year to work on the production of his own collections. He was scheduled to fly back to India on April, 2, to prepare for a showcase of his work at the International Fashioner Week on April, 7. Work for the dress progressed quickly at the onset. Chote completed the toile for the first fitting on March, 31, and altered it for a second fitting the next day. On April, 2, Vikas flew back to India, on schedule, with the toile and a Manila shawl sample, from Circe, as reference for the embroidery.

Amidst preparations for the fashion show, Vikas discussed the work for Circe's dress with his embroiderers. They estimated that the embroidery with all its colors would require at least three months to complete, making it "impossible" to deliver by the end of May 2018. They strongly advised him to drop the project.

When Vikas is not around, the workshop usually produces embellished ready-to-wear dresses for the domestic market. During my visit in October 2019, the workshop was producing such a design. A distributor wanted to order 80 units of that dress a month, but the workshop was only able to churn out about half that quantity. This was a good problem for them to have, with demand exceeding supply. The dress I saw in production was embellished with hundreds of glued-on crystals. Initially, I thought that this type of work

could be what Mohsini (2016) refers to as 'labor'. In fact, although the materials used differ from traditional embroidery and beadwork, the work still leverages the experienced hands and dexterity of the embroiderers. The making of these dresses utilized skilled workmanship.

Nevertheless, adopting Pye's (1968) use of terminology, Vikas demands 'craftsmanship' for his own designs as opposed to 'workmanship'. As a designer-producer, he is more than willing to make the distinctions between the two. His own designs require experimentation at the onset and close supervision during actual production. He told me, "If I'm not there, the work does not move." Even when he is there, the embroiderers can be reluctant to take on new work. New designs require a lot of preparatory work.

Vikas' own designs, with their higher price points, may not garner as many orders as the crystal-embellished dress, but he still secures multiple custom-orders for some styles. Vikas also pays his artisans extra for the higher quality he expects for his work. Circe's dress, however, came across as a time-consuming one-off piece involving a style of embroidery different from what they usually do. It was not technically difficult for them to adapt to, but they did not see potential return-on-investment for the time and effort that would be required for the dress embroidery. Therefore, dissuading Vikas from proceeding with the order was simply a matter of avoiding risk.

On April 22, 2018, Circe followed up with Vikas via WhatsApp. She negotiated with him, suggesting a compromise of making either a top or skirt with the embroidery if the dress could not be completed on time. Vikas actually thrives on overcoming challenges. Over one of their regular chai and biscuits breaks, Vikas tells his team that his reputation will be tarnished if he fails to produce the dress. For "brotherhood", the embroiderers agreed to start work on the dress. Once the sampling started, Vikas had to commit to the investment in materials and wages. He incurred a financial risk even before the actual "workmanship of risk" (Pye, 1968) commenced. On April, 24, Vikas sends images of the first machine-aided embroidery sample (Figure 2) to Adrian and Circe.

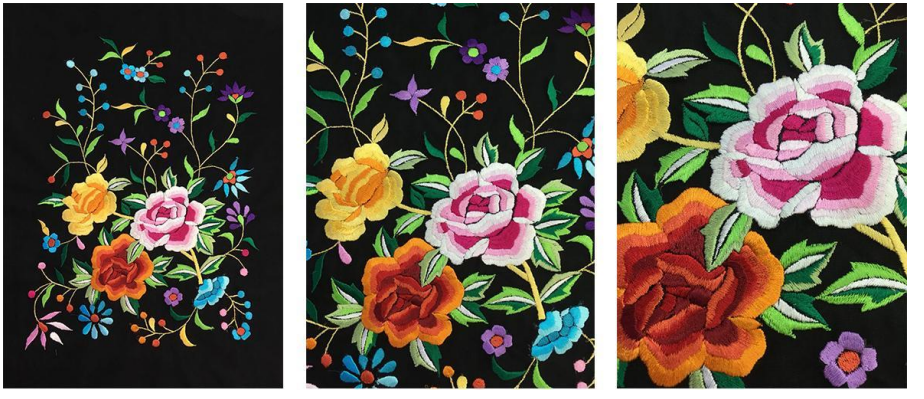

Figure 2. Images of first machine-aided embroidery sample at different magnifications

Apart from commissioning another dress with the Mexican designer, Circe's decision to get Dinu to work on the placement of the embroidery after approving the machine-aided embroidery sample was also risk-management. Believing that the scale and placement of the embroidery motifs could "make or break" the outcome of the dress, she sought Dinu's help to ensure that the embroidery on the dress would look right. This process delayed the start of the actual embroidery work. On April, 28, Vikas sent Dinu images of the dress pattern pieces and the first embroidery sample photographed with measuring tape for scale. With these images, Dinu prepared the embroidery placements (Figure 3) and shared them on May, 6.



Figure 3. Embroidery placements prepared by Dinu. Clockwise from top left image: front bodice, back bodice, sleeve, and skirt placements.

The same day, Vikas started drawing the embroidery pattern (Figure 4) on plastic sheets. Each completed section was handed over to Taufir to punch holes along the drawn lines using his machine. Once the holes were punched, the embroidery patterns were ready for use as stencils. In the workshop, these are called “kah-kah” which actually refers to the plastic material but is understood as the embroidery patterns. The artisans use a chalk solution and the kah-kah to transfer the embroidery pattern to the dress fabric which is stretched out on a wooden frame.

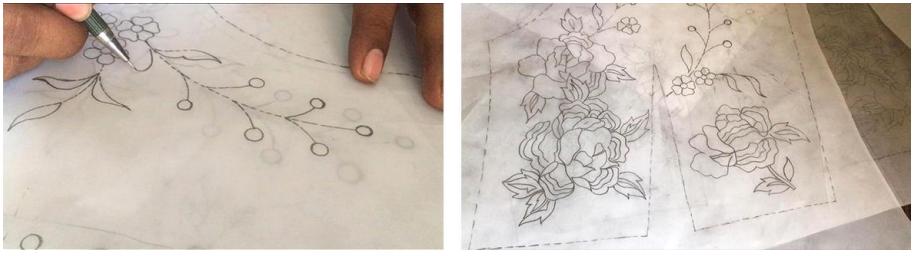

Figure 4. Hand drawn embroidery pattern, referred to as “kah-kah” in the Delhi workshop.

Dinu’s embroidery placements did not save Vikas any time directly, as the kah-kahs still had to be meticulously drawn from scratch. However, Dinu’s placements contained more negative space compared to what Vikas would have left on his own. Accordingly, this resulted in indirect time savings as less embroidery was required.

Mamu produced the first hand-embroidered sample which was followed by another embroiderer, Mona. Another four embroiderers, who worked on the actual dress together with Manu and Mona, would then "copy from the sample”. Referencing Derek Sivers’ (2010) observation of the “first follower”, Manu played the role of the leader, establishing the instructions and standard for the embroidery. Mona played the crucial role of the first followers and showed that the standard Manu sets could be achieved. The other less-experienced embroiderers then proceeded with their work by copying the pattern that had been set for them.

Vikas’ responsibility was to ensure the timely completion of the work by assigning the right number of embroiderers according to the pace of the progress. Vikas revealed that there are two flowers in the dress which are more finely embroidered than the rest. These initial flowers were embroidered by Mamu according to the standard that Vikas usually demands for his work. However, with just under three weeks left to delivery, the progress was too slow and Vikas had to instruct the embroiderers to reduce the refinement and increase the speed of the embroidery.

Worried that his own embroiderers could not finish on time, Vikas tried to sub-contract some of the work to two other embroidery workshops, offering the same extra rate he pays his own embroiderers. They rejected his offer, judging the work to be too time-consuming.

Money alone was not enough to get the work done and Vikas did not have the same amount of relational capital to leverage with the external workshops as he had with his own embroiderers.

In total, the dress took 720 man-hours to produce, including sampling and work on the actual dress. On May, 25, Vikas flew back to Singapore with the embroidered panels of the dress. That same day, Chote sewed up and finished the dress. His work took place behind-the-scenes; cutting and sewing according to drawings, measurements, verbal instructions, and photographs provided by Vikas. He never met Circe in person throughout the process. At 2 pm on May, 26, Adrian accompanied Vikas to deliver the finished dress to Circe (Figure 5). In the evening, Circe messaged her thanks to Vikas for completing the dress and asked about the price.

While certainly not recommended practice, there were two reasons why the price was not established until the end of the project. Firstly, Vikas did not have a close-enough prior reference for this particular style of embroidery involving so many different colors. It was difficult for him to accurately predict the time and resources required for its completion prior to commencement. Secondly, the project was not merely transactional. There was a relational component and the need for trust amongst stakeholders. The client had to trust the designer to complete the dress on time. The designer upon accepting the commission had to trust that his team would help him complete the work satisfactorily and that the client would pay him for the finished work. Both the client and the designer shared the risk of the project. It was a coproduction in which failure was not an option.



Figure 5. Circe trying the completed dress for the first time.

5. Benefits and limitations of technology

In this digital age, we are surrounded by so much technology that it is easy to take it all for granted. Today, when people speak of technology, they are usually referring to computers, smart devices, robots, blockchain, artificial intelligence, and 3D printing etc. In this case study, examples of technology from the present digital age, the industrial age, and the pre-industrial age were observed. More specifically, the smartphone, the sewing machine, and hand embroidery tools respectively. In this section, we examine the use of technologies in the making of the dress.

Digital technology enabled communication between actors in different locations and across time zones. The mobile application WhatsApp was used for the majority of the communications between client and designer. They only spoke face-to-face during the initial design discussion, for the initial fittings, and when the finished dress was delivered. WhatsApp was used to share visual references, follow up on the progress, negotiate solutions, provide assurance and approval, etc. Embroidery placements shared by Dinu via Google Drive, a cloud storage service, were accessed by Vikas on his smartphone. Vikas also used his smartphone's camera to capture images and take videos of the embroidery work at various stages. Images of the first embroidery prototype were sent to Circe for her approval. Subsequent images and videos of work-in-progress were used to keep her assured of progress. Vikas also provides his clients with videos of the work-in-progress as a guarantee of the "handmade". Ironically, when the embroidery seems too refined, clients sometimes question if the work was really being done by hand or machine.



Figure 6. The embroidery sewing machine (left) and embroidery hoop (right).

Machine-aided embroidery, an industrial age technology, is typically faster than hand-embroidery but has its limitations. The work area is limited to the clearance between the machine body and needle and the largest hoop used was about 15-inches in diameter

(Figure 6). Only one machine embroiderer can work on a dress panel at one time; continually repositioning the hoop after each section is embroidered. The embroidery, consisting of 17 colors (Figure 7) meant having to re-thread the machine many times for each hoop position. A final drawback is that machine embroidery tends to produce a stiffer, more rigid hand feel as compared to hand embroidery because the main fabric has to be stabilized with interfacing.



Figure 7. The 17 colors selected for the embroidery.

Ari hand-embroidery, utilizing tools from the pre-industrial age, was eventually used to complete the embroidery for the dress in 15 days. This embroidery produced a softer hand-feel as compared to machine-aided embroidery since the use of interfacing was not required. It was also the more efficient option as the larger embroidery frame allowed multiple embroiderers to work on the same piece simultaneously (Figure 8). In Ari embroidery, switching between different colored threads can be done more quickly compared to the sewing machine. Ari embroidery involves chain stitching with an awl. Without getting too technical, each stitch leaves two threads on the surface where the thread is looped and a single thread on the under-side. This results in a higher density of the face-side embroidery compared to the reverse (Figure 9).



Figure 8. Two embroiderers working on the front bodice of the dress.



Figure 9. Close up of Ari embroidery sample. Top of embroidery on the left, back of the embroidery on the right.

6. Artefact and meaning

As curator of the Frida: Making Herself Up exhibition, Circe had dedicated almost two years in preparation. The opening at the V&A museum was an important milestone for her. A regular off-the-rack dress would not be sufficiently commemorative. Her motivation to wear a version of Tehuana dress for this occasion stemmed from her research on Frida Kahlo's adoption of Tehuana costume in her everyday dressing. While Frida was from Coyocoan, Mexico City, she mixed various types of indigenous garments in her dressing. Circe felt personally connected to this research being Mexican herself and for the fact that her grand-aunt, Alfa Rios Henestrosa, provided Frida with some of the Tehuana garments she wore. In the footsteps of Frida, Circe's choice of dress was consciously driven to fulfil the duo purposes of constructing identity and showing her appreciation for artisanship. The intention of the client, in this case, imbued the artefact with its meaning.

While the dress holds personal meaning for Circe, any cultural significance depends on how it is perceived by others. Today, there is a strong association between peony embroidered Tehuana traje and Mexican identity, thanks in part to Frida's influence. Historically, the Tehuanas adopted the peony embroidery from the imported Manila Shawl. The Manila shawl, unlike what its name might suggest, did not originate from the Philippines but from China. For the Chinese, each motif used in the embroidery had a purpose and was a metaphor, but this symbolism was lost in time as the designs were adapted to suit the tastes of different markets (Arbues-Fandos, et. al., 2008). The indigenous people of Oaxaca (Mexico) changed the colors and increased the size of the peony motif embroidery in the Manila shawl. This style of embroidery was also applied to the Tehuana dress. This historical cross-pollination continues with Circe's dress, bearing Manila shawl-style peony motifs executed in Indian Ari embroidery.

The making of the physical dress was accompanied by the creation of many digital artefacts; including images, videos and text. Arguably, these intangible artefacts contribute more to the construction of cultural significance than the tangible artefact itself. On the night of the V&A exhibition opening, Salma Hayek, who played the role of the titular character in the 2002 biographical film *Frida*, came dressed in traditional Tehuana traje. Her outfit was a close interpretation of a photo of Frida as a Tehuana that accompanied the 1948 Time magazine article entitled "Mexico: Fashion Notes" (Belnap, 2017). This same image was Circe's initial reference for her dress. This outfit while so representative of Frida in our collective psyche was not found amongst her personal belongings in the bathroom of the Blue House. Should Hayek's traditional rendition and Henestrosa's modern interpretation be seen as reincarnations of a lost outfit or an immortalized image? In any case, the image of

Salma, Circe, and Frida's Self Portrait, 1948 (Figure 10) posted on Instagram has become memorialized as a part of contemporary media culture.



Figure 10. (Left) Instagram post of Salma, Circe, and Self Portrait, 1948 by Frida Kahlo. (Right) Image of Salma and Circe at the V&A exhibition opening shared via WhatsApp.

7. Reflections

The following are some of my reflections on the findings of this study in response to the research questions.

What were the requirements for this dress to be made?

This dress would not exist without the initial vision of the client, Circe, who was not only the patron/producer but arguably the lead designer. The commissioned designer, Vikas, adopted different roles over the course of the project, including translator, tailor, middleman, negotiator, production manager, artisan, quality control, photographer, videographer, customer service, etc. Possibly due to the privacy of such arrangements, such examples of co-creation between end user and professional designer are uncommon in the literature. Understanding the motivations of clients and producers in the co-design process can be valuable in enhancing existing or even creating new design service offerings.

It is important to note that money alone was insufficient incentive to get the work done. Trust and relational capital were necessary to overcome the perceived risks of the project. The client made initial contact with the designer through the author, who shared a closer

working relationship. The designer's negotiations with his embroiderers took place during the workshop "ritual" (Sennett, 2009) of the tea-break. These seemingly trivial connections played their part in the realization of the dress.

The designer's tacit knowledge was observed in other minute production decisions. Although Dinu suggested using French tulle at one point, Vikas stuck to a tulle he was familiar with because he could accurately gauge, from experience, the amount of allowance required to compensate for the shrinkage that occurs after releasing the fabric from the embroidery frame. During prototyping, he reduced the number of colors in the embroidery from the initial 21 that the thread seller picked out to the essential 17. He mobilized multiple hand embroiderers after realizing that the machine-aided embroidery would take too long. He made sure the embroiderers applied the right balance between refinement and speed. He personally oversaw the dry-cleaning of the embroidered panels and hand-carried them back to Singapore. Process management was also critical to Vikas' workflow. Placing his pattern cutter/sample-maker in Singapore allows him to perfect toiles where his clients live and make final adjustments when necessary.

The flexibility of the artisans' skill enabled the tangible embroidery work. Ari embroidery was adapted to mimic the single-needle embroidery found in the Manila shawl. The smartphone facilitated processes from design negotiations to confirmations, and providing assurance.

What is the cultural significance of this dress?

Jha and Narang (2014) state that the challenge of bridging the gap between traditional craft and fashion lies in harmonizing the local and global, the urban and the rural, tradition and modernity, creating new market potential in a way that is beneficial for all stakeholders. I believe that the making of this dress has bridged the gap between traditional craft and fashion quite successfully. In the precedent of Frida, this dress was a celebration of Circe's cultural identity and personal affiliations. As a designed artefact, this dress was the result of centuries of globalization, from the Manila shawl trade routes of the 1500s to present day expatriation; reflecting the cross-pollination of cultural symbols, design sensibility, and craft technique. In this digitally connected age, the images of the dress extend cultural significance well beyond the artifact. However, what cultural significance would the image have without the dress and the intangible design decisions, craftsmanship, and cross-pollination of cultural heritage that went into its making?

8. Conclusions

By explicating the usually implicit processes involved in the making of this dress, we see how the meaning and value of the crafted artefact is ascribed by the collective of actors involved in the making of the object rather than a single author. In this age of multiple networks and connections, the handmade still has its place alongside industrial and digital technologies as long as people continue to value its expression.

The earlier industrial revolutions may have led to the redundancy of the craftsman's workshop and craft guilds (Sennett, 2009) but the 4th industrial revolution can empower small craft businesses to once again thrive. However, as customers continually evolve, the designer's work now involves catering to – with reference to Maslow's hierarchy – "higher-order" needs. In cases like this, the client and designer are engaged as co-designers.

In this post-industrial age, quality and craftsmanship are important, but they increasingly only fulfil clients' baseline expectations (Langer, 2020). From a behavioral perspective, the higher purpose of this dress was art – an "activity of making the things one cares about special" (Dissanayake, 1995, p.223). I suggest that while conventional wisdom emphasizes brand storytelling, contemporary designers should consider how they are helping clients craft their own stories.

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Acknowledgements: Circe Henestrosa for being a constant inspiration. Her passion for celebrating local craft practice and translating the “traditional to contemporary” was the catalyst for this study. Vikas Dayal for his generous help in recounting the entire dress-making process, taking me to visit his workshop and artisans in New Delhi, and providing many of the images used in this paper.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The shape of wellbeing: investigating an approach for the development of a design requirements framework for design for wellbeing projects.

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Abstract | Positive psychology and positive design are becoming increasingly important in contemporary design discussions. The previous research work provides inspiring approaches to reflect on the way how human wellbeing can be shaped by products and indicates to the importance of the creation of meaningful activities and experiences through design. However, the actual transfer of these theoretical approaches to design practice has not yet been widely researched. This paper deals with the question of how approaches from the research field of design for wellbeing can be implemented in design projects. Using the case study of planning an interior design semester project, the investigation of an alignment strategy of the process phases requirements engineering and design in form of a design requirements framework is presented. This framework could act as a guideline for the assessment of the technical-practical, aesthetic and symbolic design function in design for wellbeing projects.

KEYWORDS | DESIGN EDUCATION, DESIGN PROCESS, WELLBEING, REQUIREMENTS ENGINEERING, DESIGN RESEARCH METHODS

1. Introduction

The research fields of positive psychology, well-being and human flourishing have been increasingly taken up and addressed by the design community. For an interior design project, where students got the task to develop redesign-concepts for an existing public building in an urban environment, the decision was made to take up the approaches presented in literature on positive psychology and positive design and try to apply them in this project. For the project's clients, it was particularly important to make sure that people feel motivated to linger, exchange ideas, have fun and are able to experience an overall feeling of wellbeing while being inside the building. In the course of the preparation of the project, the review of the related work in this research area showed that the design community is aware of the importance of this research area within design practice, but nevertheless its implementation is still in its infancy. Missing tools and methods, as well as no real alignment strategy for the subsequent design process phases are complicating its implementation process. It became clear that the approaches generated so far, focused on the question of how the user requirements engineering process can be informed by collecting positive social practices and meaningful experiences from people of the project's target group. But how to proceed from there? How to implement design for wellbeing in a design project? This paper aims to contribute to the research realm of design for wellbeing, by addressing the design process structure for projects in this field. For the preparation of the interior design project, the decision was made to work on an alignment strategy that would make it possible to move from the requirements engineering phase to the design phase with concrete results. The following chapters describe, the approach taken and lessons learned in the course of this undertaking, as well as present a proposal for an alignment strategy in form of a design requirements framework, bridging the requirements engineering and design phase of a wellbeing project.

2. Related Work

Based on the psychological approaches on the subjective (Diener, 1984), psychological (Ryff, 1989) and social well-being (Keyes, 1998, 2002), as well as human flourishing (Seligman, 2012) different design disciplines have worked on translations of these approaches in order to use them in design practice. Desmet and Pohlmeyer (2013) address the issue of design's possible contribution to the creation of subjective wellbeing of individuals and respectively their happiness and coin the term positive design as an umbrella term to describe all forms of design, design research and design initiatives which focus on the increase of subjective wellbeing of individuals. They propose their positive design framework with the three components: design for pleasure, design for personal significance and design for virtue. Brey (2015) investigates the question of how and in which way it is possible to design for wellbeing and mentions that four approaches exist to implement design for wellbeing in design projects, namely the approach of emotional design, the capability approach, the

positive psychology approach and the life-based design approach. He sees a complementarity in the four presented approaches since they highlight different factors for wellbeing. The inclusion of the role of physical objects and the symbolic meaning of material possessions has also been discussed. The role of objects was examined by means of the question, how the use of physical objects, in combination with psychological interventions, could possibly support human flourishing (Desmet & Sääksjärvi, 2016). For the design of meaningful experiences, the decoding of social practices is seen as an interesting starting point from a design perspective (Klapperich et al., 2018). Referring to design strategies for the creation of symbolically meaningful objects and interactions the SIM toolkit has been developed, which was later on illustrated with product examples for the 16 symbolic meaning-focused design for subjective well-being directions in order to inspire their application in design projects (Cassais et al., 2016a, 2016b, 2018). In summary, these efforts have mostly inspired the development of meaningful actions and experiences (Diefenbach & Hassenzahl, 2017) and it can be stated that the topic of implementing the design for wellbeing approach in a design process has not yet been addressed sufficiently.

3. Design process and seminar structure

During the preparation of the interior design project the decision was made to use, due to the projects' goal, a human-centred design process methodology. The choice fell on a revised presentation of the Human-Centered Design ISO Standard 9241: 210-2010 (International Organization for Standardization, 2019) with a focus on the product design aspects within the process (Dittenberger, 2019). This design process is divided into the phases Inspire, Collect, Design and Evaluate (Figure 1). In the process step "Inspire", the focus lies on learning about the projects' context. Methods of qualitative social research, such as observational and survey methods, are applied. Based on the results of these studies, problem areas within the project context can be identified and subsequently comparatively researched in literature. In order to investigate the identified problem areas in more depth, further methods of qualitative social research are used in the "Collect" phase, such as interviews, focus groups or cultural probes. After each method has been carried out, the aim is to focus the project on a specific problem as well as the target group and to collect for this the human, technical, aesthetic, symbolic, ecological and economic requirements. After the broad preparation of the requirements for the selected problem area, the results are evaluated and a specific aspect is selected. For its processing, a research question and a design briefing for the projects' practical, aesthetic and symbolic functions is formulated which should be addressed in the following design phase. Furthermore, archetypal users, personas, are defined to ensure that the project focuses on the selected target group. The process phase "Design" is dedicated to the development of design approaches, the conduction of design studies and analog and digital model building. This process step also includes the active involvement and creative incorporation of feedback from the target group in the design development. The phase "Evaluate" represents the final

step of the process. Before the final prototype is built, the project gets finally evaluated by people of the target group to see whether the defined design briefing meets the requirements. In an iterative approach, the process is repeated until the evaluation results fulfil the defined requirements.

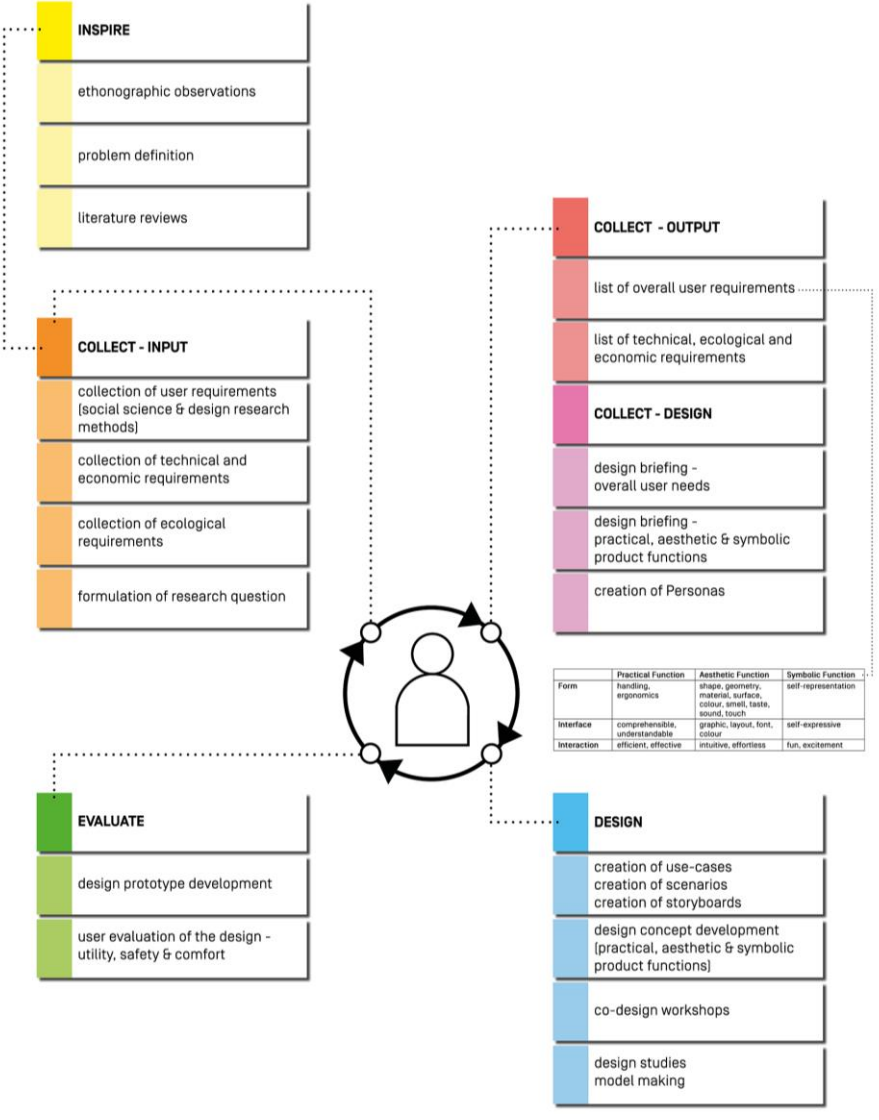

Figure 1. Human-centred design process (Dittenberger, 2019).

The project's design process phases were divided between the seminars design research and design studio practice. The design research seminar had to cover the design process phases "Inspire" and "Collect-Input/Output" and the design studio practice seminar had to cover the process phases "Design" and "Evaluate". Within the design research seminar, all framework conditions for this project had to be determined in order to use the findings to create the students' individual design briefings for their semester projects.

Design research is instructed and trained as an integral part of a design process during students' design projects, to understand the real wishes and needs of the people they are designing for. Teaching experience, gathered while working with the presented human-centered design process model, had shown, that it is essential to highlight the further use of the generated data of a design research study in order to be able to use the results for the next project phase, the design phase. It has been observed that after carrying out a user requirements study, students had great difficulty in formulating criteria for a design briefing from the results of such studies. But in order to design a human-centered solution based on real end-user needs, the results of a requirements engineering process should deliver detailed design related information to enable the creation of a design briefing.

From a design education perspective, we posed the question of how we could make the desired output of the process phases, in the form of a collection of criteria for the technical-practical, aesthetic and symbolic design function (Schneider, 2005), more clearly visible and thus more understandable.

4. Collection of building blocks for the design requirements framework

As mentioned before, by applying during a user requirements study mainly methods which provide information about the life context, the needs as well as how the lives of the target group could be improved by a particular product field, the problem occurs that there is a lack of information which would be needed in the next process phase, the design phase. In order to give the students an overview of the requirements that should be collected during the design research phase, an approach for a new design requirements framework, addressing the technical-practical, aesthetic and symbolic design functions, was created based on existing models. Since a design briefing defines parameters for the functions of the design which should be achieved, reference is made here to Schneider's (2005) subdivision of the functions of design. He suggests a division into three parts: technical-practical functions, i.e. the physical functions of objects, aesthetic functions that affect all communicative, informative and formal functions of objects, and symbolic functions that relate to the social or psychological aspects of objects. In order to visualize the students what information is required for a design briefing, Heufler's (2004) items for the creation of a design briefing and Pugh's (1991) items for the creation of design requirements were used.

4.1 Design Briefing

Gerhard Heufler describes a design briefing as a "concise description or list of all the factors, requirements and requests affecting product design" (2004., p. 185). For him, a design briefing has to define items in the categories application, target group and market; technical, economic demands; environmental impact; and schedule. The following Table 1 offers a detailed overview.

Application, target group, market	Technical, economic demands	Environmental impact	Schedule
Functions, users	Technical data (dimensions, weight)	Energy and raw material consumption in production and use	Development, design, construction
Decisive features	Environmental conditions (temperature, dampness)	Long life, repairable, retrofittable, remoutable, recyclable	
Target group definition	Operation, maintenance, service life	Reduction in raw materials	
Competition analysis, market situation	Process, action		
Corporate identity	Type of construction, model assembly, packaging		
	Requirements, standards, patents, product liability, quantity, price		

Table 1. Items for a design briefing (Heufler, 2004).

4.2 Design requirements

To work on this identified challenge on the creation of a design requirements framework for the technical-practical, aesthetic and symbolic design functions, Stuart Pugh's (1991) checklist of 24 items for the generation of design requirements was selected as a starting point. He argued in his publication *Total Design: Integrated Methods for Successful Product*

Engineering in support of the performance of participatory design for product design projects by transdisciplinary teams. The first part of his suggested total design activities consists of the six phases: user needs, product specification, conceptual design, detail design, manufacture and sales. The second part focuses on the product design specification in terms of design, manufacture and sales. The third part deals with information gathered from methods to inform the design core. The fourth part addresses the inputs needed from technology sources. The aspects addressed in the four parts were used to develop a checklist of 24 items for the generation of design requirements (Table 2).

Number	Item
1	Performance (function)
2	Environment (use context)
3	Life in service (intensity of use)
4	Maintenance
5	Target product cost
6	Transport
7	Packaging
8	Quantity
9	Production facilities
10	Size and weight
11	Aesthetics, appearance finish
12	Materials
13	Product life span (duration of use)
14	Standards, rules & regulations
15	Ergonomics
16	Reliability
17	Storage

18	Testing (quality test to withstand)
19	Safety
20	Product policy (company's portfolio)
21	Societal & political implications
22	Product liability (guarantee)
23	Installation & initiation of use
24	Reuse, Recycling

Table 2. Checklist of 24 items for the generation of design requirements (Pugh, 1991).

4.3 Symbolic meaning-focused design directions

The approach of Casais, Mugge and Desmet (2016a, 2016b, 2018) was chosen to explain the meaning of the symbolic design function. They address the topic of material possessions and their corresponding happiness-related symbolic meaning by arguing that material possessions contribute to the individually experienced happiness due to memories we have with them, achievements they stand for or aspirations they remind us of. In their paper the authors present the SIM toolkit (Casais et al., 2016a), which means the design with symbolic meaning for user happiness, as well as a symbolic meaning framework including 6 happiness-related symbolic meanings and 16 design directions for it (Table 3). Based on Carol Ryff's model of psychological wellbeing from the year 1989, consisting of the six basic elements: self-acceptance, positive relations with others, autonomy, environmental mastery, purpose in life and personal growth, they analysed narrations of personally meaningful objects concerning their happiness-related symbolic meaning. Afterwards, they started to develop concrete design directions for each of the six categories to be used during a design process. The result of this research work was the SIM toolkit.

Symbolic meaning	Design direction
Positive relations with others	Support meaningful affiliations
	Embody characteristics of a group
Personal growth	Support active personal development
	Embody personal growth

	Support acceptance and growth form past experiences
	Enhance memories
Purpose in life	Encourage positive change
	Provide a sense of control
	Keep track of progress
Environmental mastery	Support multi-sensorial communication
	Provide a context for meaningful interaction
Autonomy	Destigmatize
	Design for mindfulness
	Redirect the user's attention
Self-Acceptance	Allow shared transformation
	Allow self-expression

Table 3. 16 design directions to design for happiness (Casais et al., 2016a).

4.4 Design requirements framework

This collected information was used to create a new overview table. The aim of this new table was to give the students a compact overview of which criteria of the technical-practical, aesthetic and symbolic design function are necessary to create a design briefing. As already mentioned in chapter one, past experience from teaching showed that it is important to show the students at the beginning of a project what results of a design research study are necessary to base their design on relevant data collected. Table 4 shows an allocation of the different items to the respective design functions.

Technical-practical design function	Aesthetic design function	Symbolic design function
= physically experienced	= sensually experienced	= socially experienced

Main functions	Shape (geometry, proportion, size)	Positive relations with others
Ergonomics	Sign functions (delimination, grouping, surface texture, colour contrasts, orientation, endurance, stability, precision, flexibility/variability, operation, comprehensibility)	Personal growth
Handling and interaction	Material (warm/cold to touch)	Purpose in life
Size and weight	Surface (tactile properties smooth/textured surface)	Environmental mastery
Environment	Colour (signal/restrained effect)	Autonomy
Maintenance		Self-acceptance
Standards, rules and regulations		
Installation and initiation of use		
Reuse, recycle		
Cleaning		

Table 4. Items for the design requirements framework.

5. Alignment strategy

After creating the design requirements framework, the project phases and thus the seminar structure were worked on. As already mentioned, the design process phases “Inspire” and “Collect” should be covered within the design research seminar and the phases “Design” and “Evaluate” within the design studio seminar. As experience has shown that the design research phase raises most questions among the students, special attention was paid to the structural planning of this seminar.

5.1 Study design

The students' projects had to follow a qualitative research approach to answer their research question. The qualitative research process is oriented towards the understanding of the humanities and cultural sciences and regards the subject as the constructor of his reality. Already during the research process results are put into practice theories and hypotheses are generated. Flick (2009) describes the research process in non-standardized qualitative research through the steps of selecting a research problem, systematic literature analysis, formulation of the problem, development of a project plan, selection of appropriate methods, entry into the field of investigation, data collection (data documentation and data analysis) and discussion the results.

For the study design the approach of action research, which can be understood as comparative research, was chosen. Here, the focus is on research into the conditions and effects of social action as well as the reflected action within a design process. Although the course of an action research process depends strongly on the practical conditions, there are two steps that must be considered. According to Muratovski (2016), first a goal or a research question is formulated, followed by an action which is subsequently evaluated. The process is characterized mainly by the constant change and the repetition of information collection, analysis and processing. In several iterations, preliminary results are already being implemented and tested during the research process. Another criterion of action research is the equality of all involved, which is ensured by the constant exchange between researchers and persons of the target group.

In order to proceed with the preparation of the semester project, the next step addressed the selection of qualitative and design research methods to enable the collection of valid data for the creation of a list of design requirements regarding the aspects of technical-practical, aesthetic and symbolic design functions, after the conduction of a design research study.

5.2 Data collection of the technical-practical and aesthetic design function

A spatial analysis was planned to ascertain the collection of items for the technical-practical as well as the aesthetic design function of the project. For this the method "Photo and Video Diaries" (Milton & Rodgers, 2013, p. 24-25) was chosen. The aim of this method is to record the actual state of a situation, room conditions or product uses in order to identify potential problems.

In order to synchronize the step of data collection and the subsequent data analysis, the method "AEIOU" (Martin & Hannington, 2012, p. 10-11), meaning A - activities, E - environment, I - interactions, O - objects and U – users, was defined at the same time. The following Table 5 provides an overview of the criteria on which students should collect image material when using the Photo & Video Diaries method.

Categories	Items
Activities	Main space and room functions
Environment	Measurements, statics, acoustics
	Colours
	Light
	Norms, rules, regulations
Interactions	Human interactions – all floors/rooms
Objects	Material/Surface - Space
	Material/Surface – Products
Users	Target groups

Table 5. Preparation of the data analysis grid.

The preparation of the results of the spatial analysis within the analysis grid enables a good overview of the identifiable problems or open questions within the project.

5.3 Data collection of the symbolic design function

The data collected and the problem areas identified from the spatial analysis should be used to obtain further information about the symbolic meaning of the rooms within the building. In order to ascertain the symbolic spatial function, a guideline interview with identified persons of the target group was planned. The development of the guideline questions should be developed in group work. Based on the 16 design directions by Casais, Mugge and Desmet (2016a), the focus was placed on the parameters "positive relations with others" and "environmental mastery" with regard to the project context. The students should develop questions with the aim of finding out which activities within the building generate joyful moments and which materials, lighting moods and colour worlds are to be found.

In addition, participants should also be asked about activities they remembered which put them in a joyful mood and what the material contexts of these situations were. The results of the guideline study should be included in the data analysis grid. In summary, the result of

the analysis grid should enable the definition of a research question, which should further be used as a basis for the redesign concept of each individual student's project.

In order to show the students, the connection between the seminars design research and design studio as planned from the beginning of the semester on, respectively the start of the project, and thus also to point out the alignment strategy of the seminars, a visualization of the table for the items of the design requirements framework was created (Figure 2).

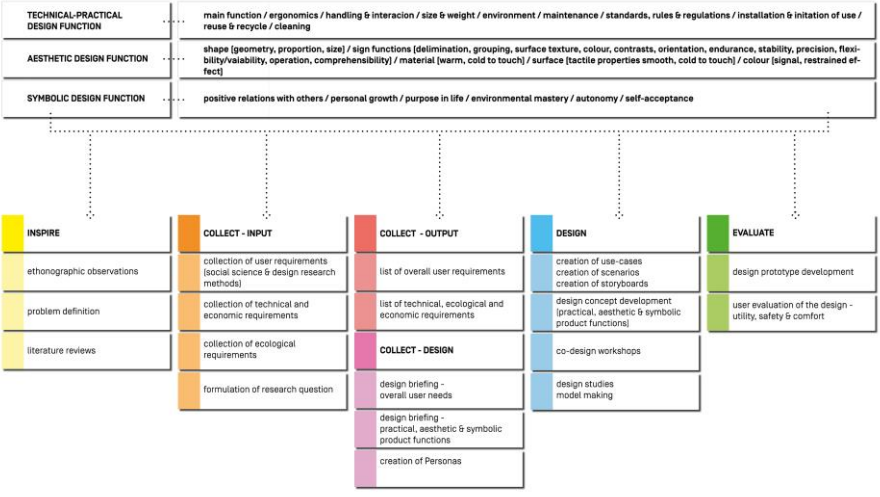

Figure 2. Visualisation of the Design Requirements Framework.

After the detailed preparation, it was also planned that the teachers of both seminars should lead the kick-off with the students at the beginning of the semester project. In the course of the semester, the lecturers should also come together for special input sessions in order to indicate the connection between the teaching content of the two seminars with a physical presence. In a first interim presentation, the students should present the results of their study from the design research seminar in the form of a design briefing for their design phase.

6. Discussion and conclusion

How to implement design for wellbeing in a design project? After the completion of the project it can be stated that the intensive planning work of the semester project supported the actual implementation very well. After the presentation of the semester project and the

semester planning, the design requirements framework was well received by the students. Within the design research seminar, the positive design literature and the existing project examples were discussed thoroughly. The topic itself and the examples were reflected very interested by the students.

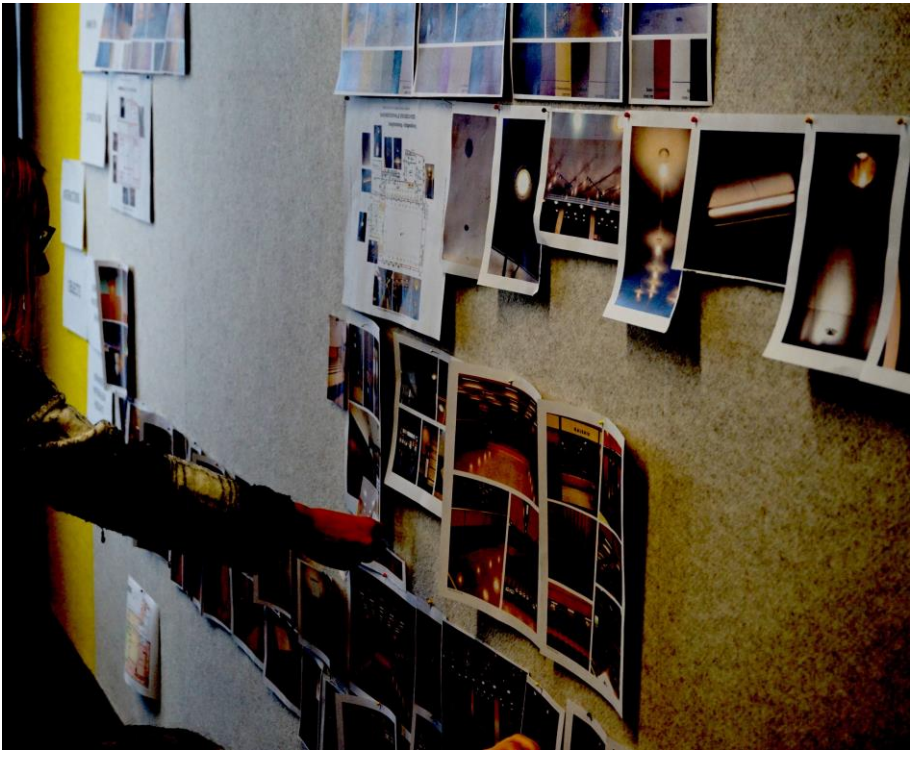

Figure 3. Students filling the data analysis grid.

However, how this content should be used in their projects was not very clear to them. The fact that design for wellbeing focuses primarily on the creation of meaningful actions and experiences is understandable for students, but the actual translation of these approaches to their own projects is very difficult to grasp.

During the implementation of the design research methods, the Photo and Video Diaries and the guideline interview, the design requirements framework was repeatedly used as a guidance to maintain the focus of the survey on the goal.

In a discussion with the students after completing the design research seminar, how they felt about the alignment strategy and the design requirements framework, it was reported that the meaning and implementation of design research as an integral part of a design

process was now much more understandable for them. The goal was always clearly insight and so they didn't feel lost in a purely theoretical approach that needed to be physically translated.

Wellbeing will become an increasingly important factor in design projects in the future. Previous research in this area has brought valuable knowledge from the field of psychology and positive psychology into design. Nevertheless, it is important to continuously work on the actual applicability of the theoretical approaches in practice. The approach of the design requirements framework and alignment strategy presented in this paper, in the sense that the factors for the technical-practical, aesthetic and symbolic function of design should act as a guiding principle in all design process phases, has proven to be sensible and practically applicable and will be worked on in further studies.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Weaving sequential changes – designing textiles with multiple embedded stages

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Abstract | The development of dynamic materials has changed the ways in which textiles are designed, but few research projects have investigated multiple sequential changes in textiles. This paper explores the design of textiles with the ability to undergo transformations involving multiple stages. Dynamic shrinking, hardening and dissolving yarns were combined in industrially woven structures to create a collection of five textiles, the texture, size, thickness, and number of layers of which were possible to change through heat and moisture. The fabrics were used in two workshops, and a series of prototypes was developed to explore potential application areas. The outcomes of the experiments show that textiles can transform in several stages through alterations to their properties, and that it is possible to embed this in their structures. Further research is needed on potential applications and how to better integrate textiles into product design processes.

KEYWORDS | WEAVING, MATERIAL, DYNAMIC, LIFESPAN, TEXTILE DESIGN.

1. Introduction and related work

This paper explores the design of textiles with the ability to undergo multiple stages of transformation within a sequence; these transformations can relate to changes in texture, size, thickness, and number of layers. Experimental work with dynamic materials, including shrinking, dissolving, and stiffening yarns, explored the concept of embedding irreversible changes in industrially woven fabrics.

The experiments presented build on the inherently changeable properties of various materials. There is a wide range of dynamic materials with various properties on the market, and these are used for a wide variety of purposes. The materials that were investigated are often used in industry within manufacturing processes, and are generally removed from the final product before it reaches the consumer.

1.1 Yarns with changeable properties

Polyvinyl alcohol (PVA) is a water-soluble synthetic fibre (Sakurada, 1985). When a piece of PVA thread is dipped in water, it shrinks, becomes rubbery, and eventually dissolves completely. Wet PVA can be formed around objects and becomes hard and translucent when it dries, losing its textile qualities. In the experiments presented in this article, a spun yarn with a dissolving temperature of 40°C was used. PVA is non-toxic and degrades into water and carbon dioxide, and is used within e.g. the food, pharmaceutical, and textile industries (DeMerlis & Schoneker, 2003; Kuraray, 2019).

The properties of PVA have been explored in several projects: Storey, Ryan, and Belford's (2008) dissolvable PVA dresses comment on the current fashion system, while Valle Noronha (2017) uses PVA threads and fabrics to embed pre-determined alterations, such as changes in shape and details, in garments.

Grilon yarns are thermoplastic copolyamide and copolyester yarns with a low melting point, and are used to separate, bond, and reinforce [something] (EMS-GRILTECH, 2019). Grilon LT yarn, which was used in the experiments presented in this paper, melts, shrinks, and disintegrates at temperatures of above 85°C (Districo, 2019). Single threads of Grilon can be easily disintegrated using a hairdryer, but larger quantities need prolonged heating through e.g. ironing or steaming.

The properties of Grilon have been explored from a design perspective by e.g. Dumitrescu and Persson (2011), whose knitted materials responded to touch by warming up, causing the structure to break. Resortecs (2019) uses stitching in a heat-dissolvable yarn to separate fabrics, buttons, and zippers in relation to the disassembly, reassembly, repairing, and recycling of garments.

Comfil yarns are thermoplastic composites that combine a reinforcement fibre and a thermoplastic matrix polymer, and are used for e.g. vacuum and compression moulding (Comfil, 2019). The Comfil polyethylene terephthalate (PET) yarn used in the experiments

presented in this article shrinks and stiffens when heated, and can be activated by steaming and ironing, for example. When combined with other yarns it creates shrinkage and texture, while the other materials allow the fabric to retain their soft and flexible qualities.

Dumitrescu and Persson (2011) use thermoplastic yarns that shrink and then stiffen in response to heat to transform the textures and patterns of knits in response to touch. Brock's (2018) 'self-assembling' Jacquard weaves use structure and yarn shrinkage to create three-dimensional textiles that gain their final form when steamed. Miyake's three-dimensional steam-stretch fabrics use after-treatment of heat-shrinking materials in industrially woven Jacquard patterns to create fabrics with three-dimensional surface structures (Howarth, 2014).

The changes in all of the dynamic materials used in the experiments presented in this paper are irreversible. The materials are not able to regain their original expressions, and instead their expressions are built up gradually (Worbin, 2010).

1.2 Designing textiles with dynamic yarns

The development of dynamic materials has changed the ways in which textiles are designed, in that various changes can be achieved in a textile's structure and visual expression. Such materials can be used to make textiles with qualities that can be changed after production, affording alternative uses. However, the designer's perspective on the material – whether it is central to the product idea or a detail chosen at the end of the design process – influences how closely the material design and product design processes are intertwined (Nilsson, 2015). A material's inherent changeability influences the changes that occur, and as such they are central to the design of textiles with the ability to undergo multiple stages of transformation, as well as investigations of potential applications. Textile techniques and material properties define the qualities of textiles, as well as ultimately the qualities and uses of products.

Several projects in the field of fashion have explored embedding changes in garments: Riisberg and Grose (2017) explore the concept of designing garments that evolve over time, facilitating an extended garment life and thus the usage of fewer resources. Valle Noronha (2017) explores the embedding of pre-programmed temporary and permanent changes into garments for stronger person-product attachment in order to highlight the materiality of the garments themselves.

1.3 Lifespan thinking

Lifespan thinking could be embedded in fashion and textiles in multiple different ways. Products could, depending on their uses, have lifespans ranging from fast to slow, with flimsy, recyclable, or durable materials that match the intended lifespan (Fletcher, 2014). Longevity could be addressed from the perspective of two different 'speeds': products with short, fast lifespans with materials that go through multiple 'loops', and extended, long

lifespans through emotional durability, repair, and up-cycling (Goldsworthy, 2017). Streamateria is a digital platform for made-to-measure, biodegradable garments with short, pre-defined lifespans, connecting designers to companies that work with renewable, biodegradable materials and processes to promote circular and closed-loop practices (Streamateria, 2019; Vinnova, 2019). Embedding multiple stages of transformation in a textile's structure encourages a better matching of the lifespans of the product and the material that starts during the design of the textile material itself.

2. Experiments

Various experiments were conducted in order to ascertain whether multiple stages of transformation, involving changes in size, thickness, opacity, softness, texture, and number of layers, could be embedded in industrially woven textiles. Single-, double-, and triple-layered woven structures were made using the aforementioned dynamic, heat- and water-reactive, shrinking, dissolving, and stiffening materials (Table 1). As a result, a collection of five fabrics was developed; the structure of each was possible to alter through ironing, steaming, and machine washing.

Two workshops were organised with designers and product developers at IKEA of Sweden to investigate the possible applications that the qualities of the fabrics might suggest. Based on the workshops, six preliminary prototypes of everyday textile products were made in order to explore the materials' changeable qualities and to adjust and change the products during their use phases. The project was carried out in collaboration with Linda Worbin from IKEA of Sweden.

2.1 The experimental setup and materials

The aim of the experiments was to explore how multiple sequential changes could be embedded in textiles. Heat and water were chosen as the main activators of changes due to their availability and the possibility of applying them to fabrics either separately (for example by ironing or washing) or simultaneously (through steaming or washing at a high temperature; Table 1).

The dynamic yarns were used as floats to create texture when they shrank, as a binding weft between the layers of fabric to enable separation of the layers when they dissolved, and as stripes to shrink parts of the fabric in order to create texture. They were combined with more stable materials such as cotton and paper yarn to form the main body of the fabric. All of the experiments were undertaken using an industrial Jacquard loom for flexibility with regard to developing and altering the weave structures and proportions of the materials. All of the structures were woven in two variations to test how the choice of dynamic material influenced the function of the textile; one used water-reactive, shrinking PVA, and the other either the heat-reactive, evaporating Grilon or shrinking Comfil yarns.

Table 1. The properties of the three dynamic yarns.

Stimulus Yarn	Ironing	Steaming	Machine wash 30°C	Machine wash 40°C	Machine wash 60°C
PVA 40°C	-	Shrank	Shrank and melted	Shrank and melted	Shrank and melted
Grilon LT	Broke slightly	Broke slightly	-	-	Shrank slightly
Comfil PET	Shrank	Shrank	Shrank and melted	Shrank	Shrank slightly

2.2 The final fabrics

A collection of five materials was developed as a result of the experiments, and is presented below (Figs. 1–5). These weaves were chosen due to the variation with regard to the number of possible transformation stages of each, as well as for the variation in stages that the different fabrics offered as a collection.

All of the fabrics were systematically tested with treatments that included water, heat, and steam. The tests showed that the fabrics could each undergo differing numbers of stages. For some, but not all, of the samples, the order of the treatments affected how the materials changed. For example, first steaming and then ironing the wavy-textured paper and PVA fabric produced a different texture than first ironing and then steaming it (Fig. 2). The fabrics could be washed several times before their layers separated, and had to be steamed or ironed for a long time in order to effect a change in them. If the fabrics are used in their textured state over a long period of time, patterns of dirt may be formed.

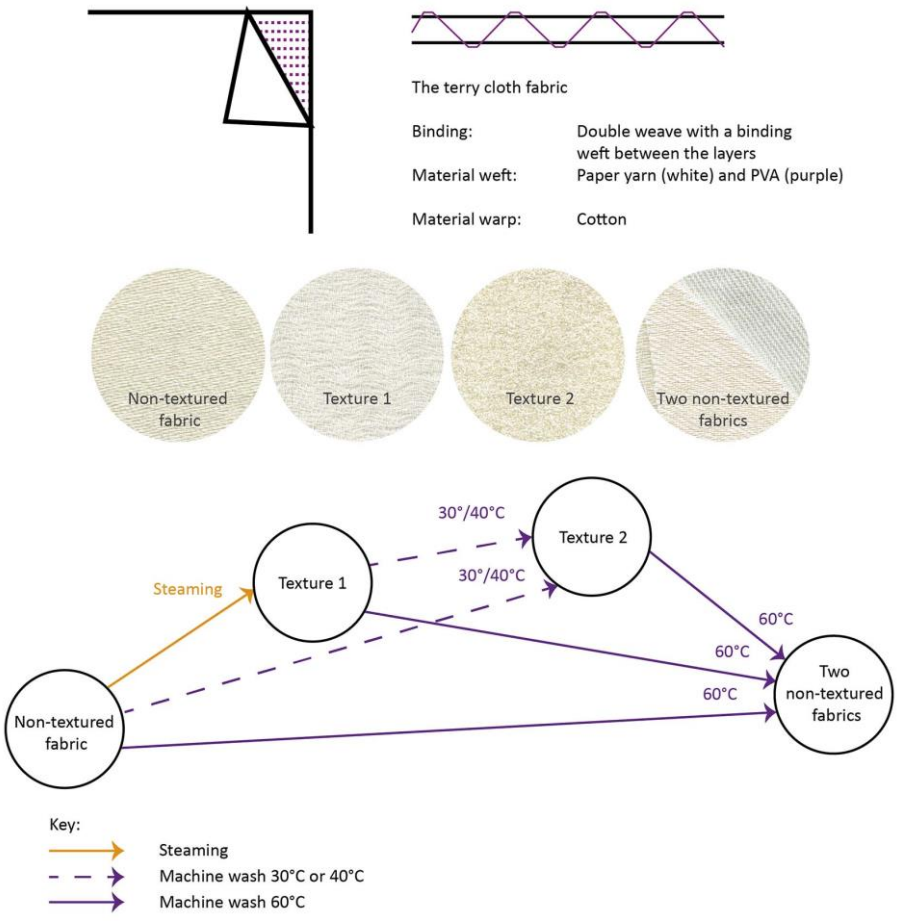
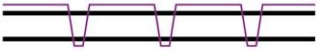


Figure 1. The different stages of transformation of Fabric 1, as well as how these were reached and the structure and materials of the fabric.

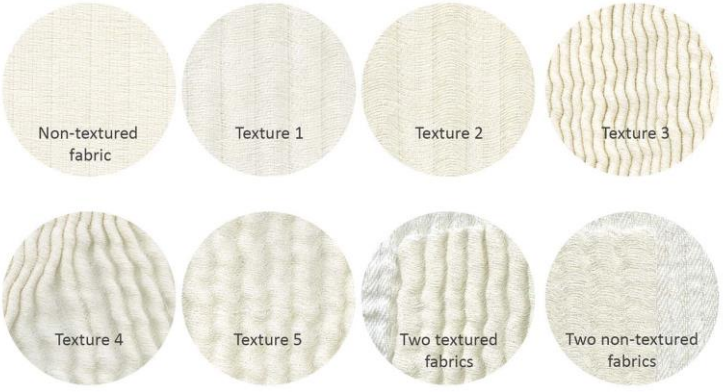
The terry cloth fabric (Fabric 1) was a flat, smooth double weave in paper and cotton yarn with a binding weft in PVA between the layers (Fig. 1). Water and steam shrank the PVA, making the fabric thicker and more roughly textured. When the PVA completely dissolved, the fabric separated into two parts. The fabric could be either shaped around objects or separated in specific places to create pockets.





The wavy-textured fabric

Binding:	Double weave with a binding weft floating on the reverse
Material weft:	Paper yarn (white) and PVA (purple)
Material warp:	Cotton



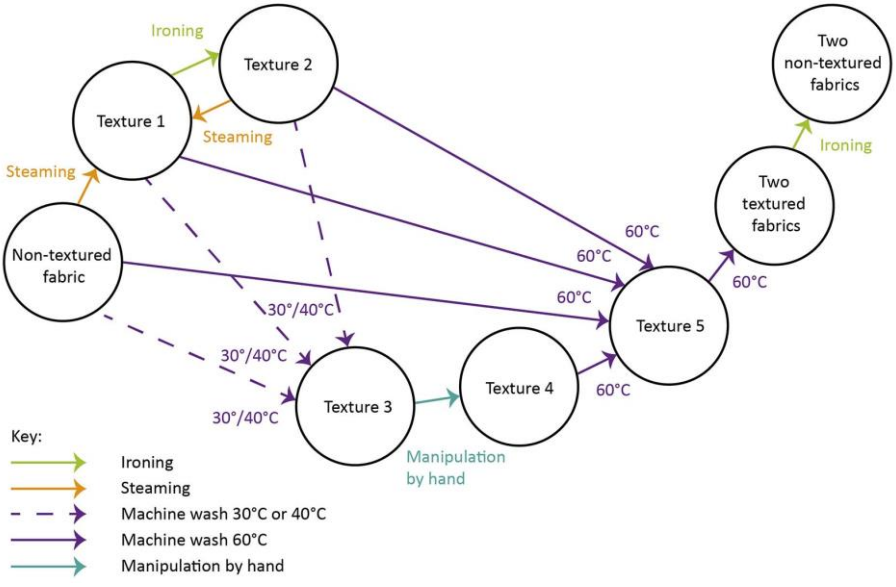


Figure 2. The different stages of transformation of Fabric 2, as well as how these were reached and the structure and materials of the fabric.

The wavy-textured fabric (Fabric 2) was a flat, smooth double weave in paper and cotton with a binding weft in PVA floating on the reverse side of the fabric (Fig. 2). Water and steam shrank the PVA, making the fabric thicker and wavier in texture. When the PVA had completely dissolved, the fabric separated into two parts. It was possible to move back and forth between some of the textured stages, depending on the stimulus applied to the fabric. The fabric could be either shaped around objects or separated in specific places to create pockets. The lines of the texture gave the fabric direction and support. Applying water to specific lines of floats could be used to make the fabric curl inwards on itself.

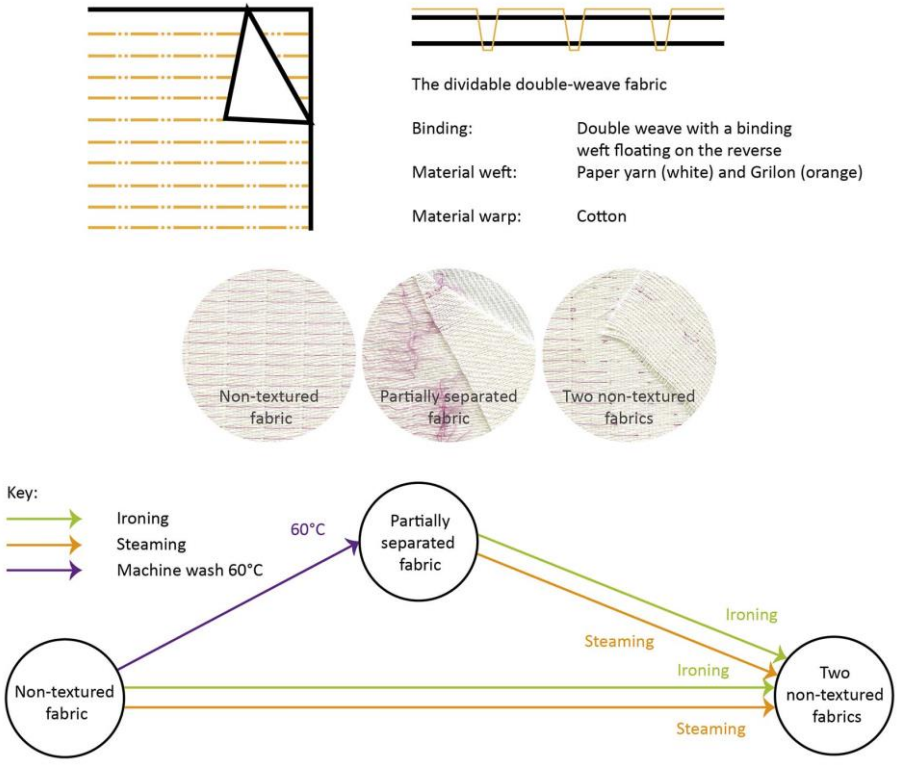


Figure 3. The different stages of transformation of Fabric 3, as well as how these were reached and the structure and materials of the fabric.

The dividable double-weave fabric (Fabric 3) was a flat, smooth double weave in paper and cotton with a binding weft in Grilon floating on the reverse side of the fabric (Fig. 3). Heat and steam caused the Grilon layers to separate to different degrees (into pockets or channels, or completely). When machine-washed at 60°C the Grilon shrank and the layers partially separated.

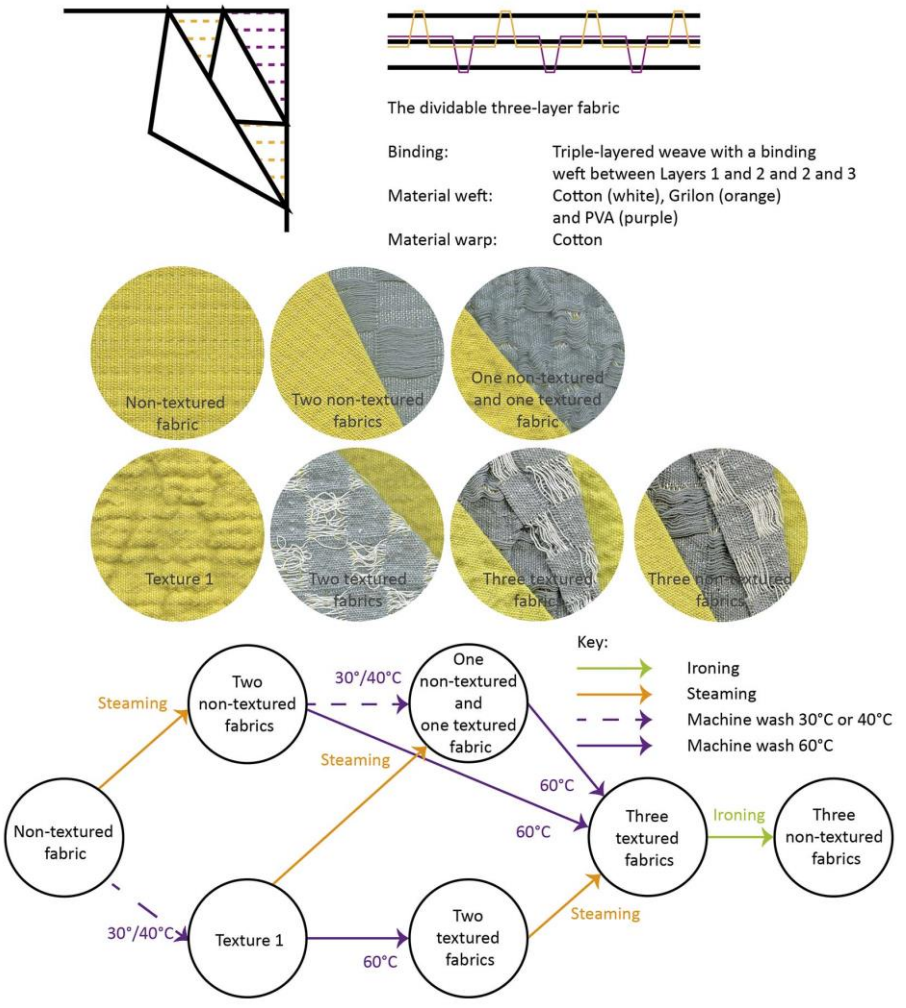


Figure 4. The different stages of transformation of Fabric 4, as well as how these were reached and the structure and materials of the fabric.

The dividable three-layer fabric (Fabric 4) was a three-layered fabric in cotton with a binding weft in Grilon between Layers 1 and 2 and a binding weft in PVA between Layers 2 and 3 (Fig. 4). The middle layer had a different colour and surface design than the others. Water shrank the PVA, giving the fabric texture. Repeated machine-washing at a high temperature dissolved the PVA and separated Layers 2 and 3. Heat and steam caused the Grilon thread holding together Layers 1 and 2 to dissolve, dividing the fabric to varying degrees (into pockets or channels, or completely).

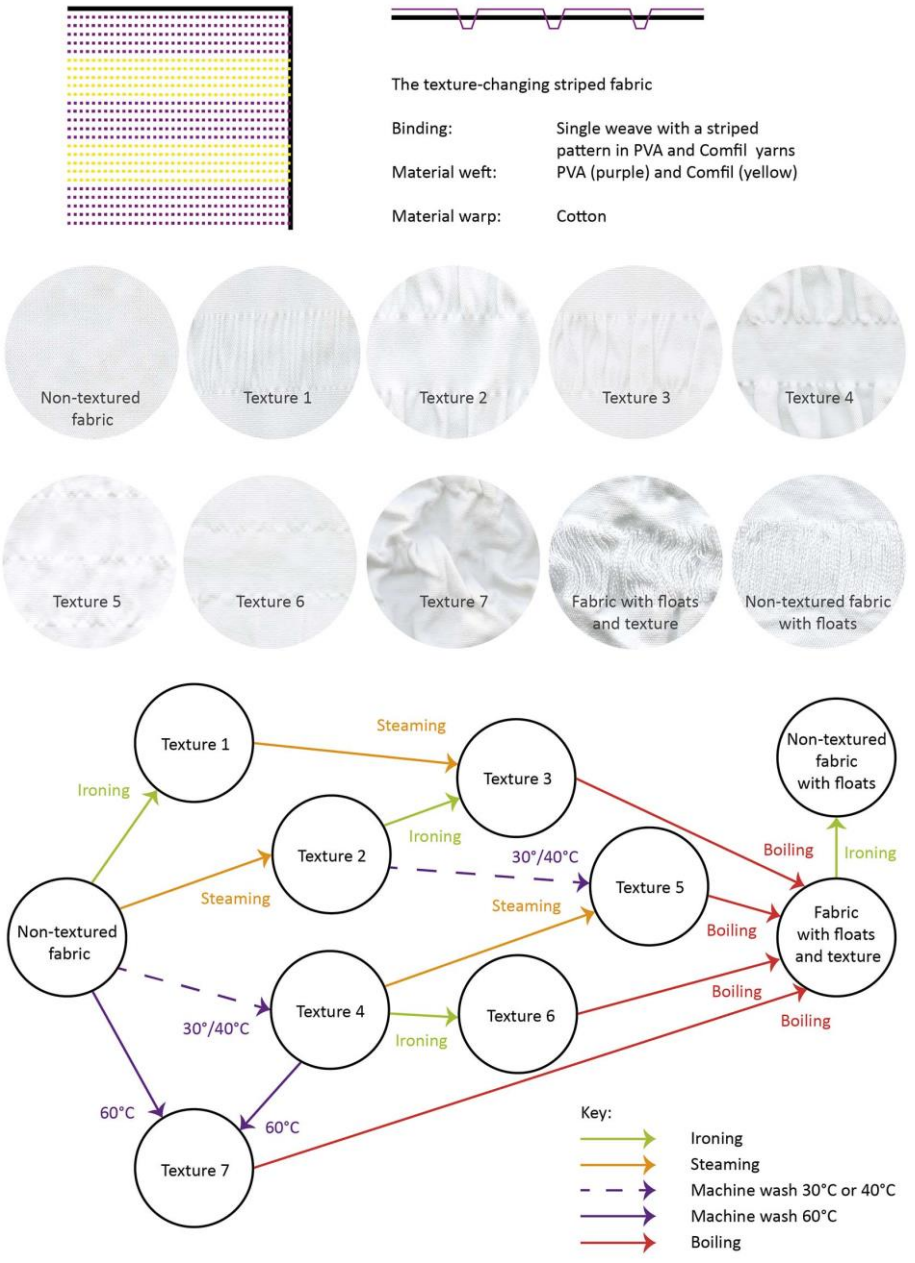


Figure 5. The different stages of transformation of Fabric 5, as well as how these were reached and the structure and materials of the fabric.

The texture-changing striped fabric (Fabric 5) was a flat single-layer woven fabric in cotton, with a white-on-white striped pattern in PVA and Comfil yarns (Fig. 5). Heat and steam shrank the Comfil, changing the size and texture of the fabric. Water and steam shrank the PVA, which also changed the texture and size and created floats by dissolving the PVA completely. The fabric could be shaped around objects, and its texture could be changed several times within a sequence by alternating between washing and ironing treatments (Fig. 5).

3. Workshops

In order to explore the possible applications of the materials, Fabrics 2–5 were woven out and used in two one-day workshops at IKEA of Sweden in Älmhult, Sweden. Each had four participants, who were a mixture of product developers and designers. The collection of fabrics and their stages of transformation were introduced to the participants, who were able to explore them using spray bottles, hair dryers, and clothes irons. The main questions asked during the workshops were: 1) What challenges do you face in your projects in relation to textiles? and 2) what expressions or functions are you looking for?

The participants came from fields including design management, childrens' textiles, and home textile design, and had different perspectives on the design process. Accordingly, the discussions involved a broad range of ideas for the materials and their applications. With regard to using dynamic materials in the product development process or embedding changeable qualities in products, understanding and communicating change were seen as the main obstacles. This likely stemmed from that fact that, from the perspective of a designer, one often starts with a problem or an idea for a product and chooses a material that fits the idea.

The ideas for using the changeable qualities of the fabrics in the production process included form-fitting fabric for a lampshade and shaping fabric onto furniture for easier upholstering and less work-intensive production processes. This latter could be achieved by adding shrinking yarn to a double weave and washing it to create a quilted effect, rather than using the time-consuming method quilting by sewing. Other applications included furniture upholstery in order to create up-to-date expressions, a baby blanket that can change size or be separated into several thinner blankets, curtains with adjustable lengths, and room dividers or wall hangings with optional storage pockets.

4. Prototypes

In order to further explore applications, some of the workshop ideas were created as prototypes; these included a bedspread, two lampshades, two curtains, and a pillow (Figs. 6–9). The pattern shop at IKEA of Sweden in Älmhult made the prototypes. The prototypes

explored changes in the function, form, and expression of everyday textiles by e.g. using the shrinkage of a fabric as an after-treatment when forming the textile, and using the shrinkage of a fabric to fit it to a product and adjust a textile product during its use phase.

The textured surface of the bedspread was created using the shrinking behaviour of PVA rather than the quilting technique; the pattern of the middle layer of the fabric defined the texture on the outside of the fabric (Fig. 6). The lampshades explored the idea of using the shrinking behaviour of PVA to fit fabric around a frame. A length of Fabric 4 was pre-shrunk with water and sewn into a lampshade (Fig. 6). Fabric 2 was sewn into roughly the right shape, then shrunk using water and fitted onto the frame (Fig.7).

The curtains and pillows explored ways of forming a textile product after its production by adjusting its length and width using heat and water. The pillows could be adjusted in terms of size in stages through washing and steaming, while the curtains were not planned to change from one specific size to another; instead, they could be freely adjusted (Figs. 8–9). As most of the changes were irreversible, a potential user would need to learn new ways of treating and maintaining their textiles in order to take advantage of the different stages of transformation and prevent unplanned changes.



Figure 6. Two prototypes that explored the shrinking behaviour of Fabric 4 to create texture through machine washing: a bedspread and a lampshade.



Figure 7. The process of fitting Fabric 2 around a lampshade.



Figure 8. Prototypes for pillows that can be adjusted in increments through steaming or washing: from bottom to top, non-treated, steamed, machine washed twice at 60°C, and machine washed at 30°C. All of the pillows had the same amount of filling.



Figure 9. Two pairs of curtains. Left: a curtain in Fabric 2 before and after shrinking. Right: a curtain in Fabric 5 before and after shrinking.

The prototypes, while very basic in their scope, showed the importance of developing materials alongside products. Some of the ideas for prototypes were not possible to achieve with the developed fabrics. The details of the textile products, such as stitching thread, lining, and trim, would have to be matched to the planned changes. The original idea behind the bedspread was that it would be suitable for a single bed in its shrunken textured state and, after being washed at 60°C, would fit a double bed. This was facilitated by the textile, which shrank by 50% at most, but was hindered by the fact that the trim and stitching would not have expanded with the fabric. Ultimately, the shrinkage of the fabric was effected through an after-treatment, giving the bedspread a heavy, textured surface before the material was stitched to create a more static prototype.

5. Discussion

The main question, which was explored from several different perspectives through experimental work with materials and weave structures, development of prototypes, and discussions with practitioners, was how changes or sequential stages of transformation can be embedded in the structure of a textile; a secondary aspect was at which stages of the design process textile materials can be utilised to achieve this, and what possibilities such changes open up for with regard to applications and designing several product lifespans in one textile.

Designing textiles with embedded changes means that the effects of these changes have to be considered when using the materials in different products or applications. Nilsson (2015)

argues that textiles can be incorporated into product design processes at several points, from constructing a new material to choosing an already existing fabric, and that their influence varies depending on where in the process they enter. Choosing a material based on an existing product idea was a common method among the participants of the workshops. The discussions highlighted a lack of awareness of the existence of changeable materials, and in some cases uncertainty regarding the need for them. The participants often started with a problem, came up with a product that solved that problem, then picked a material as the final step.

This method of choosing materials for products is challenged when it cannot be assumed that the textile will remain static after the production of a product. Changeable qualities invite a more active role on the part of textiles, wherein materials enter the design process at an earlier stage and their properties are developed alongside the intended expression and functionality of the product. This is a concept posited by Nilsson (2017). Such a method has consequences for the overall design and production process; for example, if a bedspread is designed such that its size can be adjusted through shrinking or a blanket can be divided into two thin shawls, the trimmings and sewing thread must be adjusted to allow for these changes. This suggests that there is a need for alternative ways of designing textiles and textile products that have such abilities, requiring textile and product designers to work in dialogue while developing both a product and its materials.

Textiles with embedded changes can propose alternative solutions to existing issues or be developed with a specific product in mind. Thus, time and the way a products is handled shape the exact changes that take place. Different properties of changeability lead to different types of change and various applications. For example, a fabric with the ability to gather and shrink in one direction suggests an alternative method of shortening a pair of curtains through shrinkage, which can later be reversed through washing. A fabric that can be separated into two fabrics, on the other hand, suggests an alternative method for hanging curtains by opening channels for the curtain rods, rather than sewing.

However, the design of such fabrics is challenging in that this will require users to learn new habits with regard to how they handle their textiles. On the other hand, methods such as ironing, washing, and steaming are familiar and easily accessible methods of textile maintenance. Using such methods to shape textiles opens up the idea of customising, adjusting, and taking a DIY approach to textiles without the need for advanced sewing, pattern-making, and textile construction skills and equipment. Another challenge is that consumers expect a product to maintain the same expression and function throughout its lifespan. They would thus have to understand the changeability of such textiles and ‘buy into’ the concept of change, and this would need to be communicated to them in a clear manner before a purchase is made.

Changeable qualities in textiles could also be used to replace more costly production processes. The fabrics presented in this paper were all woven on an industrial Jacquard loom for the purpose of flexibility in terms of development. They could, however, have just as

easily been woven in greater quantities on a shaft machine. If produced on an industrial scale, the intolerance of textiles to heat and moisture would require the preparation process and after-treatments to be rethought, as the materials cannot be washed without changes occurring. This could open up for reducing the amount of chemicals used in production processes.

6. Conclusions and future work

The textiles presented in this paper exemplify the idea that it is possible to design textiles that are able to undergo multiple sequential changes as a result of inherent changeability and the placement of materials in a textile structure. The number of stages of transformation did not automatically correlate with the versatility of the possibilities that were created in the fabric. Fabric 2, with its ability to change in terms of size, thickness, and texture and be divided into several layers, had multiple different stages. In comparison, Fabric 3 offered relatively few stages of transformation. However, when the possibilities of the materials were discussed during the workshops, an equal number of possible uses and applications were posited for both fabrics.

Using the inherent material property of changeability to design textiles could suggest alternative approaches to designing the lifespans of textiles, wherein a textile's qualities are connected to the material's properties and the material's properties are better matched to the textile's lifespan. The ability of a textile to undergo multiple changes in a sequence could open up for the design of several product lifespans using the same material, not by reusing the textile for a new product but by changing its structure and qualities. This would imply the need for textile and product designers to come together earlier in design processes in order to gain an improved understanding of the possibilities and limitations of materials and the requirements of the product. Further research is needed with regard to the various properties of changeability in materials and their uses and functions, and how to combine the knowledge of textile and product designers such that the development of textiles becomes an integrated part of design processes.

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About the Authors:

Author 1 Riikka Talman's PhD-research explores combining dynamic materials with textile structures to create textiles with an inherent ability change over different timespans, suggesting alternative ways of designing and perceiving textiles that accept change as one of their qualities.

Acknowledgements: This project was carried out in collaboration with Linda Worbin from IKEA of Sweden and it was funded by IKEA of Sweden.

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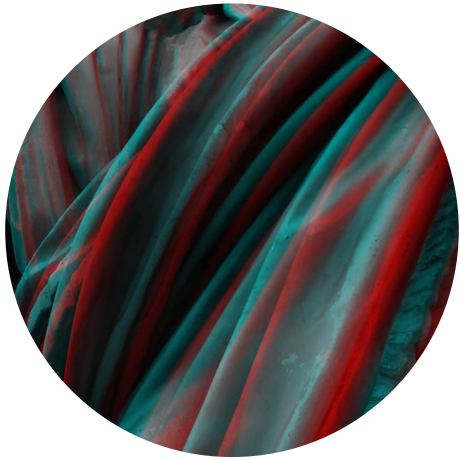

TRACK CHAIRS

DESIGN CULTURE (OF) MULTIPLICITY
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Özlem Er,
Istanbul Bilgi University, Turkey
"Design is studied and practiced at different parts of the World. While there is a shared understanding of design, there are also pluralities resulting from the realities of various localities and also contexts. The challenge continues for the design community to develop a shared understanding of design enriched and sometimes challenged through hearing and learning about these plural realities."



Raffaella Fagnoni,
Università Iuav di Venezia, Italy
"Does design have one or more visions? What kind of process does it follow? Has one or more identities? The multiple and ever-changing aspects of our discipline need to balance the roots with the dispersions, fronting the emergencies."



Gianni Sinni,
Università Iuav di Venezia, Italy
"As the territories in which design is applied are growing, the radical changes - ecological, social, economic - that we are facing need interpretative and designing tools that only multiple and original points of view can provide."



Pradyumna Vyas,
National Institute of Design, India
"Design process has to be technically deep and socially wide. With system thinking the track will explore how tacit knowledge can be used for today's context for better sustainable development. Learning from communities, co-creation, empathy, local ecosystems will be some of the lead for future."

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Architectural Design Education as an Agent of Change: The Case of the Ultra-Orthodox Branch, Jerusalem

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Abstract | Three undergraduate degree programs—in Art, Architecture and Visual Communications—were recently established as satellite programs of the Bezalel Academy of Arts and Design to serve a single, distinctive community: ultra-Orthodox women. This paper examines the unique design culture that has taken root in the "Ultra-Orthodox Branch" of Bezalel's undergraduate Architecture program through an intense meeting of diametrically opposed worlds. The program is a laboratory for a dialogue that almost never occurs in Israeli society. Through in-depth interviews with students and faculty, this research examines the role of design education as an agent of change in this unique setting of religious women within a traditional community that is currently undergoing social and economic transformation. It also considers the bridging potential of design to advance broader cultural understanding, as well as the limitations of design discourse to cross cultural divides.

KEYWORDS | DESIGN EDUCATION, BEZALEL, HAREDI, ULTRA-ORTHODOX, GENDER

1. Introduction

Three undergraduate degree programs—in Art, Architecture and Visual Communications—were recently established as satellite programs of the Bezalel Academy of Arts and Design in Jerusalem to serve a single, distinctive community: ultra-Orthodox, or Haredi women. Their curricula almost entirely mirror the main Bezalel curriculum, with minor adjustments to accommodate the community's religious mores; courses are taught by Bezalel faculty members (male and female). The first crop of women architecture students graduated in 2019 with a 5-year B. Arch degree.

This paper examines the unique design culture that has taken root in the "Haredi Branch" of Bezalel's undergraduate Architecture program through an intense meeting of diametrically opposed worlds. The program is a laboratory for a dialogue that rarely occurs in Israeli society. It is one of the numerous experiments in creating new educational opportunities for ultra-Orthodox women, yet, unlike other new programs, for example, in computer science (Genut & Kolikant, 2019) or social work (Baum, et al., 2014) the study of art and design in this community has received no scholarly attention. This research examines the role of design education as an agent of change in this unique setting of religious women and focuses on design education as an agent of change within a traditional community that is currently undergoing a social and economic transformation. It also considers the bridging potential of design to advance broader cultural understanding and the limitations of design discourse to cross cultural divides.

2. The Ultra-Orthodox Community in Israel

The ultra-Orthodox, or Haredi Jews, are fundamentalist Jews that live by a strict interpretation of Jewish religious law that governs all areas of life, from study, prayer, ritual observances, and diet, to family relationships (Baum, et al., 2014). The Haredi community is an enclave community that defines itself as a "counter-culture" that rejects Israel's dominant secular culture (Davidovitch, 2014) and live in segregated neighborhoods with their own religious, cultural, and educational institutions. The Haredi educational system is gender-separated, and the Haredi lifestyle is characterized by increasing gender separation (Indursky, 2020), rigid codes of modesty for women, and strict rules governing the encounters between men and women.

In 2018, the ultra-Orthodox population in Israel reached one million, or just over 11% of the total population (Malach & Cahaner, 2018). The Haredi lifestyle emerged during the eighteenth century to safeguard traditional Jewish religious practice in the face of rising modernization and secularization. Today, this traditional society has developed a unique social structure. Because of the high value placed on the study of the Jewish religious texts, ultra-Orthodox men typically devote themselves to a life of study and do not participate in the labor force. Women support their families, and they are also expected to marry young

and have many children—today, the average Haredi family includes 7.1 children (Malach & Cahaner, 2018). In 2017, the employment rate was slightly over 50% among ultra-Orthodox men and 73% among ultra-Orthodox women (Malach & Cahaner, 2018).

This reversal of traditional gender roles is reflected in and supported by the distinct educational systems for women and men. Boys learn general studies until the age of 12 and then move on to full-time Jewish study. On the other hand, girls receive a more well-rounded education that includes the core general studies curriculum. Women marry between the ages of 18 to 21 in arranged marriages. Their employment opportunities are often limited by a lack of training and childcare. Ultra-Orthodox women's average wage is only 70% of the Israeli average (Raz & Tzruya, 2017). Traditionally, their employment has been in the fields of education, childcare, and services in their communities. This pattern has begun to shift dramatically in the two decades, as ultra-Orthodox women have become increasingly integrated into the general labor market. Several factors have accounted for this shift. The main factor has been the growing economic pressure caused by the growth of the Haredi population alongside the reduction of government support. Data from 2007 indicated that most families in the Haredi sector in Israel lived under the poverty line (Ouziely & Ifrach, 2007). More recent data shows that poverty levels are dropping from 58% of the Haredi population in 2005 down to 45% in 2017—compared to 11% in the general population (Malach & Cahaner, 2018). The academization of the labor market has also made higher education a basic requirement for employment, leading to “some acceptance, albeit grudging, among the rabbis that women have to receive higher education that will better enable them to support their families” (Baum, et al., 2014, p. 165). And finally, the teaching market, long considered the traditional occupation of Haredi women, became saturated, so that new career options began to be considered acceptable for the first time, such as computer programming, social work, paramedical fields, and others.

Several government initiatives emerged in the late 1990s in response to these issues to encourage the Haredim to enter the workforce. To this end, Israel’s Council for Higher Education set out to establish academic frameworks that would meet the Haredi community's unique needs (Baum, et al., 2014; Malach, 2014). This led to the establishment of a number of colleges for Haredi women with a focus on practical occupations that could provide gainful employment while avoid challenging the values of the Haredi community (Baum, et al., 2014). Special features of these colleges included an in-house rabbi who was employed to vet the study materials and advise the students and daycare facilities for students who were already young mothers. In the colleges that also admitted male students, strict gender separation was maintained—in classes, in the library, and even in the routes walked through the campus (Baum, et al., 2014).

In 2012, a new model of higher education programs was developed by the Israeli Council of Higher Education (CHE) in which parallel satellite programs adapted to the needs of the Haredi community would be set up as branches of recognized academic institutions. The goal was to provide a broader range of disciplines, greater geographic diversity, and offer a

model in which the Haredi branch campus and its parent institution could share resources. The curricula would be identical to the parent institution from which the academic degrees were awarded, yet social and cultural modifications could be made on the branch campus appropriate to the Haredi needs. (Malach, et al., 2016). Fourteen of these programs were established between 2012 and 2015.

This trend must be looked at within a wider narrative of the "Israelization" of the Haredi community in Israel, whereby some have argued that "recent socioeconomic changes have forced that Haredi community to accommodate itself to Israeli reality and culture" (Finkelman, 2014, p. 286). Various scholars, often referring to the educated "New Haredim," have maintained that "models of isolationist fundamentalism no longer apply to more Israelized and acculturated Haredim" (ibid.). Yet paradoxically, while certain practices, such as internet use, academic study and participation in the workforce indicate growing liberalization, other realms of Haredi life attest to an opposite trend of increasing extremism (Finkelman, 2014). This is especially true of gender separation. As the activist Esty Rider Indursky writes, "It's hard to remember exactly when it happened, but suddenly partitions (between men and women) are everywhere" (Indursky, 2020), referring to the growing separation between men and women in the public realm and its effect on erasing and silencing women.

3. The Haredi Branch

As a child, Rivka Vardi dreamed of becoming an artist, but there were no art schools for young Haredi girls like herself. She was lucky to receive private art lessons, and she began her career as a young art teacher at the Haredi school, Oman, which was established in 1992 by the Municipality of Jerusalem. When the director of the school suddenly died two years later, Vardi succeeded her as the school's director at the age of 21. She developed a rich certificate program to train Haredi women art teachers and extensive community classes and workshops, including mobile art programs that served Haredi children city-wide. The Council of Higher Education's new policy for new Haredi academic satellite programs led the City of Jerusalem to put out a Request for Proposals in 2012. As Rivka Vardi, the founder and current director of the Bezalel Haredi Branch, tells the story, the call struck a deep chord. For years, she had a vision of creating a Haredi Bezalel, referring to Israel's prestigious and historic art school, founded in 1906. Vardi worked with Bezalel to submit a joint proposal and did extensive outreach in the Haredi community to prepare the ground and gain support for the programs. In 2014, the Bezalel Haredi Branch opened two undergraduate programs: in Fine Art and Architecture. Today there is a third program in Visual Communications.

Currently, there are approximately 125 students in the three programs. A considerable number of these students did not grow up in the local Haredi community but emigrated to Israel from the United States, France, and elsewhere. Describing the student body, a former

student explained that these women are not “mainstream” but rather “on the edge”; they have all made a path-breaking decision to study architecture, art, or design, a pursuit that is still not fully accepted in their communities. The women typically begin their studies as single women, at age 18 or 19, then get married and have children in the course of their studies. It is very common to see babies in the classrooms. A nursing room has been set up in the school. The other necessary accommodation is the inclusion of a rabbi on the staff whose role is to oversee the curriculum and advise on the myriad conflicts that arise throughout the course of study. Vardi has noted that the rabbi plays a crucial role in community relations and provides the necessary religious stamp of approval for the program.

While the program's concept is to mirror the parent institution's curriculum directly, there are some notable adaptations. Students study art history without looking at nudes: library books are bowdlerized. They study architectural history without entering a church or a mosque. As Vardi has said, "Every day and every minute we are questioning where the boundaries are, and who sets them. We are constantly falling down and getting back up” (Riba, 2018). The faculty is drawn from the standing Bezalel faculty, though not all faculty members are willing to teach in this setting. Interestingly, the faculty is composed of both women and men, a mix that is not acceptable in many other Haredi programs. And the peculiar intimacy and informality of design education—the one-on-one critiques, the intense discussions that arise within the studio setting's group dynamics—occur here too, sometimes triggering unanticipated conflicts. A student described a range of dynamics between the secular faculty and the Haredi students. Many instructors, she claimed, reveal surprising ignorance about the Haredi community. The discourse is filled with stereotypes that do not reflect the complex realities and heterogeneity of these communities, which are often defined more sharply by their differences than their commonalities. But, as she noted, the most vociferous debates occur in the classes where the instructor is open and able to listen. When the instructor does not listen, the discussion simply shuts down. Another student noted that an important advantage of the program’s small size is the access students have to their instructors. The intimate and informal atmosphere of the relatively small classes, she claimed, provided a setting for remarkably open class discussions.

The meeting of the secular and religious worlds can be productive and eye-opening—for both. One student described her sense of colliding worlds through a poignant image that left a strong impression on her: a traditionally-garbed Hasidic man engaged in a heated discussion with a heavily tattooed instructor in the art department. However, in some cases, the division of values between faculty and students has been problematic. Friction of this kind has surfaced, for example, in the students' choices of topics for their final thesis project. In one case, according to an alumna of the program, a student identified a problem related to a highly specific social pattern in the community, and her choice of topic was rejected by her thesis advisor. She claimed that the advisor simply wasn’t familiar enough with the Haredi community to understood the relevance and significance of the topic.

There is a certain ambivalence among the students regarding their professional roles towards the Haredi society. On the one hand, they have an in-depth knowledge of their communities and a deep moral engagement with them. Their studio projects and their chosen thesis topics tend to reflect a heightened sensitivity to their social environment. Many thesis projects, for example, shed light on issues on social patterns and spatial cultures that are unique to the ultra-orthodox community. On the other hand, some students don't want to "lean into their identities", as one student put it. Many don't want to be pigeon-holed into designing only for the Haredi community. This problem became evident in a discussion I held with another student regarding a potential thesis topic, in which she expressed her interest in the problems of high-rise living. I advised her to use her unique knowledge to explore the issues that are highly specific to her community, noting how little research exists on this topic. However, she felt that I was clipping her wings and replied, "but that's why I am here! To learn about the world". This tension characterizes the learning process as a whole. As Rivka Vardi notes, "some of the students are looking to open up to new worlds in the course of their studies, while others prefer to maintain their clearly formed identities throughout" (Riba, 2018).

According to one studio instructor I interviewed, the students bring greater emotional depth and complexity to their work than their secular counterparts at Bezalel. Many thesis projects are characterized by their focus on social or community-oriented issues. Several projects addressed the extremely crowded conditions in the Haredi neighborhoods of Jerusalem. Miriam Tznoiret proposed a new elevated circulation system in her Jerusalem neighborhood of Beit Israel, along with the conversion of ground-floor commercial space into public community space when it is closed on the Sabbath. Another student, Malki Kessler Ben-Ze'ev, proposed a light-filled underground system of living spaces in the neighborhood of Romema, based on the existing conversion of many underground parking lots to illegal apartments. A speculative project by Liron Aharonson imagined a new temporary city that could arise around Jerusalem, based on a scenario of mass pilgrimage to Jerusalem during the traditional pilgrimage holidays (Riba, 2018). A project by Rivka Porush addressed the political situation by proposing a series of connections linking neighboring Arab-Jewish villages that have been disconnected by the Green Line (Figures 1 and 2), taking a political position that is hardly mainstream.



Figure 1. Rivka Porush, Connecting Tzur Hadassa and Rosh Tzurim - a project that links Jewish and Palestinian villages across the Green Line.



Figure 2. Rivka Porush, Connecting Tzur Hadassa and Rosh Tzurim- section through Beitar Ilit (an ultra-Orthodox settlement) and Nahalin (a Palestinian village).

A second theme evident in the students' work is the difficult relationship between spirituality and materiality. This tension—which is perhaps central to architecture as a discipline— has particular resonance here. For example, several projects attempted to grapple with the dissonance between the two aspects of Jerusalem's dual identity as both a celestial and an earthly city. Yaella Silverman's project "A Path to Jaffa Gate" creates a connective, liminal space between the city's commercial space and its holy sites by celebrating its materiality (Figures 3 and 4). The space is excavated to expose its bedrock's earthly reality, associated with quarries and cisterns, rather than the symbolic meaning of Jerusalem stone. Yael Feldinger-Kalir's project for a train station that connects Tel Aviv with the ultra-orthodox city of Bnei Brak also addresses the need to bridge these worlds (Figures 5 and 6). Her project introduces diverse programs into the seemingly quotidian space of a commuter train station to speculate on the possibility of overlapping ritual and functional spaces in the city. She develops the themes of the duration of time, its sequences, and the sanctity of the everyday.

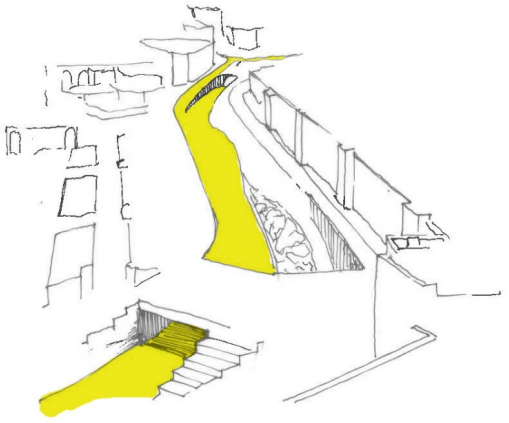

Figure 3. Yaella Silverman, A Path to Jaffa Gate, showing the descent to an excavated path along the walls of Jerusalem's old city where the exposed bedrock can be experienced.



Figure 4. Yaella Silverman, A Path to Jaffa Gate. Stones are reused from a demolished hotel to form a flowing paving pattern.

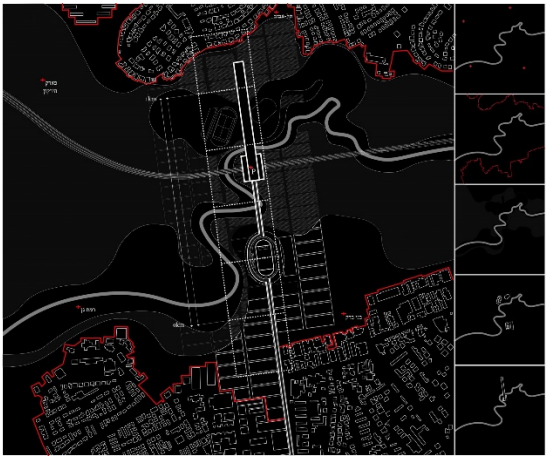

Figure 5. Yael Feldinger-Kalir, Train Station: Tel Aviv-Bnai Brak—bridging two worlds.

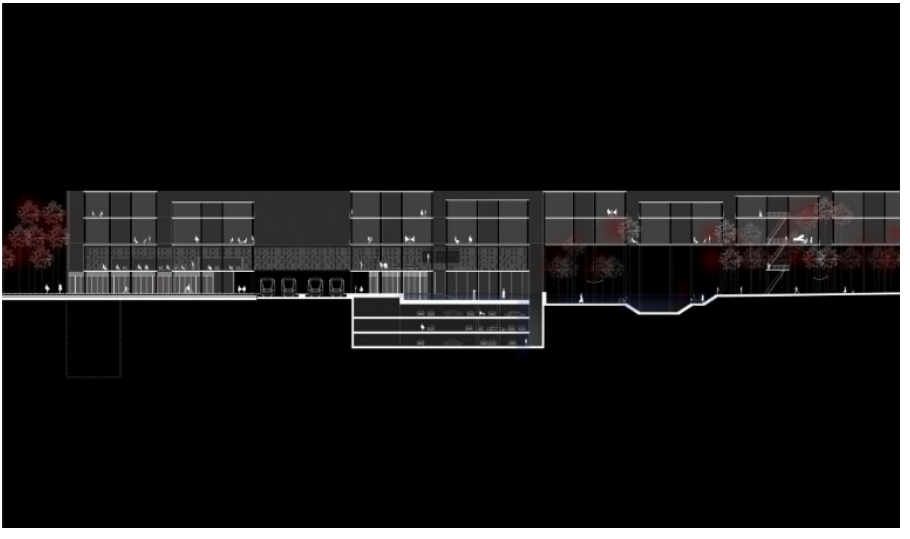

Figure 6. Yael Feldinger-Kalir, Train Station: Tel Aviv-Bnai Brak – section showing diverse programs that occur at different times of the day, including study and prayer

4. Discussion

To date, only three cohorts have graduated from the Architecture program at the Bezalel Haredi Branch. Almost 100% of the graduates are working today in the profession. Although the program is growing quickly, with increasing enrolments every year, it is difficult to predict the long-term impact of the program on the architecture profession or the Haredi community. The broader picture of Haredi integration in the workforce is less encouraging. In 2018, "The Statistical Report on Ultra-Orthodox Society in Israel" stated that "the findings show that the trend towards the rise in the rate of employment and academic studies has come to a standstill" (Malach & Cahaner, 2018).

The problematic relationship between religious and secular cultures is one of the key issues in Israeli society. This program may ultimately have an impact on the Israeli built environment by laying the groundwork for more innovative and subtle solutions to the pressing problems of ultra-orthodox housing and urban form. The Bezalel Haredi Branch is but an intriguing experiment of cultural change that is empowering Haredi women through the study of architecture. Perhaps, in the words of Director Rivka Vardi: "[…] art can be a catalyst for change. Maybe a kind of change that nothing else can bring about".

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

"But I'm a lecturer not a therapist": Educational Coaching – a proposed alternative approach to supporting students through their creative education

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Abstract | This paper argues for the potential of coaching as one element of transforming how we support students. Although limited in scope, there is enough evidence in the literature to suggest that coaching can supplement many of the historic and noble ambitions of creative educational institutions. More research is required to explore the most impactful models of coaching support and how it becomes embedded into the fabric of creative education. Coaching could sit alongside existing teaching models as an ancillary support system (Peng and Wang, 2019). Or it could be offered as training to academic faculty as another instrument from the teaching toolbox. It could also be used to train students as peer-coaches – that in turn could prove to be another powerful competency in their employability portfolio. Whatever models we employ, we should be brave, disruptive and radical in our attempts to address the challenges we face.

KEYWORDS | COACHING, CREATIVE, HIGHER -EDUCATION, STUDENT-SUPPORT, SKILLS

Introduction

We have arrived at a moment where the business world is incorporating the language and utility of creativity and creative education. As Ladkin and Taylor (2010) suggest: "… we live in a complex world, which cannot be fully understood solely by reference to scientific forms of logic and sense-making. The arts, and arts-based practices, provide different ways of both describing and relating to that complexity, thereby offering novel ways of responding to it" (p.235). Conversely, the university sector, especially creative education, is often criticised by both politicians and the corporate world for failing to adequately prepare graduates for the world of work. A 2013 study by the Association of American Colleges and

Universities highlighted employer priorities when it stated that a capacity to employ critical thinking, clear communication and problem-solving prowess was more important than a job candidate's degree subject or classification (Association of American Colleges and Universities, 2013). Alongside this, new thinking on curriculum development and delivery is required to address the rapid transformation of the workplace via the Fourth Industrial Revolution (Schwab, 2017). In 2018 the World Economic Forum published the 'Future of Jobs Review' (Bhatti, 2018), which identifies what they consider to be the '10 Skills You Need for the Future of Work'. The report predicts that in five years, one third of the skills we currently state as essential for today's workforce will have changed. The 10 new skills required were reported as: Creativity, Emotional intelligence (EQ), Analytical (critical) thinking, Active learning with a growth mindset, Judgment and decision making, Interpersonal communication skills, Leadership skills, Diversity and cultural intelligence, Technology skills, and Embracing change (Bhatti, 2018). This highlights the challenge universities face in preparing graduates for a future workplace with many unknowns attached to it – including student attributes that are interdisciplinary in nature. As a result, while many higher education institutions may choose to double-down on the 'proven' historic classic academic framework of subject-specific: lecture, seminar, and tutorial, others are questioning the ongoing relevance of such pedagogy. As Kosslyn and Nelson 2018 comment on the USA context, "… higher education is facing four overarching problems… students are leaving college woefully unprepared for life after graduation… college is too expensive… more than half of students don't graduate. And even when they do, they have often been intellectually absent during much of their time in college" (p. 6). It is perhaps ironic then, that this paper proposes the appropriation of coaching methodologies originating from the sports sector, which has in recent times been fully embraced by business, as a solution to some of the challenges that higher education faces. This paper proposes coaching as a means to assist students through their academic journey, impacting positively on their graduate exit velocity and their wellbeing.

1. Historic context

The original meaning of the term 'coach' is a conduit that carries someone from one point to another (Evered and Selman (2001). It evolved as a term for 'instructor' or 'trainer' from a 19th Century Oxford University colloquialism meaning a private tutor who 'carries' a student through an exam (Online Etymology Dictionary, 2019). The term 'coaching' however, took on its contemporary meaning at the end of the 20th century. The book The Inner Game of Tennis (1974) by Timothy Gallwey is credited with launching the sporting origins, while John Whitmore's Coaching for Performance (1988) built upon the growing appetite for increased elite sports development. Whitmore introduced the GROW model that is still used in many coaching models today. GROW in an acronym that utilises: 'G' as goals and aspirations; 'R' as reality or current situation, internal and external obstacles; 'O; as opportunities, possibilities, strengths and resources; and 'W' as will or actions and accountability (Whitmore, 1988). This legacy has evolved into performance psychology and coaching that dominates contemporary professional and wider sports environments (Mageau, G. & Vallerand, R. 2003).

The corporate world's adoption of coaching as a management and executive development framework is credited to financial advisor Thomas Leonard in the 1980s (Brock 2014, Grant and Stober, 2006). It is suggested that this came in response to outmoded top-down corporate management models that had constrained rather than supported leadership training (Evered & Selman, 2001). Since then, professional coaching has evolved into a billion-dollar industry in the USA alone (Sherman & Freas, 2004). Contemporary definitions of the term coaching are diverse. Evered & Selman (2001) suggest that coaching is defined by its genuine attempt to develop leadership interventions as 'trusted partnerships' as opposed to controlling performance management. Moen and Skaalvik (2009) define it as, "… a method which aims to achieve self-actualization by facilitating learning and developmental processes to promote the resource base of another person. The method is characterized by its active involvement of the coachee through powerful questioning and active listening" (p.31). Most definitions include as their essence, the role of the coach in supporting the coachee to develop to their maximum potential (Brock, 2014).

2. Coaching and education

From this definition of developing human potential, it is not difficult to imagine how such a motivation could be translated into the educational context. However, research into the use of coaching within education is relatively scarce – and even more so within creative higher education. The majority of studies refer to using coaching CPD methodologies to train and support teachers within the school-level contexts (Anderson and Gristy, 2013, Casanova, M. P., et al. 2014, van Nieuwerburgh and Barr, 2019, and Tschannen-Moran & Tschannen-Moran (2011) 2011). In the American context the culture of school-level K-12 coaching has been promoted via national and state-level policy pressures to improve teacher training support (Tschannen-Moran, and Tschannen-Moran, 2011). Again, in the USA the driver that

has promoted coaching modes in the higher education sector has been via attempts to improve student attrition rates degree attainment figures (Webberman, 2011). Webberman takes care to identify coaching as different from historic 'academic advising' which has long been the staple in US higher education student academic support.

Other studies include Australian research that explored coaching to support engineering undergraduates (Puji & Prasad 2013), and coaching in nursing education (Hayes & Kalmakis 2007). In the UK Moore, Westwater-Wood, and Kerr's, (2016) published an analysis of a successful peer-coaching intervention with undergraduate physiotherapy students. Coaching has increasingly grafted itself into the CPD culture of many universities, raising the question as to why it is not utilised more widely. As Lordanou, Lech, and Barnes (2015) suggest, "Taking into account that coaching is increasingly seen favourably as a developmental tool for university staff of all levels, one might be inclined to consider its usefulness for students" (p.4). Anecdotally, there does seem to be resistance from some academic faculty when the subject of coaching is raised. This could stem from the fact that the root origins sit outside of the academy, or possibly from some of the 'fist-pumping' stereotypes of coaching projected via popular culture media. Geber, 2010 points to such scepticism when she states, "… surely well-qualified intellectuals do not need 'touch-feely' life coaching…" (p. 64). Arguably there is however, an evolving notion of the teacher role in educational settings away from 'sage on stage' to more of a constructivist facilitator role (Griffiths, 2005).

"Mentoring" as a term for an academic support mechanism seems to be a more acceptable label within higher education. However, Showunmi (2014) suggests mentoring is 'person development centred' while coaching leans towards a more performance-oriented motivation with students. However, this is not an agreed position. Ramos-Voltz (2018) describes a complex process that students traverse via coaching including self-reflexive motivations as well as deep learning.

She states: Reflecting on one's own experiences is a powerful method for learning and allows the learner to leverage personal strengths and address critical development needs. The key element of (promoting sustainable learning from experience) is helping the coachee move from awareness to action in order to sustain learning. The process of reflection creates a developmental feedback loop to continually fuel a learning cycle. (p. 143)

In a study of a coaching intervention at the University of Salzburg, Losch et. al (2016) assigned students into four categories: a self-coaching group, individual one-to-one coaching, group training, and a control group. Results showed that group training and individual coaching and were effective in facilitating goal attainment and reducing procrastination in students.

They state: Individual coaching created a high degree of satisfaction and was superior in helping participants attaining their goals, … Moreover, mediation analysis show that a coach's transformational and transactional leadership behavior influenced participants'

perceived autonomy support and intrinsic motivation, resulting in beneficial coaching outcomes." (p.1)

A study by Orr and Sonnadara (2019) on a coaching intervention with medical students (that included faculty training in coaching techniques) concluded that there is evidence of the positive impact on students' well-being, self-regulation, resilience, self-efficacy and goal attainment. Bettinger and Baker (2014) tracked the performance of 13,555 students, in eight different higher education institutions (HEIs) in the USA, who had been exposed to coaching interventions over two academic years. These students had been enrolled as part of a programme where each of the HEIs had employed the services of an external coaching agency to deliver the training. The coaches communicated with the students via phone and text messages. The project resulted in a 15% improvement of the coached students in their ongoing enrolment over the control group, which led to stronger degree completion. The study also reported a 9 % improvement in student retention, and the overall positive impact persisted even after students no longer received communication from their coaches. In another US study using a coaching intervention to teach biology undergraduates creative thinking, the project group demonstrated increased exam scores (particularly with lower achieving students), increased self-confidence and an improved ability to 'do' science." (p.6) (Chaplin, 2007). Another US-based university undergraduate mixed-methods coaching study had a broader approach that set out to positively impact 'professional and personal thriving'. The results reported an increased awareness of individual values and strengths, but the largest positive effect was upon student selfconfidence (Lefdahl-Davis, et al.2018).

Peng and Wang (2019) designed an undergraduate intervention to develop what they referred to as students' 'positive learning dispositions'. A key element of this study was in using mindfulness training as the intervention lever. The study concluded that 'mindful agency coaching' and 'motivational interviewing' were potent strategies in supporting students to become resilient, mindful, and self-determined learners. Bettinger and Baker (2014) state in their study that, "The coach contacted students regularly to develop a clear vision of their goals, to guide them in connecting their daily activities to their long-term goals, and to support them in building skills, including time management, self-advocacy, and study skills" (p.2).

A study, using PhD students at a London university as its sample group, exposed them to a coaching programme to supplement their research obligations (Lane and De Wilde, 2018). The results concluded that students reported a positive impact as result of the programme, including enhanced self-awareness, confidence and assertiveness. A practical benefit to the ongoing development of the students was also suggested; "Improvements in self-awareness enabled participants to adjust their approach when communicating and working with their supervisor." (p.63) Other interventions have also focused more specifically on what traditionally might be referred to as study skills. For example, Zeidenberg, Jenkins and Calcagno (2007) noted that coaching support around note taking, time management, and long-term planning, resulted in an 8% improvement in persistence rates. Thaler and Sunstein

(2008) suggest that coaching in a higher education context does not necessarily need to be delivered as a large-scale intervention. They argue that simple coaching 'nudge' techniques, where subtle but directional hints are employed, can make the difference between students becoming motivated to complete academic tasks or not.

3. Creativity, coaching and 'quality of mind'

As stated above, there is little if any specific published research of coaching within creative education. This may be related to the contested question of whether creativity itself can be taught. In a study of its UK National Teaching Fellows, the

Higher Education Academy (HEA) 92% agreed or strongly agreed that developing creativity is possible (Wyse and Ferrari, 2014). In defining the term "creativity", the group suggested the following categories as useful: 'thinking' (solving illstructured problems in ways which show initiative); 'doing' (developing, implementing and leading new things); 'thinking and doing' (the cerebral and the practical); 'the arts' (artistic version of innovative); 'self-expression' (ability to express an innate aspect of your psyche); 'creativity as a continuum' (acknowledged artists and scientists through to ordinary people); and 'context' (contextually-based innovation inspired by responding to specific and challenging problems). Runco and Jaeger (2012) suggest that creativity is 'an everyday human activity' that is both proactive and reactive. From such pragmatic definitions of the creative process, it is arguably possible to see how coaching could support some if not all of these processes. Mezirow's (1998) Theory of Transformative Learning emphasises the importance of another cornerstone of the creative process - critical reflection. Here the coachee reflects on an experience or behaviour, examining carefully what they would like to change in order to transform a situation in a more positive way. Transformation or change involves a process of exploring the old and looking towards the new (Scott, 1997). Mezirow argues that learning to think for oneself involves such critical reflection. From a coaching perspective, thinking for oneself is empowering and this is highly valued in the coaching process.

In sports coaching, one aspect that could be transferable into creative education is problem-solving motivation (Potrac et al., 2000, Jones (2000), suggests in the text 'Toward a sociology of coaching', the aim of coach education should be the nurturing in practitioners of "a 'quality of mind', so that they are equipped to dynamically engage the problem-solving and dynamic nature of their work" (p.183).

4. Peer coaching

Hooker's (2011) study of student-to-student academic support suggests that coaching with one's peers removes the stigma of asking 'silly questions' which students sometimes feel when engaging academic faculty. Such coaching also nurtures trusting relationships which

are recognised as foundational in providing the conditions that allow peer coaching to flourish, and includes non-judgemental and unthreatening listening. Anderson, et al.'s (2005) study of peer coaching amongst student teachers helped them "… develop mutually supportive bonds as the peers progress in their development" (p.98). Britton and Anderson (2010) used an online platform to facilitate peer coaching amongst student teachers and created four supportive contexts for the intervention: academic support, technical support, emotional support, and reflective support. This resulted in improved problem-solving and working strategies amongst its cohort.

4.1 Mental health and peer coaching

With universities and government bodies reporting huge challenges around student well-being and mental health (Office for Students, 2019), new strategies for meeting these concerns seem urgent. A Unite survey (2016) found that among students who had strongly considered dropping out of higher education, 76 per cent reported feeling stressed or worried, while 46 per cent reported feeling down or depressed. Apart from the obvious humanitarian crisis that this indicates, it also has an economic effect with student retention impacting university economic securities. In terms of wellbeing, RamosVolz, (2018) suggests that via a coaching paradigm, "Individuals create a personalised map to manage the effects of change and the accompanying emotions as well as to support new ways of looking at challenging situations" (p.143). This is not an expectation that such an approach will lead to a total resolution of student well-being and employability challenges, but that it could offer a methodology that could support and compliment the best historic models of creative education pedagogy.

In a study of psychology students by Short, Kinman, and Baker (2010), a peer coaching intervention was designed to test the impact on levels of psychological distress in the lead up to exams. A control group was also tested and the results revealed that stress levels were significantly lower in the students who had experienced the intervention. The study concluded that the programme had value in supporting students particularly during a stressful period of their studies. A recent wide-ranging literature review of coaching efficacy for medical students, exploring 21 studies, concluded positive outcomes in terms of the impact of coaching on well-being. The review also reported improved resilience, technical skill acquisition, reflective practice decision-making and teamwork. (Orr and Sonnadara, 2019). A mixed methods study at Western University in the USA, targeted postgraduate students over an eighth month period with peer-led coaching.

Participants reported a positive impact on their ability to cope with anxiety and stress levels and an increased sense of resilience (Fried et al., 2019).

5. Neurodiversity and Well-being

Evidence demonstrating the relationship between well-being issues and students described as 'neurodiverse' is increasingly compelling. While there is a contested range of definitions that cover this collective nomenclature, there are agreed categories within the more defined 'Specific Learning Difficulties' (SpLD) category. SpLD is the umbrella term for a number of conditions, including: Attention Deficit Hyperactivity Disorder (ADHD); Autism Spectrum Disorders (ASD); Asperger's Syndrome; Dyscalculia; Dyslexia and Dyspraxia. (Kirby, 2013). An example of how one condition can impact a student's educational experience (in reality it is usually a range of overlapping conditions), with ADHD, the executive functioning (EF) attributes of the individual are often impaired. EF can be defined as the range of skills related to attentionregulation necessary when requiring goal-related problem solving. As Zelazo et al. (2016) state, "This goal-directed control in turn is needed for various kinds of behaviour, including persistence, being able to focus on several things at once, shifting easily between tasks, and reflective learning" (p.3). Clearly this would impact with almost any educational endeavour, but more in creative education where there are often students with specific learning difficulties. A small study in a US university used coaches with specialist training in ADHD to support students in this category. Researchers described three themes to emerge from the study: students reported improved goal attainment skills, enjoyment in working with the coaches, and also a greater sense of self-regulation and well-being. They concluded, "It appears that coaching holds promise as an emerging type of academic support for college students with ADHD to promote improved executive functioning" (Parker, et al. 2011, p.115). A larger study of 148 college students over a 5-year period using ADHD coaching was conducted using novice coaches. The interventions consisted of an eight-week coaching course that combined cognitive-behavioural therapy (CBT) and educational support. Executive functioning was the primary focus of the assistance and resulted in improved self-esteem, reduced symptom distress and on overall student satisfaction (Prevatt and Yelland, 2015).

6. Coaching and its potential to increase academic self-efficacy

In an all-female university in Pennsylvania USA, a programme was designed to support students diagnosed as having SpLD and/or ADHD (Singley, 2017). Its focus was to test for increased academic self-efficacy as a result of the intervention, which the literature has confirmed is associated with academic success and increased attainment (Bandura, 1997, Zajacova, Lynch, & Espenshade, 2005; Khan, 2013). Students in the coaching group reported stronger self-efficacy than students in the control group. As Singley states, "… results show that Academic Coaching could be an effective intervention to increase the use and knowledge of learning strategies for students with LD or ADHD, specifically addressing the challenges in executive functioning skills often faced by students with LD and/or ADHD" (p.72). Nurturing academic self-efficacy in students then, seems to a key attribute in

supporting students to thrive. Bandura (1997) defines self-efficacy as "people's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 2). This judgment has a future-oriented motivation which is distinct from confidence with its primary focus on domain-specific historic success as its motivational resource. Confidence is derived from drawing upon successful experiences of past activities, where the ability to execute courses of action supported the attainment of specific goals.

Research has shown that self-efficacy has a positive impact on academic motivation, learning, and achievement (Pajares, 1996a). Although Pajares (1996a) questions some of Bandura's claims (highlighting, for example, the necessary qualification of other factors in educational success such as effective teachers and resources), he supports the general notion of self-efficacy as a positive indicator of an individual's potential to succeed in academics. Bean and Eaton (2000) suggest that success in one area can become habitual and promote attitudes that eventually translate into behaviour. As such, students who experience academic success in one area may be more likely to persist with a different task or subject area. This accumulative potential for the development of self-efficacy is particularly pertinent in considering support for students entering university for the first time.

Gore, Leuwerke, and Ladwig (2006) argue that one of the reasons that first year students are vulnerable to attrition is that they tend to overestimate their own abilities and underestimate the requirement for effort and persistence. While evidence suggests that this misperception generally corrects once they progress from this formative experience, the critical context of the first-year college experience remains of crucial importance. As such, using the first-year context may prove to be one possible consideration for any proposed coaching intervention in higher education. Bong and Skaalvik (2003) suggest that individuals who possess strong academic self-efficacy are also more likely to a) set higher attainable academic goals, b) persist longer on challenging tasks, and c) enjoy academic work more than peers who possess a negative selfconcept and weak academic self-efficacy.

Summary

The combination of factors forcing creative educators to re-examine how they deliver a strong student experience are considerable: the marketisation of higher education, the breakneck evolution of the Fourth Industrial Revolution, outmoded curricula and student mental health and well-being. We cannot expect academic faculty to become renaissance superhumans, delivering edge-of-the-seat teaching and up-to-the-minute pedagogy on technologically future-proofed courses while offering well-being support to frazzled socially mediated undergraduates. Having said that, the era of the academic whose simple trajectory is to deliver windows of robust research-informed teaching while returning research outputs to the Research Excellence Framework is over – at least in the majority of the new

universities. The time feels right for a radical review of how we deliver creative education, but in order to achieve this, old paradigms will need to be challenged. As McWilliam, E., Dawson (2008) argues, “The resilience of the ‘lecture’, the ubiquitous culture of ‘transmission’, the credentialing process, the hard-wiring of disciplinary boundaries, and so on. It is unlikely that these elements of ‘command and control’ pedagogy will be easily relinquished by those who have been rewarded for decades for what they know and their capacity to instruct as a ‘lecturer’. (p. 641)

This paper argues for the potential of coaching as one element of this essential conversation. Although limited and fragmented, there is enough evidence in the literature to suggest that coaching can support many of the historic and noble ambitions of creative educational institutions. What is required now is more research to explore the most impactful models of coaching support and how it becomes embedded into the fabric of creative education. Coaching seems to be a legitimate and exciting response to some of the challenges highlighted here. Coaching could sit alongside existing teaching models as a supplementary support system (Peng and Wang, 2019). Or it could be offered as training to academic faculty as another instrument from the teaching toolbox. It could also be used to train students as peer-coaches – that in turn could prove to be another powerful competency in their employability portfolio. Whatever models we employ, we should be brave, disruptive and radical in our attempts to address the challenges we face. As Jeroen Chabot, Dean of Willem De Kooning Academy Rotterdam states, “The art school … needs to rise to meet these new challenges, accepting and embracing the fact that knowledge is no longer the property of academies, universities, professors or tutors; nowadays, know-how and skills are increasingly distributed, networked and shared on a grand scale. Today’s art school should serve as a nucleus for these activities, yet it often fails to fulfil this role. Now more than ever, education requires forms of pedagogy and organisational structures that reflect these dynamics.” (Chabot 2019)

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Decoding the birth of transcultural fashion

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Abstract | We have numerous types of attires, or parts thereof that have crossed cultures and boundaries because of immigration and geographical transitions such as the mandarin collar, Nehru jacket or the kimono sleeve amongst others. As designers, the earlier we accept this diversity and pluralism, the sooner we will be able to cater to this new culturally mixed society. Through case studies of the *burkini* and the Asian *Kurta*, this paper talks about non-identification of a garment from its social or political construct and its existing labels to look beyond the original cultural significance that it may have (had). There is a renewed need to re-evaluate the existing notions of pluralism and diversity that are not condoned by popular culture and a need to integrate the local with the global so that clothing can be democratised and be more accepted, accessible and made inclusive to this culturally diverse new society.

KEYWORDS | DEMOCRATIC, INCLUSIVITY, TRANSCULTURAL, MULTIPLICITY, DIVERSITY

1. Introduction

Fashion (and clothing), as we know today, has a lot of meanings and connotations associated with it. Within its varied layers, it has a language and a purpose to serve. Historically, garments and costumes have been solving the needs of mankind, as a covering for the body, as protection from the cold and extremes temperatures while, at times, also addressing modesty concerns. While sometimes dress and clothing divides society by class, race and gender; at others, it blends these boundaries via (world) garments such as denims, overalls, business suits etc. Dress, in the sense of clothing, has also been used for religious and ritual purposes, in different cultural contexts.

Fashion and dress have greater power than one can imagine. How one dresses can directly impact one's chances of getting a job, finding a date, making an impression on an audience and so forth. In the book "Dress & Identity", Roach-Higgins & Eicher (1995) state:

> "Dress helps announce (communicate) identities for persons who are socially situated […] Dress confers identities on individuals as it communicates positions within these structures" (p.13).

It is thus inevitable that a huge section of the population swears by popular brands and labels, and designers drop new styles on the runway twice or even thrice a year. Every season, new styles are churned out by fast-fashion brands and fashion magazines thrive on these representations with their commentaries. Although these magazines have been in existence for a long time, but in today's age, as Moeran (2010) said:

> "fashion magazines are both cultural products and commodities, that circulate in a cultural economy of collective meanings...they provide experiential and behavioural models — particularly in the realm of fashion and beauty — in which the reader's ideal self is reflected" (p.207).

In the present scenario of constant social media engagement, the millennials and GenZ are forming impressions from the campaigns and magazine reviews with every passing day. They discover new fashion terminology from fashion journals and existing literature available on the same. Designers and brands play a huge role in helping form these opinions with the fashion vocabulary they use to communicate.

As has been observed, most fashion is viewed so as to be consumed by western audiences with the majority of fashion and trade shows hosted across Europe and the U.S.A, whereas South East Asia is only a new entrant with the participation of primarily Japan and China in the global scene amongst a few others. "However, viewing fashion or dress (as an identity) through a western perspective only interferes with the ability to perceive fashion in other cultures" (Tortora, 2010, p.169). Tortora thinks that people from the Western countries often view local dress styles as "primitive". With the increasing of global trade, it has become easier for trends and styles to permeate from their local context to a larger global context. She further states that "[...] the fashion industry is constantly looking for inspiration eastwards as well as towards Asia, Africa and lesser explored places. As a result, Western

and non-western fashion designers incorporate elements of the dress of other cultures into the dress that they create/produce. Asian dress has contributed elements such as the standing collar called a "mandarin collar" and the kimono. Designers from India produce Western, ethnic and fusion lines."

If one observes individuals residing in developing countries such as India, Pakistan, Bangladesh etc. closely, they are often seen combining a western silhouette with their traditional attire. A typical example would be pairing a shirt with trousers, with a dupatta or a scarf or stole wrapped around the neck. Individuals have been doing so for years and there are many narratives around how migration has facilitated an intermix of styles, crafts, colours and aesthetics. With global shifts, there have been numerous crossovers such as the sari, the bright Iranian or Turkish scarves that may not necessarily wrap around the head but make a fashion statement when tied fashionably around the neck, bangles, *bindis, henna, tattoos*, etc. There are innumerable cultural clothing, accessories and visual references that have blended into mainstream (western) fashion scene. Although dress and fashion have largely been standardised to fit specific contexts, for example the business suit is more appropriate for corporate workwear while a looser fitted garment is suitable while working from home. Dress and fashion scholar Joanne Eicher echoed this point when she coined the term "world dress" as a commonly worn high volume clothing of both sexes such as jeans, athletic trainers, sandals, baseball caps and t-shirts etc.

Maynard (almost) on the contrary states "Despite this, a picture of global attire must acknowledge the crucial place of differing ethnic and personal preferences, philosophies and religious and moral attitudes" (Maynard, 2010, p.252). There are many more attires that have been exported from India and Southeast Asia such as the Nehru jacket, Indigo dyeing techniques like tie dye and Shibori, the jodhpurs, etc. Each one of these can become a case to state that it is possible to incorporate this fusion and cross-over of dress and identity while acknowledging a global consumer base.

In her book "Design, the key concepts", Catherine McDermott, a well-known writer, curator and professor writes:

> "Cultural diversity in design involves understanding how people live in different cultural and social contexts. This works on two levels: the first to increase the potential market for products and services; and second to help local economies [...] Any contemporary discussion in design creativity in the 21st century has to take on board issues of cultural diversity [...] Cultural diversity reflects a uniquely rich history of multicultural settlement, immigration and movement in the (UK) society, and understanding and expressing this (cultural diversity) is now seen as a key asset for contemporary design […]"(2007, p.63).

She further adds that "Cultural diversity helps identify people's values, aesthetic preferences and lifestyles on a global basis". Understanding cultural diversity can help make design become truly inclusive and transgenerational. Keeping this as the underlying context, the paper puts forward a case for multiplicity of clothing. This is exemplified via two case

studies, of the *burkini* and the *kurta*, by emphasising the fact that designers need to integrate the local with the global in order to cater to this culturally diverse mix of people across the globe.

It is also important to enquire how dress can be termed as democratic, what are the factors that encourage similarity or diversity of dress within nations and across national boundaries, how clothing styles move from one context to the other, how they affect people's perceptions with just the use of a certain terminology to label the garment? Using primary and secondary research tools and interviews and data collection, through online surveys as research methodology tools, the paper lends an enquiry into these important questions.

2. Case Study of the Burkini

2.1 The Burkini as a metaphor of freedom and multiplicity

The burkini or a burqini (*Burqa + bikini*) is a "woman's swimsuit that covers the entire body, leaving only the hands, feet, and face exposed" (Lexico, 2020). Islamic girls have been observed wearing fully covered t-shirts and leggings to the beach long before the burkini was designed. This was seen as a huge gap in the market, which prompted Ahida Zanetti, a Lebanese- Australian designer to create the burkini in the first place.



Figure 1. Women and girls at Patara beach, Turkey. Image source: Huber, G. (2015, September). Patara - Beach, Retrieved from https://global-geography.org/af/Geography/Asia/Turkey/Pictures/Patara/Patara_-_Beach_2

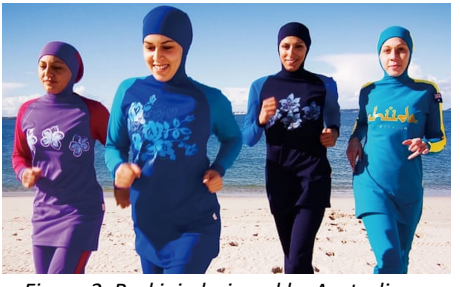


Figure 2. Burkini, designed by Australian designer Ahida Zanetti (2016). Image source: https://www.theguardian.com/commentisfree/2016/aug/24/i-created-the-burkini-to-give-women-freedom-not-to-take-it-away

Following her suit, eminent sportswear brands Speedo and Nike also saw this as a huge business opportunity and launched their modest swimwear targeting this segment, with different names. Speedo launched its “Delight Full Body Suit”, essentially a range of leggings and long rash guards that aren’t as form-fitting as conventional surfer styles. The brand representative stated that “The burkini has even been donned by women who simply seek protection from UV rays or aren’t comfortable putting their bodies on display”. On the other hand, Nike saw this introduction as a more creative pursuit. It’s creative director Martha Moore told the media “We’re excited to inspire more women to see themselves in sport by thinking creatively and designing inclusively.”



Figure 3. Nike’s Victory swim collection came through after their successful collection of sportswear hijabs (Independent, 2019). Image source: https://www.independent.co.uk/life-style/fashion/nike-victory-swim-hijab-collection-online-a9240481.html



Figure 4. Famous hijabi model Halima Aden is the first model to wear a burkini in the Sports Illustrated swimwear section. Image source: https://www.bbc.com/news/48071948

Aheda Zanetti, who designed the first burkini posits:

> “I wanted to do something positive – and anyone can wear this, Christian, Jewish, Hindus. It’s just a garment to suit a modest person, or someone who has skin cancer, or a new mother who doesn’t want to wear a bikini, it’s not symbolising Islam”.

At a global level, the burkini has made it to “The Sports Illustrated” an American magazine, in its annual swimsuit issue (2019), with famous Somali-American supermodel Halima Aden gracing the cover page. This drew positive attention to the campaign as well as severe criticism. While many readers and viewers were thrilled, that inclusivity was finally coming of age, there were an equal number of respondents who felt it defeated the purpose of modesty, by posing in a magazine that has more male readership as known. Halima herself felt this was a huge step in normalising the burkini, as a freedom of choice. Before her quitting the fashion industry quite recently she had told the BBC (2019):

> "Young girls who wear a hijab should have women they look up to in any and every industry […] We are now seeing politicians, business women, television reporters,

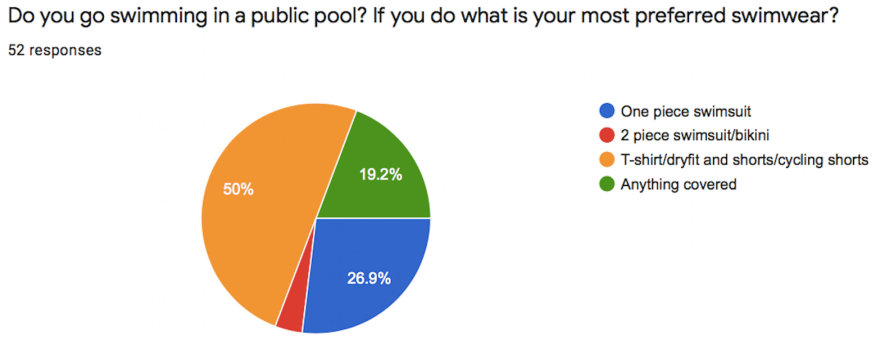
and other successful hijabi women in visible roles and that is the message we need to be sending."

2.1 Modest Swimwear in India and the Burkini

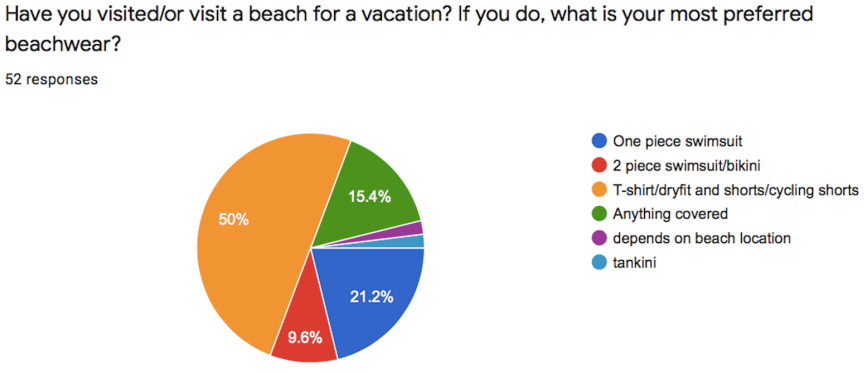
On a typical beach in India, it's possible to find girls and women across different age groups in a certain assortment of swimwear, mainly consisting of t-shirts, shorts, cover ups and very rarely in a quintessential beachwear (the bikini or a swimsuit). They are dressed fully covered, the reasons for this are associated more with culture than religion. If provided with the alternative of a covered swimwear, like burkini, they are likely to sport this modest swimwear that is giving them the ease of a water-resistant fabric and that has less lag in water as compared to being fully clothed. This may be the case in a lot of countries where modesty concerns are still relevant. For the scope of this paper however, the primary base for the survey has been India, which deems itself as a secular country allowing freedom of speech and expression.

A survey was conducted with girls and women, in the age group of 18-30 years, who frequent beaches during vacation or holidays, usually Goa or further south of India. It is important to note that from over 50 people interviewed in Delhi and the nearby regions, most of them fall in the middle economic segment consisting of fashion-conscious individuals, young professionals and students who dress fashionably, spend mindfully and use public transport like rickshaws, buses and metros for daily commute. Most of them live independently, away from their families or with friends in a shared apartment and all respondents belong to either the Hindu or the Christian faith, which is an important factor in this survey to separate religion from functionality and requirements. Two important insights were drawn from the survey, as explained below:

- 50% of the respondents said they would be happy to wear a fully covered or a partly covered swimwear especially in India where modesty concerns are a major deciding factor when a woman dresses up to go to the beach.
- 36% of the respondents either did not know of the burkini or did not want to wear one, despite wanting to be modest, because they associate it with the hijab and burqa.



Appendix 1.



Appendix 2.

Thereby, it is pertinent to note that burkini, as a modest swimwear garment, has a demand but perhaps a little more knowledge about its name would have served a wider consumer segment and could have made this much-required garment more inclusive and transcultural. If perhaps the first garment had not been called burkini, there would have been a better chance of its acceptability in the market at large, as was the intention and the primary motive behind launching it in the first place. There is a case for its use which is not necessarily confined to a religious obligation.

Although sports, and in this case swimming, as recreational or competitive, has been practised for long time and in general there has been research and debate on sport's relationship to class, race, gender and sexuality, a cultural study of sport begins to emerge only in '80s led by feminists who sought to explore the male domination of sport in the construction of gender and sexuality (Edgar & Sedgwick, 2008, p.332). When we look at the burkini or a covered swimwear in this context, where it is trying to liberate rather than dominate, perhaps there is a renewed need to re-evaluate the existing notions of pluralism and diversity that are not condoned by popular culture.

3. Case study of the Kurta

3.1 The Kurta as a global symbol of versatility – The historical context.

The timeless Kurta, or the tunic, as it is known in the west, is defined as a loose collarless shirt worn by people from South Asia, usually with a *salwar, churidar, or pyjama* (Lexico, 2020). A late eighth century Sanskrit-Chinese dictionary gives the word Kurti for the chinese *shan*, shirt, although Kurti is not a Sanskrit word (Dhamija, 2010, p.21).

Krishna (2010) writes that while some of the scholars believed that stitched garments were introduced into India by central Asia tribes early in the Christian era, others maintained the view that they arrived when the Mughals invaded the Indian subcontinent (p.129). There are varied points of view, but what's important to note here is that the "History of the kurta in the Indian subcontinent goes as far back to the Shunga rulers as in the era 184-72 B.C.E, followed by the Sakas and Kushanas, central Asian peoples who wore stitched garments" (Krishna, 2010, p.129). He further adds,

> "By the end of the twelfth century, Muslim rulers had occupied Delhi, bringing with them traditions from other Islamic courts [...]There are references of *nimcha* or a short tunic, and a *jabah* which is an upper garment made of fine muslin" (p.130).

There are numerous other references from Akbar's time until the mid-eighteenth century when these garment adaptations continued in their original or modified versions, with some variations getting renamed in order to accommodate both Hindu and Muslim sentiments that were prevalent in those times. With the advent of colonisation during the nineteenth century, some Western influence on dress and clothing was evident, with sleeves being tailored and the kurta morphed into a simpler form with straighter cut becoming more popular than the previous *angarakha/jaba/peshwaz,* which have been versions of the kurta with more volume, length, details, etc. Apart from the Indian subcontinent, there is also evidence of the stitched garment in other South East Asian countries such as the Kimono in Japan and China.

3.2 Present day Kurta

Moving forward, the 20th century dress style evolved across the varied terrains of the country in myriad ways, adapting to different climes, from a cooler climate in Kashmir and Ladakh to the extreme heat in Rajasthan and Gujarat or the tropical climate of Chennai and Kerala. Despite these variations, the kurta has managed to stay as a staple garment in addition to other draped garments specific to the Indian subcontinent, notably the sari, dhoti, etc. The sari however, has been observed to be slowly losing out to the kurta as an everyday garment, because in addition to the latter's functionality, there is more scope for contemporising and variations.



Figure 5. Some modern-day versions of the kurta in India. Style courtesy: Saumya Pande, New Delhi, India.

In present times, the kurta is seen as the daily attire of women in India, Pakistan, Afghanistan, Nepal and neighbouring countries. It is a common sight to see women wearing kurtas with *salwars* (loose pleated trousers that are fitted at the ankle) or *churidars* (close fitted bottom gathered at the ankles). But the most common pairing is with ankle-grazing pants, styled with a stole or a *dupatta* for a traditional look or without one for a more contemporary style, more like a sort of dress. There are kurtas or tunics worn across the western part of the world and it is not unusual to find Americans or Europeans wearing longer shirts or dresses with pants, closely resembling the look of the kurta as seen in India.

3.3 Global comparison and contemporising in fashion

Another modern interpretation of kurta, as observed in the last few decades, has been a beach wear in the form of kaftans or loose slip on. Some of the famous designers who have used the kurta as an inspiration in the form of a tunic are Tory Burch, Johnny Was, Gucci, Kate Spade amongst others (Figure 6).



Figure 6. American chain of luxury department stores stocks designer swimwear & cover ups that replicate a kurta (Neiman Marcus, 2020). Image source: https://www.neimanmarcus.com

Japan has been on the forefront of innovative fashion and use of technology for a long time and some of the renowned designers, notably Rei Kawakubo, Issey Miyake and Yohji Yamamoto, amongst others, have done some ground-breaking work in bringing Japan's cultural context and aesthetics to the global fashion scene. While drawing inspiration from the East and the West, Japanese brands and designers have managed to bring the traditional and the ultra-modern together in mainstream fashion.

For their launch in India, Japanese brand UNIQLO tied up with Indian designer Rina Singh, from the label Eka, for an all exclusive kurta-dress range, to serve the Indian demographic. The kurta line was not only launched in India but also in Japan, Singapore, Malaysia, Thailand, Indonesia and the Philippines, thereby moving beyond a purely "Indian"

connotation of the same. Rina says “The kurta has been India’s daily dress for years now. It is timeless, democratic and functional - aligning it perfectly with the UNIQLO LifeWear philosophy. Through this partnership, we have pursued a contemporary version of the kurta as an elegant essential for women of all backgrounds, regardless of age, culture or belief” (IANS, 2019).

In a detailed telephonic interview with her, she talks about how the kurta has been one of her key silhouettes, how she sees it and why it is virtually the go-to garment for her and many of her clients. One of the reasons for the kurta’s popularity, as she identifies, has been the society’s shift to a more global outlook, which would require the wearer to switch between an everyday sari to a completely western outfit. This however has not happened in India which is still quite deeply rooted in its strong textile and handloom traditions. The kurta, as a tunic or a dress, offers more options of keeping this tradition alive, and yet can be perceived as a global silhouette. One of the reasons why Rina’s brand Eka (Figure 7) does so well globally is its mass appeal and versatility, everything the kurta symbolises.



Figure 7. Eka’s Spring summer 2020 collection at Ogaan, New Delhi. Image source: www.ogaan.com



Figure 8. The Sartorialist, https://www.thesartorialist.com/diamonds-stripes-solids-copenhagen



Figure 9. The Sartorialist, https://www.thesartorialist.com/mayfair-london/

Globally, while scanning through the western fashion scene, the tunic has been spotted across the spectrum. It has been seen on the streets across the world, outside fashion weeks, in resort collections, amongst others. Scott Schuman of “The Satorialist”, who is a street style photographer, has numerous images of people wearing the tunic, or a tunic as a dress across the globe. (Figure 8 and 9).

WGSN, the renowned global forecasting site has shown the kurta as a trend forecast for many seasons across product categories (Figure 10).

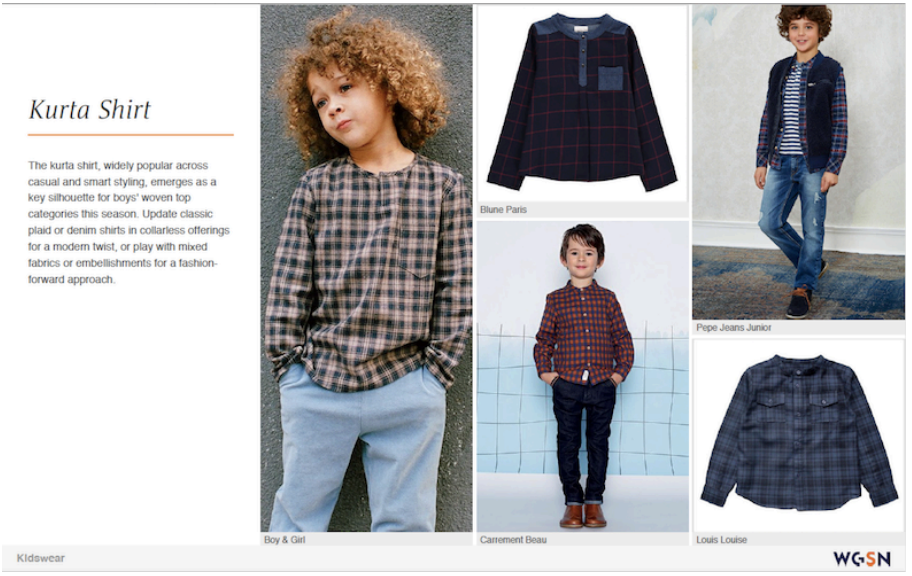


Figure 10: WGSN, the forecast site has shown kurta as an inspiration over time. Image source: www.wgsn.com

To gain a more personal insight, the author interviewed some of her friends and acquaintances across the UK, U.S.A and Australia. These women are mainly between the age groups of 35-50 years. They have been to India many times and are seen donning the tunic or kurta back home occasionally. I asked them how it got into their wardrobes back home, how many versions do they have and how often do they wear it.

Julie Lantry, a designer and an academic in Sydney, Australia, has a very quirky, experimental dressing style and through her many trips to India in the past two decades, four tunics arrived in her wardrobe back in Australia. She says:

> "I generally wear them in India. When I first started traveling to India, I noticed most people wore them and I started wearing them as it felt more comfortable both physically and culturally[…] I do wear a tunic in Australia, but more as a resort wear (over swimmers etc)."

Niki, in Brighton, U.K who has been a senior designer for the brand Monsoon in the U.K, had a kurta that she wore till it fit her, and then she had to give it away. She says:

> "For me the kurta is a specific cut, not ever low cut. I think of it as made in cotton and a certain length with splits at the side and it has sleeves. Brands like Monsoon and East do tunics and use prints that come from India so these are so close to traditional Kurtas."

It would be safe to conclude that the kurta or the tunic is a widely known form of clothing which has had various adaptations across a western clientele.

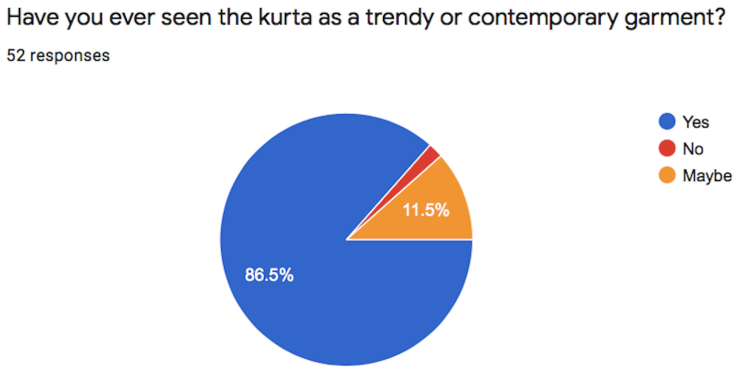
3.4 Kurta in the context of dress and sexuality

In the book "Clothing: A global history" (2008), Robert Ross in the chapter "The emancipation of Dress" says:

> "There was, and remains, a complicated balance that has to be found between women overemphasising their sexuality, so that they are not taken seriously, on the one hand, and women dressing in such a masculine fashion as a threat to male egos" (p.147).

He said this in reference to the work and business environment, but in a patriarchal society, where women are still finding their space outside of their homes, this may be true in other areas of social and cultural life too. A kurta is versatile enough to seamlessly go from home to work to convert to a dress when required to go out for an evening. It also does not seem overly modest, with the way it is styled, it can be made contemporary when worn with trousers, linen pants, or leggings. A lot of younger office-going women wear it as a dress which is longer and less revealing. It has many ways of getting styled and there are multiple variations able to create a very traditional or a very contemporary look.

In the survey conducted with the young lot of girls and women in India, not surprisingly, over 50% respondents stated that they find the kurta "cool" and they would wear it, if styled interestingly. It would be important to note here that a majority of these young girls dress up in denim, shorts and dresses for their everyday college wear.



Appendix 3.

4. Conclusion

If fashion has to be truly represented as a global, vibrant, all-inclusive entity it is important to look beyond what we see at present as inclusive. While it is important and relevant to have body, gender, racial diversity represented in Fashion, and that it shouldn't have taken this long to come about; It is equally important to show diversity of garments that cross borders and boundaries just like the brand UNIQLO did.

It can be concluded that designers and brands are endowed with the larger responsibility of perpetuating this essence of integrating the local with the global. There have been many designers who have integrated this philosophy in their work, as discussed in the paper, but there is a huge scope for more such interventions. If brands could take up more local clothing examples such as the Asian kurta or the burkini, we would see a lot more diverse and multicultural fashion on the streets. Maybe some clothes need to be dis-identified from their existing labels to be democratised in order to be more accepted, accessible, used, inclusive. It is time for designers and its recipients to resist from identifying a garment only from its social or political construct and to look beyond its original cultural significance it may have (had). There is an even bigger need for designers to look at it afresh and to build on a culture of multiplicity and materiality. There would be more blending of people and identities, and certainly a lot more fun, amalgamating cultures using fashion as a medium.

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Acknowledgements: I would like to thank my colleague Pragya Sharma, for her valuable insights and help with editing this paper, and my colleague and mentor Saumya Pande for her constant motivation to pursue academic research and strive for excellence. I would also like to thank the students and colleagues of IIAD who helped with completing the surveys.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design as a medium for an informal learning. INDICO*learning* from the interface to the activity

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Abstract | Digital technologies and social media frame an unprecedented scenario for learning, which is featured by simultaneous experiences, spontaneity, creativity, and action. In this learning context, the design approach is vital fostering communication and new technologies, self-production, and manipulation options, which provide new forms of knowledge. The design of *wayfinding* and information, play an important role in making any concept accessible, shaping diversity of stimuli in a network of tools, signs, and symbols, which enhance the learning process and make it more inclusive. This paper presents the research and development of a variety of visual, tactile, and acoustic elements to be part of an online platform, designed for learning different architectures. The aim of this project is to develop resources for hands-on learning, using different technologies more adapted to a diversity of learners and targets. During the learning process, the design engages different possibilities to build objects that gather amazement, satisfaction, curiosity, and inquiry. The next step will be, once this platform will be implemented, to validate the effectiveness of its design to provide active learning and, what is more, its possibilities for inclusive purposes.

KEYWORDS | DESIGN FOR LEARNING, ARCHITECTURE MODELS, TOOLS AND TECHNOLOGIES, HANDS-ON LEARNING, LEARNERS DIVERSITY

1. Introduction to autonomous learning

Last decade, digital technologies and social media have been and are still the protagonists of an unprecedent scenario for learning, which is featured by simultaneous experiences, spontaneity, creativity and action. The trends identified in learning and development (Haagh, 2017) show the crucial role of technologies and disruptive methods (learning paths, affinity groups, learner-contributed content, and coaching) (Dyger, 2017). There have been so many changes in both work and leisure, that it seems absolutely necessary for education to redesign most of the processes and contents generally used till now. This new educational panorama requires to involve the individual (de Jong, 2014) providing assorted resources and media elements developed with detail and rigor. These elements are mostly supported in drawings, graphics, and other elements that provide a variety of experiences by demand of the customers. The design approach is vital in this learning context, where communication and the discovering of other technologies concerning the self-production and manipulation options, are constantly providing new forms of knowledge (Puyuelo, et al., 2018). Furthermore, is a consequence for individuals to develop at the same time, their digital abilities (Jennings, et al., 2017) and the awareness of their own possibilities for learning autonomously (Olmos-Raya, et al., 2018; Puyuelo, et al., 2019).

Another critical factor in current education is fostering creativity as a sort of knowledge that has to be nurtured though learning experiences. So, design for education faces the current challenge of enhancing new inspirational ambiences. In fact, user experience is absolutely related to useful interfaces and design, where also counter intrinsically, the aesthetic dimension of visual design (Bollini, 2017). It is agreed that in any digital or real world context, design of information and *wayfinding* plays an important role in achieving the goal of making them accessible (García Moreno, 2011). In the case of an interface, which offers learning activities, the design of a diversity of stimuli can comprise an efficient and dense network of tools, signs, and symbols, which in one hand, enhance the learning process and make it more inclusive (Fernández-Villalobos & Puyuelo, 2018), but in the other hand, can make it more difficult. What is proposed is the research design of a website where you may get different elements representing a building. There you may experience as a maker, technologies such as 3D printing, blue prints, laser cutting maps etc. that can be used for producing other learning resources for people with special needs such as tactile surfaces for the blind.

This paper presents the research and development of a variety of visual, tactile, and acoustic elements to be part of a digital resource, an online platform designed with the purpose of fostering informal learning about different architectures. The aim of this project is to develop resources for “hands-on” learning, using different technologies that might be appropriate/suitable for a variety of targets. A gallery of architecture-based models provides both intrigue and educational opportunities for different stakeholders. These resources give them tools for improving inclusion and, at the same time, accessibility to potencial learners and visitors.

Both the elements designed to be the contents of use and the platform itself, aim to offer simple, direct and interactive experiences for the user. Following the idea of Kort et al. (2001) on the relation of learning and emotions, during the learning process, the design proposal engages different possibilities to build objects that gather amazement, satisfaction, curiosity and inquiry: good emotions which were associated with a higher level of learning.

O'Brien and Toms (2010) suggest to examine multiple factors of experience concurrently related to each other. These factors can be clustered into groups which include: affect, cognition, context, engagement, experiential learning, interactivity, narrative, self-concepts, and usability. Their co-presence during individual experiences will require design guidelines and addressing validation strategies in the future.

The first part of the paper presents the main ideas that guided the previous research, the objectives for modelling an ideal platform, followed by the methods, techniques and materials employed at the conceptual design. The second part, shows briefly the result as a prototype, which can be used in an open way, obtaining material and visual representations of the architecture presented. Finally, we discuss our findings from the design process point of view. The next step will be, once this platform will be implemented, to validate the effectiveness of this design to provide active, effective learning and what is more, in particular, for inclusive purposes.

2. Looking for an Ideal Model of Learning by Doing platform

Design surrounds us by shaping the way we live and communicate with the world, so design is somehow, a medium for a constant learning process and a tool to promote cultural knowledge. The evolving role of the cultural identity of places is reinforced most strongly by mediatisation, rather than through active and inclusive communication. Design spans boundaries and is shaped by disruptions, it continually evolves as it responds to the context in which it operates.

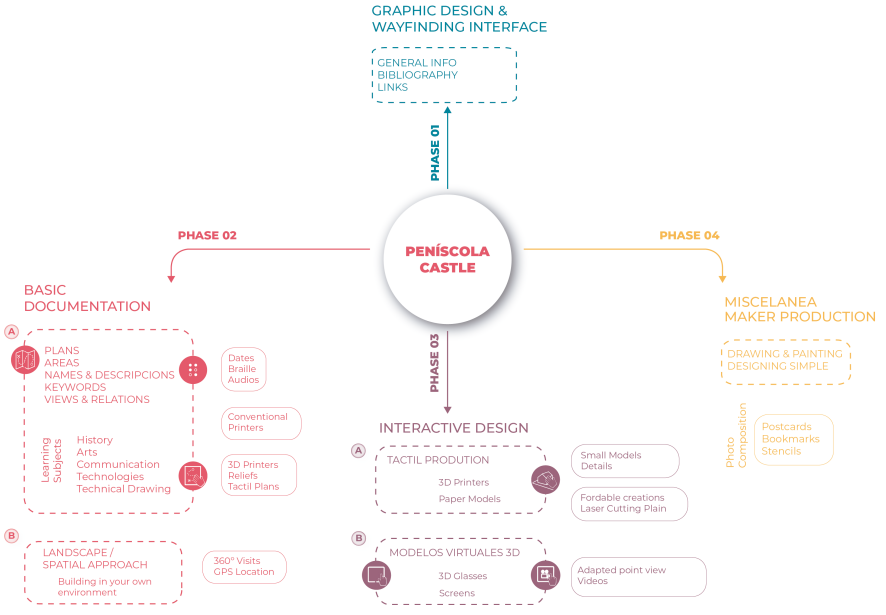
From the perspective of education and learning, to approach the representation of architecture in an autonomous way, should embrace thought processes, motivation, construction of spatial view, and a sense of flow in the activities proposed. As argued by Allen, a key to creating flow is matching challenge to skills, along with well-defined goals and rules (Allen, 2004). Thus, it is necessary to bring clear results and communication between unique features of the image of the building in our case, and the material results you will be able to reach doing the activities. According to Hennes, “constructing activity with continuity of experience in mind demands that we find a way to provide learners with a means of constructing the present experience out of what is already meaningful and important to them” (Hennes, 2002, p. 113). From this point of view, some of the activities proposed are simple objects that we can easily identified as desirable products that can be customized. Hennes also noticed that participants play an active role in a valuable way when they design

facing open-ended proposals. These sorts of hands-on activities trigger emotional experiences because they have not absolutely pre-defined outcomes (Hennes, 2002).

The main results are the open-ended enrichment and pleasure that discovering through action can provide. Following Leapers argument, some important factor groups to be included at any educational proposal will be fun, cognition, context, engagement, experiential learning, interactivity, narrative, self-concepts, and usability (Leaper, 2012).

These activities will bring motivation from a set of cognitive and emotional factors that are also suitable for educators, information designers and interaction designers when it comes to proposing informal learning experiences in interactive environments. In a typical human-centred design approach, designing experiences that trigger out affect and affinities in hands-on learning can be very challenging (Jordan, 2010, p. 8). Thus, around each building a variety of contents are displayed (Table 1) to give different inputs of information, activities, and also degrees of complexity and participation for the learner.

Table 1. General scheme of the proposal around a particular site (Peñíscola Castle); phases of approaching the contents proposed, and the models that can be obtained. Own elaboration.



The design proposal tries to explore the *Sense-of-Coherence* (SOC) theory and its concepts of comprehensibility, manageability, and meaningfulness claimed by the sociologist Aaron Antonovsly:

> "a global orientation that expresses the extent to which one has a pervasive, enduring though dynamic feeling of confidence that (1) the stimuli, deriving from one's internal and external environments in the course of living are structured, predictable and explicable; (2) the resources are available to one to meet the demands posed by these stimuli; and (3) these demands are challenges, worthy of investment and engagement" (Antonovsky, 1987, p. 19).

Since the point is to show relevant architectures, we raised three types of approaches, which are essential for a global comprehension: the contextual presentation as part of a particular landscape; the organization as a space to discover by moving around rooms, levels, etc.; and the volumes as in a building site. A repertory of representations designed and given as contents inserted at the platform, are the models to learn about the place experiencing while producing them. In all the cases, for the sake of simplicity, the different elements are presented using pictograms representing the sort of results to be achieved (Figure 2).

A specific work system has been designed for each building focused on implementing hands-on based teaching concepts and particular experiences. Looking for simplicity, all them are presented using pictograms connected with the result to achieve and its relationships with the human experiences as explained by the Gestalt Theory.

2.1 Objectives

The aim of this learning platform is to encourage the general public to enhance their knowledge for architectural items, designing and personalizing products and things, building models and resources, suited for them.

The design and development of this interface should reasonably accommodate a broad range of diverse users, favouring levels of appropriate training, including individuals with learning difficulties. Following this idea, a preliminary scheme with four layers/areas is proposed (Table 2), where each tool is independent from the rest, allowing the use of its deliverables and actions separately. Different action types within the inputs given and the object manipulation bouts proposed, are passive (video, audio), functional, sensorimotor, and social bids with objects. In this platform, only the video is completely visual and shows a short itinerary composed by five watercolours and drawings painted by hand, creating an effective result in a quite vivid style. As argued by Lunger and Scheiber (2010), film is a relatively flexible means of applying information to a substrate offering a variety of qualities to suit different requirements and purposes. In this case, in a simple way, this itinerary allows to entry this place that in reality, is not accessible.

From the design perspective, this education platform provides a sort of "cultural goods", that trigger experiences for the learner in a creative performance mode. In that way, the user is able to produce or re-produce elements that look like museums shops products, which usually generate desire among end consumers. This sort of performance is highly appreciated by certain publics or users such as designers, artists, architects, interior and fashion designers and engineers.

Table 2. Relations Inputs-Outputs and Phases of the learning platform proposed. Own elaboration.

Inputs	Learning Process	Activity	Outcomes
Audio/Texts Tables of contents/Video	Selection Pictograms and Wayfinding through the platform. Listening and reading	Attention and focus	Listening, storytelling. Pdfs and technical indications
Draws	Understanding scale and representations	Printing and hand-cutting	Flat simple elements
Blue prints	Building and producing paper models	Folding and making	Pop-up displays and fan formats
Engraved surfaces and volumes	Building and producing tactile reliefs and models	3D printing and building	Tactile floor plans, cut-out pieces, 3D volumes

Du Gay et al. have a broad understanding of the study of a cultural issue, text or artefact, and suggest that is significantly relevant taking together a sort of circuit around its representation, identity, production, consumption and regulation (du Gay, et al., 2013). Following this idea, most of the images and activities provided at this platform, invite the user to do things because they know the actions previously, and also understand the expected results. We are taking advantage or their informal social knowledge as explained:

> "Our heads are full of knowledge, ideas and images about society, how it works and what it means. Belonging to a culture provides us with access to such shared frameworks or 'maps' of meaning which we use to place and understand things, to make sense of the world, to formulate ideas and to communicate or exchange ideas and meanings about it" (du Gay, et al., 2013, p. 2).

The results invite the user to experience with and to use and evolve these designs for their own creations. Practitioners can obtain kinetic experiences of the space when they flip, pull or fold the paper in different directions. These models challenge the user's capacity to understand the place and the way to produce the model at the same time, conveying a range of spatial concepts, such as in/out, up/down, and high/low (Puyuelo, et al., 2019).

2.2 Methods, materials and techniques

Specific tasks were studied to design hands-on elements that could show relevant aspects of the architecture presented. We follow the guidelines proposed by Pappas (2018) for developing experiential knowledge and learning resources with AR/VR technologies, to make learning more productive, innovative and fun. We took this idea forward into the analysis of particular representations of each building, designing models related with their unique features. Fourteen hands-on activities and a visual animation are proposed. Some of them, such as the maps and layouts, are particularly suitable to help the user to identify routes and

to know about a site or building, in terms of distribution, proportions and wayfinding. Others, guide hand-made paper models ready to be used, painted or sized. The small book of sections requires more concentration for constructing and analyzing the space.

The designed elements aim to work and produce some models:

- Printing in 2 or 3D
- Cutting (scissors, laser cutting tech)
- Folding
- Assembling and building parts
- Moving to see and understand

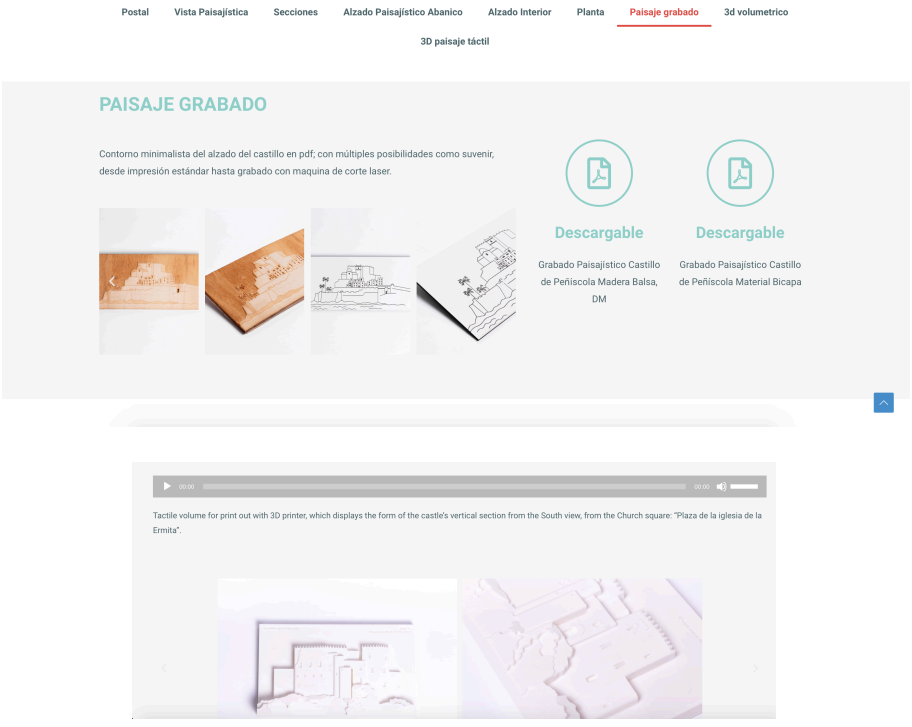


Figure 1. Screenshots. The activities are identified next to the pictures displayed in different materials, to give an open idea of the possibilities. The downloaded files might be produced in different techniques or materials (wood as relief or carved, 3Dprinted…). Own elaboration.

A previous pilot survey (n = 10) was conducted with a group of seven teachers and three professionals, to ensure the relevance and interest of the technologies proposed to allow new experiences about the topic. The data collected have the focus in some pedagogical

aspects and the utilization of the types of technologies and activities proposed (i.e. laser cutting and 3d printing).

After a short presentation of the learning platform, the technologies and the materials available at the workshop, the participants were asked to choose, between four of the activities, to produce one of them by themselves in one hour. Depending of their background, some of them were more attracted by the final result they can produce in that time while others were more interested in experiencing with the technologies. Broadly speaking, it was a satisfactory experience when, finally, the participants got their own product to bring home. After the exercise, participants were asked to delve into the cultural identity of this particular building, and were also asked to investigate their own perceptions about these designs, identifying in case its value as societal representations of that place.

3. Results and discussion

This preliminary discussion explores how cultural identity of a site/architecture, could be communicated and better understood using a hands-on approach to reveal its qualities and foster their image. This website prototype underlies through design, the educational value opening extensive opportunities for both traditional and distance education. It will be necessary to work step by step producing flexible developments that need time and research in their effectivity.

The interface enables the user to face a significant amount of easy-to-do activities and a wide range of interactions while allowing the tailoring to different learning needs. The impact of positive reaction on the user's engagement and what is called "multidimensional construct" (Reschly, 2008) is high.

The activities are described and included in an on-line system, where experimental models are made available on the *WorldWideWeb*. So, it can be used in an open way, reaching different publics and purposes, where obtaining material and visual representations of the architectures presented, might be useful. Users can choose their speed of action creating products (maps, layouts diagrams to identify routes and to know about a site or building, bookmarks, presents…) about the place, learning by doing.

According to the references selected during the research, design stakeholders should consider a range of interconnected, influential factors when facing informal learning experiences in different environments. As explained before, users can decide which of the proposals could fit better to their work, learning objective or simply what they feel like to do. From this perspective, this learning module is a means to create a flow situation and to experience the concept of "proprioception" (Mine, et alt., 1997), which has been recorded in different immersion and learning experiences (Puyuelo, et al., 2019). As explained before, manipulating an emotion effects on the participant motivation, accessibility and learning.

The possibility of self-producing our learning contents adds a value in the emotional scope for the stimulation of curiosity, focusing attention on the object.

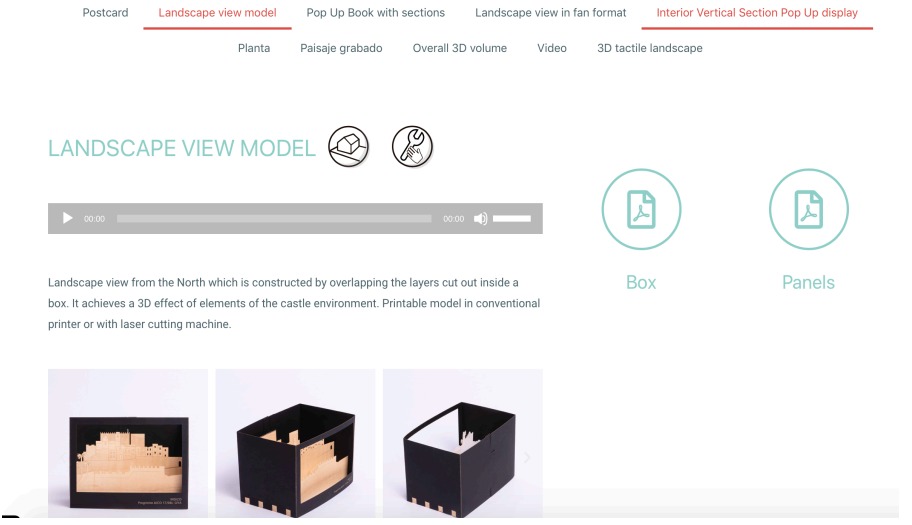


Figure 2. Screenshot. In this case the model is obtained from combining at different level of depth, three skylines of the main view of this site corresponding to the wall, the village around it and the castle on the top of the mountain. Own elaboration.

This website prototype is in phase of verification of accessibility requirements, errors found, and warnings. Once the prototype will be completed, it will be possible to verify its success online using evaluation tools that are web applications that allow to obtain an assessment report of different items. Experimental methods will also be used to address its usability with the different groups of potential users and also in formal and informal learning contexts.

The contribution of this project is stated since all its components give priority to the open design: from the interface, the elements that the user might produce, and the creativity of producing these challenging resources for different users and uses. The findings demonstrate important perspectives of cultural design and how to better understand places, motivation, and autonomy.

This ongoing platform gives an approach not solely to the issue of architecture design education, but of how to learn and teach experiencing design in a world of cultural silos, change, and diversity. The scalability of this prototype will be developed firstly, with the

stakeholders in the scope of the Comunitat Valenciana (Spain) to offer a panorama of buildings and singular sites.

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Acknowledgements: The work reported here has been a part of the research project “INDICO Learning: Innovación y Diseño de recursos y contenidos de sustrato gráfico para la interpretación y la educación inclusivas_INDICO Learning: Innovation and Design of resources and contents with a graphic substratum for interpretation and inclusive education", which has been supported by the Valencian Regional Government in the AICO program (Ref /2017/046).

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

De-stereotype UX Design – Discussing and managing issues related to the clustering of users in the design of innovative solutions

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Abstract | In UX Design, research about user provides design hints orienting the creation and development of innovative services and systems. The outcomes of these studies are postprocessed and transformed in maps and diagrams, such as the Mental Model and the User Journey maps, and in the description of paradigmatic users to act as reference in the phases of the project process. This work develops a discussion on the potential effects of cultural bias and stereotypes on the reliability and accuracy of the design-oriented user studies. The authors, being involved in UX Design research and practice, provide here a strategy to prevent bias effects especially in tests with users.

KEYWORDS | UX DESIGN, USER STUDIES, STEREOTYPES IN DESIGN, ENVISIONING EXPERIENCE

1. Introduction

The design of innovative services and systems is based on user studies providing insights on needs, requirements and values of the target users, and orienting the development of meaningful and usable solutions. In the years, user centered methods evolved giving rise to UX Design approaches, that are now vastly employed in every field of design (Hassenzahl, 2010; Garrett, 2011).

User studies provide a great amount of information and data that, in order to be suitably employed in the design process, need to be synthesized and transformed into convenient forms of envisioning and representation. UX Design tools such as the Customer Journey Maps (Følstad, 2016), the Mental Model Diagrams (Pillan et al., 2018), and the popular Personas are vastly employed to transform the outcomes of research on users into design hints and opportunities (Kalbach, 2016). Research on users includes primary research, i.e. investigation performed by observation activities, interviews and ethnography conducted by the researchers on field, and secondary research (also called desk research), (Buxton, 2007; Stickdorn et al., 2018; Tullis & Albert, 2013), based on data extracted from literature, reports and surveys previously conducted for other purposes. Primary research also includes experiments with users based on instrumental monitoring of biodata by eye-tracking, EEG, ECG, and others, aimed to collect evidences about the engagement of users in their interactions with applications, cyber-physical environments, digital services (Reali et al., 2017). These experiments provide insights about the cognitive efforts, the perception processes, the pleasure of use and the emotional involvement experienced by the people while they interact with the solutions under analysis; the outcomes of the tests support the analysis of usability, accessibility, engagement and the investigation of the variability of human responses and reactions (Plassmann et al., 2015).

In UX Design, the outcomes of the research on users need to be processed and condensed so to be effectively employed in the design and validation activities. Information about users are usually summarized in maps and diagrams representing the technological and organization system; the value proposition related to the user jobs, needs and expectations (Newbery & Farnham, 2013); and the timeline of the service delivery from the point of view of the users in their interaction with the system touch-points, also including pain points and design opportunities. Chronological maps - such as the User Journey Maps – report the logical sequence of activities performed by a person who is considered as emblematic of one typology of users to which the product or service is addressed, and provide paradigmatic storytelling that becomes the reference for the value proposition (Følstad & Kvale, 2018; Kalbach, 2016).

In fig.1, we represent the expected outcomes of the research on users within a UX Design approach. Methodologies for research on users, data collection and post-processing, have been amply investigated in the last decades, but, in the knowledge of the authors of this paper, little attention is paid on the importance of recognizing and managing potential bias

that could influence the researchers investigating on users and, in most cases, the studies concerned specific issues (Marsden & Haag, 2016; Cabrero, et al., 2016; Cabrero 2014).

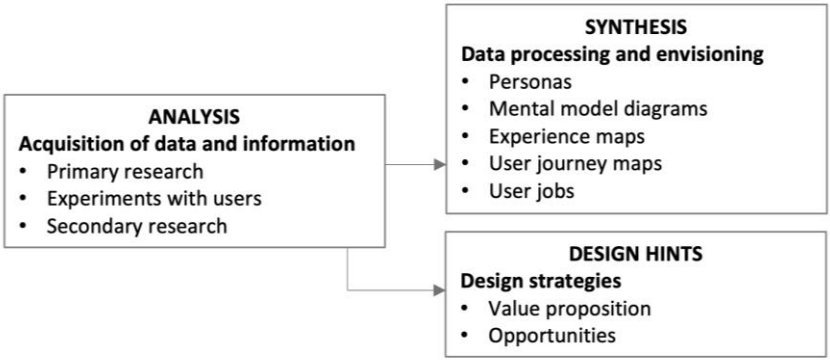

Figure 1. The outcomes of the research on users in UX Design.

The authors of this work are scholars and professor on UX Design methodologies, and members of a research laboratory at PHEEL - (PHysiology, Emotion, Experience Lab, Politecnico di Milano); the focus of the researches on users at the laboratory is the evidence-based investigation of user experience with respect to their interaction with services, interactive solutions and digital applications; the investigations employ different research methods, such as desk research, ethnography on field, interviews and experiments with users also involving instrumental facilities for the monitoring of physiological parameters, i.e. eye-tracking and others. The authors collaborate with companies in UX Design researches for a variety of application fields, such as digital media and services. With this work, they intend to give a contribution to the development of suitable approaches for the extraction of design hints from the user studies. The focus here is on how to prevent the potential influence of the cultural stereotypes on the outcomes of the investigation on users. Regarding this, the authors discuss in the following some issues related to the impact of stereotypes in design and present the strategy they have elaborated in order to reduce bias effects in their UX Design activity. The paper aims at offering a contribution to the complex topic of social prejudices and stereotypes in design, and strategies to be adopted in the design practice.

2. Clustering and definition of types in design

In UX Design, researches are aimed at providing a holistic understanding and modelling of the experience of users regarding a product, a service or a brand, a company or an

institution; the research investigates cognitive, emotional, cultural dimensions of the personal experience since all these factors play a role in shaping attitudes and decision processes. Studies on users are notably important in Interaction Design and in Service Design; the aim is the analysis and understanding of the How and Why of human activities, as an essential requisite to design meaningful What of novel solutions (Benyon, 2014). In Service Design, the investigation of the experience also aims at reducing the misalignment between the proposition of value offered by the service provider and the perception of value as it is perceived by the final user. The basic assumption is that "Organizations are out of sync with what the people they serve actually experience" (Kalbach, 2016). The purpose of user research is to orient the design and development of new solutions toward the most useful and advantageous implementation from the point of view of the final users. User studies in UX Design need to be vast and inclusive in order to be effective; on the other hand, in order to effectively orient the design process, data and information need to be synthesized and transformed into clear and easy to grasp guidelines.

The design of services and digital/physical systems focuses on the dynamic description of activities in terms of typical journeys, jobs and paths (Benyon, 2014). Human beings are all different but with respect to some specific characteristics or tasks, from the industrial point of view it is convenient to classify the members of a target group in types or cluster of people that present some similarities. In the fashion industry, as an example, the production of clothes of different sizes represents a good compromise between the standardization of the products and the variety of the dimensions of the human bodies. The same happens in the design of services for all application purposes and the identification of suitable clusters of users is a way to cope with the complexity of the human diversity. As an instance, in health care services (Moody et al., 2018; Kokorelias et al., 2019) the investigation of the variety of human physiological and cultural characteristics is a key issue in the development of person-centered approaches to medical treatments and services. In marketing, the identification of recurring paths of behaviors and attitudes is carried on together with the quantification of segments of populations so to produce the market segmentation and the consequent strategies for value proposition and communication (Fonseca, 2011; Arora, et al., 2008).

The definition of types of users is a tricky task and it depends to the object of the design process. As an instance, in the development of a new operating system for smart phones, in order to effectively evaluate the relative impact of the new on the potential users, it could be convenient to consider groups of users that are familiar with different existing operating systems. In the test of a new driving control system, it should be important to make user tests involving drivers with different expertise and styles of driving.

In some cases, the clusters of users also share some similar social or anthropologic characteristics, such as age, gender, or the belonging to an ethnic group. In other cases, there is no tight correlation between the elements of social identity and the specific attitudes and behaviors that are the focus of the design. As an instance, in a previous work

(Pillan et al., 2019), the authors reported the research performed to develop a sustainable system for home automation; this study identified three main cluster to be taken into account in order to provide suitable personalization of the interfaces: i) users requiring a full automatic system; ii) users willing to have a total control and understanding of the system; iii) users willing to adopt a behavior apt to minimize the consumption, provided that the interface is very usable and efficient. The study also demonstrated that the correlation between the three group and the social characteristics of the users, especially in terms of age and gender, are not simply correlated. As an instance, group i) included both ageing people with scarce abilities in the use of digital interfaces together with young residents with interest for sustainability and cost reduction.

The identification of reliable types of users, effectively representing the variety of attitudes and needs of the users, is a delicate task that could be affected by simplified interpretation of the information provided by the research.

The most common way to synthesize knowledge on users is Personas. More than twenty years ago, in his book 'The inmates are running the asylum', Alan Cooper presented his Personas (Cooper, 1998) as an effective way to summarize the knowledge about the potential users of innovative solutions. Personas work "because a persona gives us an operational mental model of a particular kind of user." (Floyd, 2008) The success of Personas and of the more recent envisioning tools and maps corresponds to the need of designers to have an agile tool to use in the project process that take into account the needs, preferences, attitudes, and ways of thinking of the prospect users.

> "It is difficult to design for another person. One must develop an empathetic internalization of their understanding of the world, their experiences in it, etc. It is even harder to design for a collection of other people with all their subtle variations. Thus, designers revert to designing for themselves without really thinking about it, which is facilitated by humans' natural tendency to assume that other humans think exactly like they do, until there is evidence to the contrary. At best, designers may design for their personal stereotypical conceptualization of the "user". Personas help avoid this tendency because they make a group of users concrete in the form of a fictional, single user for whom the designers are designing; thus, they are a handy tool to facilitate user-centered design." (Floyd, 2008).

These characters are not real but should be realistic, so to allow a prediction/projection of behaviors and preferences; when they are not realistic, the design can fail the goal of providing a satisfactory solution due to functional or cultural inadequacy. Turner & Turner (Turner & Turner, 2010) discussed the limits of the approach that has become so widespread:

> "Despite placing the user at the center of the design process, UCD by necessity must involve at some stage a representation of the different aspects of users and

> what they want. And, a representation is, by definition, less rich and detailed than the thing itself.
>
> … Despite simplified representation of users is a necessity in the design process, designers should always be quite aware of the limits of these descriptions".

The two authors reconstruct the history of user studies in Interaction Design, and pointed out the complexity of user studies in design without involving prejudices and stereotypes; they discuss the intrinsic biasing of design research pointing out that "we call people users, which implies that we are primarily, and perhaps only, concerned with those aspects of their psychology and behavior which is directly relevant to the use of interactive technology."

As these authors point out, Personas, as all the other envisioning techniques based on the identification and description of types, can reflect stereotyped thinking.

A stereotype is a convincement or a 'fixed idea that people have about what someone or something is like' (Cambridge Dictionary). Stereotypes, therefore, can be based to knowledge that is not necessarily false, but that can be used in a misleading way and producing fake assumptions and projections. Typical socio-cultural stereotypes involve gender, age, culture, technical capabilities, economical availability. Having simplified cognitions is natural for human beings, also responding to the need of an efficient use of the limited capabilities of human mind and operation memory. The problems with stereotypes arise when limited knowledge is employed as absolute truth, and when phenomena and characteristics associated to some samples of a human group are extended to all the members (Bordalo, et al., 2015). Furthermore, bias in judgement and research arise when a limited knowledge about a group of individuals sharing some specific characteristics (as an instance, gender, age or belonging to an ethnic group) is considered as capable to predict trends, behaviors and attitudes, so producing prejudices, biased judgement and rejection. On the contrary, empathy with users feeds creativity (Van Boeijen & Hao, 2015).

3. Tricky activities in managing tests with users

The researches on the user experience that we perform at the XXX lab integrate a variety of methods, including traditional ethnography on field, focus groups and interviews, tests with instruments such as eye-tracking. Tests are aimed at an in-depth investigation of the user experience during their interaction with physical environments, digital services and applications or while performing complex activities such driving a car. Usually, we perform investigations on existing solutions or on prototypes of innovative ones, within collaborations with companies and other institutions. Our approach is based on the triangulation of information about behaviors with those obtained by the monitoring of biological parameters, and the self-reported experiences collected through interviews.

In figure 2 we represent the main steps of a typical experimental process at XXX; it includes four phases. In phase 1, the team in charge on the experiment collaborates with the external

partner to define the goals of the investigation and the methods to employ in the tests with users, depending on the expected outcomes and on the characteristics of the artefacts under analysis.

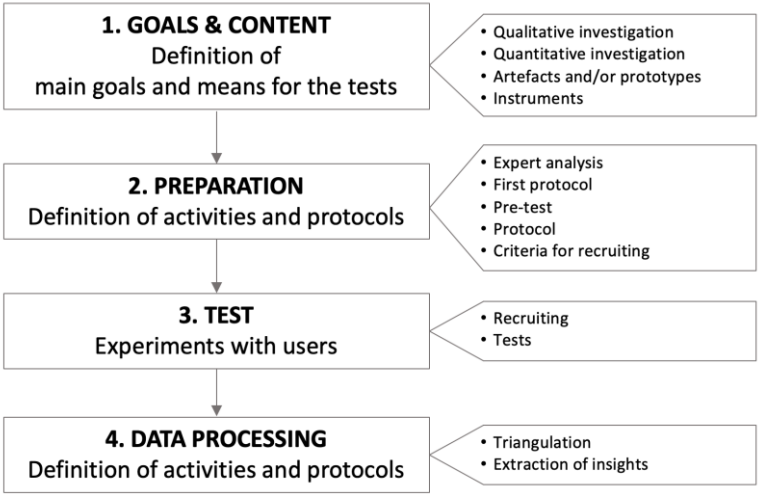

Figure 2. The main phases of the process adopted for tests with users.

Phase 2 is dedicated to the detailed organization and assessment of the experiments with users; to the definition of the characteristics of people to be involved in the test and of the consequent criteria for recruitment; the creation of the experimental protocol, including the context and the tasks. Such activity is based on the access to the artefact to be tested and the performance of a deep study of its structure, interaction paths, and possible action options, that is a simulation of the concrete context of use. The artefact is then tested by researchers as experts of technologies and provides a sort of baseline on modalities and time of interaction. Defining possible criticisms and bottlenecks in the interaction support the research path in the estimation of an effective set-up, allowing to direct the definition of the sample and the recruiting features. The aim is to identify small but very representative selected groups of users, opening the way to a deeper understanding of the delivered experiences elicited by the interaction with the artefact under test. Furthermore, we perform a pre-test, involving the participation of 1 or 2 users in line with the target audience. This process supports the development of the whole project, and the identification of possible further bias and stereotypes that could have missed the previous study phases.

While phase 3 is dedicated to the recruiting and experiments with users, phase 4 is for the processing of data and the extraction of design insights and opportunities.

With respect to the possible influence of cultural stereotypes on the outcomes of these experiments, we consider all the four phases as crucial.

In phase 1, the team collaborates with representative of the external partners (UX designers, interaction designers or marketing experts) so to define the reference population and share previous knowledge about the target users with its relative segments or clusters; this produces a common ground of assumptions that will orient all the following phases. As a case study, in our collaboration with a television broadcast company, the research aimed at developing a new platform for web-tv broadcast. The initial inputs by the company indicated the minor availability and technological skills for elder generations and assumed a correlation between type of contents, age, gender and attitudes toward digital solutions. In the collaboration with a company that produces sports cars requiring advanced driving skills, the involvement of female drivers in the tests was not initially taken into consideration. In the studies commissioned for innovative services for banking and payment, the attention of the company collaborating with us was focused on GenZ and on younger users, since they are considered the trend-setters for future behaviors and attitudes. The preliminary information provided by companies that have a long term relationship with users is certainly valuable and provides a strategic start for research, on the other hand, the role of UX designers is to offer a refreshed and hopefully more realistic representation of the target users, and research activities should also be capable to provide new perspectives and interpretation of information.

With respect to phase 1, we consider the importance of detecting convincement and assumptions that could be related to stereotyped representation of the reality instead then on sound knowledge. As stated by Floyd, we believe that

> “Our social intuitions consist of many parts; some are hard-wired, some are developed from the experiences we have in our life, some are developed from our conversations with others about how other people think and act, and most are some combination of all three.”

In order to manage the risks related to the influence of potential stereotypes, we consider the importance of recognizing all the explicit and implicit assumptions and to make them emerge in the collaboration so to challenge them either to verify their reliability or to rebut it since

> “It is important to be cognizant of the stereotypes which are selected, and the implications of selecting them, in order to avoid ethnic, gender, or status profiling. Properly used, however, they can still serve as a powerful mental "subroutine" encapsulating a significant amount of shared intuitive understanding of the world between designers.” (Floyd, 2008).

About phases 2 and 3, we remark the delicacy of the activities dedicated to recruiting. The search and selection of the people to involve in the tests is based on a description of the target users and on his preliminary segmentation into clusters created to represent the

variety of the people included in the target, so to cover with the tests all the types that appear as relevant for the research goals. The recruiting is therefore performed by preliminary interviews aimed at verifying the affinity of the interviewed subjects with the types that we intend to focus on during the analysis. During the tests the different types of users can be involved in different experimental protocols, depending on the goals and topic of the investigation. As an instance, in the research focused on different technological solutions for tv-broadcasting, the company asked us to focus on younger users while analyzing the interactive experience with more recent solutions as Google Chromecast. Our experiments revealed that the acceptability and desirability of a specific technology is not trivially related to social characteristics such as age. Test with users are expensive and time consuming; in most cases, these analysis aims at providing qualitative insights, while quantitative data are collected with more traditional methods on a statistical base.

Generally speaking, we consider recruiting as a very tricky activity, since a wrong selection of the people involved in the tests can evidently influence the outcomes of the study, and it could produce a mirroring or bubble effect, reflecting cultural stereotypes instead than creating objective knowledge. A further check is performed during the test sessions, adopting non-participative observation techniques. Such activity allows researchers to perform an in-time evaluation of the correct labelling of each user, and their belonging to the specific group she/he was assigned to. In fact, even when the recruiting phase is performed with strong care and attention, people can lie or mislead a self-evaluation of their own characteristics or level of familiarity and proficiency. For this reason, the further validation performed during the tests supports a correct interpretation of the data gathered through the experiments, and a final check of possible bias and stereotypes to be considered in the results interpretation.

3. Strategies to manage bias in research with users

In UX Design, the integration of information provided by different research methods is constantly evolving, also including approaches based on data mining for design. On the other hand, we point out the importance of developing techniques apt to extract design hints out of data, also capable to prevent misjudgment and interpretations conditioned by cultural stereotypes. As a contribution to this purpose, we propose here the strategy we take now as a reference in our UX Design activity and teaching.

In our approach, we consider that the interpretation of data for design purposes should be based on a suitable framing of the complexity of human mental processes; from brain sciences, we extract models and theories about perception, cognitive and emotional processes that provide a framework for the interpretation of the data and the limits of the methods of investigation. Furthermore, we point out the importance of recognizing those results of the tests that are strictly related to the evidences based on the experiments, making a difference with abductions and intuitive interpretation of the phenomena.

We point out the importance of developing awareness about personal prejudices and stereotypes in the team engaged, in the preparation and deployment of the test with users and in the data-analysis. To this purpose, we include in the test process some discussions on possible bias that could influence the test preparation and the data-analysis so to recognize implicit stereotypes and bring them explicitly in the conversation. In an analog way, in the collaboration with a company, we list and discuss the validity of the preliminary assumptions on users and on the context under analysis; the validation of this assumption can become one of the issues to be investigated in the analysis.

In the definition of the test protocols, we take into account possible interferences produced by the environment (due to the artificial characteristics of the test context) with the suitable development of the experiments.

We constantly discuss the limits of the knowledge about users that can be extracted from the experiments. We refrain from abductive extraction of information, from generalization of results, and from deduction that are based on a limited sample of users; this is done by collecting insights and crosschecking them before generating design hints.

In the postprocess of data, we base the extraction of clusters of users on the patterns of their interaction with the product or service under test regardless to their demographics. We assume that the correlations between the results of the experiments and the main characteristics of the users recruited in the test, such as demographic attributes, education, social status, gender and others, can be accidental or produced by bias effects in the recruitment.

We also assume that motives for personal behaviors, preference or attitudes are never trivial and should always be derived ex post the research with users.

In the case experiments show consistent correlations between some socio-demographic characteristics of users and the patterns of their experience, we suggest further inquire for a deeper understanding.

4. Conclusions

While UX Design is becoming pervasive, we point out the importance of developing a critical discussion on the possible influence of cultural stereotypes on the researches that are supposed to provide the design hints and indicate the space of opportunity. Clustering users into types is considered now as a common activity, we argue that designers adopting a UX Design approach should be capable to manage the creation of the reference types with sense of critics and awareness of the potential consequences of dealing with bias effects.

The design of products/services based on clustering of users produces and promotes new social stereotypes capable to broadcast and influence cultures. In order to obtain knowledge suitable to orient the development of innovative services and systems, user studies should

be performed having well in mind the limits of the existing tools with respect to their capability of representing the human needs and convenience.

In our opinion, user studies should always consider humans as evolving entities, and we consider this as ethic assumption of design as a discipline. The envisioning tools we currently use to describe the virtual scenarios we are designing should be interpreted as a means of social and political conversation on their desirability and not just as mere guidelines to ensure the success of memes.

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Acknowledgements: The research reported in this paper has been developed within the PHEEL research laboratory at Politecnico di Milano. The authors wish to express their appreciation for the meaningful collaboration to all the researchers and to the head of the lab.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Framing diversity: designing hearing aids from a deaf culture perspective

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Abstract | Deaf people are proud of their culture and not being able to hear is secondary to the positive experiences created by their social lives and 250-year-old history and culture. This reality is often misled by the adoption of medical criteria which regard Deafness as a medical condition measured against the "norm" of hearing people. This paper presents a research-through-design project which developed smart jewels to counteract the stigma of disability addressing functional and cultural needs of Deaf people. Workshops were organised involving Deaf people, makers/engineers, designers and Italian sign language interpreters who were engaged in a *Thinking-through-making* process where the experience of Deaf participants was exploited to drive embodied explorations of future hearing aids. The design case calls for a participatory design model in which designers and users can co-create solutions addressing not only the (dis)abilities of the body but and more importantly, the human experience.

KEYWORDS | DIVERSITY, DEAFNESS, HEARING AIDS, SMART JEWELS, PARTICIPATORY DESIGN

1. Introduction

According to the World Health Organization (WHO) (WHO, 2018), 466 million people worldwide, over 5% of the world's population, have moderate to profound hearing loss (HL) in both ears (Tucci, et al., 2010). Disabling hearing impairment in adults refers to hearing loss greater than 40dB. It is estimated that by 2050, over 900 million people will have disabling hearing loss.

The numbers are impressive, and reflect a very complex and nuanced reality where deafness and hearing impairment are often misunderstood.

First of all, it is necessary to distinguish between the terms physically deaf and culturally Deaf. A small 'd' is used when referring to people from a medical perspective, while a capital 'D' is used when referring to people culturally defined as Deaf (Woodward, 1972).

Deaf people (with a capital "D") have little or no hearing ability. They use the Sign Language of the country where they live as their primary language. Even if some of them may hear environmental sounds and understand some speech, they identify themselves as a linguistic minority.

Deaf people feel that they belong to the "Deaf Culture", an ethnic minority with a defined language composed of verbal (signs) and non-verbal elements (facial expressions and postures), communication and social protocols, forms of artistic expression, entertainment and recreational activities (e.g., sports, travel, and Deaf clubs). Being part of a cultural community means that they do not feel impaired or disabled.

Oral and late deafened deaf (with a lower case "d") also have little or no hearing, but, unlike Deaf people, they typically do not use Sign Language as their primary language. Oral and late deafened people do not identify with the "Deaf Culture".

Despite the benefits that people with HL can obtain from use of hearing aids and assistive technology, many of them refuse to use them (Vernon & Pratt, 1977). The main reasons for not owning/using hearing aids are the denial of the problem, discomfort, a sense of foreignness, and aesthetics ("it is a foreign object deep in the ear", "it pinches", "it hurts", "it is too big"), shame, social rejection and stigmatisation. This suggests that the hearing aids address HL in a way that is technically efficient but does not take the user's experience into due consideration.

Considering deafness from a sociocultural perspective, rather than a medical problem or insufficiency to be compensated, implies addressing a complex tangle of needs of D/deaf people that go beyond hearing compensation. We argue that disability should not be regarded as a problem to solve or a lack to compensate but as a design opportunity (Pullin, 2009).

In this paper, we introduce the design case, describing the methodological approach that resulted in development of an interactive jewellery system composed of interactive modules

which continuously sense the acoustic qualities of the environment and notify the wearer of the occurrence of specific sounds through micro-movements, vibrations and light patterns (Marti & Recupero, 2019). The paper concludes with a set of recommendations that can support designers of future assistive devices in engaging vulnerable stakeholders, in particular Deaf people, as equal partners in the design process.

2. The Design Case

Quietude (www.quietude.it) is an EU project which develops assistive devices for people with hearing impairment and HL. It was funded within the H2020 WEAR Sustain (https://wearsustain.eu/) programme.

The project adopts a participatory design approach (Bjerknes, et al., 1987; Smith & Iversen, 2018) to learn about inspirational and actionable insights into the socio-cultural practices and expectations of D/deaf people.

Participatory approaches to design (Sanders, et al., 2008) engage stakeholders in co-creating artefacts destined for them, ensuring that their viewpoint and interpretations are considered in research throughout the design process. These methods are pursued throughout the entire research project with the goal of not just empirically understanding the problem at stake, but also envisioning, shaping, and transcending it in ways users find satisfactory (Spinuzzi, 2005).

2.1 Workshop series

The project included two workshops which were adapted to respond to different forms of expression (Sanders & Stappers, 2008). Activity based on visual expressions, material exploration and hands-on techniques intertwined with verbal discussions mediated by Italian sign language interpreters.

Workshop 1

The initial inspirational workshop took place over six days in the Fab Lab of the University of Siena (Italy), with the involvement of four women who had been Deaf since birth, two sign language interpreters, an ethicist and a mixed group of designers, technology experts and makers (Marti, et al., 2018). The group of Deaf participants was composed of an architect (40 years old), a psychotherapist (41 years old), a special education teacher (30 years old), and a university student (21 years old). A free and informed consent form was signed by all participants.

The aim of the workshop was to inspire each other, encourage empathic understanding of Deafness and HL, and start developing concepts of hearing aids to address some concerns of the current devices.

On Day 1, participants were prompted to reflect on feelings of Deafness which were mapped on body maps using simple post-it notes (Figure 1).

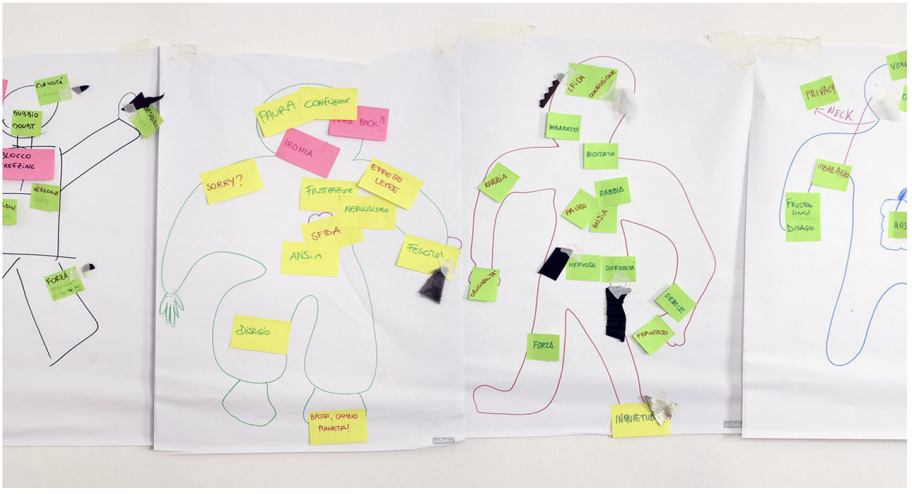

Figure 1. Body maps.

For example, embarrassment and shame were located around the ears and referred to hearing devices. Originality was located on the hands to underline the unique features of sign language.

Day 2 focused on selecting forms and materials (Figure 2) and experimenting with simple vibrations motors (Figure 3). Deaf and hard of hearing people are familiar with the use of vibration. Though not all participants perceived the vibration in the same way, the neck, the bones around the ears and the wrist seemed to be the parts of the body most sensitive to vibration.



Figure 2. Exploration of materials.



Figure 3. Experimenting with vibration motors.

Day 3 focused on developing concepts; Days 4–5-6 were devoted to materialising ideas and developing low-fidelity prototypes (Figure 4):

- A bobby pin with parts that move according to the ambient sound detected by directional microphones embedded in a brooch. This object signals deafness to others and notifies the wearer of crucial sound events.
- An armband that translates different sonic qualities in the environment, including range, volume and direction, into vibrations.
- A 3D shape-change necklace that expressively enacts live or recorded sounds, translating the sounds into micro-movements.

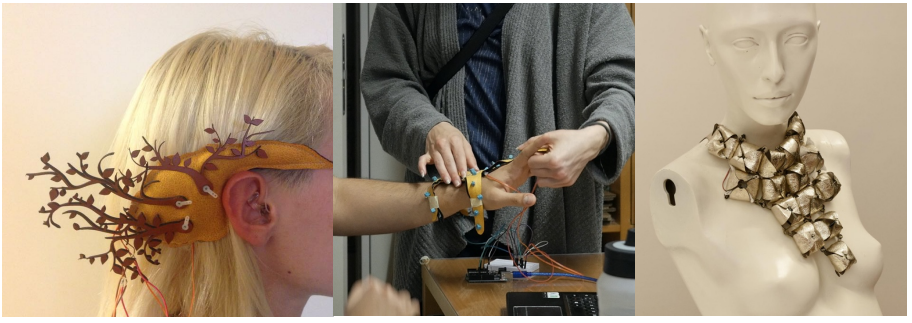

Figure 4. Bobby pin, armband and 3D shape-change necklace.

In this activity of thinking-through-making (Ingold, 2013) the prototypes served as a vehicle for generating research questions and collecting complex needs/requirements in a research through design process. Discussion topics included:

1. Awareness about personal sounds (e.g., doorbell, name, etc..) and public notifications, such as alarms, announcements in public spaces, and more.
2. Safety to prevents sounds requiring a quick response from going unnoticed.
3. Personalisation according to individual preferences and sensitivity.
4. Cross-modal experience of sound through sight, touch, on-body vibrations.
5. Aesthetics: hearing aids should be beautiful, smart and comfortable to wear.

Workshop 2

The second workshop was hosted by Mason Perkins Deafness Funds Onlus, a non-profit organisation which provides services and training for the deaf community in Siena (Italy). The organisation supported the project, facilitating contact with the local deaf community and providing interpreters. In this second workshop, we tried to balance the number of Deaf

and hearing participants and also to propose a place that was familiar to the Deaf experts, to give them more confidence in their ability to contribute. The workshop lasted 1 day, in consideration of the difficulties that the Deaf participants had encountered participating in the previous workshop for several days.

Five participants who had been deaf since birth and used the Italian Sign Language participated in the session: 4 women from 20 to 50 years of age and one 17-year-old boy. A free and informed consent form was signed by all of them. The group of hearing experts was composed of a psychologist, a designer and two technology experts. Two design researchers facilitated the workshop, supported by a sign language interpreter.

The aim of the workshop was to reflect on the needs and desires that emerged during the first workshop, engage the participants in a thinking-through-making activity and evaluate the prototypes developed during the first workshop.

Thinking-through-Making

After a card sorting activity aimed at identifying desires and prioritising the needs emerged during the first workshop, participants were involved in a making activity based on a desire selected from the previous phase. Various materials including textiles, paper, cardboard, tape, pens, glue and hooks were put on the table. All participants were encouraged to fabricate their own personal accessory, give it a name and present it to the others. The idea was to transform what had been discussed verbally in the previous phase into design probes, moving from abstract to concrete, to invite all participants to be kinaesthetically engaged and to reflect together (Luck, 2018).

One Deaf participant made an accessory named “Alive”, a shape-changing jewel that moves like a living object in response to sounds (Figure 5 left).



Figure 5. The probe "Alive" (left) and "Stella" (right)

Another Deaf participant developed "Stella", a bright necklace that looks like a shining star to underline how important it is for hearing aids to be able to express a personal sense of style (Figure 5 right).

The young boy developed an armband, explaining that he would like to wear an accessory that can notify him of sounds that would otherwise go unnoticed (Figure 6 left). A Deaf girl developed a belt to be placed around the shoulders or chest. The belt acts as an undergarment that allows the wearer to feel sounds through vibrations (Figure 6 right).

Other probes were developed by the hearing participants to underline equality in the participatory process.



Figure 6. Armband and belt probes

Evaluation of prototypes

The third part of the workshop was devoted to presenting the prototypes developed during and after the first workshop, trying them out and collecting feedback. The evaluation regarded both the jewellery and an early prototype of the App. The bobby pin, armband and necklace were put on the table along with other prototypes developed at the Fab Lab after the first workshop, including an interactive ring which translates sounds into lights in continuous listening mode (Figure 7).



Figure 7. The interactive ring prototype lighting up with sound

Participants were free to try out the jewels and comment on them. One of them who had participated in the first workshop was amazed to see that most of the comments raised previously had been integrated into the prototypes. These included the aesthetics of the jewels, the possibility of exploring the sonic qualities of environmental sounds and therefore addressing Deaf people's curiosity about sound, and the possibility of choosing the accessory that best suits their preferences.

The ring was criticised because it interferes with the use of sign language, in which the hands must be used only to sign. The light could confuse the interlocutor.

The hair clip was discarded because the vibration produced by the embedded motor could interfere with a hearing aid located behind the ear.

The necklace and the armband were considered the most interesting accessories. Deaf participants stressed the importance of being aware of the environment (quiet or noisy) and of recognising specific sounds of interest.

The last part of the workshop was devoted to the evaluation of an early prototype of the App. Before the workshop, the App had been demonstrated to one of the participants who usually plays a leading role in the group. She drove the evaluation session by explaining the functionality and performing a live demonstration of the service. Her mediation was essential. She was able to create an atmosphere of trust and empathy which greatly

facilitated engagement of the other participants. No major defects were identified in the App. The participants appreciated the ease of use, the possibility of customising the intensity and type of feedback on the accessory, and the idea of creating a personal library of sounds to be recognised by the jewels, alerting the wearer.

In summary, the two workshops marked important milestones in the design process in terms of exploration of the complex needs of Deaf people, elicitation of requirements and preliminary evaluation of early prototypes.

3. The jewellery system

After the second workshop, a suite of jewels was designed as a modular system to allow different types of formal configuration and personalisation of use. The modules embed sensors and actuators allowing self-actuation and kinetic modifications in the presence of particular sounds.

The suite of jewels includes three necklaces which notify the wearer of incoming sounds with different behaviours: dynamic light (Figure 8), vibration (Figure 9) and a change in shape (micro-movement of the modules) (Figure 10). A video of the system's behaviour can be viewed at: http://www.quietude.it/wp-content/uploads/2018/03/Quietude_DemoHD.mp4?_=1.

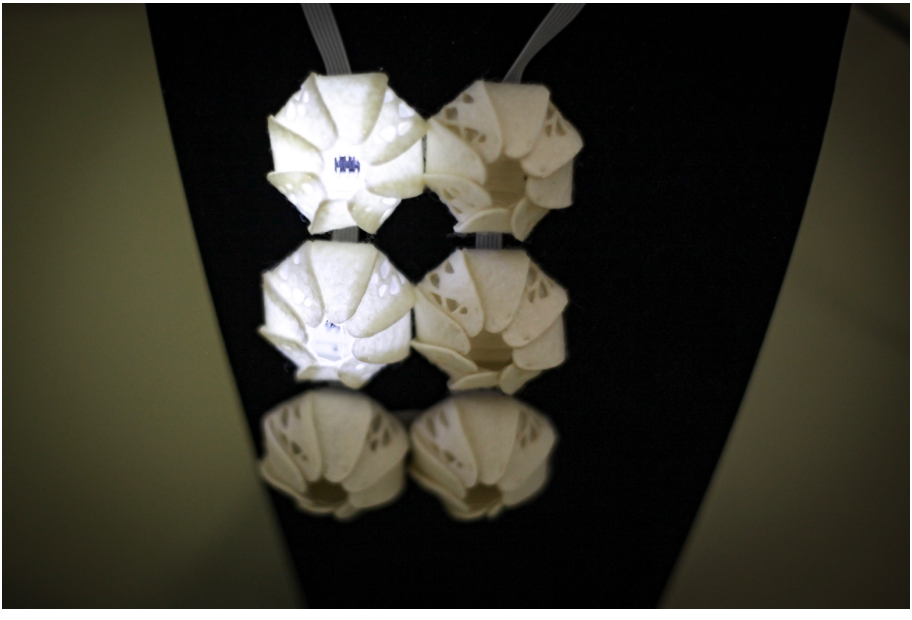

Figure 8. Necklace with dynamic light

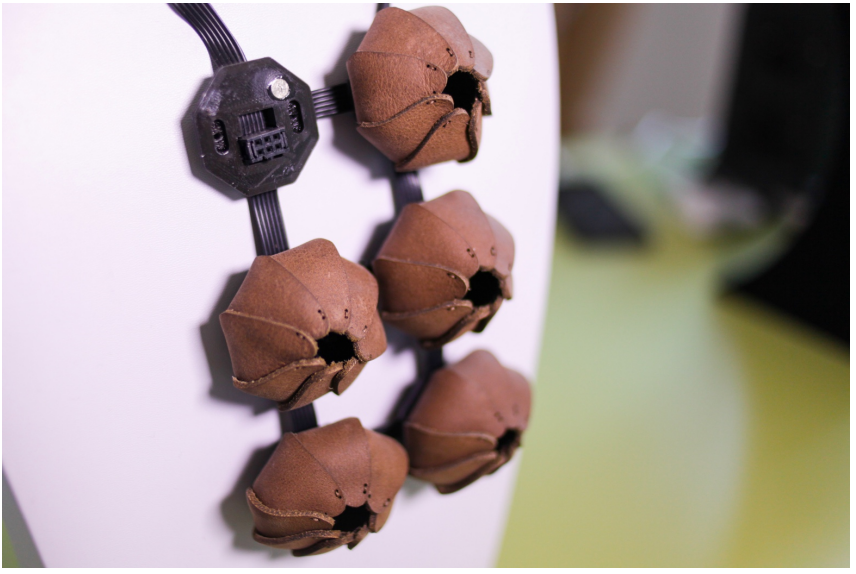

Figure 9. Necklace with vibration



Figure 10. Shape changing necklace

The formal design of the modules was inspired by a powerful metaphor that emerged during the first workshop. One of the participants used the expression “feeling under water” to describe deafness as hushing of the perception of sound.

Drawing on this metaphor, the suite of jewels was inspired by the undersea world. The modules resemble sea urchin shells, and the colour palette reflects images of sand, deep oceans and coral. The jewels were conceived as modular structures which can be assembled to create the wearer’s own personal jewels. Modularity addresses the need that emerged during the workshop for placing and playing out the jewellery on the parts of the body which are most sensitive to vibrations and micro-movements.

The jewels are handcrafted: modules are sewn by hand, connectors are fabricated by recycling flat connectors from obsolete computers, and, most importantly, no glues or adhesives were used. In this innovative design, modules are connected through 3D-printed interlocked supports. The system’s behaviour can be defined and fine-tuned through a smart phone app that works with the accessories.

Modules are made using laser-cut eco-leather, felt or fabric petals which are folded and sewn to create a shell-like shape (Figure 11).

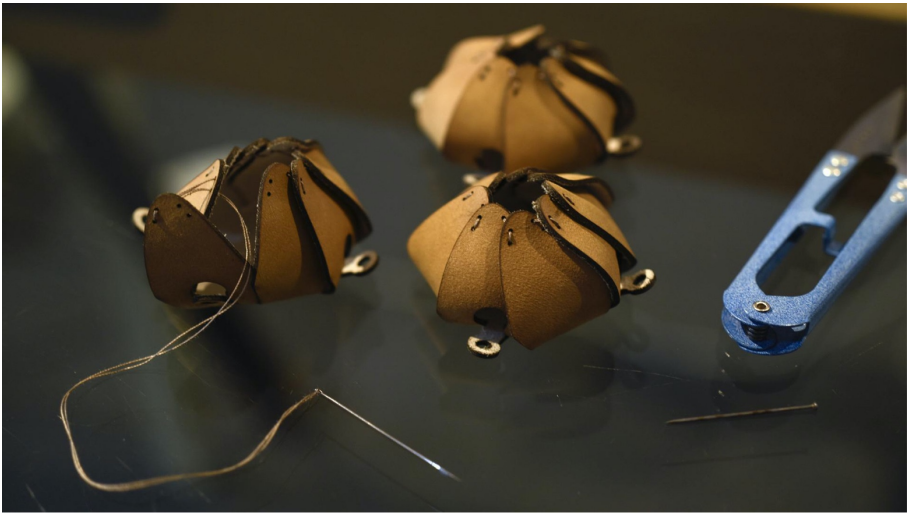

Figure 11. Sewed eco-leather modules

The electronic components are placed in an octagonal PCB that keeps the modules fixed and stable in a horizontal position (Figure 12). Some modules contain electronic boards and sensors (e.g. the Bluetooth communication board and microphone), some contain actuators (e.g. LEDs, servo-motors, vibration motors), and others are empty, simply used as part of the

aesthetic value of the system. This modular system permits creation of a variety of fashionable jewels, including necklaces, armbands, brooches, etc.

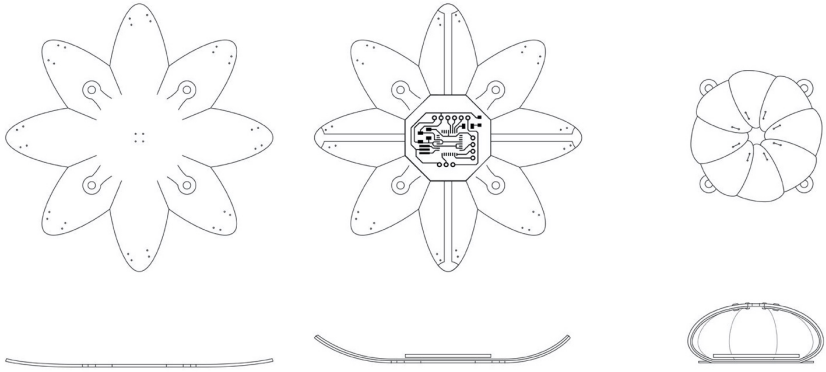

Figure 12. Laser cut module, electronic components and final seam

The jewels can sense sounds in two different ways: through real-time continuous monitoring, to notify the wearer of the frequencies and amplitudes of sounds in the surrounding area; or upon occurrence of certain specific sounds, defined by the wearer using the mobile app.

The necklaces with light and vibration behave differently. Instead of using simple on, off, and blinking behaviours, we have adopted a richer vocabulary. Drawing on Harrison's study (2012) of what kinds of information are typically communicated by point lights, we designed light and vibration patterns that follow the spectrogram of the incoming sounds (Figure 13).

The 3D shape-changing necklace performs micro-movements in response to external sounds. The actuators embedded in the three necklaces are directly mapped to the intensity and amplitude of incoming sounds bending them towards the lower centre of the module.

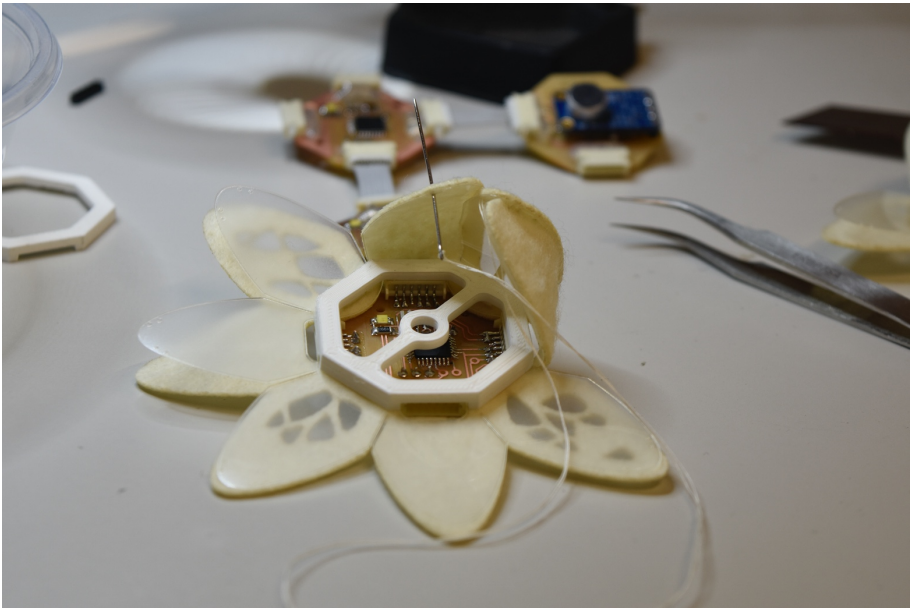

Figure 13. Embedded electronics

The combination of the micro-movements of the petals of different modules results in a coordinate and expressive movement of the overall structure (Figure 14).

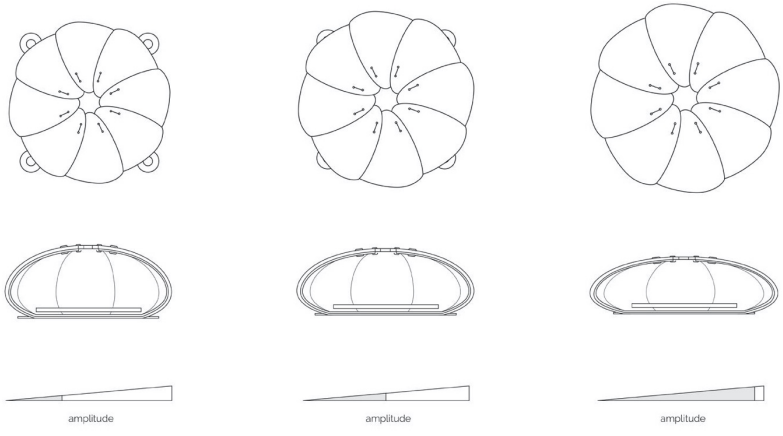

Figure 14. Micro-movements of the shape-changing modules

3.2 Smartphone application

The jewellery system is connected to a smartphone application (Figure 15) permitting personalisation of sound recognition in input and kinetic transformation and shape change in output. The jewels and the smartphone communicate via Bluetooth.

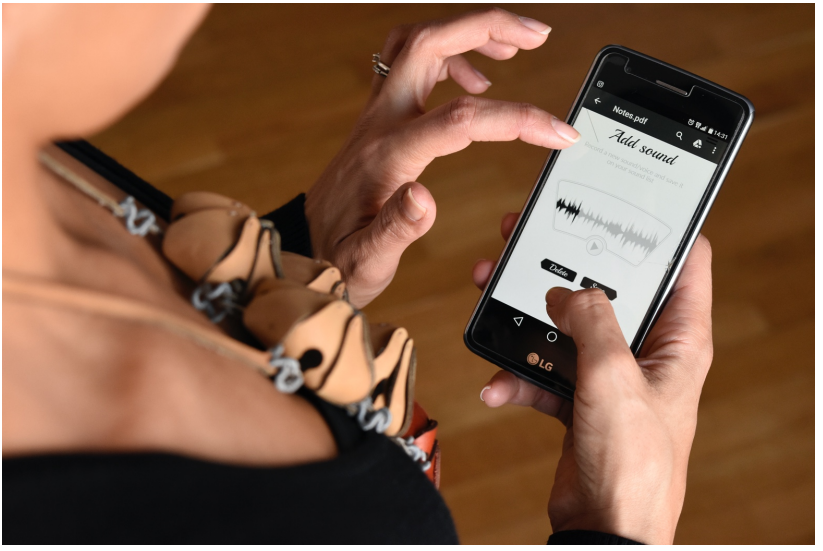

Figure 15. Smartphone app

The app permits customisation of both input and output, with construction of a personal library of sounds that can be monitored and replayed on demand through the accessories (Figure 16). The key feature of the application is the management of the kinetic, light or vibration output on the basis of a comprehensive sound recognition process.

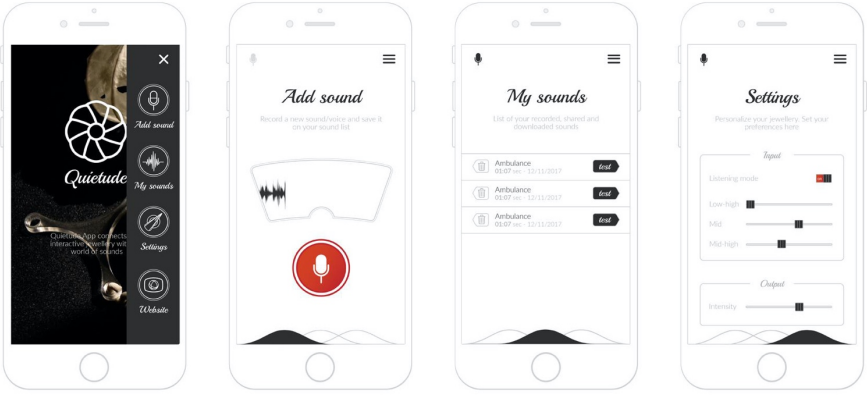

Figure 16. Smartphone app screenshots

The user can create a library of sounds by recording personally meaningful sounds through the microphone embedded in the jewels. These sounds are then labelled and stored in the app, permitting real-time sound monitoring and on-demand playback.

4. Conclusions

This paper moves from an analysis of Boys's (2014) research calling for a shift in the attitude toward disability from a medical model to a sociocultural model.

Transforming hearing aids into fashion accessories is an attempt to stimulate reflection on diversity and provoke a cultural shift, reconsidering the continuous entanglement between disability and ability beyond the tendency to standardise or normalise human skills.

The design case described in the paper highlights the importance for the designer to understand the sociocultural context of use as well as the meanings people give to the designed artefact. In the project, this led to adaptation of participatory design methods that engaged with the community and allowed people with diverse auditory skills to contribute and co-design solutions.

The proposed approach poses several challenges, due to cultural differences and understanding of experiences of the participants, and due to suitability of methods and techniques that may not be appropriate or need adjustment as highlighted also by Slegers et al. (2014); Hendriks et al. (2015); Tucker (2015); Marti & Bannon (2009).

The challenges that emerged during the project are summarized in the following.

Prior knowledge of the deaf culture

Researchers and designers often have limited knowledge of deaf culture which is sometimes confused with hearing impairment. They often rely on the reported experiences of their stakeholders that are individual and sometimes fragmented or conflicting due to the specific level and typology of deafness. To minimize this problem, some researchers suggest to assign to the impaired participants the role of experts, hiring them as paid team members (Hendriks, et al., 2015). In our project, we learned the importance of forming a solid prior knowledge of deaf culture before involving deaf people in participatory design. Deaf culture includes practices related to a suitable arrangement of the working space that hosts the co-design activities. In the DeafSpace project (https://www.gallaudet.edu/campus-design-and-planning/deafspace) Hansel Bauman developed a catalog of architectural elements to design built environments for deaf people (Hope, 2017). These include: ensuring proper sensory reach (visual and tactile) in 360 degrees to extending Deaf people's awareness and making spatial orientation easier; arranging space and proximity to allow signers maintain enough distance to accommodate each other's signing space when conversing; maintaining clear visual communication while walking and conversing; avoiding shadow patterns and backlighting that disrupt visual communication; preventing acoustic reverberation that can be only distracting and also painful to deaf people use hearing aids or cochlear implants. All these architectural elements have to be accommodated in any comfortable co-design space for deaf people.

Choosing appropriate spaces for participation

Spaces of participation should not only comply with the guidelines reported above. They should be also familiar to the deaf participants. The second workshop worked much better than the first one since it was hosted at the Mason Perkins Deafness Fund Onlus, a familiar place for the participants where the deaf community is used to meet and socialize.

Using the appropriate language

"Hearing impaired" is an equivocal term which mixed up people with different levels of hearing loss, communication modes and cultural identities under one definition. Some deaf people don't like to be defined as "hearing impaired", some others object to the word "impaired," which implies, for them, that a person is flawed, deficient or imperfect. Using an appropriate language is quintessential.

Choosing the right methods

In the project, we experimented with different methods for engaging deaf people in the design process. However not all of them were equally successful. Activities involving abstract

thinking were less engaging, like the one focused on reflection on ways of accessorising the body performed in the first workshop. Drawing from this experience is advisable in order to avoid situations distant from the Deaf participants' experience and imagery.

The mediation of interpreters

The co-design team has to include professional sign language interpreters to bridge the communication gap between the deaf/hard of hearing and the non-signing language users. The sign language interpreters are fundamental intermediary to create an atmosphere of empathy and collaboration. They have to be professional, skilled and certified.

Equivalence in participation

All stakeholders have to be equal partners in participatory design. In our project, some methods proved to be particularly successful in achieving equality like thinking-through-making during the second workshop. This stimulated creativity and joint reflection.

Encourage the role of leader

Even if in the co-design team there is not an assigned leader and the group dynamics are free-flowing, leaders can show up in different ways. In our project, a deaf person spontaneously took the responsibility of stimulating the activity showing integrity, empathy for others, and promoting joint reflection. This happened in particular during the second workshop, where a deaf person accepted to take the responsibility to drive the evaluation of the App. She was able to understand the main goal of the activity and act accordingly. This was tremendously successful. It is advisable to let deaf people drive informal evaluation activity to facilitate the participation of the other deaf participants.

Ethical challenges

Beside practical ethical issues concerned with co-designing with vulnerable people (e.g. managing the informed consent), there are other challenges related to the fact that researchers and designers may feel insufficiently prepared for dealing with disable participants. In our project we involved an ethicist who supported us in facilitating the activity by ensuring an appropriate use of time (sessions were in total not longer than two hours with several short breaks), selection on the sign language interpreters and space set up. This turned to be a precious support.

Acknowledgements

Quietude has been developed in collaboration with a multidisciplinary team. I would like to thank Iolanda Iacono, Michele Tittarelli, Simone Guercio, Matteo Sirizzotti and Annamaria Recupero for their invaluable work on the human-centred design and system prototyping at the Santa Chiara Fab Lab of the University of Siena. I would also like to thank Gianluca Daino and Riccardo Zambon from T4All s.r.l. who developed the App. A deep gratitude goes to the Deaf people who participated to the workshops and to Miriam Grottanelli De Santi, president of Mason Perkins Deafness Fund Onlus who facilitated the contacts with the Deaf community.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Gazes and Gatekeeping: Reconceptualising the entrance portfolio in the post-colony

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Abstract | In South Africa, entrance portfolios and tests are widely used in student selection, as academic proficiency is considered an insufficient predictor of success in Design studies. These socially constructed conventions are powerful components of Design Culture and their frequently tacit criteria serve as invisible gatekeepers to the knowledge field.

Understanding these conventions require prior knowledge of Design. However, due to the distributive injustice of apartheid, many of the "born free" generation, who apply to study design at the University of Technology where this study is based, have had little or no formal art education.
This paper describes recent interventions made to facilitate a more inclusive and socially right student selection processes within the context of, and in response to, student protests demanding free and de-colonised higher education. Legitimation Code Theory provides the 'conceptual toolkit' to uncover and contest the knowledges and gazes most valued in entrance portfolios and tests.

KEYWORDS | HIGHER EDUCATION, DECOLONISATION, ENTRANCE PORTFOLIOS, LEGITIMATION CODE THEORY, GAZES

1. Introduction

In South Africa, where this study is based, entrance portfolios and tests are widely used to select students applying to study Design at university. These selection instruments are considered necessary, since academic proficiency alone is not considered a sufficient predictor of success in design studies. The socially constructed convention of the entrance portfolio is a powerful component of design culture and is widely used throughout Europe and North America (O'Donoghue, 2009). Its gatekeeping function determines which students are provided or denied access to instruction in the knowledge field and ultimately to the field of practice.

Prior to the dismantling of apartheid in 1994, the validity of entrance portfolios was premised on applicants' familiarity with these conventions, since art or design were part of the school curriculum for most white learners. The distributive injustice of apartheid ensured that the majority of black learners were denied this privilege. Twenty-five years later, the long shadow of this injustice still haunts the selection process. Many of the "born free" generation who apply to study design at our university, have had little or no formal art or design education.

This paper discusses recent interventions to address the unequal distribution of formal design knowledge amongst students applying to the Foundation year of an Extended Curriculum Programme (ECP) in Design, based at a University of Technology (UoT). The aim of these interventions was to make the selection process more transparent, inclusive and socially right. They were made within the context of country-wide student protests demanding free and de-colonised higher education, and in direct response to criticism of the selection instruments by members of the Student Representative Council (SRC) at the time of the protests. The SRC criticised the selection instruments of all the design courses, which they viewed as exclusionary instruments that discriminate against black students with little or no formal art or design education. This paper is a reflection on, and a response to, their question: *How can you test knowledge that has not been taught?*

To respond to this question, I will contextualise the ECP entrance portfolio and test within the discourse of decoloniality. I will then use Legitimation Code Theory (LCT) to establish what knowledges, which knowers and whose gazes are most valued in the ECP selection instruments and processes.

2. Context

This study is based at a UoT that offers vocationally oriented diplomas in Fashion, Jewellery, Product and Visual Communication design. It has deep roots in colonial- apartheid history

and racist ideology and is the result of a post-apartheid merger of two previously segregated Technikons, both established during the height of apartheid (CPUT, n.d., b). Unlike the predominantly middle class constituency served by research-intensive historically white universities (HWU), UoTs tend to attract students from middle, to low, income families (Badat, 2016).

Between 1994 and 2013, the number of black students enrolled at universities increased to almost 75% of the total student population (Cooper, 2015). However, graduation rates lagged far behind increased participation, largely due to the entrenched inequality of the school system inherited from apartheid. To address the articulation gap between school and university, Government-funded Extended Curriculum Programmes (ECPs), which extend three-year qualifications by a year, were tasked to provide "underprepared" students with "epistemological access" (Morrow, 1993) to disciplinary knowledges and practice (Luckett & Shay, 2017). Prior to the de-colonial student protests, the coloniality of many of these knowledges and practices, and of ECPs themselves, were not closely scrutinised by many academics working within ECPs (Luckett, 2019), myself Included.

The multi-disciplinary Design ECP, in its current form, dates from 2018, when two discrete Design ECPs merged. It accepts about 80 students annually. Most applicants apply directly to the ECP foundation year but some unsuccessful applicants from the mainstream first year design courses are referred. According to statistics obtained from student questionnaires from the past 2 years, 68% of ECP students have no formal art or design education, 85% rely on Government scholarships to study and only 35 % consider themselves proficient in English, the official language of instruction. The selection instruments for ECP, as for all four mainstream design courses, include a prescribed entrance portfolio and, in some cases, a practical test. All applicants thus respond to the same set of assignments, ostensibly to promote equality of opportunity. These are the selection instruments that student leaders found exclusionary and unjust.

At this UoT, no statistics are available to prove a positive correlation between entrance portfolios and first year scores. According to O'Donoghue (2011), the predictive validity and continued relevance of this widespread selection practice is under-researched. His longitudinal studies of entrance portfolios found that the strongest predictor of success in first year was the school-leaving certificate art/design score rather than the portfolio score. Since less than a third of successful Design ECP applicants have art as a school graduation subject, the validity, fairness and contextual relevance of the entrance portfolio and test take on increasing significance.

Between 2015 and 2017, students from this UoT joined country-wide protests demanding free and decolonised higher education. Although the Government met the students' demand for free higher education in 2017, the process of decolonising curricula and other forms of institutional culture is a work in progress, to which this paper hopes to make a small contribution.

3. Decolonisation

When student protests ignited around a statue of an arch imperialist on the campus of an elite historically white university (HWU), 20 years after political liberation, the entrenched coloniality and whiteness of the institutional culture of this university, and many other like it, were unmasked. According to Mbembe (2015), the real question was not about whether to remove the statue of Rhodes, but why it took so long to do so. The slow pace of transformation at South African universities is indicative of prevailing attitudes amongst many academics, whose arguments in defence of "academic excellence" and "equal opportunity" frequently mask entrenched racism and coloniality (Luckett & Shay, 2017). Coloniality and colonialism are not the same:

> "Coloniality …refers to longstanding patterns of power that emerged as a result of colonialism [and survives in] books, in the criteria for academic performance, in cultural patterns, in common sense, in the self-image of peoples, in aspirations of self and in so many other aspects of our modern experience" (Maldonado-Torres, 2007).

Students responded to these "patterns of power" in different ways, but common demands were for the decolonisation of the predominantly Eurocentric curriculum, for a pedagogy that embraces the diversity of students' life-worlds, for the transformation of skewed staff demographics and for the dismantling or re-structuring of many institutional practices and spaces experienced as alienating, exclusionary, racist, demeaning, and oppressive by black students and staff. "We can't breathe" became a much repeated refrain and alluded to the "suffocating" institutional culture of HWU in particular, where success for black students is premised on assimilation into an institutional culture that does not recognise or affirm the plurality of other languages, cultures and ways of knowing, doing and being (Badat, 2016).

To articulate their demands, students drew from a rich tradition of Black Consciousness and anti-colonial literature. Within the constraints of this paper, I shall foreground only those most salient for reconceptualising the ECP selection instruments from a de-colonial perspective.

Key for de-colonial scholars is how to epistemically re-frame hegemonic Eurocentric epistemic disciplines , canons and interpretive frames that constitute the curricula and institutional culture of post-colonial universities (Heleta, 2016; Mbembe, 2015). In Africa, these universities and their curricula were modelled on the modern 19th century European university, imported to the colonies as part of the colonial "civilising mission" (Mamdani, 2016). Thus, for Ngugi wa Thiong'o (1981), de-colonising the African university requires "re-centring" marginalised indigenous knowledges, knowledge practices and vernacular languages in contextually relevant curricula. This process of re-centring African epistemic traditions does not entail "closing the door" to epistemic traditions from Europe, but their de-centring in favour of a more diverse, epistemic pluralism (Joseph Mbembe, 2016; Ngugi, 1981).

Furthermore, the Western epistemic tradition is premised on the separation between the knowing subject and the object of knowledge. From this ostensibly neutral position, the knower claims to generate objective, "universal" knowledge (Mignolo, 2009). Castro-Gómez (2007) describes this position as *the hubris of the zero point*, a position from where, according to Mignolo, the knower "controls the disciplinary rules and puts himself or herself in a position to evaluate and dictate" (2009, p.4). To de-link from this hegemonic interpretive frame, Mignolo proposes engaging in *epistemic dis-obedience* by shifting the focus from the known to the knower, whom he assumes is always implicated geo-and body-politically in the known.

As is well documented, Western models of art education have their roots in Renaissance Europe, when the art academies wrested power from the craft guilds as centres of teaching and learning (Macdonald, 2004).This development marked the start of a separation between art and craft and between the conception of the artist as genius, superior in social status to the skilled craftsman, and requiring an education that the craft guilds could not provide. What is lesser known is that these novel concepts of art and the artist arose concurrently with the colonisation of the Americas in 1492, followed by the colonisation of the East end of Africa, heralding a modern world driven by capital accumulation and progress. Colonialism therefore constitutes the "darker side" of this modernity, which includes the violent dispossession, racist negation and enslavement of colonial subjects. Seen from a de-colonial perspective, modernity/coloniality are two sides of the same coin (Dastile & Ndlovu-Gatsheni, 2013; Grosfoguel, 2013).

The Rome Academy, established in 1633, remained the leading centre of art education in Europe for 300 years. During this time the academic model of art education spread from Europe to England and its colonies, followed in the 20th century by the teachings of the Bauhaus (Macdonald, 2004). Imported along with these pedagogies were hegemonic conceptions of art and design, of beauty, of the canon and of ways of visualising and representing the world. This euro-centric cultural heritage was and still is "pervaded with by the inequalities of class, gender, race and ethnicity" (Wolff, 1990). The entrance portfolio, with its gatekeeping function, is part of this heritage.

In order to conceptualise the "disciplinary rules" or knowledges and gazes privileged in the entrance portfolio/test I turn to Legitimation Code Theory (LCT).

4. Conceptual framework

LCT is a social realist sociology of education, developed by Karl Maton, which builds on Bernstein's code and Bourdieu's field theory (Maton, 2013). From the global north, LCT nevertheless provides useful conceptual tools for analysing socially constructed knowledge-

knower practices, including design (Dong, et al., 2015; Giloi, 2017; Shay & Steyn, 2016). In this paper I draw on one dimension of LCT: Specialisation.

Specialisation is used to determine the basis of achievement in knowledge fields and practices, the "rules of the game" (Bourdieu & Wacquant, 1992). According to Maton (2006, p.58) "knowledge is always about something and by someone". All knowledge fields consist of both epistemic relations to the object of knowledge and social relations to the knowing subject or knower. These knowledge-knower structures combine to create four specialisation codes, determined by the relative strength and weakness of the social (SR) or epistemic (ER) relations of knowledge: The specialisation codes thus enable the analysis of what counts as legitimate knowledge (ER) and who is affirmed as an ideal knower (SR) in a field of practice (Maton, 2006).

A *Knowledge code* (ER+/SR-) legitimates specialist knowledges of an object of study. *What you know is valued more than who you are.* In design, knowledges that can be communicated and evaluated reasonably explicitly conform to this code. A *Knower code* (SR+/ER-) legitimates *who you are* and privileges attributes and aptitudes, such as gaze. A designer's gaze is integral to the design process and to professional identity and refers to the designer's "voice", values and "eye". An *Elite code* (ER+/SR+) legitimates social and epistemic relations in equal measure whilst a *Relativist code* (ER-/SR-) privileges neither (Maton, 2013).

Acquiring a "gaze" enables the recognition of the legitimate evaluative criteria and the ability to realise these in legitimate texts (Bernstein, 2000). Maton (2013) extends the conceptual reach of Bernstein's understanding of gaze by distinguishing between four knower gazes: the born, social, cultivated and trained. These gazes are generated by the relative strengths of their subjective relations (SubR +/-) and interactional relations (IR+/-) to knower practices. Simplifying, gazes are social practices that specialise kinds of knowers in terms of both *who they are* and *how they know* through interaction with significant others. This study does not use the trained/blank gaze.

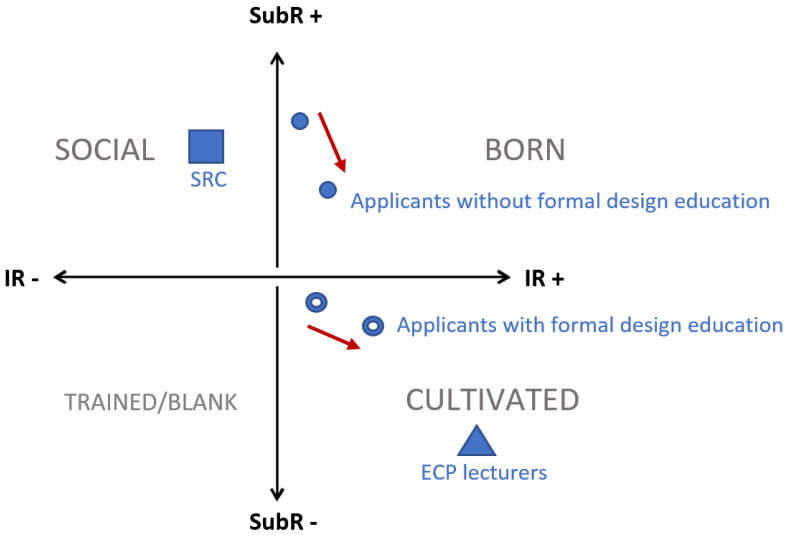

Figure 1. The social pane – gazes (Maton, 2013). Relative positions of the SRC, ECP lecturers and applicants, with and without formal design education.

A *Social gaze* (SubR+, IR-) is determined by social category such as race, class, gender or sexuality, where they are socially constructed as categories. Which *kinds of knowers* can claim legitimacy to this gaze matter more than *their ways of knowing?* The **social gaze,** within the context of this study, is shared by the SRC whose question challenges the "whiteness" of selection instruments that discriminate against black applicants with little or no formal design education. *Cultivated* gaze (SubR-, IR+) is an acquired disposition that strongly privileges legitimate interactions between significant others or ideal knowers (ways of knowing), but minimizes who you are (kinds of knowers). It is inculcated by an "ideal knower" through participation in communities of practice or acquired through sustained exposure to canonical works. Maton describes this gaze, which "resides in the mind's eye", as a "canon introjected" (2013, p.99). This gaze is shared by design lecturers responsible for student selection and applicants with formal art or design education. A *Born gaze* refers to inborn, "natural" talent and is a result of a genetic deposition. However, all gazes are socially constructed. This gaze therefore equally legitimates *kinds of knowers* and *ways of knowing* (SubR+, IR+). The ECP entrance portfolio requirements call for "some evidence of visual aptitude/ability… to study design"(CPUT, n.d., a), a **born gaze.** However, the legitimate "ways of knowing" attributed to the born gaze remain tacit in these entrance requirements.

5. Methodology

The practical component of the ECP portfolio, including recent interventions, provided the data for this study. Being a multi-disciplinary course, lecturers responsible for choosing the portfolio requirements, myself included, eschewed discipline-specific tasks in favour of observational drawing, to assess students' visual aptitude, visual communication skills and level of technical proficiency. These drawings included a self-portrait, a simple still life, a view of an interior, and a six-frame storyboard. For example, the self-portrait required that students "look in a mirror and make a carefully observed, freehand drawing of your head and shoulders (do not draw from a photograph or from your cell phone)". The still life, described as "an arrangement of objects on a surface", called for making "a freehand drawing from direct observation of three objects on a table top" (CPUT, n.d., a).

The ECP entrance test, to which local applicants were invited to attend instead of doing a portfolio, consisted of a still life drawing, paper construction exercises and an exercise to assess the imaginative use of colour and pattern. After a detailed briefing, students were left to work un-aided.

During the selection of students for the newly merged ECP in 2018 certain common mis-readings of the portfolio and test requirements came to light:

- *Portrait:* Drawings were either too small or too large for the page, stylised or lacking in closely observed detail, or they were drawn or traced from photographs.
- *Still life:* Lack of familiarity with the still life genre was evident in drawings where objects were either randomly placed on the page, arranged alongside each other, or drawn individually on three separate pages. Many applicants erroneously privileged the table/surface on which very small, out of scale, objects were arranged, devoid of closely observed detail.
- *Interior:* Poorly proportioned drawings of furniture, flat or floating in space, revealed lack of familiarity with canonical convention and the basic rules of perspective. Some interiors were evidently copied from the internet or invented with or without the aid of technical drawing.
- *Storyboard:* Ignorance of the conventions of storyboarding was evident in drawings depicting a continuous narrative instead of the required six-frame format and the use of text to explain the story.

Misunderstandings such as these are familiar to selectors and some of these admittedly indicate genuine lack of aptitude. But within the context of de-colonial protests, and the SRC's critique, they could no longer be ignored. This led to the three interventions aimed at making the gazes, valued in the entrance portfolio and test, more explicit.

The first intervention involved turning the entrance test into a lesson. Instead of the customary practice of leaving students to complete assessment tasks un-aided, lecturers remained in class to teach after briefing the students. This created an opportunity to make

the tacit conventions of drawing, composition, and construction more explicit. It also broadened the customary merit-based assessment criteria to include students' capacity to respond to being taught. To improve comprehension of the portfolio requirements, the second intervention entailed translating the entrance portfolio requirements from English into two vernacular languages widely spoken by students. The third intervention, aimed at making the tacit rules of portfolio more explicit, was to use visual examples of past applicants' work to illustrate desired criteria and mistakes to avoid.

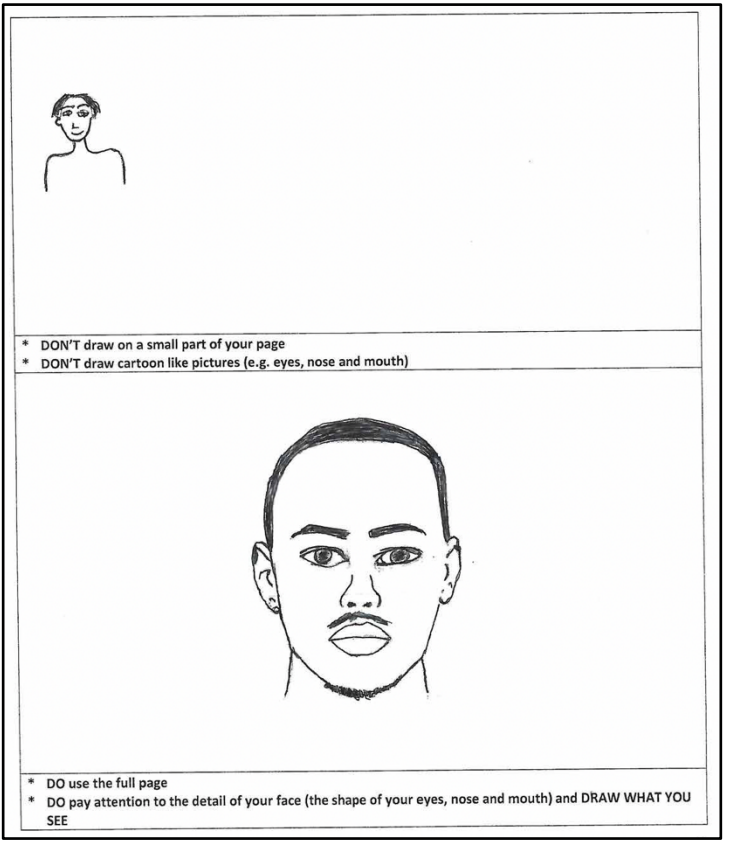

Figure 2. Poor and average examples of past applicants' drawings of a self-portrait included in the ECP portfolio.

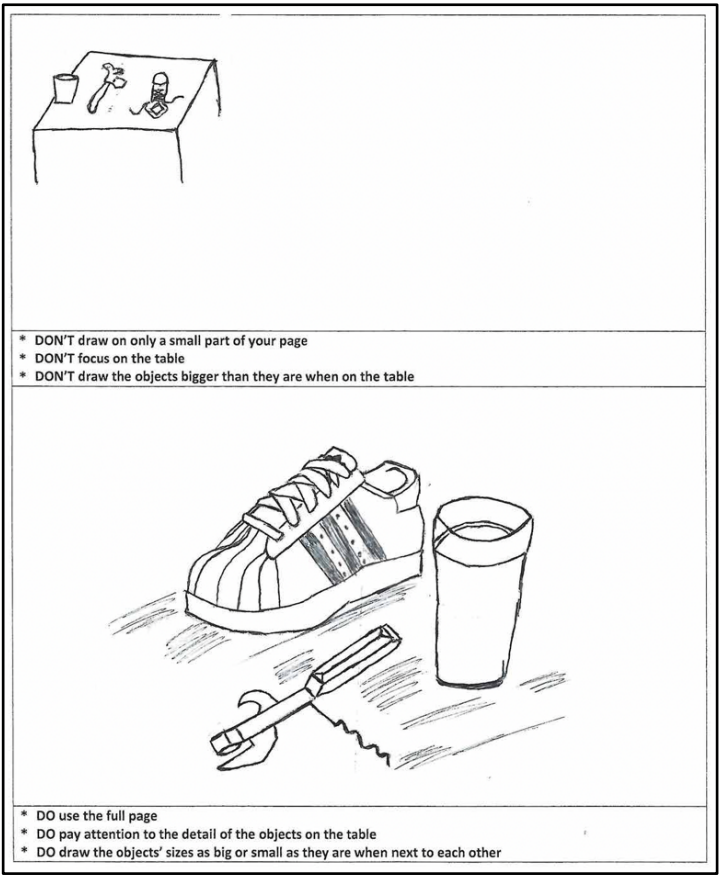

Figure 3: Poor and average examples of past applicants' drawings of a still life included in the ECP portfolio.

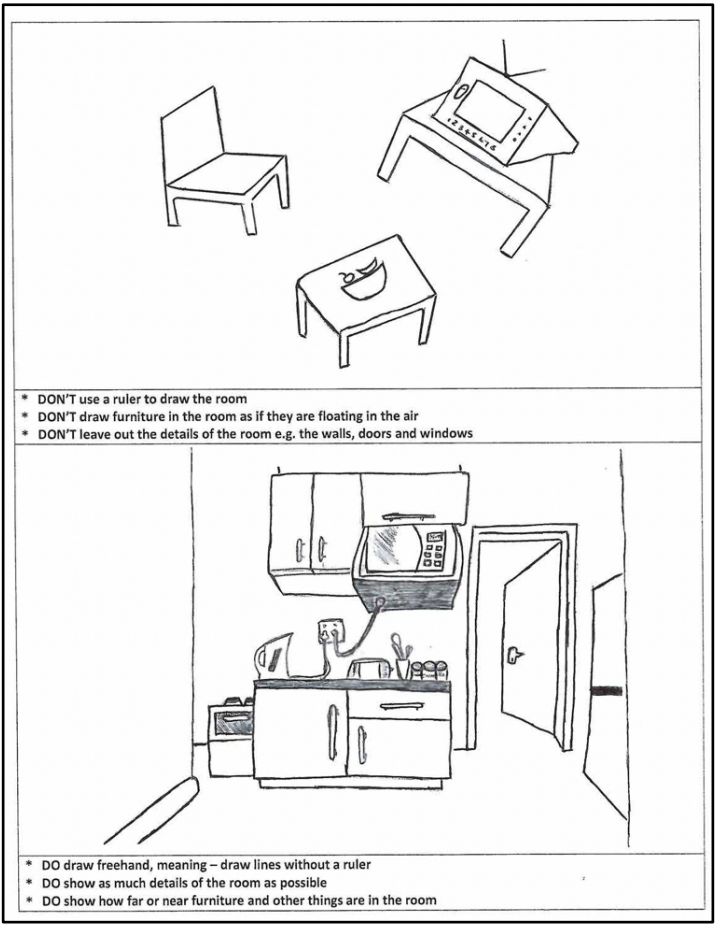

Figure 4: Poor and average example of past applicants' drawings of an interior included in the ECP portfolio.

6. Analysis

Analysis of the data starts with unpacking **the SRC's question**: How can you test that which has not been taught?

One possible answer to the SRC's question is that entrance tests and portfolios do not assess prior design knowledge but evidence of visual aptitude: a born gaze, that you either possess by way of birth, or not at all. This a-social and a-historical understanding of a born gaze places all applicants on an equal footing, regardless of their access to a cultivated gaze, to

ideal knower practices or whether their cultivated gaze is shared by the selectors. This position is not unique to South Africa. O'Donoghue' (2011) describes how, by appearing to privilege inborn talent over familiarity with and access to the cultural capital valued by art and design schools, the entrance portfolio creates the illusion of equal opportunity whilst maintaining the status quo. What is significant in this familiar response, is that the born gaze is associated exclusively with a biological disposition and that the social construction of this gaze by means of interaction with significant others is ignored.

The SRC's question is rhetorical. Implicit in it is full awareness that "which has not been taught" refers to a cultivated gaze that assumes familiarity with the hegemonic Euro-centric canon and ways of visualising and representing the world. Adopting social gaze, the SRC's question thereby challenges the coloniality and exclusionary whiteness of selection practices that discriminate against black students with little or no formal art/design education. Their question exposes a discriminatory practice masquerading as equal opportunity, a practice that downplays the significance of a cultivated gaze by claiming that a born gaze is all that matters.

The first of the three interventions, made in response to the SRC's question, was to turn the entrance test into a lesson.

Significantly, this is an acknowledgement by selectors that using a born gaze to justify withholding instruction is an exclusionary practice. It is also an attempt to address the unequal distribution of formal design knowledge amongst applicants attending the test. By acting as ideal knowers, the lesson provides lecturers with an opportunity to engage with applicant and to make the legitimate ways of knowing, that structure the test, more explicit. It strengthens interactional relations (IR) of the gazes of applicants with and without formal art education (Figure 1).

Using examples of past students' work similarly attempt to "teach" applicants which kinds of knower and ways of knowing are considered legitimate by the ideal knowers who evaluate portfolio submissions. Visual examples provide some access to the tacit conventions imbedded in the portfolio. As with the taught test, they strengthen the interactional relations (IR) of the gazes of applicants.

Although it is too early to quantify, these interventions appear to have increased the number of successful applicants. Unfortunately, the values of these interventions are limited by their failure to address the hegemonic canons and interpretive frames that constitute their content. The portfolio's capacity to elicit evidence of visual aptitude is particularly constrained. All three drawings and the storyboard assume some exposure to the hegemonic canon and call for very particular and culturally specific forms of visualisation and representation. Furthermore, the choice of prescribed portfolio content doubly disadvantages applicants without formal design educations, since they lack familiarity with the legitimate gaze, and they are denied of the opportunity to demonstrate their aptitude to study design in more diverse and contextually relevant ways.

Re-centring marginalised vernacular languages are key to the decolonisation project. Considering that English is the mother tongue of only 35% of applicants, it is not surprising that the portfolio requirements are frequently misunderstood. Translating the portfolio into two widely spoken vernacular languages is therefore a significant act of decolonisation that affirms the life worlds of applicants.

Finally, by recognising that more than 60% of applicants to ECP have little or no formal art or design education, these interventions de-link the ECP selection instruments from the ideal student (Luckett, 2016) of the past, middle class, English-speaking, probably white and in possession of the privileged cultivated gaze.

7. Conclusion

The analysis of the ECPs selection instruments, with the help of the specialisation codes, makes visible how the gatekeeping function of this this socially constructed knower practice is constructed and maintained.

From a decolonial perspective, the analysis demonstrates how hegemonic patterns of power, brought from Europe during the colonisation of South Africa first by the Dutch and later by the British, can persist, uncomfortably and at times unnoticed (like the statue of Rhodes) in "common-sense" practices of design culture like entrance portfolios and tests. Common misunderstandings of entrance requirements demonstrate the marginalisation of applicants who are not familiar with canonical genres and practices and for whom English is not their mother tongue. The analysis reveals how conceptualising portfolio from a point zero position can mask cultural bias and negate the life worlds of applicants who do not conform to the normative, "ideal" student, well versed in the "right" kinds of design knowledge. Finally, the analysis shows how the narrow forms of visual representation favoured by the prescribed ECP portfolio exclude other, more diverse ways of demonstrating aptitude for design studies.

In conclusion, the interventions discussed in this study can be understood as examples of a social realist perspective, intent on providing applicants with "epistemological access" to disciplinary knowledge. Providing epistemological access to the cultivated gaze of the discipline is a valid response to the SRC's question. But from a de-colonial perspective, these interventions, with the exception of the translations, could be viewed as an erring on the side of assimilation into the normative euro-centric gaze (Luckett & Shay, 2017). Decolonising the selection instruments require de-linking from this gaze, re-reading the canon, re-centring marginalised design practices and ideal knowers, and affirming plurality of expression. Such a de-linking does not entail doing away with entrance portfolios and tests but rather provides an opportunity to re-imagine more diverse, inclusive, and contextually relevant ways of predicting success in design studies.

For me, as a white academic involved in student selection, this study is both an admission of having been implicated in a discriminatory practice and an act of abandoning the hubris of the zero point. This study was motivated by a question, and I conclude with another, which may have resonance beyond the post-colonial South African context: how can we further re-frame an exclusionary and under-examined practice of design culture?

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Acknowledgements: The author would like to the Conference Committee of CPUT for their financial support.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Hybridity as a culture of making

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Abstract | Using an experimental design course for industrial design undergraduate students as a case study, this paper explores which new approaches towards design education can be applied to foster a contextually-based practice. Understanding design as a fundamental trait of being human (Heskett, 2002, p.4) and a key factor influencing the quality of life, the authors argue for design education informed by both practical and theoretical research in order to encourage cultural hybridity.

KEYWORDS | DESIGN EDUCATION, EXPERIMENTATION, HYBRIDITY, INDUSTRIAL DESIGNDESIGN METHODS

1. Introduction

In the second decade of the 21st century, Design education poses multiple challenges, especially on the undergraduate level, that is still perceived “as a means to achieve financial security and upward mobility” (Ilhan, 2017, pp. 17-21). Given the background, the industrial design field has been in a turning point for many years and is in the ongoing process of defining itself anew between rapid technological, environmental and societal changes (Richardson, 1994). Within this context, we believe that design education must move beyond skills-based one and service-oriented, in which the role of the designer is mainly defined as problem-solver, towards a more manifold approach, fostering a contextualized practice (Abdulla, 2018). We understand contextualised practice, as one that is connected and relevant to the milieu (Abdulla, 2018, p.156). In order to achieve it, the content of design education has to be connected to the reality of the students and has to encourage them to look for their narratives and contribute to the plurality of design expression. Consequently, to challenge the outdated epistemology of design practice and distort – as decolonising design (Abdulla, et al., 2018) puts it – “a hegemonic discourse of design centred around functionality and the rhetoric of neutrality”, we must develop new ways of teaching, learning and thinking about design that explore “other ways of worlding” (Escobar, 2018, p.65). This paper examines how hybridity can contribute to developing practice-based design curricula that foster experimentation, interdisciplinarity and dissolve the polarity of theory and practice (Findeli, 1994). “La Cultura del Fare” (from Italian: the culture of making) a course in which we have taught, serves as a case study, opening a wider reflection upon design education. In this text, we do not want to offer a universal solution, or a recipe, we rather describe the method and structure, as part of our ongoing practice-based research on design education. The course was held as a one-semester main long studio class within industrial design undergraduate course for the fifth-semester students.

2. Hybridity as Approach

Conceptualising the syllabus for the course, we use hybridity as a starting point. Perceiving design as a modality, we explore hybridity as an inherent part of cultural expression. Even though, as stated by the Palestinian philosopher Edward Said, since the Enlightenment, the West has been trying to separate “cultural and aesthetic realms from the worldly domain” (Said, 1993, p.68) , we believe that they have to be rejoined. Within this context, design education, as an intrinsically cultural practice, offers an opportunity to explore the ways of developing practices beyond current boundaries of methodology and aesthetics employed in the field of product/industrial design. We understand hybridity not only as merging of different and contradictory entities (Davendorf & Rosner, 2017), rather as a fluid category that allows exploring new ways of making design, as well as transcending the static idea of product identity. Here we draw from Jamaican cultural theorist Stuart Hall, and his idea of fluid identity that is never-completed, always in the “process of becoming – a process of

shifting identifications, rather than a singular, complete, finished state of being" (Hall, 2017, p.16). Within the course, we wanted to see how we can encourage students to reflect upon their diverse identities, the cultural, historical identities of used materials and technologies, and product identity in general. Therefore, unlike many industrial design courses, we decided not to work with a product-brief or established guidelines that limit and hinder experimentation, rather we explored and developed methods fostering reconfigurations, blending modes of designing and producing. Drawing on Paola Antonelli's concept of "thinkering"[1], we focus on maker experimentation as a device for innovation, encouraging hybridity. Within this framework, we understand hybridity as inherent cultural expression, questioning universalism and modernist tradition, that still form some of the most important references of design. Hence, we wanted to explore how this way of working can contribute to different ways of thinking about products and teaching design.

Believing that "it is impossible today to act without knowledge, or to know without doing" (Maldonado, 1967, p.12) as stated by designer and educator Tomas Maldonado, we examine how to unify the theoretical and the practical framework within the course, in terms of both what we design and how we design and teach. The how is as important– in our approach– as what. Within our model, we are researchers and, according to design educator Danah Abdulla, the test theory in practice, studying and evaluating our work, in order to refine our understanding and improving it (Abdulla 2018, p.89).

In assuring that students know exactly what this course builds upon, we created a structure that was presented to them at the beginning. Defining a structure and methods was also crucial, on the one hand, to organise our aims and goals, on the other to be able to analyse the process. As an educator, Johanna Lewengard eloquently puts "Focusing on methods that help us to identify gaps between intention and outcome, and using a broad set of tools for analysis [...] creates a more holistic view (of design)" (Crippa, et al., 2019).

Traditional design methodologies, especially within a market-oriented field as industrial design, use applied science as main logic and involve working with a product-brief that predefines a set of questions and problems inquired and looks to find solutions. Within this model "good design is the outcome of an inspired syllogism" (Antonelli, 2012) and design education often aims at ensuring that this linear process takes place. Questioning this approach, as it limits design outcomes and aiming at educating reflective practitioners (Schön, 1987), we focus on fostering situated, relevant, research-informed design practice.

So, hybridity also refers to our pedagogical outlook. On the one hand, we have the transformation method, the starting point for experimentation, on the other, we examine to what extent the design research, conducted in parallel with the practical hands-on one, makes it possible to contextualize projects regarding their historical, social, and

[1] Thinkering – «combination of design thinking and tinkering that involves strategic disruption, realistic application and maker experimentation». (Walker, 2015)

technological dimensions, thereby supporting the development of the concept and the making of design decisions. Within the course, we analysed how choosing an integrated educational approach, instead of separating design history from design theory and research from praxis, extends product development through varied dimensions and perspectives, opening up a forum for discussion on the future of design within the industrial design field.

3. Conceptual and theoretical principles

3.1 Background

The research on hybridity as a method started in 2002 with the project "If we could knit wood: Transformation in arts and crafts." The project analysed the processing techniques in the traditional craft workshop and formulated new approaches using digital processing methods. The idea was to pair processing methods with materials that are not processed this way (e.g. knitting wood). Further iterations included different workshops and enabled to quickly test the pairing method and see its potential for further application. The formal results were promising, but due to time restrictions, they stayed on the stage of the material experiment as a sample, rather than becoming a product or an object. Therefore, it was clear that, to fully explore the possibilities behind the method, a longer project was needed, ideally within a design education framework. This was possible in the "La Cultura del Fare", a course offered as the main studio to the fifth semester undergraduate students, that we discuss in this paper.

3.2 Method

Traditionally design is understood and taught as a problem-solving practice (Abdulla, 2018; Escobar, 2018; Findeli, 1994), in which designers choose from a set of practical methods and procedures that adapt to the problem. Designers often rely on their visual and cultural memory, that guide them exploring possible solutions. Traditional methods and processes are deeply embedded in the designer's tacit knowledge and can be therefore limiting.

Aiming at challenging the implicit solutions and normative visual and form languages, we developed a new approach to tackling product development. The rationale behind was to enhance the experimentation beyond the known ways of making and its visual, tangible representation. This approach poses particular challenges as people generally prefer to choose familiar systems and procedures that give them security rather than face new, unfamiliar ones. Even though designers pride themselves to be innovative, design still reproduces consciously or not "universal" norms and adheres to specific Modernist aesthetics. (Ahmed 2019; Escobar 2018).

"The culture of making" course explores the notion of cultural hybrid, through hands-on research of materiality, tactility and fabrication processes, going beyond the generic

understanding of what “making” and just “experimenting” means. Instead, it focuses on cultural and historical narratives embedded in processes, materials and their visual, formal, utilitarian manifestations as products of industrial design. In this context, the emphasis of the course was on hybridity, using advanced digital manufacturing methods and the transformation of traditional production modes, in order to create culturally and technologically determined hybrid artefacts. Introducing “Hybridity as a culture of making” we believe to facilitate the design of products , that go beyond only formal considerations and rather are rooted in the cultural experiences of the students. It also brings a framework for expanded creativity and experimentation and enables a disciplined way of working.

The developed design method applied in the teaching process separates material and processing method, by the unorthodox pairing of ubiquitous materials (metal, wood, clay etc.) with action verbs (baking, blowing, weaving, melting etc.). The term “sawing wood”, for example, implies a clear image of the material and processing/treatment of the surface, without the students having ever had sawed wood themselves. This tacit knowledge is based on memories, experiences, and personal value systems. In contrast, the term “knitting wood” cannot be assigned to a stereotype. It has to be interpreted through a creative process or reframing. This approach allows students to avoid their processes becoming restricted by culturally conditioned or stereotyped strategies, during experimental phases.

Working with digital production modes played an important role in the process, as with the help of computer-aided design and production, we can radically question the basic typologies that have emerged in the history of design and work with new ingredients, often using form languages and expressions (e.g. ornamentation) countering dominant visual narratives. We do not employ “hybrid craft” as a way of mixing analogue and digital modes in order to extract “the best aspects” from both processes (Davendorf & Rosner, 2017), rather first we immerse ourselves in the experimentation phase, allowing to fully explore the creative possibilities of different fusions and this implies that the mixed categories are not fundamentally opposite. Therefore, we envision the hybridity as a culture of making, being a process of binding categories together, instead of emphasising the differences. The beginning of the process should be playful, without rigid rules on what is right or wrong, and be an interaction between media and experimental techniques.

3.3. Course

The starting point of the course was an intensive one-week long workshop “Transformation 01” that set, in many respects, the groundwork for further explorations in the studio class.

In a series of 1:1 design exercises, students experimented with familiar materials through challenging, unorthodox operations (e.g. baking, knitting, cooking, weaving, melting etc..). Through surprising pairing (material – action verb, see Table 1), the goal is to provoke the students to go beyond their familiar perception of materials, traditional manufacturing/processing methods and to reinvent the notions of known and familiar to produce unexpected results. Students worked in pairs or small groups defining together

hypotheses and goals, moving fluidly between making activities that allow releasing of thoughts and rational calculations of ideas to be tested by making. The interchange between intuitive response (hands-on modelling) and conscious assessment (discussion and analysis within the team), creates the crucial balance that enables to progress to new findings.

Table 1. Transformation 01

Action Verbs	Material
Sawing, bending, folding, embossing, knitting	Metal
Binding, cutting, casting, moulding, scrolling,	Wood
layering, weaving, embroidering, carving, cooking, impregnating	Paper
	Casting Materials
Pressing, stretching, spanning, knotting, perforating, breaking, heating, cleaning	Leather
Milling, binding, boiling, splash, coloring, peeling, wrapping, chopping, melting, soldering	
Bloating, cutting, carving, etching, sticking	
Refining, welding, shrinking, grinding	

The inherent qualities and properties are experienced on a 1:1 scale, stripped of their conventional context, and set within the new framework of knitting, casting, dipping, coating, blowing, coiling, revolving, pleating, weaving, spinning etc. Through experimentation with surfaces, volumes, colours, states of matter, students translated the given material, through their lens, and transformed to three-dimensional units, specimens and objects (not yet necessarily functional), following the logic of the assigned operation/action verb (e.g. knitting).

After this intensive experimentation process, a common “bank” of experiments was created, out of which students could freely choose those for further development. Within this process, it was important to dissolve the individualistic, possessive approach towards the work and to open it for everyone. Consequently, students could engage in collaboration and co-creation of knowledge in a more horizontal way.



Figure 1. Folding + Casting Material: an example of experiments from Transformation 01 exercise.



Figure 2. Cooking + Wood: an example of experiments from Transformation 01 exercise.

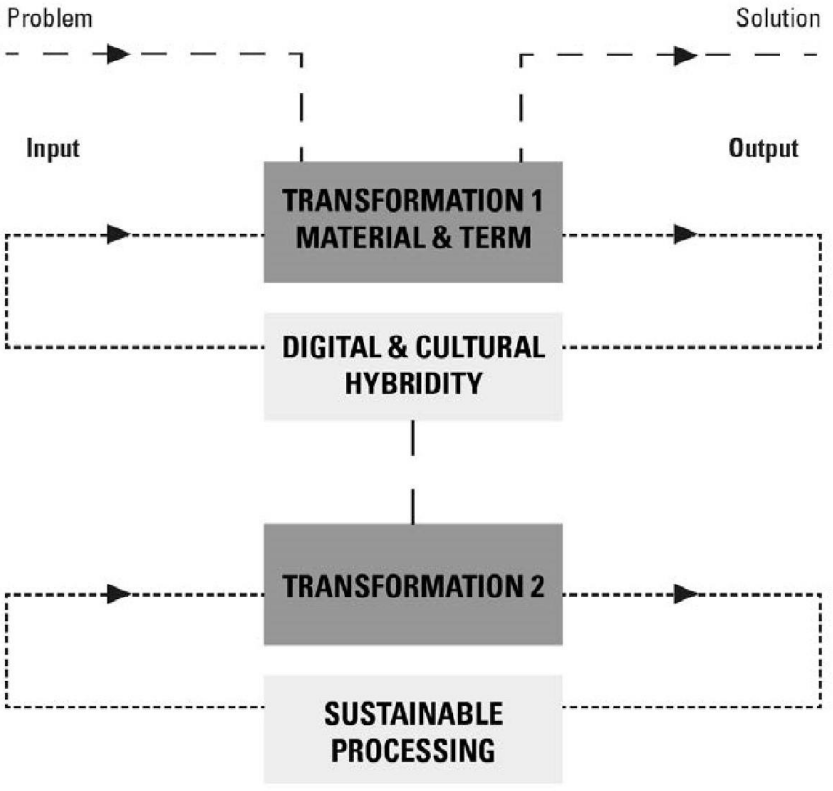

Figure3. Scheme showing the ways of working within the course.

In the following steps of the process, students had to translate the experiment into an object/product. In order to achieve it, students were asked to develop a research question, rooted in the chosen experiment, to guide them through the process. They were also encouraged to research the history behind materials, production processes and to locate and relate them to their own positionalities and identities. This process, working with a research question and investigating instead of just "simply" making, was challenging for undergraduate senior year students, who in the course of their design education got used to working with a product-brief, responding to clearly defined problems. Suddenly, we asked them to completely change their way of working and designing, as well as we required a research layer to inform their projects. Informing their practice through research, not focusing on solving problems, rather infusing with knowledge and at the same time interrogating their own position, culture and identity, opens diverse possibilities for the

pluriverse (Escobar, 2015). Below we will describe two projects that in our opinion show how this method is useful for creating contextualised design practices.

4. Projects Examples

Both examples show two radically opposed design approaches that emerged within the course and informed pluriverse way of designing, enabling students to find their voice within the practice. One informed by a historical research, the second by material and form research through designing and experimenting. We believe that this way of teaching design, applying hybridity in the process, enables a lot of flexibility and at the same time provides students with a structure fostering contextualisation of their practice.

4.1. Knitting Metal – an example of creating a history-informed practice

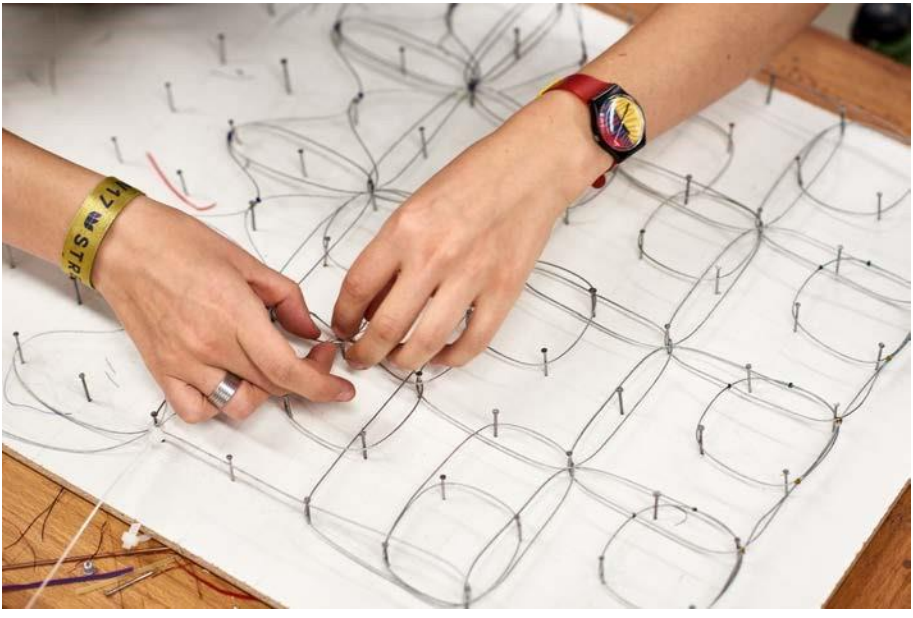

Figure 4. Knitting metal: an example of experiments from Transformation 01 exercise.

Starting the experiment with metal and the verb “to knit”, one group of students created a myriad of different samples, knotting, twisting, weaving wires, cables, rods, eventually achieving surfaces very similar to the actually knitted wool. In order to continue further with the project, they stopped the process of experimenting and researching by designing and focused on the history of knitting. By reading the history of this craft, they observed how the position of knitting shifted due to the industrial revolution. Before, hand knitting was a

highly valued craft performed by trained craftsmen part of a guild, often performed in the public space. The mechanisation of knitting, changed craft's status, and hand knitting became mostly a feminine activity bound to the domesticity. This information was interesting for these two students, as they looked at the internal hierarchies within design and how some forms of making are highly valued, and therefore categorised as design, while other practices are made invisible and excluded (knitting being one of them) (Buckley, 1986). They analysed the transition of knitting from the public to the domestic sphere and then its re-claiming by the feminist movement and the Women's March in form of a "pussyhat". Studying the history of knitting they formulated a question "How to bring knitting from the domestic to the public? How do we let the emotional to influence the mobile character of the object?". These questions guided their further design process. Aiming to bring knitting to the public sphere, they decided to work on a structure that could be implemented outdoors. Therefore, they chose a thicker metal rod that they knitted, to create both stability and flexibility. Knitted meshes enable bouncing back and forth and the rocking and its playfulness, induce an emotional response and become part of the project. At this point the function is defined as a rocking stool for outdoors. Trying to blend between the domesticity of knitting and the material landscape of urban space, the designers decided to use cast concrete, that got reinforced with the metal knitted rods, to create a sitting surface of a rocking stool. The project goes beyond the dualisms of public/private, urban/domestic, soft/hard, feminine/masculine, rather focuses both/and. Using hybridity as approach enables to dissolve the dichotomies and to mesh the categories together, creating a playful object, which identities are narrative, rather than pre-defined. Looking at the design process, we can also assert that theoretical considerations directed experimentation and the other way around, so the proposed methodology enabled both theory and history-driven exploration as well as free material-based experimentation. This helps add another layer of knowledge and allows students to use their positionality and their lived experiences as women to influence the design process.

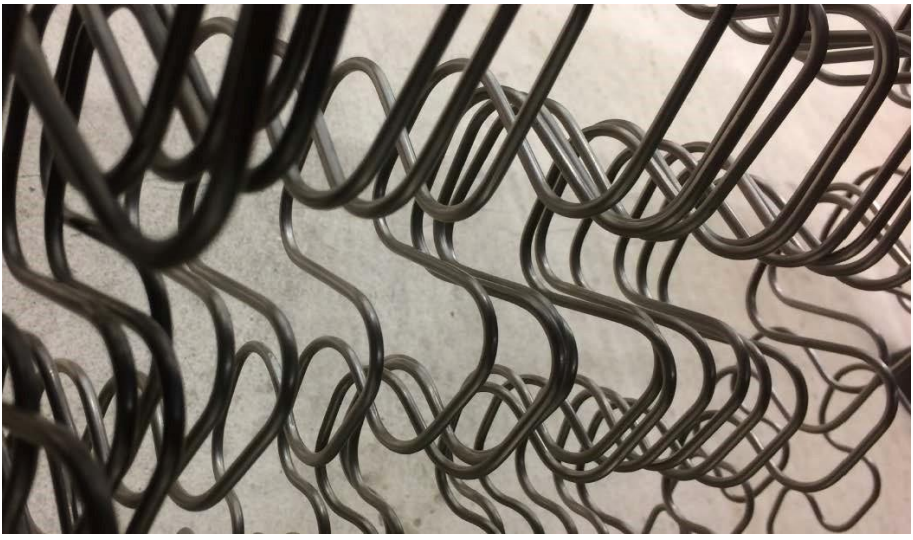

Figure 5. Knitting metal: work in progress.

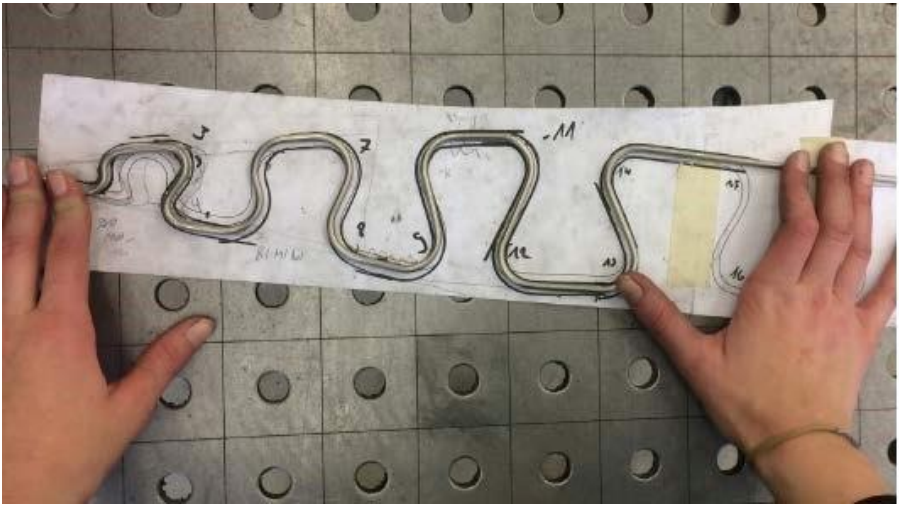

Figure 6. Knitting metal: a stencil to knit a metal rod.



Figure 7. Knitting metal: the final result, a rocking stool for a public space.

4.2. Printing textile – sustainability in experimental context

We believe that this method can also help to enhance the sustainability of the production process. While conventional design methods create products and this dictates lifestyles, the experimental phase inherent to hybridity enables deeper comprehension of manufacturing processes. Speaking about sustainability we are not interested in the superficial understanding of the term as “green materials”, avoiding production waste or separating product parts at the end of the life cycle, rather we explore the possibility of redesigning the whole design process in a sustainable way.

Printing textile was a starting point for one of the students, who after the experimentation phase in which he worked with textiles, focused on merging printing with felt. The student who was a 3d printing tutor during his studies, challenged himself working with fabrics, material not necessarily present in industrial design curricula. He explored what happens when we 3d print directly on felt, creating joints connected to the material, without any additional elements or adhesives. In the process, he developed joints 3d printed with the PLA filament on felt. Their geometry enables to insert easily wooden legs and therefore shaping felt into a three-dimensional ergonomic seating surface of a stool. He drew from his technical pre-university education as draftsman and his experiences as 3d printing tutor. In the process, he defined his visual background as a technical one and let this aspect inform his design. Instead of working hands-on with materials, he sketched using a CAD software different possibility, and then printed them and tested out. A multimaker printer was used in the process, which shows how this design could be easily reproduced using home or semi-professional 3d printers, opening the accessibility and production for a wider group of users, avoiding transportation costs and its environmental footprint. The concept can be also scaled on the commercial scale, enabling a producer to manufacture the stool at the retail points, without being bounded to a specific production facility, producing the furniture in-store on demand, rather than having a stock. So, applying hybridity, the student discovered new potentials for the design and included sustainability as an inherent part of the process, thinking as well about potential business models for the further development of the project.

5. Conclusions – towards a contextualised design practice – why is there a need for new methods?

Traditional design methods focus purely on solving pre-defined problems, leaving some possibilities unexplored, and limit design practice. We argue that methods, focusing on the strategic role of experimentation in the design process, informed by theory, history and research, open up alternatives to the solutionist understanding of design and foster innovation, outside of the established traditions. Experimentation and research, in this view, are not contradictory, polar categories, rather mutually shaping ones.

Design education is in our opinion a crucial framework to research and explore new design methods for industrial design, that is difficult to achieve within the industry-based structure, driven by free-market considerations. In this respect, the undergraduate studies are fundamental as they give the first insight and lay the ground for future design practice. Therefore, within our course, we wanted to create an environment in which students can explore their respective cultural identities, their memories, their experiences, their backgrounds not in a theoretical way, but in a practical one. Reflecting on how who they are, what they know, influences what they do.

Even though reflexive design practices are fostered in many other design courses (Levengard, 2019; Abdulla, 2018; Escobar, 2018; Ahmed, 2019) industrial design education is still very service and market oriented. The contribution of "Hybridity as a culture of making" methodology sheds light on how we can shift the ways of teaching design practice, creating a framework that is student-centered, history and theory informed and experimental at the same time. The novelty of the course, within the industrial design undergraduate studies, is the way of how this pedagogical approach, together with the developed design method, foster enquiry and innovation and enable students "to become active learners who engage with the world around them" (Abdulla, 2018, p. 292).

The presented approach is not an easy one, it demands from the educators and from the student's commitment to contribute to the process. This way of teaching is also much more time-consuming as students were challenged by the new way of working, radically different from what they have learnt so far. As the example of two students who looked at knitting shows, using their positions as women and their experiences working with male-dominated discipline (one is a carpenter), motivated them to inform their project through gender perspective. Investigating the history of this production method, helped them to contextualise the project and ultimately guided further design decisions. Offering a space that merges theory and practice, examines to what extent the design research conducted in parallel with the practical hands-on one, makes it possible to scrutinise projects regarding their historical, social, and technological dimensions, thereby supporting the development of the concept and the making of design decisions. Within the course, we analysed how, instead of separating design history from design theory and research from praxis, choosing an integrated educational approach extends product development through varied dimensions and perspectives, opening up a forum for discussion on the future of design and design education, within the industrial design field.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Hyper-Contextual Futures in Mexico City

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Abstract | This paper focuses on the activities undertaken by the Global Futures Lab Observatory in Mexico City (GFL/MX). The Observatory aims to provide hyper-contextual future visions through techniques and methodologies that range from critical design and traditional future forecasting to speculative anthropology. The core of the initiative is the will to address the lack of diversity within the speculative design field, heavily based on Northern European and North American perspectives. Since the start of the GFL/MX initiative in 2017, different cohorts of Mexican students have been invited to develop future scenarios in which identity and cultural factors have priority over technology and the dominant ideas of progress. In these pages, we will analyse the pedagogical model of the GFL/MX workshops. We will also illustrate some best practices for culture-based future thinking and finally, we will reflect on the students' outcomes and how they relate to specific cultural nuances.

KEYWORDS | SPECULATIVE DESIGN, DESIGN DECOLONIZIZATION, SPECULATIVE ANTHROPOLOGY, MEXICO

1. Introduction

Critical design, speculative design, design probes, and design fiction are some of the interchangeable terms that describe a particular type of design that merges product design, future forecasting, and scenario building to create fictional but credible/plausible objects, presuming certain technological, sociological, political or economic hypotheses were confirmed. The lack of diversity of most of the future visions depicted in the last decade is one of the main problems associated with these specific design disciplines. “Do we really want to foist our hates and fears on the rest of the world? Aren’t there many alternative futures out there, in the hearts and minds of silenced cultures worldwide, that we should seek out and nourish?” (Dator, 2019, p.162).

The Global Futures lab Observatory in Mexico City is a spin-off of the research project Global Futures Lab (GFL) started in 2016 by Rhode Island School of Design, Professor Paolo Cardini. The GFL aims to collect “souvenirs from the futures” from different parts of the world, celebrating different dreams, dreamed through the lens of deeply contextual and subjective speculative design exercises. The implied universality of most of the speculative design proposals produced between northern Europe and the United States in the last two decades, together with an omnipresent western technological determinism, failed in creating a pluralistic dialogue around different cultural identities and their ideas of the future.

The specific relation between temporality (time) and cultural context (space) applied to future thinking defines the boundaries of the research framework analyzed in this paper. The future can relate to space and time in four different combinations:

- **Undefined time and undefined space**
  When either time and place are unknown, we usually observe the presence of Utopias and Dystopias. Whether they picture idyllic green skyscrapers or dark underground worlds, those representations tend towards stereotypical ideas of future, often lacking cultural representations and always too far from any tangible reality.

- **Defined time and undefined space**
  Future scenarios in which the timeframe is set but lacking of any contextual information, could give birth to dominant perspectives. Different cultures have different perceptions of time and this eventually leads to different definitions of progress. The linear perception of time, for instance, is merely a Western position, while in many cultures time has a cyclical form.

- **Defined time and defined space**
  When we work within a defined time/space dimension, we usually observe a more rational exploration of implications, risks, and opportunities related to plausible future events. This is the case for foresight methods which have been used since

the first half of the twentieth century and utilize systematic and pragmatic analysis of data to extrapolate credible future projections.

- **Undefined time and defined space**
  Finally, when we have an absence of time constraints but within a defined space, we are dealing with concepts like Eutopias or Eupsychias. The first ones are attainable futures in the real world while the second is an aspirational state or inner "utopias". In the presence of a clear context definition, "If we release future from its temporal constraints, we can open a fruitful analytical path that demonstrates the role of "future" in creating everyday social worlds" (Salazar, et al., 2017, p.127).

Global Futures Lab Observatory in Mexico City (GFL/MX) is based on the last two concepts. The clear definition of the "place", or more specifically the cultural context, has been set as an indispensable condition to the various design briefs. Time, on the contrary, could switch between determined, as in traditional future forecasting methods and undetermined, as in critical design practices.

Together with Future Studies and Critical/Speculative design, speculative anthropology is the third discipline completing the pedagogical framework of the GFL/MX. In particular, the study of societies' material culture is of great interest in this research context. The creation of fictional artifacts, or diegetic prototypes (Kirby, 2010), belonging to specific future cultural contexts, can help the understanding and familiarization with those scenarios, often very difficult to grasp without any tangible representation: "Objects and tools represent a particular field of investigation; they land themselves much better to be used as keys in the interpretation of complex relationships" (Poli, 1973).

The creation of "new and fantastic" artifacts rooted in a strong cultural framework is a key element to mitigate a ruling capitalist technological determinism. Objects and products, as well as technology, when not indigenous but adopted, can be dangerous imperialistic and colonizing entities. Across design history many projects, like Papanek's low-tech radio receiver for "underdeveloped" countries (Clarke, 2018), or Negroponte's One Laptop for Child project, have sent the problematic message that everyone can't wait for the blessing of the Western culture and technology to start envisioning their future (Srinivasan, 2017, p.3).

The central concept of the GFL/MX is the search for hyper-contextual futures and the rejection of universal concepts as "commonality" or "humanness" being historically tools of white, European epistemological and territorial colonialism (Valentine & Hassoun, 2019, p.245). Moreover, fostering the creation of future visions strongly connected with specific cultural identities will encourage the passage between the passive condition of "waiting for" a pre-packed universal future to the active condition of "waiting to" the one locally thought and built (Appadurai, 1990, p.127).

2. The Global Futures Lab Observatory in Mexico City

In 2017, students from the CENTRO Advanced Design Institute in Mexico City have been invited, together with many other international institutions, to take part in the Global Futures Lab initiative participating in a series of workshops titled “Souvenirs from the Futures”. After that first collaboration, Paolo Cardini, Professor at Rhode Island School of Design, and Karla Paniagua, director of Centro’s master program in Future Studies (Diseño del Mañana/Design of Tomorrow), decided to establish a permanent Observatory in Mexico City and to include the Global Futures Lab workshops as an integral part of master's curriculum.

CENTRO Advanced Design Institute has a Futures Studies graduate program since 2015. The framework of this program provided an adequate territory for this experience, considering

> “The purposes of futures studies are to discover or invent, examine, and evaluate and propose possible, probable and preferable futures. Futurists seek to know: what can or could be (the possible), what is likely to be (the probable), and what ought to be (the preferable).
> In the words of Toffler, futurists try to create new, alternative images of the future —visionary explorations of the possible, systematic investigation of the probable, and moral evaluation of the preferable.” (Bell, 2003, pp.73-74)

The Futures Studies program consists of 2 semesters during which students learn and practice methods and techniques including Futures Wheel, Trend Impact Analysis, Structural Analysis, Causal Layered Analysis, and Personal Futures, among other pathways (Glenn & Gordon, 2009). Students learn how to choose and combine these resources, taking advantage of each one to accomplish the different tasks of the professionals futures studies (Bell, 2003, pp.80-95): the study of possible futures; the study of probable futures; the study of images of the future; the study of the knowledge foundations of futures studies; the study of the ethical foundations of futures studies; interpreting the past and orientating the present; integrating knowledge and values for designing social action; increasing democratic participation in imaging and designing the future; and communicating and advocating a particular image of the future.

The idea of setting a permanent observatory of speculative design futures at Centro, came from the interesting possibility to overlap the traditional Future Studies education offered by the program with speculative design practices and methods that usually belong to art and design environments. Although speculative design has roots in traditional forecasting techniques, it diverges substantially in means, tools, and intention. Forecasting methods, characteristic of Future Studies, use systematic and pragmatic analysis of data to extrapolate credible future projections. On the contrary, speculative design practices typically utilize a less scientific and more humanistic approach, their messages are less affirmative and more critical. Moreover, through this long-term collaboration, we aimed to use the Global Futures

lab approach, which forces the focus on local identities, to help students to avoid future stereotypes and inspire deeper attention to the Mexican context.

2.1 Activities and Pedagogical Model

Before going through any process or pedagogical strategy, is important to highlight the profile of the students involved in the workshops. The Future Studies program at Centro is highly multidisciplinary and only some of the students have design skills or capacity to use design tools. Their background can vary from marketing and strategic consultancy to design or governmental administration. This factor was crucial in planning and crafting the workshops' activities in a way to allow students to include design as part of the creative process but without limiting their visions to their actual design skills.

The Global Futures Lab workshop, led by Paolo Cardini and Karla Paniagua, takes place at Centro once a year for three days. However, after the end of the workshop, the students keep developing their design proposals with the support of the program's faculty. Each workshop is organized into three main phases: Stories, Scenarios and Products.

During their first session, students are challenged with the writing of a short fictional story. Everyone is invited to write about a hypothetical situation happening in Mexico, in an undefined future. The frame of the exercise is intentionally kept very loose and the only constraint is about the fact that the stories shouldn't talk about major systems or society at large but rather focus on everyday events in someone's life. Within this exercise, it's fundamental that the students use their first language to populate their stories with words, expressions, and behaviors, typical of their culture.

The second session is based on the exploration of details and nuances from the short stories, to better define their scenarios. This process starts with the reading of everyone's text and subsequent debate. The stories' conciseness leaves plenty of blank spaces to be filled by the creativity of the rest of the group who contribute to expanding each scenario with new and unexpected elements. Future casting techniques, as Glenn's Futures Wheel, can be utilized to help students navigate all the implications and consequences related to their future visions.

The third and final session focuses on the ideation and materialization of the diegetic prototypes. Students are asked to populate their future scenarios with fictional objects or services. Students design what the products do, how they work, who they are for, and where they exist. The final goal of those fictional artifacts is to carry the essence of their narratives and act as facilitators for conversations around students' future speculations.

2.2. Pedagogical guidelines

All the activities developed during the workshops are crafted in a way to foster original thinking and avoid pollution from pre-built ideas of future. In the following paragraphs, are listed a few pedagogical guidelines to facilitate the creation of hyper-contextual futures.

- **Preference for a loose methodological framework.**
  Nor Critical/speculative design or Future Studies methodologies are set as a rigid frame for students' creativity. The information provided about this kind of practices is mostly around their conceptual meaning and the illustration of future stereotypes created by non-contextual thinking. Students are left free to adopt whatever tool they feel comfortable with for the development of their design proposals. The soft methodological approach also helps mitigating any instructor-pupil power dynamics that can influence students' ideas.

- **Development of future visions starting from micro individual narratives.**
  Future scenarios are often a representation of system thinking and they help us understanding the complexity of the "big picture". Differently, in the GFL workshops, students start their speculations at an individual scale, they are invited to reflect on very subjective future experiences and look first at changes in people's lives rather than what we can find in the macro structures of our society. This approach promotes a human-centric perspective and alleviates the risk of cultural homogenization (Hugenberg & Sacco, 2008).

- **Use of dialectics as a tool to unveil contextual clues.**
  Group debates are crucial elements to build a solid contextual framework. Before engaging with any tangible design or forecasting activity, students are invited to "talk" about their scenarios. The conversation happening around the students' short stories represents a rich exchange of opinions about the current status of their society and it enhances reflections on identity and culture; as mentioned previously, language is a strong cultural element and one of the purest expressions of someone's identity (Bucholtz & Hall, 2004, pp.369-372).

- **Use objects as representations of identity.**
  Once the students start engaging with the creation of their artifacts, is extremely important to facilitate a semiotic and anthropological analysis of the objects. The goal is to identify the cultural elements that informed their functional and aesthetic decisions, and to detect alien features that reveal themselves to be "too generic" or "imported from other cultures". Students are invited to see objects as a direct representation of human behaviors and to culturally locate the artifact within the cultural context of reference.

3. Results: Looking for patterns

In Table 1 we present a breakdown of the results achieved by the first three cohorts of students who took part in the Global Futures Lab workshops. It should be noted that, as mentioned above, not all the attendees are designers, so a consultant on design and fabrication is assigned to accompany the process during and after the workshop.

Is fascinating to observe the variety of topics selected by the students who, let free to express their creativity beyond any rigid framework, gave voice to hopes and concerns about their future. Technology and its new dilemmas; magic, religion and spirituality; memory and identity; scarcity of resources, constitute the focus of interest and concern.

Table 1. Artifacts breakdown

Project & Authors	Description	Prototype	Main topic	Subtopics
The Arc of Life, Matilde Breña	Individual use box containing pill to assist voluntary suicide	Jewelry Box, Cardboard and fabric	Technology and new dilemmas	Civil rights
Ovotril (patented egg), Alan Sáenz	An industrial version of the chicken egg remedy used in traditional Mexican medicine to cleanse the body from the "evil eye."	Packaging Design, printed paper, cardboard and plastic	Magic and religion	Cultural heritage
Anima 1, Ana Gutman & Lizah Pesah	Synthesis of the "digital being" of a person condensed in a resin cube. The cubes are spiritual mementos of digital deaths.	Epoxy resin cubes containing various personal belongings	Technology and new dilemmas	Identity, memory, permanence
Anima 2, Alejandro Ruiz	Synthesis of the "digital being" of a person, 3D printed version.	3D printed ring	Technology and new dilemmas	Identity, memory, permanence
Spiritual fluid, Édgar Flores, Lourdes Serrano, Vicente Martínez	An application that allows practicing any belief at any time, with the corresponding rituals and paraphernalia.	UX/UI, Digital prototype	Magic and religion	Identity plasticity
Memories scavengers, Abril Chimal & Julián Flores	Plant and pot with computing device that, activated with water, tells stories about the traditional neighbourhood of Tepito.	3D printed vase and physical computing interaction	Memory and identity	Cultural heritage

Seed ring, Alejandra Rosillo	Jewelry piece inspired by the poison rings containing seeds able to conservation the genetic heritage of the traditional Mexican chinampas (floating gardens).	Digital model	Conservation of genetic heritage and sustainability	Cultural heritage
Pro-Pelle scrub, Mariana Alcocer	Cleaning and skin care system for a scenario in which there will be no water available for personal hygiene.	Digital model	Scarcity or lack of resources	Hygiene, domestic rituals
Emergency kit, Carlos Shelley	Emergency system for cases of security fail of the iris reader.	Hand-illustrated model	Technology and new dilemmas	Identity, security
Books reader, Arturo Rossier	AI algorithm that converts books into tweets	Digital model	Technology and new dilemmas	Learning
Mexican nationalism manual, Camila Anaya	Cultural heritage Guidebook containing all the mandatory precepts to be and live like a "good Mexican" within an ultra-nationalist scenario.	Book design, printed and bound	Memory and identity	Cultural heritage
Interior planter for malls. Sofía Menchaca	Indoor nature, Bio domes and Indoor gardens for the built environment	Hand-illustrated model	Technology and new dilemmas	Sensory perception
Itinerant empathy pavilions, Sophia Arrazola	Ubiquitous learning experience that fosters an emotional and empathetic connection with the urban environment	Cardboard model and illustration of the learning system	Technology and new dilemmas	Emotions
Universal voting system, Mauricio Hernández	New post-political parties' election system based on goals-based anonymous electoral programs	Cardboard model of the voting booth and ballot's material	Technology and new dilemmas	Democracy and civil rights
Talent assessment system, Mariana Nuñez	Talent self-assessment system to facilitate the hiring and training of human resources	Cardboard model	Technology and new dilemmas	Human talent management
Indigenous genetics bank, Jesica Bastidas	Institute that preserves the genetic heritage of the indigenous people of the country.	Cardboard model of an ultra-safe DNA bank	Memory and identity	Cultural heritage

Powder food display, Fernanda Rocha	Speculation on the future of food in which synthetic powders will replace traditional meals.	Cardboard model of food packaging and distribution unit.	Technology and new dilemmas	Sensorial perception
Dictionary of gestural and somatic terms, María Eugenia Cué	Emotional Thesaurus to help navigating human feelings during social interactions.	Cardboard model	Memory and identity	Communicati on
Internal tourism system, Carlos Buenfil	Experiential tourism kit for a scenario in which psychotropic consumption in Mexico is legal.	Cardboard model	Technology and new dilemmas	Sensorial perception
Transcultural tour, Diana Espinosa	Digital simulator for tourism in traditional Mexican villages	Cardboard model	Technology and new dilemmas	Cultural heritage
Pocional, Elena Cruz	Emotional experience enhancers. Psychoactive remedies to restore our ability to “feel”.	Blown glass prototypes	Technology and new dilemmas	Emotions, Alternative medicine

Through the analysis of the available data, we can cast a few observations. The discourse around innovation and technology, and its long-term consequences, represents a recurring concerning theme in the students’ work. The preservation of identity, heritage and memory are also critical and recurring topics, mostly fostered by the fast and vertiginous changes of the Mexican society, especially in consideration of the richness of the local cultural heritage.

Interestingly, some of the projects express political concerns, specifically the work produced during the workshop held in 2019. This data is pertinent if related to the social climate at the time of the activities. The workshop happened just after the latest presidential elections, a political tide that clearly permeated students’ future thinking and their models: challenges about how to achieve transparent and democratic elections or concerns regarding a totalitarian state, were central topics.

Although present in a smaller quantity, magic, religion, and scarcity of resources are other significant speculative subjects. Both are well tight with the Mexican context and they represent strong cultural reflections. Magical and spiritual thinking still holds a particular place in the present society and they represent a tangible connection with pre-Colombian beliefs. The latter, together with the present environmental crisis, has been also the input for a reflection on the detriment of nature and its consequences.

Below we refer to three particular projects that we consider deserving special attention.

The Arc of Life (Cohort 2017)

The artifact in Figure 1, entirely hand-made with silk by fabric designer Matilde Breña, corresponds to a future scenario in which suicide is no more a taboo. In Breña's future, when citizens turn twenty, parents give their children this personalized jewelry box-like little cabinet. The box has small drawers for the storage of personal memories such as the first tooth or the first strand of hair. Through a fingerprint reader, the young adult has also access to a suicidal pill, a single lethal dose to be used at personal discretion. The speculative context of the Arc refers to the normalization and legalization of euthanasia.



Figure 1. The Arc of Life

The event, during which the box is given to the children, is also part of the author's speculation and it is inspired by the Mexican folklore's rituals. The presence of the family as the core emotional element of the narrative, together with the aesthetic of the objects, far from any techno-dystopian image, provide the project strong cultural references and matches perfectly with the local context.

The Mexican Nationalism Manual (Cohort 2018)

This heavy and thick book, leather-bound, with sewn folios, presents a design inspired by authoritarian and ultranationalist regimes (Figure 2). In all its elements, from typography, iconography, to the colour palette, the manual suggests the presence of a dictatorial power with the agenda of preserving and protecting the Mexican heritage. Created by Camila Anaya, and assembled by a local bookbinding master, the book is illustrating all the rules that the future citizens of a totalitarian future must observe for living, thinking and behaving as “proper” Mexicans.

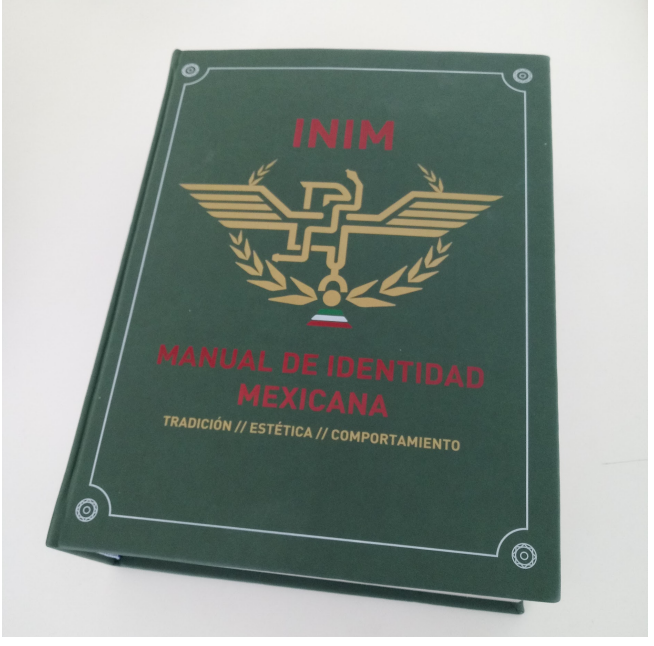

Figure 2. Mexican Identity Manual

The dystopian tone is evident in this speculation but there is also a laud invite to reflect and discuss the relation between tradition, identity and cultural evolution. At a time when there is a lack of identities in the global context, the author explores the opposite side of the spectrum where the noble intention of cultural valorization turns into a repressive system of cultural homogenization.

Pocional (Cohort 2019)

The term "pocional" results from the fusion between the words "potion" and "emotional". This scenario, developed by Elena Cruz, merges traditional esoteric practices, psychotropic

drugs, and mainstream medicine. This project forces the attention to the increasingly complicated relationship between humans and their feelings. In Elena's vision, the predominance of digital interaction, the loneliness and individualism characteristic of the present society, will result in humans' limited capacity to experience and feel. When the time will come for artificially induced emotions, everyone will receive a bottle for each major emotion: joy, anger, surprise, disgust, and fear (Figure 3). Those bottles will represent our life-long emotional capital which everyone will have to manage and use wisely.



Figure 3. Pocion *al Bottles*

4. Conclusions

To conclude, the archive of future visions created within the Global Futures Lab Observatory in Mexico City offers a rich framework for some reflections.

From a methodological and pedagogical perspective, the overlapping of critical design practices with traditional forecasting technics and speculative anthropology allowed students to move with a certain agility and unleash their creativity. Critical design and speculative anthropology, through the use of highly subjective micro-narratives, made possible to keep the focus on the specific cultural context. From a more pragmatic perspective, according to Wendell Bell's tasks for Futures Studies, we observe that the workshops contribute to some of them, including the study of possible futures, probable futures and the study of images of the future. We also observe that while some of the projects are deeply rooted in the fictional/speculative realm, they could be developed further towards more plausible solutions.

From a content standpoint, while the different themes selected by the students precisely capture the zeitgeist of the current century, they are also extremely contextualized representations of global concerns. Is worth to be noted that the conversation around progress and innovation that happens in the students' proposals is not following the traditional path of blind technological determinism; it is rather leaning towards a more interesting cultural determinism in which the contextual framework informs the use of certain technological opportunities.

Finally, reflecting on the challenges fronted during the GFL/MX program, we can identify sometimes a discrepancy between the quality of the students thinking and the quality of the produced outcomes. Physical artifact offers a valid opportunity for communicating and debate around future scenarios otherwise difficult to communicate. However, the limited design skills of most of the participants can make difficult the passage from the concepts to their representation. This problem has been partially mitigated by the help of Centro's support faculty and external design experts who assist the students in the creation of their artifacts.

The Global Futures Lab Mexico City Observatory will continue to collect students' hyper-contextual visions and report on the cultural significance of those contributions.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Learning and Differences reciprocally shared and validated: A decade long Participatory Design collaboration between KG Elementary School and AD University

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Abstract | Imagine the feeling of successfully transmitting/sharing your wildest ideas with others, when communication is one of your largest hurdles. Over the past decade, the King George Elementary School (KGES), a private K-12 school that serves children with learning differences, including autism, dyslexia, anxiety, and ADHD, has worked in collaboration with second year industrial design students from ADU (ADU). This participatory design project that includes mailed creation kits, generative activities at KGES, user testing, and presentations within the KGES community, investigates how co-design could help K-7 students with learning differences. This paper focuses on the evolution of the annual design collaboration process and its residual impact on both students and faculty. In both institutions, individuals are given means to express, communicate and envision in ways they never expected. Design is shown to support embodied learning, using making, movement, and sensory cues to foster students' expression and agency.

KEYWORDS | LEARNING DISABILITIES, PARTICIPATORY DESIGN RESEARCH, AGENCY, EMBODIED LEARNING, CHILDREN

1. Project Overview

Over the past decade, the King George Elementary School (KGES), a private K-12 school that serves children with learning differences, has worked in collaboration with undergraduate and graduate design students from (ADU). The partnership, seeded in 2010 through an initial project that investigated how textile-based objects might help grade 7 students with learning differences, now supports a range of projects on an annual basis. For members of this K-Masters studies level community, it provides valuable sites for change and agency. Students and faculty from both institutions are given means to express, to communicate and to envision new unanticipated outcomes. Within the collaboration, there are three annual projects, and over its ten-year lifespan the project partnership has included approximately 150 KGES students; 170 ADU undergraduate students; 9 ADU graduate students; 15 KGES faculty and staff; 5 ADU faculty and staff.

For the purposes of this paper, the project discussed is the KGES and ADU *classroom collaboration*. Annually an elementary class of KGES students engage in a participatory design process with a second-year Industrial design studio from ADU. ADU students are tasked with developing a prototype that supports the learning of their KGES participants. Through this collaboration KGES students, also referred to as co-creators, explore self-expression through the design of tools for their own learning (Figures 1, 2, 8, 9).

2. Research Methodology

This document is a retrospective review of the classroom collaboration over the past ten years. It pulls insights from two main sources, including:

1. Six Interviews with project stakeholders, on both the KGES and ADU faculty.
2. Review of reflections on ADU student process, which was completed for all years of the study. Each year is its own cross section.

These lived experiences are relational and strong interconnected themes emerge from the data collected. Insights in this paper are based on human experiences and feelings, carrying valuable reflections for the design community. It shows that design research itself can be a vessel for community building and collaboration. That health through design takes a committed effort over time, and that design can envision itself in longitudinal studies. Following KGES or ADU students, after they have engaged in collaboration, would be helpful in furthering this research.

3. Contribution from Participatory Design

The classroom collaboration applies Participatory design, a strategy within design practice that prioritizes contributions from stakeholders across all stages of creative practice (Mattelmäki, 2006; Sanders & Stappers, 2008). Within this collaboration students, faculty and staff, from both KGES and ADU, all act as key contributors to the project. The KGES students' lived experiences, stories, thoughts, and tangible actions are not only collected and observed by the design students and faculty but also discussed and built together through acts of collective making and reflecting. Though, the KGES students are the primary contributors as they bring "fresh ideas and idealistic views to the design process" (Rigolon, 2011). They criticize the perspectives and assumptions of the ADU students, through how they engage, often exposing views that adults move beyond with little thought (Rigolon, 2011; Sutton & Kemp, 2006). These can be crucial moments for ADU students.

Participatory design in education can be labelled as efficient for design practice, rapidly producing novel and innovative concepts (Yalman & Yavuzcam, 2015). This approach is aligned with industry and prioritizes developing skills in design (Schepers et al., 2017; Read et al, 2014). Alternatively, it can also be linked to place making (Rigolon, 2011), identity and self-confidence of participants (Schepers et al., 2017; Mazzone et al, 2010). In this second scenario participatory design processes a range of design research and development activities, supports not only problem framing and action towards new ways of being, but through verbal and non-verbal dialogue exposes layers of complexity or latent issues (Moline, 2014). It often ends when a goal, re-defined through the process, is reached. This can be artefacts, but "genuine participation should generate knowledge in the children, enable their voices to be heard, impact decision-making and empower them" (Schepers, et al., 2017, p. 2).

Smith and Iversen discuss scaling participatory design to support "engaging people in the complex acts and networks involved in contemporary social […] transformations" (2018, p.10). This decade-long research project has scaled to include Master's students, professional development for teachers at KGES and within the Vancouver school board, and continues to be a research catalyst for several faculty at ADU. Additionally, the structure and intention of the collaboration has been applied to other projects within ADU's Health Design Lab.

Scaling participatory design work requires scaffolding design and research goals while keeping in mind that often the heart of major insights comes from the trusting relationship between the designers and participants (Smith & Iversen, 2018). These research projects are aligned to scale further, beyond continuing to support social and ethical interventions in the schools and within the practices of ADU students when they graduate.



Figure 1. Creative Cloth by Student1 (2018) supports drama curriculum. Each CreativeCloth contained ornaments (moon, bolt) and notions that could be interpreted as both a character or connected as a background.

3. Classroom Collaboration Overview

Started in early 2010 as a studio-classroom partnership, the project paired Faculty 1's second year industrial design students with KGES grade 7 students in order to develop learning tools through the power of participatory research in design (Author 1, 2019). KGES balances social and open learning within the classroom with individual instruction for students to achieve specific literacy and math goals. Faculty 1 recognized that many KGES students need to move, they use kinaesthetic and auditory cues to support their learning. This mirrors curriculum in industrial design, where students are required to experiment with materials to understand ways of knowing. Touch, sound, temperature, texture and many more factors affect the emotive properties and our connection to objects. Designers prototype as a way to think through problems and situations, this means that literacy and math may be equivalent in importance to manipulation, motion and physical creation (Author 1, 2017; Root-Bernstein, 2013). Faculty 1 recognized that KGES and ADU students had much to share through these types of interactions that make up embodied learning. Arguably, this affinity to embodied modalities of learning is the reason why the collaboration has continued successfully for a decade. The project outcomes, during this time, have shifted based on the annual research questions posed and the diverse range of KGES students engaged. They include: musical instruments that enable KGES students to express and communicate in unique ways; chairs that support motion and hand movements required for embodied learning and concentration; play devices that support social connection. Each project speaks to the context discussed by the KGES co-creators, situating them as agents in the process.



Figure 2. RingSeat by Student2 (2017). The flexible fabric seat on a steel role cage recognizes that the ability to move supports learning for many students at KGES.

Faculty 1's initial structure has continued successfully with minor variations over the project's lifetime. Each Spring semester ADU students are introduced to learning differences and given an opportunity to learn about the children they will be working with by a KGES teacher. Often this brief is done by the teacher of the previous years, giving them the opportunity to reflect on the project and disseminate some of their own learning. With this base in place, the ADU students begin working in groups of two to develop design probes for their two co-creators at KGES; within the partnership, we call these probes co-creator kits (Figure 3). This is a medium for initial introductions from afar and also sensitizes the KGES students to the types of activities that design researchers might engage in. The word research is not well understood at the K-6 level and often the assumption by KGES students is that they will be observed or asked direct questions. But design probes (Mattelmäki, 2006) generally consist of three to five making activities, and an opportunity to share some personal interests through mapping, photography or mark making. In late January of each year, the ADU faculty member (Faculty 1, Faculty 2) delivers the ADU Probes to the KGES students, along with an introduction talk on what designers do, and an invitation to participate. Over the following two weeks the KGES students work through the design probes before their interpretations are returned to the ADU students.



Figure 3. Co-creator probe Student3. Probes sensitizes KGES students to creative activities and often include text, art supplies and other forms of making (2019).

After the probe exchange, the ADU students use the KGES responses to support their initial in-person visit to KGES. In mid-February, the ADU students spend half a day at KGES being introduced to their co-creators and the school. They engage the KGES students in more participatory design related activities, often including some sort of world building as a way to share content about each other's daily life and personalities. Figure 4 shows how is spontaneous a part of this work. It clearly suggests that conversation continues and relationships between the KGES and ADU students are developing.



Figure 4. In early interactions at KGES some students start by creating forts. This known and relatively risk-free activity allows students to discuss needs or comfort, building the initial conversations that shape much of the final work (Student 1, 2018).

With this experience under their belt the ADU Students return to the studio to work on research synthesis, design ideation and concept generation. The following third and fourth interactions between the co-creators become a messy balance between imaging possibilities and creating prototypes to discuss and test. One of these interactions occurs at ADU University where the KGES students get the opportunity to learn how the prototypes have been made. Through the course the children's responses and contributions are taken into account and used for the final refinement and revisions of the ADU students designs. And after three months working on the project, ADU and KGES students present their final design outcomes to the KGES community (Figures, 1, 2, 8, 9).

Since 2018, ADU Faculty, Faculty 2 has led the project. By exposing their expertise and experience, Faculty 2 has shifted the emphasis into the school yard. In asking ADU students to consider and find means for activating outdoor spaces for self-regulation and learning. Faculty 2 links the exploratory nature of design with physical exploration of a specific context: the school grounds. Here, the risks that design can take become obvious to more than just the KGES classroom participants; fear of failure, judgment, being physically uncomfortable in a new context, pushing boundaries and testing how materials can be used (Faculty 2, 2018). The entire K-12 school community gets glimpses of the often-chaotic process (Figure 5) and are able to provide feedback as the objects and environments are re-created by the KGES-ADU student teams.

> “kids often don’t understand how the things they use everyday went through an entire sequence of steps, [through this project] they see the original thing reshaped and reformed” (KGES Faculty3, 2019).



Figure 5. Messy Suits by Student 4. Seeing this chaos from a distance looked unproductive, bordered on vandalism, and was disruptive. ADU students confirmed that "fatigue from the physical activity helps down-regulation" (2019).

4. Impact on KGES students

A key driving benefit to the collaboration is showing the younger participants a future path in post-secondary education. Over the course of the twelve-week project, KGES and ADU students build strong relationships, their input is listened to and valued by ADU students. These mutual relationships involve mentorship that sits outside of the usual student-teacher format found in the K-12 environments. Alexandra Lange, the author of "Design and childhood", writes about how materials, products and the built environment influence child development at home and in the classroom. She notes that teachers are often expected to be guides or sources of information and that this creates a hierarchy that would directly bias the participatory design process (2018, 9). Co-creators, in this case KGES students, need to know that their input is what the designer is looking for and that anything may be relevant even if it potentially tangent to the task in progress. This approach is often new for children and their teachers, who are more accustomed to prescriptive outcome-based art-piece projects. Rather than aligning this work with teaching specific competencies, which may not allow for open-ended or self-initiated work, the project invites KGES students and teachers to embrace the unpredictable.

ADU students become seen as peers by the KGES students and this difference produces a unique type of engagement with the projects. The KGES students quickly perceive this difference and space of exploration that is non-assessed or errorless (KGESFaculty4, 2019). This freedom from assessment, in turn, opens the door to unbridled creativity. Combining this with the facilitation inherent in participatory design supports directing that creative output toward the projects. Just imagine the feeling of communicating your wildest ideas, when communication is one of your difficulties. ADU students are forced to re-evaluate how

they reach their co-creators, often moving away from text-based content towards manipulatives and creating meaning through form building and prototyping (Figure 6).

> "[KGES students] struggle to find ways to communicate their ideas. This is a tremendous vehicle for a lot of them. It is a way to show people what they understand" (KGESFaculty1, 2019).



Figure 6. Ambi by Student3. Ambiguous objects supported the co-creators in expressing themselves through how they stacked, placed, and manipulated. (2019)

By the third interaction KGES students take ownership of the projects but also find the mentorship and attention that comes from the older ADU students extremely exciting. KGES students literally drag ADU students around, showing them the extent of their understanding of the world on the KGES grounds. These interactions open up new and exciting conversations that would not happen from a distance or by reading about learning differences in a textbook. As we see it, the younger KGES students unwittingly give the ADU students the exact types of insight that most designers are looking for. Not the scripted answer to a survey question, or the one that makes them fit in, but feelings and responses that come from a deep understanding of their own situation. There is an ongoing desire to share thoughts, that builds as the term progresses.

They are advocating for their ideas and helping to shape the outcome. Through the collaboration KGES students become seen as the experts in their own learning. They may not always be able to articulate this expertise with words but certainly do it through actions.

How they think with the objects the ADU students bring to KGES. The definitions of their learning difference, become an aspect of the behaviours or feedback that influences the project but not the reason for it.



Figure 7. Group collaboration at its peak. Students from both ADU and KGES form strong bonds that support listening and collaboration.

Many KGES students are anxious (KGESFaculty1, KGESFaculty4, KGESFaculty3, 2019). They left the regularized school system because they needed a fresh start to rebuild their confidence and get direct instruction on strategies that support them in at least one area of formalized learning. KGES "students don't want to fail because they have failed so many times in their last school" (KGESFaculty3, 2019). For this reason, acceptance of mistakes is not typically a trait observed in KGES students. Difficult tasks might require movement around the room or school, sometimes even resulting in frustration or outbursts. ADU students model process which is active, requires failure, reframes problems and builds empathy for others. It is unclear if KGES students can explicitly share that these skills are transferred to them, but ADU students do reflect on their own learning in this way through the reflections they submit at the end of the term. This suggests that through the process of the project KGES students may also move toward being emotionally ready to initiate work independently (KGESFaculty4, 2019). This is present in small self-initiated projects that the KGES students create for the ADU students between visits, whether drawings, sculptures or simply ideas they share immediately upon ADU students return.

> "It's brought out their creativity that they've always had but have felt they can't explore in a typical classroom because they are not willing to make a mistake. And here that ability to make a mistake is really just completely mitigated by the fact that you're supposed to; it's part of the entire process" (Author3, 2015, p.52).



Figure 8. Tempo Totter by Student4. Tempo totter is a stool that channels energy though both hip and hand motion, producing a range of tones for musical output. (2019)

When the project reaches its final weeks, many ideas have been realized into physical prototypes (Figure 1, 2, 8, 9). KGES students often interpret the ADU students' prototypes in an unexpected way. They play, connect, shape and change them, shattering ADU students' assumptions of how they would be used. This is an important part of design and design learning for all students. As these mash-ups, linked to values, often lead to innovation. Sometimes at this phase of the project ADU students feel disappointment, but it is not the same type of disappointment that a KGES student feels doing rote or outcome focused work. It also is not that the ADU students failed to listen. It is just that, to make some of these ideas' tangible, students have to work within their skills and the material production limits of ADU University. The key here is that both KGES and ADU students have to grapple with compromise, not all ideas are immediately possible. They begin to recognize that the outcomes are just one of many possibilities to define the project. It is extremely freeing to know that there is a different kind of right answer in the world, answers that can revolve around our own criteria, current limitations and context.



Figure 9. Wing-it by Student5. Wing-it are field game pinnies and soft projectiles that re-envisioned how we get tagged and where in dodgeball style field games. Students at KGES developed their own rules and ways of playing. (2019)

The final presentations occur at KGES and allow the students to show pride in their work, they have the opportunity to engage peers from other classrooms. This serves as an important means of giving credence to the KGES students' own creativity and input. This sense of accomplishment that comes from actively and deeply engaging with the projects is modelled by the ADU student's own engagement in the project (National Research Council and Institute of Medicine, 2004, p.32). Additionally, through this initiation into design process, the KGES students' tendencies to make, explore and be active are validated. The project shows them a possible path through post-secondary education in design or art. A career path or practice that may have previously been unknown or seemed out of reach. Currently, in the 2020 cohort of this project, there is at least one ADU student who graduated from KGES. Unique learning styles can easily and positively be applied to creative thinking.

> "The acts of making, that designers find so satisfying, is built into early education, but as they grow, many children lose the opportunities to create their own environments, bounded by a text-centric view of education and concerns for safety" (Lange, 2018, p.9).

5. Impact on KGES Faculty & Staff

Design as a curriculum topic was introduced in British Columbia in 2015, situating KGES faculty in a unique position through this collaboration. KGES fosters an environment that allows students to advocate for their needs in learning, and placing design into their pedagogy was a means to this end. Design was not integrated at KGES because it was prescribed, it was integrated to suggest that there are alternative ways of teaching curriculum that might be more appropriate to the types of learners they cater to. Design

supplies a way to instruct that supports students in “determining what they need to learn” (Gini-Newman, & Case, 2018, p.8). The head of School, KGESFaculty1, has come to understand what this collaboration brings.

> “There is a great deal of learning on our end. I know for our teachers it is about the design process and thinking outside the box. It gives them ideas, and an offbeat way of looking at the things they take for granted. It is an enriching learning experience as much for the staff, as it is for the kids” (KGESFaculty1, 2019).

This comes with some difficulties or costs to others in the school. Design is a way of working toward change and, in its open-ended exploratory mode, can often be quite disruptive in the school environment. The projects have been interrupted in more than one classroom, they are often loud, can damage the grounds, can be perceived as unsafe or simply take up space. Even more frustrating for some faculty and staff participants is that at times design exposes issues but does not necessarily resolve them. In many contexts these hurdles would be enough to end a project. These obstacles, which in the early years of the partnership may have been perceived as a reason to stop, are no longer perceived as such. The culture of the school supports the collaboration and its messy, unpredictable and sometimes misguided approaches. Designers are not all teachers. “The experience is so rich for us that it does not matter if we have an off year or a misalignment” (KGESFaculty1, 2019); the collaboration is resilient.

The collaboration has introduced students, faculty and staff of KGES to design, and methods of inquiry integral to the design process; Design brainstorming, ideation, making as thinking and participatory design theory have been made accessible to KGES. Participating faculty are integrating aspects of design into their own pedagogy and this helps them experiment with augmenting learning through objects and physical environments.

> “I’ve come to understand the design process a little more. It is constantly sprawling back, looking at new designs, improving, and getting ideas from the most interesting places” (KGESFaculty2, 2019).

6. Conclusion

ADU students' education is enriched with aspects of sustainability as it relates to social equity, place-based learning, context driven design and even the use of materials that are likely to result in their graduation. Often ADU students engage in Participatory methods for social transformation for their final year capstone project. Further research on this possible imprint is being conducted in 2020-21.

ADU’s Health Design lab has seen how these benefits to students and partners can be ported into two other partnerships. The first project, of three years, continues to support cross-generational knowledge by asking ADU Communication Design students to co-design publications on the life stories of the elderly residents in long term care. The publications are

available for future residents, family members and the care team (Author 3, 2019). And the second project, of two years, pairs communication design students with individuals with visible and invisible disabilities (Author 3, 2020). The KGES partnership structure and model has built awareness that long-term partnerships build community and support health across its spectrum. Over time, the first and second projects will be about health through design as much as the KGES-ADU collaboration is.

For the last ten years this research has evolved to include ADU Industrial Design classrooms, research assistants from both the undergraduate and graduate level and within KGES faculty, students, librarians and specialized tutors. KGES students show confidence in their way of being in the world, ADU students grow their understanding of design process beyond simply making artefacts. Faculty at both ADU and KGES supply avenues to support student growth through this open-ended co-design project, and as a result this community is changing, toward a culture and built environment that fosters student expression. A lot of learning occurs on both sides of this collaboration that comes from a unique relationship, developed through process. It is a model of design pedagogy that could be beneficial for any design classroom.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

On (un)becoming in Design Academia: A Coloured female's autoethnography

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Abstract | This paper draws on an auto-ethnographic exploration as part of my PhD study. In this paper, I respond to the question: "how did my earlier lived experience of exclusion informed my (un)becoming a Design academic in higher education in South Africa?" I explain how I became aware of my exclusion due to my race, gender and my social economic situation at a young age, by a system designed to exclude none white people, like me. Further, I unpack how this system has impacted on myself worth, on my readiness and struggle for post-graduate education opportunities. I demonstrate how this lived experience of exclusion has informed my higher education teaching. My academic undertakings hold strong values of inclusion, equality and social justice. I retell my journey, highlighting the effects of this legislated racial exclusion through the struggle for inclusion.

KEYWORDS | AUTHOETHNOGRAPHY, RACE GENDER, DIVERSITY, INTERSECTIONALITY

1. Introduction

At a workshop of Design educators in Cape Town, Western Cape, South Africa, a colleague makes a comment to me about the lack of "historical specificity and political analysis" in the work of educationist in study, work and everyday life (Lave, 2012). It is my opinion that this same silence continues in the fields of Design Education where I work professionally in High Education, as a teacher; as an emerging researcher involved in higher education in South Africa (a country where higher education and access to higher education is deeply political). South African education has a long history of political interference and struggle. I am particularly aware of how history and the past inform and experience the present along with its aspirations. In this paper, I am commenting on individual's past and how these paths can inform present professional identities, practices and values. Writing about this, I discover some silences about the link between politics, the past and my professional life. I also provide a setting, of my experience growing up in South Africa, as an auto-ethnography. In doing so, I offer my understanding of the remaking of social order, however ever small its impact my be.

I write about my younger lived experiences as part of my PhD series. In this paper, I focus on when I became aware of how I was excluded by race and gender from educational opportunities. An introduction to my younger self is depicted in this work to provide background to my PhD work. This sets the stage for the struggles I now face during my post-graduate studies in (un)becoming a Design Academic and its complexities as a woman of colour in higher education. Further, it illuminates how politics, the past and histories are involved and the struggle I face in my professional identity.

1.1 Context for the narratives

Apartheid and I were both in trouble in 1980's. The Republic of South Africa was experiencing birthing pains that would set off a decade of events and that eventually would shape its history. As I was gasping for my first breaths from an unwanted womb, on the hill in Bishop Lavis (figure 1), popular protest by the masses of ordinary South Africans against apartheid education and other related issues reached new heights in '80s (figure 2). The government at the time responded with extreme brutality, equal to the life in the popular Cape Flats, in the Western Cape, South Africa. The apartheid legislation at the time was efficient both in excluding the majority of South Africans from a range of human rights, and in preventing all South Africans from having social relationships with each other (Hoosain, 2013). The topic in which they were most successful and which had the greatest impact, was excluding the majority of South Africans from quality education (Salo, 2007).

Who I am is defined by my childhood, growing up during the final years of apartheid. My family was forcibly removed from District 6. Thereafter, they were unwillingly placed into a gang infested, poverty stricken, coloured township in the Cape Flats. But is defined also by finally attending and teaching at a University of Technology in the Western Cape. A journey

of becoming and (un)becoming a scholar and a teacher of Art and Design, in a highly political, racialised and gendered environment through a PhD program. This paper hopes to be part of that journey.

The objectives of this paper are to help understand the journey of women of colour in academia. Further, it may offer valuable insights into culturally situated, complex (race and gender), multi-layered, relational identities of women of colour (Reinharz & Monroe, 2017). In this diverse and complex space in Design Education, the research takes place and is ongoing.

The significance is to understand how a childhood event may impact the life journey. How is experienced the process women of colour go through to negotiate their identities in Design Education and the lack of diversity in Design Education (Akama & Barnes, 2009). Additionally, the study considers the individual (myself) as the subject of the study, which normally, in Design would be focused on the artefact. A focus of my lived experience of exclusion becomes the focal point, and the journey becomes the design process.



Figure 1. Bishop Lavis," Die Bult" (the hill) 1980. On the other side of this street there was my birth place, four houses away from my church to the left, my house and local super market to the right. This was also neutral gang turf. Also, the first wall I drew on.



Figure 2. Grassroots newspaper report on the 1985 protest increasing.

2. Methodology

Through a reflective auto-ethnography, I make sense of my personal lived experience as post-graduate student, Design teacher and woman of colour, in a post-protest environment. I explore methods that enabled me to know myself. I use auto-ethnography as a detailed depiction of my internal conversations and the conversations with others in the process of excavating my journey of becoming and unbecoming a Design educator in a post-protest context (Tuhiwai-Smith, 1999; Ellis, 2003).

I value my own beginning, and therefore I am in the position to have authority in my work and to identify who I am in relation to others. In order to know myself and to understand who I am as a post-graduate student, I must start from the beginning, when I first became aware that I was different and not white not enough. As an emerging academic professional, I dedicate my work to auto-ethnography as a research method that embraces reflection, responsiveness, transparency of the researcher (myself), relational awareness and conversations between my practice and my research (Pillay, et al., 2016).

In this paper, I reflect critically on memories, photographs, documents and inner dialogues by freewriting (Chang, 2008) to provide an account of my lived experience (Korabik, et al., 2008). I obtained ethical clearance through institutional channels but also from my family to use some of our family photographs included in my study. My family were able to assist and be part of my PhD study by searching for photographs and telling the stories and events that impacted my life. They were proud that our family photos, history and generational stories would have value. This motivated them to tell their own stories and maybe to continue to

write about some of them. I act with care and awareness by removing or renaming characters in this paper as I am aware of the impact any identification may have on other people mentioned in our stories and those who may read it. I am also aware of my focus in this study as a woman of colour and the implications that may arise from the complexity of this narrative.

3. Framing my narrative in identity, intersectionality and auto-ethnography

3.1 Coloured Identity

The fact that South Africa is such a culturally diverse country, meant that individuals of multiple ethnicities were given an intermediate status. Therefore, the term "coloured" refers to a person of "mixed-blood" (Korabik, et al., 2008). Before apartheid laws were implemented, people of colour usually mingled with Europeans and adopted some of their culture and identity (Montero & Sonn, 2009). According to Ratele and Duncan (Ratele & Duncan, 2003), coloured identity is viewed as a social construction of the apartheid regime. It was crucial for the apartheid regime to de-emphasize the African roots of the coloured person, and to promote the idea of an independent separate coloured identity. Boddy writes that coloured people are a community that cannot be considered white nor black (Boddy, 2009). Thus, this conflicting situation placed the coloured community of South Africa in a rather dangerous position between the oppressor and the majority of people that were oppressed. However, including coloured South Africans in the group classified as white was just as complicated, because it tainted racial purity. Thus, coloured people were regarded as second-class citizens before and during Apartheid. In conclusion, clinging to colouring as a racial identity is full of complexities. Davis summed up the situation regarding the complexity of colour identity as "South Africa's coloured community has remained marginalized by history and even historians" (Davis & Johnson, 2015). One can argue that the way colouring is currently perceived leaves little hope for future generations to see themselves represented in a positive way in the new South Africa. However, according to Erasmus (Erasmus, 2001), colouring has infinite possibilities for transformation. She warns against limiting colour identity as it is trapped between black and white identities.

3.2 Intersectionality

Kimberlé Crenshaw, law professor and social theorist, first coined the term intersectionality in 1989 (Crenshaw, 2017). The theory emerged two decades earlier, however, when black feminists began to speak out about the white, middle-class nature of the mainstream feminist movement. Many black women found it difficult to identify with the issues of the mainstream (white) feminist movement, issues such as the pressure to be a homemaker. Black women, who often had to work in order to keep their family afloat and therefore

without the luxury of being homemakers, did not feel as these issues pertained to their experiences. At the same time, many black women experienced sexism while participating in the Civil Rights movement and were often shut out from leadership positions. This intersectional experience of facing racism in the feminist movement and sexism in civil rights encouraged black women to call for a feminist practice that centralized their lived experiences (Mirza, 2014; Mackinlay, 2019).

3.3 Auto-ethnography

This paper uses auto-ethnography, a critical reflection on stories from my life, in particular about my younger years. This method advances our understanding of possible alternative narratives and uses of visuals (photography, imagery and freewriting) in qualitative research (Pensoneau-Conway, et al., 2017; Ellis, 2003; Holman Jones & Pruyn, 2018; Gachago, 2015). These methods have been used to study changes in life situations, ideas, self-perception and in shaping displaced identities (Hoosain, 2013). I use these methods as previous research states that, into the literature, there is a lack of insight about doctoral research that recognises the different experiences that come from the researcher's life (Richards, 2015).

3.4 Generating my narrative

This struggle for quality reignited during the student protests of 2015, 2016, 2017, and the gender-based violence protest of 2019 in Cape Town, South Africa (Gouws, 2017). During these times of protest, opportunities arose for research about continued inequalities in society, in particular in the field of Design Education (Armstrong, 2009). One such opportunity arose for me, undertaking post-graduate design studies and understanding that power in education plays a role in learning, even for academics (Boler, 1999). As an emerging researcher, I investigate my own academic journey as a woman of colour, designer, and teacher in higher education, in post-protest times defined by a shift in how young people of colour, and in particular the so-called 'Coloureds', see themselves and engage with each other and the world. This questioning about myself, was sparked by the Stellenbosch paper about coloured women and their low cognitive function.

I decided for a reflective narrative approach in which I write up the story of my life, focusing on my early life and the impact of where I grew up. I wrote mostly at 3 am after this method was suggested to me by my supervisor, when I complained that I had nowhere to write that was quite enough given the ensuing commitments of being a mother of three young boys, a and all the other responsibilities we have as women. Holding all the struggles we have as women of colour, to be able to do it all (mother, career, research, designer). I wrote about how angry for the depiction of coloured women in the Stellenbosch paper; the rage for how and why I ended up in a poor area of Cape Town. I wrote about the political system that kept us there and how it was designed. I presented these at SAVAH 2019 conference, Defsa 2019 and used it for the application to my PhD.

3.5 Analysis of the Autoethnography

The primary goal of this paper is to understand how identity and self-perception changed along my journey in academia. Drawing on auto-ethnography, I investigate my awareness and adaptation to academic culture and social system and my growth in academia (Ellis, 2003). The ongoing struggle of people of colour, in particular women, for a place to breath, for recognition in academia, continues to be a story that pushes against dominant narratives in a context defined by masculinity and race (Salo, 2007). Research like this offers alternatives that disrupt the current status by offering a women-focused narrative. Additionally, cultural production and approaches to diversity in Design Education for academics has not been fully explored (Akama & Barnes, 2009).

From the critical analysis of my stories various themes emerged, which I will fully unpack in my thesis. For this paper the themes that started to emerge, even as I was writing, is the one I explain here, only the earlier part of the life story. In unpacking my story, one must understand that explaining one's past is already the current understanding of that past, the meaning of my assumptions and biases. I am not making a broad statement about identity or design education, rather, I hope to provide a glimpse of how the past and present interact in one particular setting and, further, reflect on how my intersectionality and feminist views interact and explore how all this impacts my profession identity.

3.6 Summary of narrative

To facilitate readers understanding of the following section, I provide a short brief: the next section is an extraction from a larger story. This section focuses on the days in my life in which my identity as an artist was "seen" by a gang leader and when my education options were predesigned by apartheid, my race and my gender. Further, it shows how women options would be considered and consulted in a gang culture. This is a tightrope performance as violence and abuse for being too vocal or critical could be punished. Under the finding and discussion section, I explain how these relate to my struggle with my professional identity.

4. My Story

4.1 A woman's place

Coloured townships such as Bishop Lavis, in the Cape Flats, were created through the racialised legislative processes of the apartheid era. These townships and the processes of racial classification and forced relocation that created them, assigned to the racial category "coloured" a unique political, physical, three-dimensional and socio-economic meaning. While apartheid legislation, such as the Population Registration Act of 1950, defined who "coloureds" were, the Group Areas Act of 1950 required that they were allowed to live on

the city's edges, away from the central business districts and other well-resourced amenities. Yet, while coloureds were discriminated against the white population, they were also relatively privileged in comparison to those classified Africans (Black) (Diergaardt, 2018). Further, legislation such as the coloured labour preference policy simultaneously, created a hierarchy of deprivation in the Western Cape. In which coloured were given job preference over Africans (Blacks) as well as ensured a ready cheap workforce for the clothing, textile, canning and farming industries of the Western Cape (Salo, 2007).

The three-dimensional meanings that informed colouring were informed by the group's relocation to Cape Flats, while its gendered meanings were shaped by the specific location and redefinition of adult-coloured women, within the apartheid bureaucracy, through welfare and housing regulations. Within the hierarchy of black deprivation, coloureds were given preferential access to social security grants, such as the child welfare and disability grants, over African (Salo, 2007; Diergaardt, 2018). Further, the public housing in the urban Western Cape was provided to coloured rather than Africans (Blacks). This was designed in order to create a stable racialised working class and secondly, to prevent the creation of a large urban African population in this region. Coloured women become the unwitting beneficiaries of this set of racial legislation and therefore were strategically positioned as power brokers for their communities within the apartheid social structure, making coloured men economical unattractive.

Less coloured men were favoured for work opportunities and therefore could not claim to be the bread winners and protectors of their families, challenging their perception of masculinity. In order to obtain housing, they had to prove that they had dependents, a wife and children. In this regard, having children was a commodity. The factors of unemployment highlighted by Statistics South Africa (1996) were approximately 30% since the long absences from household during imprisonment prevented men from providing for their families through legal means.

The gendering of the racial coloured category occurred in two ways. Firstly, through the bureaucratic assumptions about family formation that informed the state social security programme, and through the specific feminisation of the industrial workforce in the Western Cape urban economy (Diergaardt, 2018). The apartheid state assumed that all families conformed to the westernised heterosexual family norms, where fathers and mothers fulfilled stereotypical gender roles. Consequently, child welfare grants were payable only to women as mothers and public housing was provided only to families with women and children.

Secondly, within the economic sphere, the feminisation of the labour force in the textile industry, together with the impact of the Coloured Labour Preference policy in the Western Cape, resulted in coloured women being the preferred worker. Until the early '90s, adult women held relatively powerful economic statuses within these townships as the conduits

to scarce economic resources and shelter. In the present day, the cultural status of these women as power brokers still holds in the township. This is despite the fact that their economic power has diminished slightly as many were retrenched from their jobs in the clothing, textile and canning industries. These women embodied and continue to embody the bridge between becoming and unbecoming of coloured women. They are the moral compass and medicate the state, police, gang and education in the township.

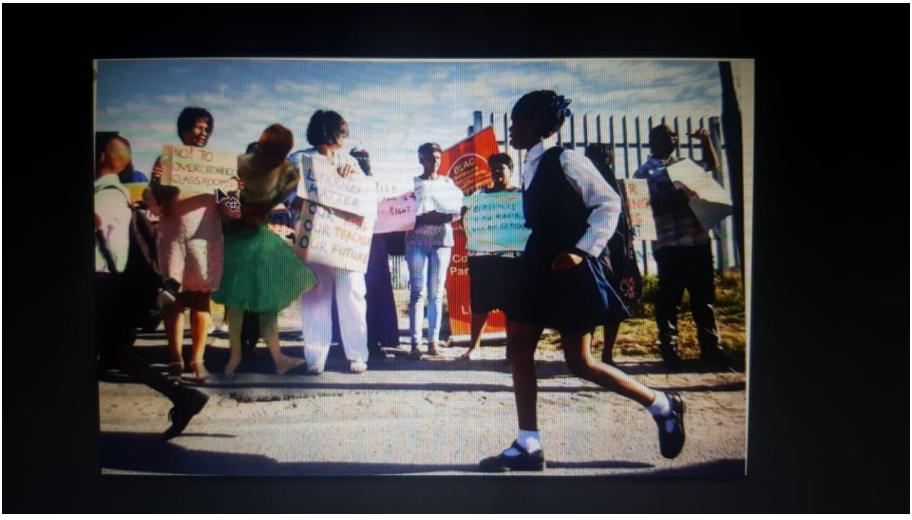

Figure 3. A demonstration by coloured woman protesting about education in front of a school. The Dega Ballerina is in the crowd as a participant.

3.2 Freewriting (my journey growing up in this system)

This is a freewriting piece and thus it is used in this paper as it was written with little editing: the translation to English may have diluted the true meaning of the content, but every effort was made to make this part accessible to the international audience.

"Vroumense hort nie hee nie" (Woman don't belong here).

I was 10, sitting on the sidewalk drawing on an old school book. He walked by, standing over me with his small figure and new shoes. He wore Levis. I could tell by the chappies (tattoos) he stood for the "nommer" (the Numbers Gang in Cape flats). When I looked up, I could not believe my eyes, it was him "die dik ding", the main man. I could see from the side of my eye that the passers-by and people on the street were interested in the attention I got. He sat down in his hirrke (haunches). He spoke slowly and softly, like he did not want anyone to hear. "jy is mos boeta Gummy se laaitie, (I know your grandfather, Gummy) awe ek hoor die ou op die see (I hear he has been on sea), 6 maande al, (6 months already) en jou ougirl slap mos in" (and your grandmother sleeps in a white family's house working as a maid). He

made it clear he knew my grandfather and knew that my grandmother was not home and worked in the white neighbourhood. He knew I was alone, except for my dad and his brothers.

“jy teken nogal kwaai” (you draw well), he said. “ko druk gou die chap op die muur” (I want you to draw this gang sign on the wall). A way in which a gang marks their turf. I could not refuse him in front of everyone in the street. I saw him beat up his own gang members who steal from the community. His mommy is a supervisor where my aunt used to work. She runs things from third floor, pink flats. She (his mother) sees all from up there and rules with an iron fist. Here we have our own justice and reconciliation. I also knew that by doing this I would be associated with them (gang), which may not have been a bad thing: after all, he already said it, I am alone out here. I got up and we walked to the wall with him two steps ahead. Visually it is clear, men are men here.

Htjie, looks over his shoulder and says, “jy is reg groot gemaak” (you were raised correctly). He indicated a young man, who I will later get to know as Jimmy, who was standing on the third floor (blocks of flats). I always found it strange that the apartheid government built those jail-like housing. Jimmy whistled in response to the main man's request which was signalled by that finger in the air. We stopped at a wall of one of the flat blocks. Jimmy arrived with a box that contained paint, brushes and spray paint. I look up and see her mother up there watching, she is in charge but she makes all men feel important and useful. I was excited because I had never had coloured pencils, let alone this equipment. The man took off his shirt, showed me a “chappie” (tattoo) on his chest and told me to ‘druk di’ (draw that). I started under the watchful eye of all his getuietjies (gangmenbers). While I was drawing, they played music from cars and played dice (gambling). The ladies were standing on the stairs watching me, one of them shouted “jy better reg teken of jy kak vandag klein klein.” (You better draw right or you will be in trouble as young as you are). Everyone was making jokes, laughing, and smoking. For the most part it was actually a nice concrete picnic of poverty.

When I was done, the main man walked over and sat next to me. He said “Jy is kwaai. Jy is gehoorsaam en loyal. Jy is n regte soldaatjie” (Sei arrabbiato. Sei obbediente e leale. Sei un vero soldato). He stood up and loudly said to the rest of the younger gang members: “Sy staan vir die nommer” (she is a “nommer”) and the rest of the member retaliated with protest. They were not happy that the main man would call me a member. The women from the stairs shouted out, “hee hoor julle nie, die man se mos, sy is protected”. I realised here that this is a man’s world but the women council is strong in decision making. The younger members looked over to the older men who had blue baatjies (who had gone to prison and had served time in jail). They were playing dumanoes (dominoes) at the end of the block. One of them saai, “vroumense hort nie hee nie” (women are not allowed in a gang officially). The main man, became more assertive and almost angry. “Ek se mos, sy is onder my protection. Sy is mine. Niemand vat hee nie. Sy hort nie hee nie ma ek maak dit reg…ek dra ha kak”. This meant that he vowed for me, and would pay my debits to the gang.

You are clever, he said, it's a pity you won't be in school for long. I will talk to my mother, she will make a place for you in the shoes factory. It's not like this apartheid government would let you learn anything real anyway. It's even worst cause you are a girl, you are only good for one thing. Too bad though, because you would be a good leader here, I can see it in your eyes, you have no "bang hare" (not scared). I can see you with the drawings, you're a front-line soldier, but you are not a boy.

His mother came down from the stairs, he walked me to her, and said "he vat ha" (take her). She was a "big laaily aunty" and she sore a lot. I walked into the house, she said "ons is die brain van die besagheid" (we are the brain of the business), let the men play their games we deal with the real money. I looked around the room: it was a regular home just like any other around here. In the conner sat a small figure of a lady, as I came closer. She said, you must learn to take beatings, her face was swollen and bruised. The older women said: but we protect each other even "when you vang on kak" (when wrong). I looked at the small bag of money in a bread plastic bag and she said you will leave the business if you steal.



Figure 4. Pink flats, Bishop Lavis in the '90s. A demonstration by coloured woman protesting about education in front of a school. The Dega Ballerina is in the crowd as a participant.

5. Findings and Discussion

My analysis of this narrative allowed an exploration of the following key concepts:

By the ages of 10, I was aware that I was coloured and that because of apartheid my options for school would be low. I knew that I had talent but because I was not a boy my options were perceived limited. I knew that there were paths available that others would prepare. That I needed someone to speak for me, someone who could champion for me. That I needed a man to persuade others about my worst and my belonging. Art/design is only seen when someone of influence says is valuable.

That women have found ways to survive and had formed strategies to live even in gangs, even in townships like these. Understanding how my younger self saw the drawing and what it was used for, helps me to understand why I am so keenly interested in higher education in design, recognising the value of local art and what communities, even gang culture, call art.

These insights gave birth to my PhD strategy in which I investigate how women of colour used strategies to survive and thrive while perusing a post-graduate degree in Design. In the next section I will discuss how I will use respectability politics, creative resistance and research as making, combined with black rage.

5.1 Keywords

Intersectionality

Intersectionality allows people to understand each other by a broad understanding rather than a trait. It also helps to identify common ground, for example: I am a black woman, highly educated, able-bodied. Being black and a woman are two traits oppressed by, while being highly educated and able-bodied are traits I am privileged to have. There are many factors that contribute to difficulties in a person's life, by focusing only on one area, there can be misunderstandings. Intersectionality helps us understand each other, by understanding that one life intersects with many parts of us (Smith, 2013). It also helps in understanding the differentiated oppression white women and women of colour experience in a broader context. However, in the context of academia, it helps to recognise the different implications it has for different races.

Respectability Politics

While these distinctions were and remain about class, they were and are expressed primarily in behavioural, not economic, terms. Respectability politics is deeply problematic because it emphasizes individual uplift and ignores structural inequalities, which are not changed by

ascending class status (Harris, 2003). Black feminist Brittney Cooper (2018) argues that respectability politics is the heart of an anger management project. Learning to manage one's rage by daily tampering it down, is a response to the routine assault on one's dignity.

I hope to see respectability politics, creative resistance and research as a continuum of possibilities for reframing curriculum and pedagogy. Considering the Fallism protest, as mentioned before, I highlight the call for a decolonised education and university, by drawing on Isabirye and Moloi (2017). In line with this, it would be important to consider African feminism from the point of view of a decolonial feminist. Wanelisa Xaba (2017), explains how students responded to structural violence on Black South Africans daily; how education has been used as a tool to suppose colonists' cultures of oppression. She goes on to say:

> "Fanon is useful and remains very important, his work on responding to colonial violence does not extend to the gendered ways in which violence is embodied".

This gendered ways of how women of colour have had to embody structural violence speaks through the research project if I hope to offer some reframing of curriculum and pedagogy.

Through narratives, I hope to reclaim an emotion often regarded as negative: anger serves as a means of social and personal transformation (Boahene & Rodriguez, 2012), a way to heal from oppression and exploitation. Boahene and Rodriguez and used critical race feminist theory as a framework, a storytelling to share experiences in the White academy. I am inspired by this work and agree that anger is a necessary step to achieve critical consciousness. Women of colour have learned to use their anger, as a means to survive everyday racism and also how to cope with it by understanding that this rage partially helps us to survive and thrive and the alterity defines us.

Black feminist auto-ethnography

The primary methodological framework will be that of auto-ethnography. Collins (2009) suggests that Black feminist auto-ethnography (BFA) can serve as a theoretical and methodological means for Black female academics to critically narrate the anger and pain of Black womanhood (Griffin, 2012). Kelly (2016) states that auto-ethnography attempts to identify creative ways for research to amalgamate the personal experiences of the researcher and the participants with the call for decolonised methodologies.

I hope to use these moments when I have remained silent and forced to struggle to find my place, my ethnicity marked as troublesome, inferior, or opposed to, or as a threat to the academia. As I watch as people listen to "them" instead of us "angry black women", the white privilege in practice, I narrate my moments. My voice is given back to me through this auto-ethnography. In this way, auto-ethnography is also a way to oppose otherness thanks to its power to see these moments of ethnic otherness and resist them.

Auto-ethnography is an act of creative resistance.

Feminist Thinking

The research study is developed in a feminist post-colonial theoretical framework that flags the complex intersections of gender with race and class (Mirza, 2009). Through conversation, the study will focus on lived experiences captured in the narratives of the participants, the researcher and the research process. The aim behind this conversation is to uncover the lived experiences of a group of women of Colour (Turner, 2002), designers, academics and post-graduate students. The study will be located within the larger body of literature which explores how masculinity and white supremacy, as conceptual tools with material consequences, operate within the academy.

Feminism was historically dominated by white, northern/western, middle-class women who represent the experiences of "all women" as if they were unitary. This has long been criticized by black, postcolonial, de-colonial and African feminists who demanded a more nuanced engagement with feminist questions. Black feminist authors provided terminologies to put into words what I am feeling. Davis (1983, p.13) reminds us that feminism must be for those at the very bottom of society:

> "Revolutionary hope resides precisely among those women who have been abandoned by history and who are now standing up and making their demands heard".

In the light of the above statement, the book of Bell Hooks, "Teaching to Transgress: Education as the Practice of Freedom", can be linked to my theoretical framework and considerations of feminist thinking, as well as my research question, my problem, my aims and objectives.

Hooks (1994), highlights that "the classroom remains the most radical space of possibility in the academy". It is her book that is ethically oriented and can be used to augment the significance of my proposed study, and its critical potential to unearth how we, academic women of Colour, are navigating a classroom that was never built for us, and it was not designed to consider our approaches, technologies and radical minds. In the same way the Design post-graduate classroom was not designed for us to thrive. Therefore, the significance of the women of Colour in design is immense because it holds the promise of unearthing the specific pedagogy of women of Colour.

Feminist scholarship allows to make visible the power dynamics of class, gender and race. It allows revolutionary ways to challenge the way mainstream research has reproduced and valued male domination and gender inequality, as well as all forms of other inequalities. For example, research in SA during apartheid reproduced and rationalised racism that holds apartheid ideology in place (Adhikari, 2005). This approach allows to challenge the violence of representation, objectification and "othering" of research participants through power relations, also merged with other forms of inequality (Reddy, et al., 2016; Khunou, et al., 2019).

The conceptual theories that will be drawn upon are intersectionality (a key concept that emerged from black feminist theory) respectability politics, theories of affect, the politics of emotions and in particular black anger as a strategy for women of colour (Nash, 2019).

6. Conclusion

This paper is clearly not a grand statement for the victory of social justice or the correction of how post-graduate studies can be improved for academia in design higher education. It simply offers a comment on the silence about the fact that the past is present in our living today. Not to mention how politics impacts on identity do not make it invisible. The effects of the past, in my present fight for justice and for women of colour to survive and thrive in design, in higher education, in my classroom, staff-room, workshops and personal studies, live with me.

I believe that using narratives as a means to excavating my past has offered valuable insights for social change and for my role as a researcher in an academic space. This work has been emotional, as well as provoking reflection on the many layers of my identity and the labour involved in hiding who I am. I look forward to the journey of (un)becoming as I discover and develop my professional identity. At the same time narratives allowed me to reflect on the relationships needed in perusing post-graduate studying and (un)becoming.

The process of narrating offered me opportunities to consider my life against the backdrop of social forces and change. The strategies that I have employed since childhood to survive ganglands and navigate education.

Finally, I am aware of the critics about auto-ethnography and narrative research methods. As for this paper's contribution to the Design higher education community, my stories may not respond directly with recommendations, but rather comments that higher education in South Africa is focused on access and an understanding for who is in the classroom. I ask the same consideration for academics who trained and lived in the silence of the apartheid system designed to provide limited access and ill-equipped education opportunities. That they too be given the opportunity to show up as part of the "All" of who we are.

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During the 2002 to 2006, she was employed at Naspers where she was a graphic designer, photo editor and publication layout artist. Her knowledge about graphic design and technical skills on various graphic design computer software was a good combination. It was here that she discovered the love for learning and believed in lifelong learning, particularly in this Industry.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Ethics of Knowing a Shared Language and Intention in Design

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Abstract | The ability to identify and discuss designs that have supported the overgeneralization of historically marginalized communities is imperative to guide a social shift in the design community. This paper will outline the value of a shared ability to identify racialized design, the ethics of knowing a shared intention, and the understanding of a shared language when discussing racialized design. The use of a shared language provides collaborative partners with the opportunity to narrow down the elements of racism evident in various forms of racialized design. The opportunity to reimagine racialized artifacts, systems, or experiences and change patterns of thinking that perpetuates the continuum of oppression. The Racism Untaught framework helps identify racialized design and critically evaluate anti-racist design approaches.

KEYWORDS | RACISM, RACIALIZED DESIGN, DESIGN RESEARCH, ETHICS, SHARED LANGUAGE

1. Introduction

The ability to identify and discuss designs that have supported the overgeneralization of historically marginalized communities is imperative to guide a social shift in the design community (Fricker, 2007). This thread of research originates from over thirty workshops run by Racism Untaught as it iteratively developed tools and design interventions focused on critical analysis and reimagining of racialized forms of design. Racism Untaught was initially created to fill an identified gap, an opportunity for educators to foster conversations and learning environments, focused on critical thinking and diverse forms of making, for historically marginalized and oppressed communities. This paper will outline the value of a shared ability to identify racialized design, understand a shared language, and the ethics of knowing a "shared intention" when discussing racialized design.

First, we will outline the framework's development to understand the organization of the workshops run by Racism Untaught. Then, we will describe how the cards that outline elements of racism, created a shared understanding for racialized designs and how this shared language became an essential thread of research. We will describe how participants in our workshops saw this language as a way to speak to their own social experiences with racialized design and convey knowledge and validation of those experiences. Through this research and the execution of courses and workshops, we recognize a need to acknowledge the ethics of knowing a shared language in the practice of design. The value of a shared ability to identify and discuss racialized design enables participants to responsibly contribute to design and acknowledge their agency to influence rhetoric in the public domain.

2. A Shared Ability to Identify Racialized Design

The value of a shared ability to identify racialized design in the design process helps to challenge and analyze everyday artifacts, systems, and experiences. To ensure that designers contribute to design responsibly, they must understand their ability to influence rhetoric in the public domain, not only from a visual perspective but also from a systemic perspective (Mercer & Moses, 2019). Racism Untaught is a research study focused on developing tools to facilitate discussions on racialized design– design that perpetuates elements of racism. Racism Untaught was created in response to multiple design educators asking developers how to incorporate social design and discussions of race, culture, and identity into the classroom. The first version of the framework was developed in the Spring of 2018 over a series of brainstorming sessions and concept mapping. We refined the framework iteratively over a series of workshops and courses to ensure that each tool in the framework was improved. The framework begins by giving participants an identifier—an artifact, a system, or an experience—at the beginning of the design challenge. These three identifiers include comprehensive examples of racialized design, of which designers have the power and privilege to positively affect design in our society. It is imperative to incorporate these lessons into a diverse and inclusive pedagogy, to ensure that we design curricula that

understand the implications of design within our culture and communities. The decision was made to show both a historical and contemporary directive of artifacts, systems, and experiences focused on different forms of racialized design. This decision was made to ensure that participants in a workshop, or a Racism Untaught course, saw the development of racialized design as a contemporary and current issue. The developers also curated a collection of the three categories as a resource for design educators to use if they teach this framework in their courses.

Through the use of the framework participants will apply the design research process to identify racialized design and critically assess anti-racist design approaches. The first step in the process is called context; this step has over sixty cards that include definitions and terms focused on elements of racism. We have recently added cards focused on elements of sexism, and we are currently working on adding other elements of oppression. We ask participants to use the terms in this deck to create context around the identifier they have been given and discuss how forms of oppression are perpetuated and supported in the world around us. We ask participants to say why each element of oppression is relevant to the identifier and which elements are not. The first step also includes a diagram outlining the Levels of Oppression. This allows further contextualization of the instance of oppression on four different levels: 1) beliefs—personal beliefs, ideas, and feelings that perpetuate oppression, 2) agentic action—when oppressive beliefs translate into oppressive behaviour, 3) institutional—structural oppression that results from agentic oppressive behaviour, and 4) cultural—norms, values, beliefs, and trusted systems of truth acquiring that preserve, protect, and maintain oppression (for example, white supremacy). This, further, contextualizes the participants' instances of oppression, prompting them to consider where the problem was created and how each level perpetuated it. This step prompted the research thread in this paper and will be further explored in the remaining sections of the paper.

The next step is called define. This step has roughly fifty cards, including qualitative and quantitative methods and theories to define how the participant might approach the design challenge. In this step, participants are also required to create a thesis question to help focus their design challenge. We provide participants with this guiding question, “How might design be used to [action] in order to [create change] with [stakeholders]?” Participants garner factors from their research in order to move forward to the next step, ideation.

The ideation step includes over one hundred cards. During this step, participants begin to determine what they will create— an artifact(s), a system(s), and/or an experience(s)—and which will help dismantle the form of racialized design. They are prompted to determine how they can affect change and how they can be a part of the solution. This step includes a quadrant map to help evaluate the value of each idea. On the X-Axis, participants are instructed to consider the intent of the idea in comparison to the impact and on the Y-Axis, participants consider how far the idea might shift stakeholders from systemically oppressive thought(s) to anti-oppressive action(s). Participants plot their strongest ideas and discuss

whether their idea only has good intentions or if it will have an impact and focus on anti-oppressive actions against oppressive thought.

The fourth step, called prototype, has approximately thirty cards. This walks the participants through a low-, mid-, and high-fidelity prototyping process. The low-fidelity prototype is non-functioning and is initially presented to communicate an idea. A mid-fidelity prototype is limited in functionality, and a high-fidelity prototype requires minimal modifications for the final deliverable. We find that oftentimes in this step, participants will move back and forth through the framework to further contextualize or use methods to help them understand how the idea they are creating impacts communities.

The fifth step is called impact; this step helps participants understand the impact they are having with the work they produced. There are two approaches to this step. The first approach is the rubric for grading academic work. In a course setting, participants will define a rubric that demonstrates both a mastery of the determined deliverable and the ability to incorporate methods and processes at an advanced level of understanding. The second approach is through the use of the impact card deck, approximately twenty cards. The cards are most likely to be used by people in industry but oftentimes used by people in academia in addition to the rubric. The individuals in an organization will use the card deck to measure their design impact on the implementation of their ideas.

3. Understanding of a Shared Vocabulary

The Racism Untaught workshop has been conducted in over forty separate events. At first, our intention of running it numerous times was to iteratively improve the tools we had developed. We intentionally ran the first workshop at a conference with like-minded designers and researchers, people who conduct research to critically analyze and re-imagine systems of oppression or as a form of activism (Warner, 2013). We did this to make sure all the words in the framework, specifically in the first step, were as comprehensive as possible. We included five blank cards in each deck for each step of the process so that participants could write a word and definitions they thought were missing. We began to run the workshop at conferences that had a more contemporary view of design and with a broader set of topics. This helped us refine the words and definitions even more. We continued to add words and create and apply our own definitions based on these conversations. The following ten words are from the Context step in the framework:

- Aversive Racism: a form of implicit bias in which a person persistently avoids interaction with other racial and ethnic groups.
- Blockbusting: convincing white property owners to sell their houses at low prices by promoting the fear that racial minorities will be moving into the neighbourhood.

- Cultural Erasure: forcing non-Western cultural groups to adopt Western culture, including attire, the English language, Christianity, and Western birth names.
- Exoticism: objectifying, othering, sexualizing, and/or dehumanizing Women and Femmes of Color who do not align or fit within Euro-centric beauty standards; also known as racialized sexism.
- Implicit Bias: the unconscious attribution of particular qualities to a member of a certain social or cultural group.
- Intent Over Impact: prioritizing well-intended actions over the negative impact they might have had on a Black, Indigenous, or a person of color (BIPOC).
- Microinvalidations: a comment or action that subtly and often unconsciously or unintentionally, excludes or negates the experiences, feelings, and experiential reality of a Black, Indigenous, or a person of color (BIPOC) (for example, "you have good hair, so you are not really Black").
- Nativism: policies or systems favouring native inhabitants as opposed to immigrants.
- Redlining: the racially influenced and systematic denial of various residential services, including access to specific neighbourhoods through selectively raising prices.
- Xenophobia: an intense or irrational dislike or fear of people from other countries.

Once a workshop is complete, there are usually few participants who ask or take for a copy of the first deck of cards. This applies to both white people and BIPOC, but for different reasons. BIPOC could say, "I have experienced this at work (or at fill-in-the-blank), and I want to know how to respond when it happens again." They felt empowered by these cards, and one even said, "I could keep these cards in my desk, and when I am experiencing a form of racism, I will be able to refer to these words and pull out the card and say, this is what I am experiencing." We also noticed that white people wanted these cards in order to learn about racism and dismantling racialized design. They were seeking a shared language to speak more accurately on their own social experiences with racialized design.

When the term *sexual harassment* was determined as one way to describe the intimidation and exploitation women were experiencing (Brownmiller, 2000), it provided a word for a shared experience that didn't exist. This shared knowledge and way of speaking created a collective understanding for a group of people. The ability to match an experience with a term provides an individual with the ability to understand the mistreatment and then take measures to prevent that experience from happening again. A shared language provides a group of people with the ability to discuss injustice more accurately. It creates a boundary for the harasser to no longer have more power (Fricker, 2007). This is also described as hermeneutical marginalization, "the injustice of having some significant area of one's social experience obscured from collective understanding owing to persistent and wide-ranging hermeneutical marginalization" (Fricker, 2007, p. 154).

In order to create a space for conversations, where these words were being discussed we asked participants to determine and then apply community agreements. An example of community agreements includes:

- It is important to listen actively and compassionately and try to understand others before being understood.
- Every voice is important, and more perspectives will strengthen the conversation.
- Speak from your own lived experience by using "I" statements and refrain from telling other people's stories.
- Invest in yourself and invest in each other by respecting our shared space and keep time in mind.

The community agreements and the definition of racialized design provide a courageous space for participants of different social identities to discuss the difficult topic of racism.

We have begun to run workshops only using the cards focused on elements of oppression. These workshops allow a more focused dialogue and, further, provide more discussions on social experiences. We have participants who arrive ready and eager to work with us, and we also have participants who are ready to challenge our ideas. We welcome both and work to guide the conversation in a shared space. We have had participants who challenge the examples of racialized design we provide and some of the definitions we use. We were happy to have this dialogue and support participants to join the conversation to work together in order to create a shared understanding. It is rewarding to see people be empowered by the knowledge of shared language and to see how this helps shape the conversation around racism in a direct manner. In the United States, students are not typically required to take foundational courses on racism. We hope that the Racism Untaught framework can be utilized in any course, not just those focused on critical analysis of different forms of oppression.

4. The Ethics of Knowing a Shared Intention

The use of a shared language provides collaborative partners the opportunity to narrow down multiple elements of racialized design and reimagine new solutions and changes in patterns, while working together to deter the continuum of this overgeneralization. This change in design takes time but will provide a strong foundation for a developing work that is able to recognize both visible and invisible forms of racialized design. In order for change to take place, "[…] the constants–media, language, repertoire, appreciative systems, overarching theory, and role frame– are also subject to change. They tend to change over periods of time, longer than a single episode of practice, although particular events may trigger their change" (Schon, 1983, p. 275).

This change also requires designers to be aware and have more knowledge of racialized design. The ethics of knowing the “shared intention” of an object depends on the social cognition connected to an artifact, system, or experience (Fiebich, 2014). This social cognition does not depend solely on an individual's understanding but on the "shared intention of social group members who constitute a particular institution” (Fiebich, 2014, p. 3). The proposition of an idea can be believed or denied based on our unobserved matters of fact (Fricker, 2007). How do designers conclude that a design is continuing the overgeneralization of a historically oppressed community? The tools developed by Racism Untaught provide a more informed conversation when working with multiple disciplines, allowing partners to outline and identify elements of racism. It provides the design community with a set of terms that seek to understand the social experiences of those who experience racialized design firsthand and those who need to convey knowledge and validation of those experiences (Mercer & Moses, 2019).

> A designer makes things. Sometimes he [*she, they*] makes the final product; more often, he [*she, they*] makes a representation of – a plan, program, or image – often an artifact to be constructed by others. He [*she, they*] works in particular situations, uses particular materials, and employs a distinctive medium and language. Typically, his [*her, their*] making is complex. There are more variables than can be represented in a finite model. Because of this complexity, the designer's moves tend, happily or unhappily, to produce consequences other than those intended. When this happens, the designer may take account of the unintended changes he [*she, they*] has made in the situation by forming new appreciation and understanding and by making new moves. He [*she, they*] shapes the situation in accordance with his [*she, they*] initial appreciation of it. The situation is reflective (Schon, 1983, p. 79).

It is imperative for designers to learn a process they are able to incorporate into their work that results in responsible design.

5. Conclusion and Next Steps

As a society, we continue to create racialized design while arguing the need to be “untaught” racism. This contradiction leaves us blaming others for racist incidents while leaving ourselves out of the social justice movements. The fear to engage leads us to do nothing, which sets us up to actively perpetuate systems of oppression. It is our hope that Racism Untaught can help undo the disconnect and positively impact our communities to develop new and inclusive design at any level. This effort is necessary to redesign how individuals engage with and create artifacts, systems, and experiences to break down systemic racism. We have begun adding cards focused on sexism and ableism to work toward an intersectional conversation on oppression. The ultimate goal is to extend the framework to include homophobia, transphobia, cissexism, gender binary, ageism, and other forms of oppression.

Next steps in this work are to continue to run workshops, both in academia and industry. We will continue to run workshops on the first step and the entire process at conferences in order to continue learning, and invite other educators to teach from this framework. This work is focused on cultivating learning environments for people in industry and academia to explore further issues of race and racism, from the obvious to the invisible. We will continue to research and develop tools that participants can use to identify racialized design and critically assess anti-racist design concepts while developing space for a dialogue on racism and racialized design. These conversations require a safe and courageous space to allow participants to speak about their social experiences with racialized design or convey knowledge and validation of those experiences. These types of conversations are imperative to guide the social shift in participatory design (Fricker, 2007).

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Acknowledgements: We would like to thank our advisory board for their support and feedback. Heidi Bakk-Hansen, Historian, Researcher, & Organizer, Dr. Gioconda Guerra Pérez, Assistant Vice Chancellor for Diversity, University of Illinois, Dr. Paula Pedersen, Inclusive Excellence, University of Minnesota Duluth, Dr. Jeanine Weeks Schroer, Philosopher & Race Theorist, University of Minnesota Duluth, Jennifer White-Johnson, Art Activist, Designer, & Educator.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Neighbourhood Home. System of environments for plural inclusion

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Abstract | Migrations have always changed the way humans live: nowadays a multiplicity of people with different background, gender and lifestyle converge in big cities and they are often perceived as a threat to pre-existing culture and native cultures. But what does 'home' mean? For most it is the neighbourhood, that involves people's everyday life. This paper presents a visionary project called 'Neighbourhood Home', a system of new environments for future inclusive cities, that aims to make all the inhabitants 'feel at home'. In this Homes, through music, or language, handicraft, clothing etc., people can rediscover their common roots, that have always been, today as yesterday, interconnected through plural cultural expressions. In the first concept of Home designed, 'MeetEat', an ingredient is chosen on seasonal base to make voluntary and informal cooking classes in the neighbourhood. The 'Neighbourhood Home' system could turn diffidence into curiosity for what is in common and exclusion into sharing awareness and wisdom to face the challenges of the present and the near future.

KEYWORDS | MIGRATION, ROOTS, INCLUSION, SHARING, CULTURAL HERITAGE

1. Introduction: city as a home

Cities have always been the main character of human history. According to the World Urbanization Prospect 2018, globally the majority of people live today in urban areas: from 751 million city residents in 1950 to 4,2 billion in 2018, and is expected to increase to 8,6 billion in 2030 and 9,8 billion in 2050, more than double compared to today (UN Department of Public Information, 2018).

Cities have also been the place where changes occur quickly and continuously. Throughout history we have seen changes so profound and at such a rapid pace, that it is often difficult to recognize the beginning and the end of their transformations, as well as to find our way through the once familiar places. In our age, characterized by strong mobility, these changes are often perceived with anxiety and concern (Bauman, 2018). The city represents, on a reduced scale, everything that is on our planet; is a place where all the diversities must coexist. The rich and the poor and all the ethnic, cultural, origin and status differences: as in the world, in the big city everything is mixed (Augé, 2017).

When we think of “people”, “population”, we think of a group of individuals belonging to a specific territory and with common roots, traditions and culture. With today's social changes and migrations, however, just as the borders of cities expand and become blurred, in the same way people move, leave their territories, become contaminated and seem to lose their roots.

> “Nomads traditionally studied by ethnologists have a sense of place and territory, a sense of time and return. This nomadism is therefore different from what is metaphorically called such when speaking of current mobility. […] It corresponds to the paradox of a world in which, in theory, anything can be done without moving and in which nevertheless one moves” (Augé, 2010, p.9).

Today's society can be seen as a large laboratory in which new social forms, solutions and meanings are produced and social innovation is created (Manzini & Jégou, 2003). From designing products for the survival of those who have nothing, to research platform for the constitution of new realities: this is what the movement of social design do, not for charity or good works, but to participate in rebuilding the world “seen by those who live in it” (Manzini & Jégou, 2003, p.13). The term "social design" is globally used for different disciplines: some are related to the design of products and services for humans, others refer to a kind of design that goes beyond the artifact and aims to develop new realities for the individual. Social design is the design of a process that contributes to improving human well-being and livelihoods (Holm, 2006). In recent years, designers are co-designing with users to create responsible projects that fit people's actual needs and values, rather than commercial. Social design is also considered as a discipline that “conceives and develops solution ideas that take into account the quality of the interactions involved” (Manzini & Coad, 2015, p.59).

2. Theoretical framework: why foreigners are drivers of change and an opportunity for local communities

Although it has always been part of the world's history, the migratory phenomenon has intensified so much in recent decades that it has been considered by many one of the greatest characteristics of our time. According to UN estimates, in the decade 2007-2017 the number of people who fled war conditions in developing countries reached 68,5 million (UNHCR, 2018), but there are also many people in the world who left their country due to famines, desertification and climate change.

From the XXVII Immigration Report we learn that in 2017 Italy hosts 5.144.440 immigrants - speaking only of the regularly resident - or 8,5% of the total resident population, and ranks fifth in Europe – and eleventh worldwide – in the list of countries that host the largest number of international migrants. Most of them live in major urban centers (Caritas & Fondazione Migrantes, 2018).

Those who leave their home to move to another territory, however, are "strangers" for those inhabitants, and often raise suspicion. "Strangers tend to give anxiety precisely because they are "strange" and therefore frightening in their unpredictability" (Bauman & Cupellaro, 2016, p.8). Locals, the native ones, are often hostile towards those they do not know: the fear of the foreigner often derives from an insufficient knowledge of cultures and customs from different territories. Often foreign gestures are re-interpreted or even misunderstood by the locals, because they are strongly influenced by not knowing how to proceed, or how to behave in a situation they have not created or are able to control (Bauman & Cupellaro, 2016).

In fact, the 2018 report of the European Commission shows that half of Europeans (46%) are not very well informed about immigration and integration and, in general, tend to overestimate the number of immigrants in their country. Four out of ten Europeans believe that immigration is more a problem than an opportunity for their nation, and this opinion is even more negative in Italy, one of the countries that demonstrate major hostility towards immigrants. Moreover, most Italians do not believe that integration is taking place successfully (European Commission, 2018).

In the report "A fragmented Italy", a general feeling of self-loss emerges from Italians because of these social changes. Half of the Italian population reports that they have sometimes felt foreign in their own country. In fact, 59% of citizens fear that the national and the traditional cultural identity are disappearing and 53% describe their country as weak, angry and divided. Almost 60% of public opinion expresses concern about the migration phenomenon and believes it has a negative impact on the country. Only a minority (16%) thinks otherwise (More in Common & The Social Change Initiative, 2018).

> "The negative sentiment towards immigration is exacerbated by fears for security and by the perception that Italy has lost control of its borders, as well as by the

> inability of the authorities to effectively manage the migration phenomenon" (More in Common & The Social Change Initiative, 2018, p.9).

But is often forgotten that this feeling of loss is not only experienced by hosts, but, above all, by guests, who have consciously left their own territory and culture, and also their home, affections and memories. The new place they live in is foreign to them and their condition is often loneliness. Furthermore, the famous "integration" activity often does not involve an exchange, a mutual consolidation and a common organization. Rather, what is meant is a pact of tolerance if the foreigner proves to be able to put aside his roots, his differences and uniqueness, his traditions and his knowledge to embrace those of the new territory; only by denying what makes him 'different' there will be a dialog. However:

> "the history of humanity is dotted with mergers of different groups [...]; it is a story of languages, religions, knowledge that have met and continue to meet, merging with each other" (Giusti, 2007).

The migration is a complex and controversial topic today and this research paper tries to answer the following questions: how can we use design to create a stronger connection and make the lifestyle of foreigners in the city more similar to the right idea of "inclusion"? How can we deal with the integration of foreigners in multicultural neighbourhoods? What kind of drivers of change can be foreigners and temporary residents who live and interact with an urban community? How can they become an opportunity for the entire neighbourhood community? Can we design tools, new places where the foreigner can feel more "at home" while interacting with cultures other than their own? When we try to give substance to sustainability, we try to reinvent the everyday by enormously increasing the most elementary functions of everyday experience. We often ask ourselves questions that are not easy to answer. How could community life be more sustainable? And what does this mean? (Manzini & Jégou, 2003).

This paper presents a M.A. thesis project (2018-2019) whose study arises from a reflection on whether a different approach is possible, one that considers the migrant as a person with specific needs and could become supportive to municipal policies. Also, it could help managing the complexity of the problem in the neighbourhoods of Rome, like in other cities. The social design comes to the aid, a discipline created to handle the complexity that the current society daily creates, and that can really direct it towards a sustainable evolution.

Working in synergy with some reception centers and communities in the territory of Rome, through focus groups, co-planning activities and specific meetings that involved migrants, some concepts have been defined to mediate between the local and the migrant culture.

3. Methodology: From ethnographic research to envisioning new human scenarios

For a human-centered approach an ethnographic research was conducted to base the project on people's real feelings and desires. The investigation was carried out in contact with the inhabitants of the great city of Rome in two places rich in diversity and multiculturalism. The first place was the Esquiline Market in Vittorio Emanuele, a space rich in ingredients and people from all over the world. This is a famous place of commercial aggregation for the whole city, both for Italians and, above all, for foreigners, whom are here able to find the ingredients for their typical dishes.

> "I miss my mother, my family, my sister. But we keep in touch, I see them online, and slowly I don't miss anything here in Italy"[1].

> "At the inauguration of this market we had a great party. It was called "Taste the world". Everyone brought something and every day there was a different cuisine, together with dancing, music, etc. It was the union of the world on the table, a union that brings happiness, love and peace"[1].

For the second stage was chosen the peripheral district of Centocelle, one of the places in Rome where local and foreigners live in equilibrium and the serene climate allows conversation and exchange:

> "What do you miss of your land?" - "Ingredients, the dishes that my mother cooked in my family". "Tell me about a good time of yours in a market in this city" - "Once I was telling how meat is cooked in my culture and a person looked at me in amazement. He said that his family also cooks like this. It was beautiful, it made me think that the world is small" [2].

To extend the field of research and allow people to speak more freely and anonymously, the survey "What is 'Home' to you?" was launched on Facebook. Eighty responses were collected from this survey, then analysed and clustered in a Word Cloud map, with the aim of tracing the most frequent feelings of people about 'Home'. The majority perceive 'Home' as the place where affection and warmth can be found, where they are welcomed and appreciated and in which they have so many memories. "Feeling at home" is about a sense of belonging in everyday life, a dimension in which to feel like family, a place that is well known. At home people relax because they feel protected and because they can express themselves spontaneously and be authentic, a reassuring refuge. In home there are relationships and sociability, the possibility of aggregation and the "being together" which forms a community. But the most interesting aspect that emerged from the survey was the role of the neighbourhood, smaller and more welcoming than the vastness of the city and therefore perceived by many as a Home. The neighbourhood is a set of places, streets,

1. Sellers at the Esquiline Market interviewed in person. 09 April 2019
2. Moroccan mother living in Centocelle, interviewed in person. 13 Aprile 2019

activities and people who frequent it, with whom memories are built and represents an important part of daily life.



Figure 1. Word Cloud map of the clustered answers to the survey "What is Home to you?".

4. Concept: the Neighbourhood Home

4.1 The system in a glance

Thanks to interviews and surveys, the neighbourhood was identified as the context of the project, smaller than the overall city and a place where insecurity can be lighted up by a progressive familiarity of places and people, daily met. The project focuses on the theme of "inclusion", not only of others but also of themselves in a constantly changing territory. The aim is to promote co-creation behaviours in the neighbourhood and the transmission of knowledge from different cultures within the community, a great potential for building a neighbourhood cultural heritage, that is part of everyone.

From these insights the system concept 'The Neighbourhood Home' was born, a collective and flexible space, open to socialization and receptive to the needs of individuals as well as the proposals for improvement of the neighbourhood. In this place the inhabitants of the neighbourhood can do networking, get to know each other more deeply, promote local activities and create together new shared values that can reflect everyone. As many Neighbourhood Homes as the number of neighbourhoods in the city can be created, forming a system of structures that act as a network of welcome, assistance and creativity.

Each Neighbourhood Home has two fundamental objectives: in the first phase the goal is to improve the inclusion of the inhabitants of the neighbourhood, old and new together, with the aim of creating a new common belonging. This goal can be achieved through a mediator, common to all the peoples of the world: culture. In all its forms, from culinary to literary, artisan, musical, etc. culture can be a link between people throughout the world. There will be a Home of Music, a Home of Costumes, a Home of Language and many others.

Based on the specific cultural focus to which each Neighbourhood Home is dedicated, there will be open activities organized within a minimal pre-established plan. The contents of the activities will not be fixed but variable, as they are spontaneously proposed by the inhabitants of the neighbourhood, to guarantee flexibility and allow everyone's creativity to emerge and shine.

Each Neighbourhood Home will therefore provide spaces and tools for carrying out self-managed and open activities, which will help exchanges and sharing of culture and knowledge.

Consequently to the creation of inclusion among the inhabitants, the second objective of the Neighbourhood Home system is to enhance and develop the neighbourhood itself, the city and the territory. The project aims to create a network of empathy and solidarity first between citizens and then between them and the territory in which they live, stimulate them to advance proposals and ideas for the improvement of their neighbourhood. In a space perceived as their own “Home”, it is easier for the inhabitants to talk about the problems and identify practical solutions together, organize petitions and volunteer events for their community. In this way it can gradually create a neighbourhood cultural heritage, shared by its inhabitants and more open to new transformations.

The buildings are imagined as newly built pavilions, each with a specific shape based on the cultural focus and located in land that needs redevelopment within the urban context. The construction and management of the pavilions can be taken over both by public authorities, such as the Municipality, the Region, etc. and private individuals, such as local, national or international companies sensitive to social issues.

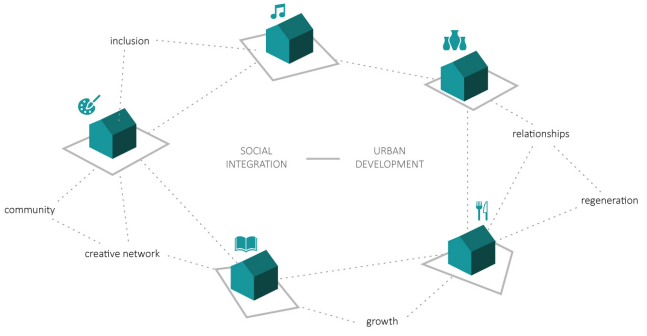

Figure 2. Neighbourhood Home system.

4.2 Food-related concept. The Neighbourhood Food: MeetEat

The first Neighbourhood Home designed and pilot project is 'MeetEat', from the union of the words "Meet" and "Eat", since socialization in this neighbourhood cultural center is promoted through food.

In fact, nourishment is one of the vehicles of peoples' traditions and lifestyle through the preparation and sharing of dishes: to get to know a different culture, eating different food is considered by many to be easier than learning a different language (Montanari, 2011; Montanari, et al., 2015). The sharing of food takes on particular meanings both for the individual and for society, since it is enriched with a symbolic and relational meaning that goes beyond its nutritional value: "Sharing the same food is at the origin of all rituals" (Barilla Center for Food and Nutrition Foundation, 2019, p.16). Sharing a meal represents an ancient and always effective means of meeting people, a bridge between cultures that allows to grasp the differences first, but then, above all, the things that are in common.

As highlighted in the essay "The fabulous story of vegetables", ingredients in history have always travelled across lands and continents following people (Bloch-Dano & Prencipe, 2017), which is why todays typical ingredients of a culinary tradition are often actually originating on the other side of the planet.

From these reflections, it was imagined the MeetEat core activity: people can participate in cooking classes focused around an ingredient chosen by the Home on seasonal base. These cooking classes are spontaneously proposed by anyone in the neighbourhood to make the inhabitants know a piece of themselves and their culture. This activity will allow people not only to gain confidence to each other in a relaxed context, but also to understand how the ingredients connect each other in the world.

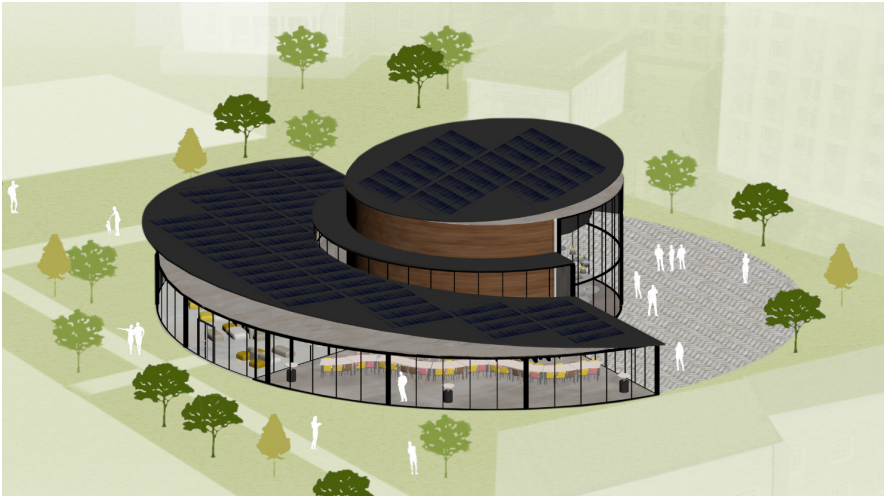

Figure 3. 'MeetEat' pavilion from above.

The 'MeetEat' structure is entirely designed around the themes of integration, nourishment and sustainability. The path inside the 'MeetEat' Neighbourhood Home begins in the Entrance area with a reception available to the passers-by curiosity and information. An entire wall is dedicated to interactive digital frames in which the user can discover future initiatives and look at photos of past activities: these have become memories shared in the neighbourhood. It can also have information on the network and the activities of the other Neighbourhood Homes in the city, that are in constant communication with each other. Registration for the initiatives can take place on the online platform, on the interactive screens or at the desk set up for support. Dialogue, meeting and waiting take place on modular and freely aggregable seats in the center of the room.



Figure 4. Entrance area: reception desk and view of the Dining Hall



Figure 5. Kitchen area: the 'Earth' section during a cooking class.

The Kitchen area is the thematic focus of the structure, because the main activity of this Neighbourhood Home takes place in this space: the informal cooking class. The inhabitants of the neighbourhood can turn in volunteer as teachers of a dish of their own culinary tradition. During the cooking class they will be able to tell stories, the origin, tricks and gestures necessary for the skilful preparation. Monthly, the Home will publish an ingredient themed calendar and people can set the corresponding cooking classes. Ingredients will highlight how many cultures have common roots, and people can discover new culinary knowledge, techniques and gestures. All those who want to participate and learn new recipes will be able to register freely, bring the ingredients with them and use the spaces and tools provided by the structure.

Tools and furnishings organization within the Kitchen area is innovative and does not reflect any specific tradition: the Neighbourhood Home needs to abstract itself from specific culinary cultures and identify a common core for all food preparation, in order to embrace the largest number of techniques and ensure flexibility. This original and “neutral” interior concept aims to bring out new behaviours and values that favour community and participation, rather than choosing a typical layout of one culture at the expense of others. For this scope, the general process of preparing a dish was analysed: it starts from the pantry to find the ingredients, goes through the preparation (cutting, cleaning, kneading, washing, etc ...); cooking - if present - (boiling, frying, smoking, grilling, steaming, cooking in the oven, etc.); ending with the dishing and the washing activities. For each of these steps, the necessary tools and functional components were designed.

In order to satisfy a multiculturality, a new aggregative rationale was identified: taking inspiration from the Lévi-Strauss culinary triangle, it was chosen to cluster activities and functions according to the four natural elements, because each one is essential in all the culinary traditions and is able to evoke the ancestral rites of the culinary space.

There is a “Water” section in which there are the activities of “filling” (containers, pantries, shelves, refrigerators) and washing. The “Earth” area is dedicated to handwork such as “kneading”, “cutting”, “forming” etc. and corresponds to worktops equipped with sinks, drawers for instruments and waste bins. At the center of the room, six functional blocks are designed for fire-related activities, each of them provided with a different type of cooking: stove, oven, wood-burning oven, grill, plate and deep fryer. These six pillars represent -at mythical level- the fireplace of the tribe, around which stories, culture, myths and rites are transmitted. The “Air” section is merged with the previously “Fire” area for what concerns smoking and steam cooking, and the absorption of vapours is guaranteed by ventilation hoods placed on the kitchen blocks.

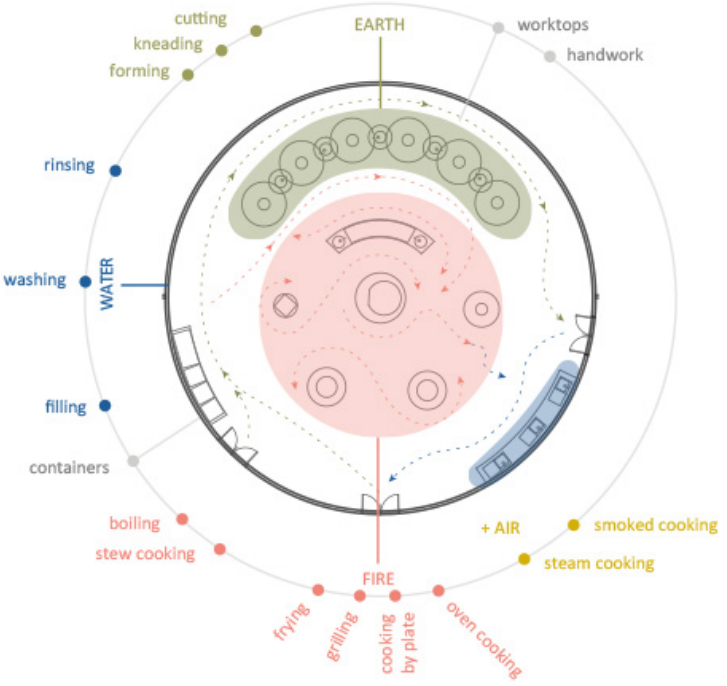

Figure 6. Semantic and functional organization of the Kitchen area

Finally, the consolidation of the experience within the MeetEat structure takes place in the glazed and openable Dining Hall, that allows to extend activities outside. Thanks to the presence of tables that can be combined in multiple ways and allow compositional flexibility, it is possible to achieve two objectives: the consumption of the dishes in a social eating, which generates sociability and strengthens the confidence among the guests; and the possibility of holding neighbourhood meetings to discuss problems, find solutions and organize events of collective social commitment. In this way can be created a community as a network, responsible for its own Home and neighbourhood, eager to take care of it and respect it with a new trust and a renewed sense of belonging.



Figure 7. A social eating in the Dining Hall (street view).

5. Conclusions

Today we still live on a Planet where there are several paradoxes. But those that characterize food sustainability (malnutrition, unsustainable production systems and the fight against food waste, just to name a few) have required in recent years to concretely rethink our objectives, to find immediate and long-term impact solutions. Studying new scenarios in the field of cultural and food sustainability is fundamental. Design as a participatory and co-creation method in food experience design can help to glimpse opportunities where today we only see criticalities and problems (Massari, 2017).

There are many existing design projects to increase the interaction of migrants and foreigners in the social supply chain of food and solidarity, such as the tools for integrating the activities of associations operating in the management of foodstuffs. Instead, there are fewer projects for the dissemination of sharing culture, tools and systems for inclusive integration within cities. The roots of all people have always been interconnected with each other by exchanges and migrations in trade and history. Culture is the human dimension par excellence and takes on the appearance of innumerable forms of transmissible and shareable rituals, which enclose the soul, the very essence of peoples and their values. Understanding rituals through different cultural expressions allows understanding the cultural traditions, values and “myths” of people around the world and helps generate inclusion with each other. Transmitting and sharing culture generates not only a more inclusive society in each neighbourhood, but also a possible neighbourhood cultural

heritage, composed of shared rites and myths, that can be transmitted and can become part of people in their daily lives. No longer an “I” and “them”, but an "us".

The Neighbourhood Home system aims to trace the similarities between people, the roots in common; at the same time, it helps to develop curiosity and interest in distinctive cultural traits, to teach how precious diversity is and how much growth and wisdom it can offer. The project can lead to the creation of more inclusive cities and nations: today this goal would be not only desirable but also fundamental, because plurality and diversity are beneficial for all when they become connections and exchanges.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Universal Visual Languages in a Male-oriented Society

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Abstract | Communication Design today plays a role of social and cultural responsibility. It represents, and at the same time shapes, the society, acting on both individual and collective biographies. An *inclusive* and *sustainable* Communication Design needs therefore to be able to take into account the multiplicity and diversity that characterize society, making itself an expression of pluralism and respect. The context in which we live and act is characterized by an enormous amount of media messages which still spread and feed, limiting and degrading gender stereotypes - both consciously or unconsciously.
The urgency to act towards a fair representation - free of negative gender stereotypes - is reiterated by the resolution of the European Parliament of 17th April 2018, which highlights the duty of the media "*to ensure [...] diversity of opinion and media pluralism, to promote respect for human dignity and to combat all forms of discriminations and inequality by, among other things, portraying diversified social role models [...]"* furthermore it "*stresses the role of the media as an agent of social change and its influence in the shaping of public opinion and calls on the Member States to promote content on gender equality in public media*".
Starting from this context we intend to adopt the interdisciplinary point of view of Gender Studies, focusing on the consideration about the representation of the genders and the centrality of the white man, elevated to a "unique prototype of the human species" (Melandri, 2011). The contribution therefore means to focus on the gender asymmetries conveyed by schematic visual representations, specifically the pictographic language. The objective is to highlight how artifacts and communication systems, which are *universal* by definition and addressed to the whole community - therefore ideally representative of the multiplicity - are strongly asymmetrical and oriented to the male.

The subject of study are therefore the visual forms that are part of the pictographic language with an informative and prescriptive function, an area that has well-established origins in the history of communication design, starting from the studies of Neurath and Frutiger.

This kind of visual forms are characterized by a high degree of objectivity but at the same time they unconsciously translate models that include behaviours, duties, responsibilities and expectations linked to female and male identity, the subject of social expectations, which allows us to focus our attention around those gender roles to which women and men are encouraged to conform. The observation therefore concerns the forms of schematic representation which permeate everyday life. A both quantitative and qualitative analysis of the gender asymmetries (hierarchies, roles, contexts...) will allow to highlight through which modalities pictographic languages contribute to convey negative stereotypes towards women.

The proposed contribution is located in an area of communication design which is historically central but not widely investigated from the point of view of gender studies and which still results strongly unbalanced towards the male sphere. We therefore assume a gender-sensitive perspective to exercise an innovative point of view for the discipline of design (Decataldo & Ruspini, 2014), in accordance with a vision that enhances the multiplicity towards a fair and equal representation of genders in the media context.

KEYWORDS | PICTOGRAPHIC LANGUAGES, GENDER INEQUALITIES, IMPLIED STEREOTYPES, FAIR REPRESENTATION

1. Introduction

1.1 A polluted environment, the need of an *ecological* communication

Communication Design nowadays plays a role of undeniable socio-cultural responsibility. It has the task to "translate" (Baule & Caratti, 2017) the content into a visual form by making it accessible and it is therefore responsible for the resulting message and the effect it has on the community to which it is addressed. As Ezio Manzini states in *Designing as everyday life politics:*

> "Design has always played a social and political role. Directly or indirectly and whether consciously or not, it has assumed all kinds of stances towards dominant social, cultural and economic systems: ranging from enthusiastic support to radical criticism and alternative propositions" (Manzini, 2016).

Design therefore acts on social reality, influencing opinions, expectations, attitudes and habits and it changes the perception that individuals have towards reality.

These premises highlight the urgency to outline a Communication Design which is *sustainable* from a socio-cultural and ethical point of view. The metaphor of the *environmental sustainability* can be traced back to a passage written by Bucchetti in 2019, in which he refers to the concept of "media landscape" and the pollution of the media landscape. We live in an environment overflowing with images and media messages. The quality of these messages — especially when reiterated — has important consequences on the construction of individual and collective biographies. It is also through Visual Cultures that harmful, *polluting* stereotypes are conveyed and amplified such as discriminations on the grounds of gender, ethnicity, age, etc.

That is why it is essential to rethink how communication could be defined *sustainable*. We need therefore a Communication Design: (I) able to take into account the complexity of reality and to face the multiplicity that characterizes the environment in which we live, act and relate, and therefore able to make responsible choices; (II) aware of its social responsibility and of the consequences that a stereotyped message can have on the group of individuals to whom it is addressed; (III) vehicle of values such as inclusiveness and equity rather than spreading disvalues that undermine, in more or less implicit ways, opinions and expectations towards certain social groups.

Our contribution is situated at the intersection between Visual Cultures and Gender Studies. The paper intends to provide a contribution from the Communication Design point of view, by assuming the perspective of Gender Cultures as analytical category. The use of gender as a descriptive axis allows us to carry on a wider reflection about the *implicit* stereotypes conveyed by the visual languages that every day characterize the environments in which we live and grow. We decided to focus the observation on the pictographic languages of everyday life, from wayfinding systems to instruction manuals. The pictographic languages represent an area of Communication Design — historically central — which is characterized

by a high degree of universality and perceived objectivity (Bucchetti & Casnati, 2020) but not immune to stereotypes. This represents an environment affected by forms of pollution that are less obvious than others — for example the advertising sector — but equally harmful. These forms of pollution act slowly and at an underlying level, which end up to be perceived as normal. Our aim is therefore to investigate whether and through which modalities and forms pictographic languages are actually representative of multiplicity or whether they — universal by definition — are influenced by a society still male-oriented and therefore subject to gender stereotypes.

1.2 Why Gender Studies – the urgency to reach gender equality

There are several reasons which led us to adopt the point of view of Gender Studies. The urgency to act towards the eradication of gender inequalities is, first of all, underlined by the institutions at international level. Starting by the Cedaw adopted by the United Nations in 1979, which represents "the most important international legally binding instrument on women's rights"; the World Congress Women's World; the Instanbul Convention of 2011, to protect women and fight against all forms of gender violence; up until the *ONU Agenda 2030*, which places gender equality at the top of the objectives to reach sustainable development: to “achieve gender equality and empower all women and girls [....], and all forms of discrimination against women and girls everywhere".

In this context the *Global Gender Gap Report* for 2020 highlights Italy's backwardness in achieving gender equality. The country occupies the 76th place out of 153 countries (six positions below compared to 2018). Measures were also taken within the field of media focusing on the forms of representation of women. One of the main examples is represented by the work of the Gender Equality Commission in relation to the issue *Media and the Image of Women* (Amsterdam 2013) and the resolution of the European Parliament of April 2018 (2017/2210 (INI)) on the impact of marketing and advertising on equality between women and men, which reaffirms the role of responsibility of marketing, advertising and media images and

> “highlights the importance of promoting media literacy [....] so as to encourage young people to develop critical thinking skills and to help them identify and denounce sexist representations and discrimination [...]. Stresses the need for preventive measures [...]; points out that advertising can be an effective tool for questioning stereotypes”.

This contribution is part of a wider work carried out by the research group xxx. The group works on issues related to the representation of women in the media by experimenting new models and communication tools, focusing on the socio-cultural responsibility of the designer himself.

2. Communication Design, stereotype and social identity

Media images, by their own nature, communicate by models in order to be immediately recognizable and comprehensible to the social groups they are addressed and these *models* contribute to activate gender stereotypes which in turn are responsible for the definition of self-schemas. They affect both "cognitive resources" and "emotional reactions to sexist statements" (Camussi & Monacelli, 2010). Media communication draws from a collective cultural basin, using already established and consolidated models and returning them amplified. The designer himself is inevitably conditioned by his own socio-cultural background and, if he does not have the tools for a critical re-reading of his work, the project will result permeated by the dominant culture.

From this point of view social reality and media representation are part of a vicious circle in which the media take on the role of a "faithful and deforming" mirror of reality (Baule & Bucchetti, 2012). It could be defined as a feedback process that continuously pollute the *media landscape*. The designed images are in line with the sensitivity of the moment but, at the same time, have the power to shape it. The repetition of a stereotype leads to its rooting and its transformation into prejudice, ending up by determining expectations towards specific groups of individuals and consequently shaping social identity. This mechanism is most evident in contexts such as advertising and marketing, as highlighted by Clarke and Griffin (2007):

> “[...] the cultural message about how women should look and act is endlessly disseminated on covers of women’s magazines sold at supermarket check-out counters, in the news media, on TV, in films and in advertising, all of which endorse a value system that preaches bodily perfection”.

The issue we wish to address concerns the role played by designed communication products — which are employed in society to circulate information, data, goods, services, etc. — in contributing to the development or maintenance of gender inequalities. We therefore wish to focus on iconic and pictographic representation which respond to prescriptive, orientation, guidance functions and which are by nature designed on the basis of normative principles. All those cases where the message of communication is perceived as universal and objective.

3. Universal visual languages

Starting from a consideration expressed by Bucchetti,

> “Each “visual configuration” is a text: the place where its signification materialises and manifests itself; that place, in other words, where two levels may be recognised and distinguished, belonging to each language, to each sign system: the level of the signifier and the level of the signified; the level of expression and the level of content”.

Cecilia Robustelli refers to verbal language as it enables us to codify thoughts and express opinions and expectations. The same principle can be applied to visual languages. The content and the coding of the message itself provide information about the idea of gender owned by the speaker – or in our case by the designer - and may cause discrimination.

> "A language which is respectful of gender differences constructs the message to avoid its reading in terms of subordination or discrimination, through the adoption of precise semantic or grammatical strategies, the former relating to the content and the latter to the use of the methods provided by the language system for recognising and specifying the existence of different genders" (Robustelli, 2015, author's translation).

How do visual languages, which are defined *universal,* behave? Is it possible to apply the notion of *universal masculine* even to pictographic languages? If we consider language as the expression of a culture and interpretation of one's own thoughts and opinions, how does the designer act in relation to multiplicity?

The reasons which led us to identify the pictographic languages as research field are briefly listed below (Bucchetti & Casnati, 2020).

1. They are simplified representations of reality. They make it possible to relate to the surrounding world through the adoption of *meaningful* practices and behaviours;
2. they are signs that should — by their own nature — be accessible and immediately clear to the entire population. The effectiveness of the sign is greater if it does not require the acquisition of new decoding rules. Interpretative rules should ideally be embedded in the socio-cultural basin of the target population;
3. they have a normative dimension, they have the task of transferring rules, indications and prescriptions;
4. they are addressed to a wide range of recipients, to the community as a whole, so they have a recognized universal value;
5. they are perceived and recognized as objective messages.

Starting from these assumptions, a first phenomenological research with a preliminary value was carried out, aimed at defining the study area. This represented a first on-field research which allowed us to identify and collect those pictographic signs which are peculiar to public and private environments that we are used to frequent and that characterize our routines. From public signposting to other wayfinding systems, pictograms on product packaging or instruction leaflets, focusing on icons depicting people. This first exploration allowed to isolate and identify issues that may give rise to specific in-depth analysis, aimed at extending the iconographic material basin and verify whether certain aspects, found in individual cases, are recurrent or not.

4. Gender discrimination conveyed by pictographic languages, three main areas

The observation highlighted how the pictographic representations of the male and female figure "give rise to denotative signs that refer, depending on the circumstances, to distinct classes which are not necessarily coherent with their own denoted, according to a vision closely related to male domination".

> "The strength of the male order is measured by the fact that it does not have to justify itself: the anthropocentric vision imposes itself as neutral and does not need to be enunciated together in speeches aimed at justifying it. The social order functions as an endless symbolic machine tending to confirm the masculine domination on which it is based" (Bourdieu, 1998).

Abdullah and Hubner (2006) underline the role of pictograms and the consequent need to be as independent as possible from culture:

> "Pictograms are used to warn, guide or protect and need to be immediately decipherable. They must get right to the heart of the matter by visually conveying a vital piece of information in such a way that it cannot be misunderstood, and they should therefore be internationally recognizable and independent of culture".

What emerged, on the opposite hand, highlights the tendency of communicative projects to inevitably reflect the culture and thought of the designer — who grows and forms within a certain social group and with a certain culture. As the verbal language, the visual configurations examined in the study reflect a historically located social situation, inevitably leading to judgements that "diminish, reduce and, ultimately, penalize the positions that the woman has come to occupy today" (Sabatini, 1993).

Therefore, three main areas that represent different ways in which gender stereotypes occur have been identified. Areas that, once delimited, can become the object of future in-depth studies or a starting point for the designer to reflect on.

4.1 *Man-as-default*

The public sphere was the starting point from which the observation originated. Signposting characterizes all public spaces and generally represents codes that are supposed to be assimilated by the community.

They are *neutral* and *universal* systems by definition, from which, however, inconsistencies that lead to a strong orientation towards masculinity emerge. Specifically, implicit elements have been identified which reflect and justify a clear condition of gender inequality, which has not been resolved yet. The predominance of the masculine is clear and seems to coincide with the representation of the neutral, i.e. used when the message is addressed to the whole community. The issue is emphasized by a low presence of female figures which, as

we are going to see later on, seem to be mainly related to the mother/family dimension or, more generally, to care roles.



Figure 1. Examples from the Italian public signage system

The definition of *neutral masculine*, drawing, once again, from the field of linguistics, indicates “uses of language that do not correspond to those of grammar but which attempt to justify themselves based on a misunderstood interpretation of sexual plurality. Everyday language and the press reinforce the use of the masculine plural grammatical gender in its extensive and inclusive interpretation, in other words, to indicate male and female referents” (Robustelli, 2015, author’s translation). The same happens when addressing the plurality of citizens through the use of icons. Figures with masculine traits are used when the message is addressed to both men and women, while for specific cases, i.e. when addressing circumscribed groups, the figures may assume feminine traits, for example if in relation to a child, therefore in the role of mother. The "non-marked male" is therefore identified with the bivalent function of the male gender, which refers both to the male sex and to both genders. We can also talk about *fake neutrality* of the masculine when one "claims that what is only of man is universal"(Sabatini, 1993). The *Man-as-Default* (Kotthoff & Wodak, 1997) seems so obvious to us that it ends to be considered *natural*, both the motivations and the processes are taken for granted (Ghisleni, 2004).

4.2 Hierarchies

In the previous section the notion of the *neutral masculine* was introduced. If, however, we consider the numerically inferior cases in which female and male figures are co-represented, our attention is immediately drawn to hierarchical relationships and to those parameters that lead the beneficiary of the message to perceive a subordinate relationship of women to men.

Dimensional relationship - In case of co-representation, the female figure appears smaller in size than the male figure. Among the examples collected, is particularly interesting the danger sign "crossing children" (Fig. 2), in which the female child is clearly smaller than the

male child. The difference is emphasized by details that characterize different age groups (the bag for the male and the lunchbox). Size, posture and connotative elements also subtend the role of the man as *guide* or *protector* of the woman, referring to the universe of gender roles.



Figure 2. Children crossing sign, Italian public signage system



Figure 3. Elderly people crossing sign, United Kingdom

Topological space - The spatial correlation between the female and male figures. In the representation of two or more subjects of different sexes, the female figure is perceived "behind" the male one. The perception of the position can be suggested, as in the case mentioned above, by the orientation of the two figures. The two kids (Fig. 2) are represented while running and their orientation defines who is in front, leading and assuming a role of responsibility and power and who needs to be led (the female kid). The same happens in the case of the "lift" pictogram which is part of the Italian public signage system. In this case the woman icon is placed in the middle (Fig. 4), between two male figures, to reiterate the need for protection.

Another modality of representation is well exemplified by the pictograms indicating "groups" and "groups with baggage" (designed for Zurich airport's wayfinding system) (Fig. 5), which place the woman icon in the background over the male figure thanks to an overlapping composition in which the male pictogram is read perceptively over the female pictogram.

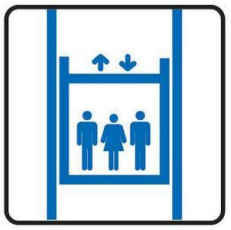

Figure 4. Lift sign, Italian public signage system

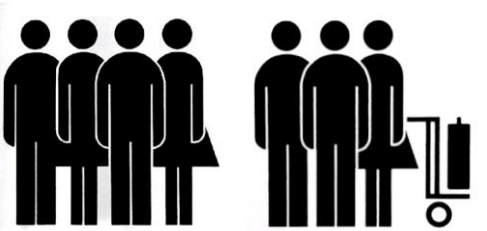

Figure 5. Groups and Groups with luggage signs, Zurich airport, Swiss

Quantitative Relationship (in representation of groups) - It concerns the numerical relationship between female and male figures. When multiple subjects are represented, as in the examples mentioned above, an unjustified numerical prevalence of the male figure emerges.

Type of Action Performed - The action that is represented and attributed to a male rather than a female figure implies another fundamental issue concerning gender roles, which is specifically dealt with in the next paragraph.

4.3 Gender roles

The third defined area concerns the roles attributed to the woman when the communication is specifically addressed to her. This area is more generally part of the issues concerning the fixed roles attributed to women in the media.

Female roles

> "Women have long been the symbol of men's desire and fantasies, essentially bodies with no other history than the one defined by male interest, by the criteria of value/disvalue in practice in the patriarchal symbolic order that absorbed the feminine into the masculine and gave as the only possibility of existence subalternity or parity" (Pallotta, 2012).

The issue brings with it wide-ranging problem areas such as work-life balance, the issue of glass-ceiling, inequalities in work, etc. The observation highlighted the fact that, even in the case of pictographic languages, there is a fixity of roles. The woman is mainly attributed the roles of mother, caregiver, housewife. By way of example, it is useful to mention the pictogram placed on the shopping cart of an important distribution chain, which represents a female figure (Fig. 6) in the act of pushing a shopping cart inside which a child sits. The supermarket in this case is Esselunga, whose wayfinding system uses a visual language very similar to that of public signage, in which the *male-as-default* prevails. The designer's "need"

to decline the icon to the feminine emerges from the relationship between a child and the act of shopping.



Figure 6. Accompanying children on escalators, Esselunga supermarket, Italy



Figure 7. Pedestrian area sign, Sweden public signage system



Figure 8. Safety signs on escalators, Italian public signage system

The icon of the mother occurs in other cases of co-presence with pictograms representing children, an example is given by the signage in stations, airports or shopping malls near escalators. The sign usually carries a series of warning or danger messages. in all messages the subjects are declined to men, even if in groups or couples, except for the signal indicating that children must be accompanied by an adult person, relegating once again the woman to the maternal and care dimension (Fig. 8). The same happens in some road signs placed near pedestrian areas (Fig. 7). On the sign, part of the public system, we can see the pictograms of a walking man, the icon "crossing children", with all the considerations previously stated, and a third icon representing a female figure in the act of pushing a baby carriage.

Furthermore, the representation on the packaging of household products — detergents, cleaners, etc. — denotes deep-rooted gender stereotypes. Only female figures alone or accompanied by children are represented on this type of products. Even when warnings for use or dangers are given, the figures are marked feminine. An emblematic example is the icon that most laundry detergent packages display to encourage correct behaviours. The message is "keep out of the reach of children". To transmit this information, a little girl is depicted stretching to pick up the product placed on a shelf above her. The action performed by the child confirms that the product is aimed at a female audience (the symbol

is similar if not identical on other products of different brands) and implies the role that she will play as she grows up. The girl is represented with a dress, ponytails and a doll in her hand, a key reference that symbolizes the learning of the roles of care we have seen to be of female domination.

Male roles

If the woman is attributed roles that relegate her to the domestic sphere, the male figure is attributed active roles, which refer to positive values. From a first observation on the same product category mentioned above — household detergents — only one case was found depicting the male figure. It is a stain remover that shows some male silhouettes on the packaging. While the woman is represented doing the laundry or, in some cases, as a simple silhouette, to highlight the target audience, the man is represented as a sportsman. The product is called *sportswear, penetrating anti-odour, specific sanitiser for technical garments* and the three silhouettes represent a skier, a cyclist and a runner during their respective sporting activity (Fig. 9).

Still in the field of technical/sporting products, if we observe the forms of pictographic representation that have a prescriptive function and guide to the "correct doing", which are developed in sectors such as clothing and technical/sporting equipment, we can see that they are addressed to a male audience even when the product is not differentiated according to sex. An example is given by the sport climbing equipment (harnesses, safety devices, etc.), unisex products whose images of instructions (on tags, pendants, websites, etc...) present mainly male figures. The female figure is represented when, talking about safety devices, the practice of *couple control* is described and her role is passive (Fig. 10).

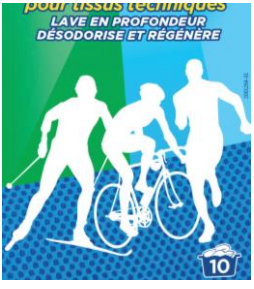

Figure 9. Sportswear package detail

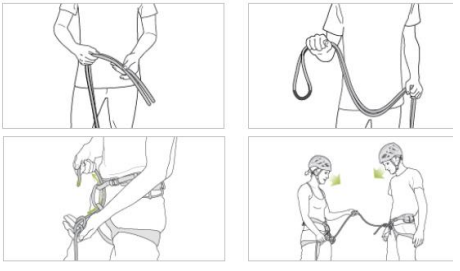

Figure 10. From Petzl instructions, climbing devices

The assignment of active or passive roles on the basis of gender is recurrent in other areas such as the emergency instructions. In three of the collected cases — referring to material distributed by airlines — the actions to be carried out in emergency conditions, in which some passengers have to take an active and collaborative role, are explained through a sequence of images. In the first one the company is Ryanair, the man has an active role (he wears a mask and life jacket, he takes care of the emergency exit) while the female figure is represented in the passive act of descending the emergency slide. Another case that deserves our attention is the one from Lufthansa, in which the subject is a female stewardess — represented in the action of taking care of a young boy by making him wear a mask and life jacket — but still, the “strength” operation — to turn the lever to open the hatch — is done by a man. The female image returns in the storytelling to show that kids and children should be picked up on the emergency slide, so once again in relation to the caring activity. In the last case (SAS) the man once again takes care of the opening of the door, assuming the role of hero and guarantor, while the woman is represented exclusively to focus the attention on the obligation to remove heels before using the inflatable slide, referring to a dimension of frivolousness.

5. Towards a sustainable Communication Design

The three identified areas highlight the persistence of gender stereotypes in areas of communication that have a recognized value of universality and neutrality. These are stereotypical forms less evident than others but which characterize everyday life by polluting it. Any kind of recurring image, despite not paying particular attention to it, ends up appearing so obvious to us that it is considered "natural", even by the designer himself. Referring back to a Ghisleni's passage in *Sociologia della quotidianità* (2004), everyday reality and the images that are part of it are expressions of "practices of reciprocity which, being mostly unconsciously assumed, tend to make everyday life a world taken for granted"

We deem that the work carried out so far may constitute a further piece within the perimeter of Communication Design for gender cultures, but we also believe that it may represent a model for a wider reflection in the direction of a communication design suitable to deal with contemporary issues (*Agenda ONU 2030 for Sustainable Development*). This kind of design should be: (I) inclusive; (II) fair to the social groups it addresses and to all individuals; (III) representative of multiplicity; (IV) promoter of values rather than a vehicle of disvalues. “Social design is the practice of design where the primary motivation is to promote positive social change within society” (Resnick, 2019).

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DESIGN CULTURE(OF)

NEW NORMAL

HEALTHCARE
EDUCATION
WORK/PLAY



TRACK CHAIRS

DESIGN CULTURE (OF) NEW NORMAL
HEALTHCARE | EDUCATION | WORK/PLAY



José Allard,
Pontificia Universidad Católica de Chile, Chile
"The world is in crisis. It seems that the Covid-19 pandemic will force us to rethink our way of life, redesign many of the practices, habits and solutions that have characterized our social, political, economic and cultural system. In other words, we are called to design our future now."

Adam de Eyto,
University of Limerick, Ireland
"This COVID-19 pandemic has changed the practice of many designers, altered our applied research approaches and disrupted our design education modes in ways that many could only imagine 10 months ago. How have you embraced the opportunities, challenges and constraints in your new 'GLOCAL' context?"





Philipp Heidkamp,
Köln International School of Design, Germany
"Being in a state of transition and flux, new formats, habits, tactics, platforms, collaborations, competencies, and values are emerging in the field of design culture. We seek for different perspectives addressing this historic moment in time - whether it might turn out to be another normal or a reset…"

Michael Krohn,
Zurich University of the Arts, Switzerland
"New Roles and Responsibilities. An important role of design is and was "Improve the quality of Life". But what means this in a time when "Life" itself is in danger and what are designable qualities in this respect? What are appropriate reactions of the design community?"



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A Comparative Study of Online Teaching Modes of Sino-Italian School of Design: A Politecnico di Milano, Tsinghua University, and Tongji University perspective

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Abstract | Covid-19 has been disturbing the formal societal life, education not be excluded. With computer science progress, the ecology of distance working has been flourishing. To prepare for the regular situation of the epidemic, this study has started to explore an iterated online education model toward the unpredictable environment. The researcher took Politecnico di Milano, Tsinghua University, and Tongji University as research objects, and engaged a mixed methodology to conduct the investigation, which constitutes literature study, case study, interview, and comparative study. Meanwhile, a Randall Collins' s Interaction Ritual Chain theory was integrated to analyze the concrete conditions, the data were classified into three aspects of online education, the group symbols, the high-intensity emotional energy, and the group unity. Within this study, the three aspects correspond to the touchpoints, the form, and the performance of online design education respectively. Based on the outcomes, the researcher gave suggestions to the current condition.

KEYWORDS | ONLINE EDUCATION, SINO-ITALIAN SCHOOL OF DESIGN, COMPARATIVE STUDY, INTERACTION RITUAL CHAIN

1. Introduction

Covid-19 has been making the traditional education model transited rapidly ever since last winter. According to UNESCO statistics, as of March 30, 2020, the coronavirus epidemic has caused 1.53 billion students to suspend classes globally, accounting for 87.6% of the global school students (Unesco, 2020). Although pandemic condition disturbs the normal societal life, people have been overcoming this issue by taking advantage of synergy during quarantine time. This study takes online teaching of design as research objects based on the three universities that had international collaboration, and utilizes a comparative method to investigate the diversified experience rooted in their pedagogy. The goal of this study is to share useful teaching approaches with the design education field and relevant stakeholders between China and foreign countries and regions.

2. Literature review

The authors had reviewed the historic processes of how distance education developed worldwide, which referred to the China's development process and the experience from the U.S.

China has been undergoing four periods of distance education model and during which who also been influenced by other countries: the first three are correspondence education, radio and television education, and third-generation distance education (Chen, 2020). The main method of correspondence teaching is self-motivation study, and the form of face-to-face pedagogy is supplemented. Correspondence education in China first appeared in secondary normal colleges. Ever since the Reform and Opening, radio and television education model was successively recognized as the most significant type of distance education, the approach of this model is by positively or actively watching. Radio and television education is broadcasted uniformly throughout the country, mainly offering theoretical foundation and professional basic general education courses to meet social needs based on the actual conditions. Thirdly, since the 1970s, the University of Phoenix began to explore the establishment of an adult education learning system, and provided educational services to students through the Internet in the late 1980s. In 1989, it became the first worldwide recognized online education degree in the United States' institutions. After that, online education platforms had been flourishing with the development of computer science, such as Udacity, edX, and Coursera. Among them, 2012 has been seen as the first year of Massive Open Online Courses (MOOC) by The New York Times (Pappano, 2012). Additionally, XuetangX MOOC platform was established by Tsinghua University in 2013, which marked China has stepped into the third-generation distance education stage (Wang et al., 2020).

From correspondence education to MOOC, the efficiency of education has increased largely. However, the passive learning model makes the distance education lacks interaction between the educators and the learners. This reduces the emotional energy that has been

regarded as the essential factor of educational engagement. Based on the issues mentioned above, real-time communication platform (RCP) had been designed to meet this gap, which can break the geographic boundary and provide audio and video service to the users. RCP was initially created to serve telecommuting work and distance business, its accessibility has also been extended to the education field under quarantine conditions. At a first glance, RCP gave the solution to respond to the call 'keep learning during class suspension' (Ministry of Education of the People's Republic of China, 2020).

New-born technology had always been evaluated by stakeholders. In the March of 2020, American Shorelight institution released the American Collegiate Live program (ACL), which allowed international students to learn online university courses in their domestic homes, then go abroad after gaining the general accredits (Shorelight). Also, some China's universities gradually set educational cooperation with foreign institutions. The domestic students started university life at home and would go to partner institutions after finishing the fundamental requirements, such as Westlake University with Cornell University, they set an example of this coordination model in China (Xv, 2020). The RCP used in Zoom, Microsoft Teams, Tencent Meeting, etc. Collective online education appears many merits, such as the flexible forms of teaching materials, the freedom of space-time limitation, the efficient learning outcome evaluation, and the effective check of work attendance.

Nevertheless, the disadvantages of RCP become visible after collective utilization. Some design researchers had begun to investigate the shortcomings of RCP by classified inquiry, which involved the course design, interaction effects, learning process, outcomes and the attitude of students toward blended learning. In general, there are several issues reflect the weaknesses. First, the divergence of learning circumstances had caused various influences on students, which made it difficult to guarantee learning efficiency. Second, students tended to hide behind the screen by closing the camera, which was common in China and misled the class effectiveness. Last, over-loading usage of digital equipment not only affected the physical health, but increase the mental burden on both sides. Yet, a number of authors commented the outcomes by their experience, but empirical research, and they seldom pointed out a solution or orientation (Figure 1.).

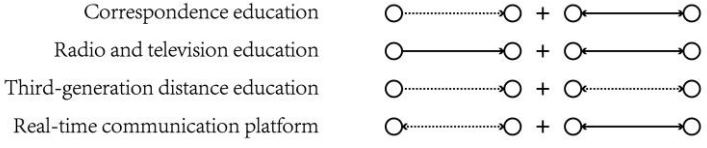

Figure 1. China's four periods of distance education model. The circle in the diagram indicates the stakeholders of design education. The full line means the process of offline education. The dotted line means the process of online education. The direction of the arrow is also the direction of information flow. The left side of plus sign presents the main education model, the right is the assistant one. Author self-painted.

Given the current situation mentioned before, this study proposed the research problem: facing the possibility of regular epidemic prevention and control, how can online design education be iterated to a more humanistic circumstance? To respond to this problem, this study attempts to integrate a sociological framework on the current design education system by probing into the selected cases.

3. Methodology

Research methods used in this study are literature investigation, case study, interview, and comparative study, which consisted of the research methodology of this study.

In the first phase, the author explored two areas of the literature, which are the common situation and pedagogical cases of online design education between foreign and China's institutions. During this process, the general development of this field had been figured out.

Additionally, the author selected three universities' design education systems as case study objectives, Politecnico di Milano (Polimi), Tsinghua University (THU), and Tongji University (TJU); then respectively interviewed their students about the condition of online design education during quarantine time. The data collected from the above procedures constitutes the original research materials.

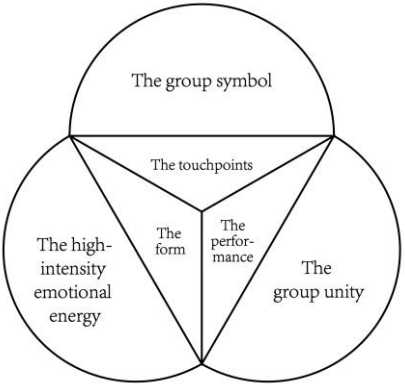

Figure 2. The usage of the IRC framework in this study. Author self-painted.

The last phase was to comparatively analyze the cases' similarities and differences from the following three perspectives, the group symbol, the high-intensity emotional energy, and the group unity. They were originally integrated into the Interaction Ritual Chains (IRC) theory of Randall Collins, who suggested combining micro and macro views in the context of sociological background, providing a theory of change from one situation to another, as well as a model for in-depth analysis of social phenomena and behavior (Collins, 2005). In the

view of education field, IRC had a bearing on the ideal status of online pedagogy. In detail, the three perspectives were designed to correspond to the touchpoints, the forms, and the performance of online design education in the three universities (Figure 2.).

4. Discussion

Ceremony is a special behavior system developed by human society. This system first appeared in the religious field. Later, Goffman expanded the scope of the application of rituals. He believed that rituals are ubiquitous in life (Goffman, 1982). In the secular field, it is the same as in the formal religious occasions. It plays an important role in shaping individual characteristics and dividing group boundaries. When online design education approaching perfection, of which spiritual satisfaction is becoming absolute. This study collected the teaching process and the individual feedbacks from the interviewees of the three universities, they also acted as teaching assistants, on which the following analysis was based (Table 1.).

Table 1. The matrix diagram of the three online design education.

	The group symbol ↓ The touchpoints	The high-intensity emotional energy ↓ The form	The group unity ↓ The performance
Polimi	Microsoft Teams, Zoom and Cisco	Blended learning model, ritual space construction	Sustainability, inclusiveness
THU	Rain Class, Tencent Meeting, Zoom, Tencent QQ and WeChat	Blended learning model, digitalization of the practical school education	The immersive experience of digital education
TJU	Tencent Meeting, Zoom, Tencent QQ and WeChat	Blended learning model, distributed education model, abroad semester program model	Sustainability, the experiment of the emerging education model

4.1 The group symbol

The IRC can produce distinctive group symbols, which are realistic carriers that carry the emotional energy, the group morals and the group unity, and trigger a strong sense of collective belonging among the members. In this study, the touchpoints of the group symbol are the RCPs and the teaching contents.

The School of Design in Polimi has been utilizing Microsoft Teams, Zoom and Cisco as the RCP for their online classes throughout the quarantine time. Compared to the others, Cisco settles a few cameras in the practical classrooms to catch the teachers' statements,

behaviors and expressions. It provides a real-time classroom system to engage students in an immersive environment, which produces a sense of ritual. In addition, Cisco allows students to review the previous videos of the classes, then the customer stickiness gradually emerges. Moreover, the login authority of Cisco carefully recorded the identity information of each participant, which protects the intellectual property of the teachers and the students.

In 2016, XuetangX and Tsinghua University Online Education Office jointly developed and launched a smart teaching tool Rain Class. It integrates information technology into PowerPoint presentation software and WeChat social platform. The teachers push the pre-class learning materials with MOOC videos, exercises, and voice to the students' smartphones to facilitate teacher-student communication, timely feedback, and real-time answering and bullet comment interaction. Rain Class covers every teaching section and provides teachers and students with complete data support, attendance monitoring, personalized reports, automatic task reminders, personnel grouping and other teaching services.

Different from the previous two institutions, The College of Design and Innovation in Tongji University tends to frequently use Zoom or Tencent Meeting to conduct online teaching and administrative management, and it has no specific RCP.

Except for the advantages of RCP, there are also several issues unveiled during this process. Above all, the technical problem is one of the most influential factors toward online education, which directly delays the teaching activities, such as the limited bandwidth and the instability of the system. In addition, the time difference is another troubling point while conducting international courses.

4.2 The high-intensity emotional energy

Emotional energy is not a specific emotion in the usual sense, it is a long-term stable social emotion. Emotional energy is the most critical factor and the core in the IRC. The strength of the emotional energy will be an important factor that affects students' online engagement. In this study, the organization forms of online design education are regarded as the embodiment of accumulating the emotional energy.

Polimi employs a blended learning model to conduct education under the pandemic context, which allows the domestic students to come to the university in person, and engages the international students online at the same time.

THU has broken down the original long-term lectures into a 40 minutes' unit and added the text contents of the learning materials. The students watch in front of the screen more clearly than on the offline projection. To make the students have a better immersive experience, they adjust and enrich the pictures, videos and blackboard writings that need to be used for different media, so as to reduce the time caused by the screen staying. Besides the formal professional classes, video conferences and online exhibitions are also inevitable

activities. In order to give students better tutorials and motivate them, teachers will often share what they have done during the epidemic in class, so as to enhance students' enthusiasm for professionalism and expand their thinking.

TJU has been iterating design education model from The College of Design and Innovation. Even in the middle period of the quarantine time, they have been attempting to extend the blended learning to the community. This benefits from the previous experimental outcomes of serial community regeneration activities. TJU never limits its education inside the university campus, every corner of the neighborhood can be the learning center, which has maximized the spatial and educational resources. NICE 2035 prototype street and NICE Commune are the typical representatives of this idea. The distributed educational system shares the burden of the traditional university model, the emerging co-creation centers act as the resilient learning center, which supplements the school learning. On the other hand, the community-based learning center can protect its users from external infection by real-name registration system. Also, The College of Design and Innovation started abroad semester program at the beginning of 2020, which has received dozens of domestic students who originally plan to go to Art Center College of Design and Parsons School of Design.

The accumulation of positive emotional energy can stimulate high-intensity emotional energy, so that members are full of enthusiasm and confidence in the interactive ceremony. The relationships between teachers and students directly affect learning efficiency, the educational institutions should customize their interactive models based on the condition. For example, the project-based learning and case study-based learning models are seen as essential training models among empirical disciplines, yet the practical conduct methods have to be adjusted according to the situation.

4.3 The group unity

Group unity is the essence of the ceremony. Its occurrence requires the condition of the common presence of the situation and the gathering of the people. Within the online environments, the common presence has been seen as the basic requirements of design education, which involves the teachers and the students. The touchpoints and the forms are the foundation of the group unity, of which they decide the performance. Although the physical presence is an important condition for the formation of group unity, its theory is still applicable to cyberspace. It is not based on the experience of gathering and interacting with people in the physical presence, but it can provide close interaction situations. Cyberspace can evoke the virtual presence of collective psychological structures. In this virtual presence situation, the visual focus is weakened, but it can be compensated by imagination and experience, and a higher level of visual focus and emotional connection can be established.

However, the spatial discreteness results in potential risks, such as the delay, instability and disconnection caused by the technical issues. Also, the diversified domestic circumstances interrupt the students at varying degrees. Sometimes, the students even make use of the technical problems to cut class, which causes the resource waste of online education.

Furthermore, as a comprehensive discipline that combines theory and practice, design has always been facing challenges about tutoring sketch or prototype making online. For example, limited with the size of the camera, both students and teachers usually draw sketches out of the screen without perception. And the three-dimension modeling tutorial is tougher for the teachers. Therefore, online design education should call for the improved technology of remote control.

Mead believes that human beings not only can express other actors as objects, but also have the ability to express themselves as objects (Mead, 1934). This is the so-called objective self. The opposite concept is the subjective self. When teachers and students are doing teaching reflection, of which the memory becomes the objective self's component of self-concept, and it is necessary to reflect the meaning of this action for his identity from the standpoint of others. There are numerous factors that influence the performance of the group unity, the author recognizes the attitude of empathy as the most essential factor that affects it.

5. Conclusion

Facing the possibility of the regular context of epidemic and quarantine, it is necessary to consider a more pleasant and customized circumstance to support online design education. Several recommendations can be proposed toward the current situation based on IRC analysis.

The process of teaching is actually a social interaction process between teachers and students using symbols as a medium (Lu, 1990), which indicates the touchpoints in the background of this study. It can be seen that symbol construction plays a critical role during the online teaching. Nowadays, in the online teaching of colleges and universities, both teachers and students should stand on the point of object self to co-create the synergy on this virtual space. Otherwise, it may cause the meaning of the symbols incomprehensible, which leads to the failure of symbol construction. In other words, the pedagogical contents and the RCP should be prepared carefully and make them suit for the concrete situation, also the technical support ought to be always ready for the emergency.

Communication plays an important role in the development of a good teacher-student relationship. It is a key foundation for stimulating the emotional energy between them. The variety and smoothness of communication methods is the guarantee for a desirable teacher-student communication, of which the lack will weaken the relationship and hinder the emergence of emotional energy. An inspiring teaching environment is good for the interaction and the production of emotional energy. The model of the flipped classroom and the micro lecture provides constructive suggestions, which encourages the students to participate in the teaching process and break the time limitation of online tutorial (Zhou et al., 2020). Last but not least, educational institutions ought to develop a more inclusive blended learning system. Under the perspective of IRC theory, the distributed thinking of design education may help to share the burden of distance learning, which integrates the

fragmented space and time to build a resilient learning environment during the regular epidemic condition.

In cyberspace, the efficiency of knowledge communication will decrease, so do emotion. This reminds us that the participates of online education should conduct empathy except for the perfect technical supports, such as the establishment of the common focus. At the same time, the bespoke evaluation system largely affects the performance of online design education. For teachers, a clear power list can be useful for them to modify the teaching behaviors, which also stimulates enthusiasm. And for students, the diversified domestic surroundings influence the learning performance directly, which needs the collaboration between the schools, the society, and the homes to guarantee their learning.

In the next phase, this study will continue to pay close attention to the situation of online design education in a wider context, which extends the research scope to the regions of American and Africa. The outcomes will not only benefit the current condition, but help to iterate the design education model and fit it to a more inclusive and sustainable future.

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Acknowledgements: Thanks for the selfless help of Mr. HUANG Sheng-Yu from Tsinghua University and Mr. JIANG Ji-Xiang from Politecnico di Milano toward this study.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A COVID-19 Horizon Scan Looking for Post-Pandemic Implications for Design

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Abstract | So far 137 million people have been infected by the COVID-19 virus worldwide, and over 2.96 million lives have been lost. The urgent and sustained response to COVID-19 has impacted on everyone's life in one way or another. This paper contributes to the collective and reflective appraisal of COVID-19's impact by conducting a horizon scan in search for some of the post-pandemic implications for design research. After reviewing some general implications, we investigate two focus areas: (1) supply chain disruptions, and; (2) post-pandemic cities. While some measures may remain temporary and ad hoc, our analysis suggests it is imperative to derive a learning dividend and legacy from this traumatic and profound experience. We conclude with some remarks on community activism and ways for design to evolve in order to create more socially and ecologically just practices and outcomes in the aftermath of this global crisis.

KEYWORDS | PANDEMIC, COVID-19, CORONAVIRUS, CRISIS, VIRUS, RECOVERY, POST-PANDEMIC

1. Introduction

The coronavirus pandemic is a global crisis that, at the time of writing, has claimed the lives of over 2.96 million people worldwide, and over 137 million people have been infected by the COVID-19 virus.[1] This crisis comes with an opportunity for us to rise to the occasion in new ways we might not have been able to previously. The special circumstances of the crisis thus afford us a window to see possibilities that we did not see before and to do things that we could not before. We owe it to those affected directly and indirectly by this pandemic that we do not waste this opportunity to seriously and critically reflect on COVID-19's impact and the post-pandemic implications for design research and practice.

This paper does not entail a systematic literature review, which uses a replicable and rigid search algorithm to perform a meticulous appraisal of all primary sources on a given research question. The specific literature on COVID-19 we wanted to capture for this review is far too recent, fast paced, and interdisciplinary to be adequately captured by a systematic literature review. Instead, this paper combines a specific type of literature review called a horizon scan (Hines et al., 2019) to identify research work and studies that have been published on the topic of COVID-19, with the aim of contributing to the emerging debate in the field of HCI about trends, gaps, opportunities, and implications. Horizon scanning is a useful method for our purpose, because it allows us to capture a diversity of research publications at an early stage of their development, and the resultant list of references offers a rich collection of publications for the reader to draw upon for follow-up research and cross-disciplinary connections.

Our search method employs a broad horizon scan of COVID-19 related papers published in 2020. We used databases such as the ACM Digital Library, IEEE Xplore, Scopus, and Google Scholar. In addition to the HCI literature, we also purposefully included papers from other disciplines such as STS, sociology, cultural studies, human geography, health, and policy. This enables us to establish a transdisciplinary perspective. We are particularly grateful for two meta-reviews of the evolving COVID-19 literature (Dalsgaard, 2020; Lupton, 2020). We also employed a bidirectional snowball technique by following relevant references cited by the papers we found as well as checking on Google Scholar whether any new papers have been published that cite these papers. We use this meta-analysis to offer a critical appraisal of this evolving domain that argues for the significance and urgency for the design community to collectively consider post-pandemic implications. The paper can thus be classified as a hybrid "survey" and "opinion" contribution using the taxonomy by Wobbrock and Kientz (2016). It contributes to ongoing and emerging discourse on design and COVID-19, such as papers in the July 2020 special issue "Design in the pandemic" published in the ACM *interactions* journal (Taylor et al., 2020).

[1] https://news.google.com/covid19/map

The paper is structured as follows: First, we review some of the general literature on the topic of coronavirus and COVID-19 to establish a baseline overview. We then review and investigate two thematic foci. These have been chosen (a) to avoid overlap with previous coverage (Taylor et al., 2020), and; (b) based on the interest, expertise and previous and current work of the authors. We acknowledge that a range of additional themes could and should be explored, too. However, to keep this review within the available scope, we had to limit our selection to (1) supply chain disruptions, and; (2) post-pandemic cities. For each, we cover measures taken, societal consequences, design's role, and some possible long-term repercussions for research and practice. While some measures may remain temporary and ad hoc, we argue that it is imperative to derive a learning dividend and legacy from this traumatic experience. We reflect on this and the role of design in supporting community activism in our conclusions. Our analysis and critical review suggest that this can help the design field to evolve in order to create more socially and ecologically just practices and outcomes in the aftermath of this global crisis.

2. COVID-19

The first coronavirus cases in Wuhan, China, already started spreading at the end of 2019. AlJazeera's timeline reports: "On December 31 last year, China alerted the WHO to several cases of unusual pneumonia in Wuhan, a city of 11 million people. The virus was unknown."[2] An overview of the outbreak in China was published in the *Journal of the Chinese Medical Association* (Wu et al., 2020). As the virus spread from China to Thailand, USA, Nepal, France, Australia, Malaysia, Singapore, South Korea, Vietnam, Taiwan, and other countries, the World Health Organization (WHO) declared the coronavirus crisis first a global emergency (30 January) and eventually a pandemic (11 March). For the first time in Australia's history did the Prime Minister Scott Morrison declare a national "human biosecurity emergency" (18 March). Urgent strategies and measures were needed and deployed in an attempt to control the pandemic. Anthony Fauci, a member of the White House Coronavirus Task Force established in late January 2020 under US President Trump to deal with the coronavirus pandemic, and colleagues published an editorial in the *New England Journal of Medicine* outlining their strategies for navigating uncharted territory, saying:

> The Covid-19 outbreak is a stark reminder of the ongoing challenge of emerging and reemerging infectious pathogens and the need for constant surveillance, prompt diagnosis, and robust research to understand the basic biology of new organisms and our susceptibilities to them, as well as to develop effective countermeasures. (Fauci et al., 2020, p. 1269)

[2] https://www.aljazeera.com/news/2020/01/timeline-china-coronavirus-spread-200126061554884.html

While the COVID-19 crisis certainly opens uncharted territory, the virus and its spread behaves similarly to previous pandemics, and as such well-established control measures and tactics such as social distancing and contact tracing have been recommended and deployed successfully in a systematic approach (Zhao et al., 2020). However, global directives and recommendations by the WHO based on the dire worldwide statistics of infection numbers, recoveries and sadly, deaths, fail to adequately capture and empathise with the human dimension and the lived experience of patients, family members, carers, and health workers. Everts calls this the "dashboard pandemic."

> Notwithstanding the global dashboards of the World Health Organization (WHO) and Johns Hopkins University, most dashboards have a built-in spatial imaginary of territorially confined spaces and societies whose integrity must be defended or regained. What is missing (or sometimes hidden in plain sight) from dashboards is more nuanced spatial, temporal, social, and epidemiological information. (Everts, 2020, p. 260)

The positivist, global, and clinical approach must be tempered with realism and the experiential. This requires local contextualisations and adaptations in order for health directives and strategies to work and be applied in different socio-cultural contexts (Mahmud & Al-Mohaimeed, 2020). The preparedness and vulnerability of African countries facing coronavirus (Gilbert et al., 2020) is different from the situation in Australia (O'Sullivan et al., 2020) and other countries (Georgeou & Hawksley, 2020). Without a solid understanding of how to tailor and adapt to local nuances and specificities, health directives and control measures are at risk of failure. It is the skills and expertise of the humanities, social sciences and design fields that are most apt and suitable for these tasks and thus ideally positioned to complement the advice and scholarship by public health experts and epidemiologists. Science and humanities disciplines together can make a difference and beat this pandemic. Designers are particularly well positioned to connect scientists and humanities scholars. They can use their polymath mindset and lateral thinking skills to create the epistemological, methodological and empirical links that create the transdisciplinary understanding required for humanity not just to bounce back but to bounce forward.

Designers and other scholars were quick to spring into action to address immediate needs and urgent pressures. Some of the COVID-19 related work being reported so far focuses on social distancing (Wiberg, 2020); quarantine (Brooks et al., 2020; Salamanca & Vargas, 2020; Shields et al., 2020); remote work and working from home (Kramer & Kramer, 2020; Manzini Ceinar & Mariotti, 2021; Rogers, 2020) and their associated remote collaboration tools for work and education such as Skype, Slack, MS Teams, Zoom, Facebook, Discord, Miro, Jitsi, etc. (Brown, 2020; Lottridge, 2020; Teräs et al., 2020; Williamson et al., 2020). In the domain of health and hygiene itself, design's focus on touch interfaces may now see an increasing need for touchless interaction such as gesture and voice (Iqbal & Campbell, 2020) or new ways for personal devices such as smartphones to be used to interact with shared public interfaces such as ATMs and traffic lights. There are also urgent challenges for HCI to help rethink general medical practice (Thornton, 2020), hand hygiene compliance (Banerjee et al.,

2020), as well as new ideas for conserving the supply of personal protective equipment (Bauchner et al., 2020). Working with colleagues in political science and media studies, design research should also confront the way social media platforms are used and misused for the coordinated and viral spread of coronavirus misinformation and disinformation (Bursztyn et al., 2020; De Coninck et al., 2020; Graham et al., 2020).

In addition to the immediate and urgent pressures, there is a desire to learn from this experience for the long term. Salisbury (2020) asks, "what might we learn from the COVID-19 pandemic?" and "What next?" (Remuzzi & Remuzzi, 2020). Will the pandemic bring us together and will we see – despite social distancing – a new form of "human togetherness" (Gardiner & Fulfer, 2020)? Will the pandemic make us reprioritise what matters most to us? As a result, will we expedite action on climate change or focus only on the immediate threat at hand? If politicians and corporations let this "good crisis" not go to waste, will they have ours and the planet's health and well-being in mind, or just their own profit or re-election (Klein, 2020)? Will the pandemic see a proliferation of the digital, or will we enter a postdigital era (Coeckelbergh, 2020)? And what is design's complicity and responsibility in how we got into this mess (Monbiot, 2016; Monteiro, 2017, 2019), and what role do we see for ourselves moving forward (Dalsgaard, 2020; Taylor et al., 2020; Welankar, 2020)? What will be the post-pandemic implications for design? We will now turn our attention to two specific themes.

3. Supply Chain Disruptions

The outbreak of COVID-19 has demonstrated the fragile state of many organisations, primarily those highly reliant on China to either supply products or raw materials. Nonetheless, consumers in China have shown strong grassroots resilience due to locally specific consumer dynamics and frameworks such as "community group buying" systems (Georgeou & Hawksley, 2020). Unlike natural disasters, the global pandemic is not restrained in terms of impact to one geographical location or a time period (Ivanov & Das, 2020). During a pandemic different aspects of the supply chain are impacted either concurrently or sequentially, where manufacturers, distribution centres, logistics, and consumers are affected, stopped or paused at different or even overlapping times due to lock-downs and quarantines (Bonaccorsi et al., 2020; Ivanov & Das, 2020; Thomsen et al., 2020). Therefore, relocating stock to other areas or seeking alternative sub contractors or suppliers does not necessarily resolve the supply chain disruption. For decades supply chain optimisation has focused on minimising costs causing many companies to become vulnerable to global shocks as revealed by the pandemic. There are new supply chain technologies becoming available transforming into digital supply networks (DSNs) allowing companies to connect with their complete supply network, enabling collaboration across their supply chains and end-to-end visibility (Deloitte, 2020). Advanced Industry 4.0 technologies such as Internet of Things, robotics, artificial intelligence, blockchain, DSNs, and 5G telecommunication networks are designed to meet future global challenges (Deloitte, 2020). Boosting domestic and local

supply chains and manufacturing is also seen as a step to mitigate global vulnerability. Ivanov and Das (Ivanov & Das, 2020) indicate that capacity flexibility and product diversification need to be considered to allow for agile and responsive manufacturing technologies where companies can produce the goods that are in demand by remaining markets. A prime example has been the global use of additive manufacturing, fabrication, 3D printing, to manufacture medical supplies and the crowdsourcing and even the making of DIY healthcare equipment across a distributed set of community members and companies (Bragazzi, 2020; Manero et al., 2020; Richterich, 2020; Salmi et al., 2020). This approach has been used across the world to overcome supply chain breakdowns. However, it has raised questions concerning standards and medical certification, too (Manero et al., 2020; Salmi et al., 2020).

In Australia, COVID-19 is driving demand for Australian made products while supply chains are weak and manufacturers have experienced a hollowing out of their capabilities, down to approximately 6% of gross domestic product (GDP) (Green, 2020). Australia is seen to be over reliant on the export of raw materials and the import of cheaply made goods. In response to COVID-19 the manufacturing sector is receiving an increase in support for research and development while the Australian government has created a national task force to reinvent Australia's manufacturing sector (Green, 2020). The Innovative Manufacturing Cooperative Research Centre (imcrc.org) aims to accelerate Australia's manufacturing sector into the fourth industrial revolution, Industry 4.0, by supporting the uptake of advanced manufacturing technologies such as robotics, 3D printing, augmented and virtual reality, machine learning, AI, and data analytics. Industry 4.0 promises growth in design and manufacturing, where advanced digital technologies support existing infrastructure to develop new, efficient and automated processes. Robotics and AI have faced concerns and controversy in relation to job losses and data privacy. These are valid concerns which need to be mitigated and responded to by providing upskilling and training support for workers, policy development and government supported infrastructure for procurement, investment, and research partnerships (Green, 2020).

In the health sector, Industry 4.0 is referred to as a "smart system, used as a flexible production line for almost entire production processes" (Javaid et al., 2020, p. 420). In a recent detailed literature review of the application of Industry 4.0 technologies to fighting the COVID-19 pandemic Javaid et al. (Javaid et al., 2020) identified the following benefits, including better planning of activities regarding COVID-19, minimising health risks to health workers, manufacturing of protection and precautionary items in relation to the virus, provision of medical parts in time due to smart supply chain, robotic applications for treatments of infected patients, virtual reality for training, promoting flexible working environments for treatment infected patients, uptake of digital technologies in everyday life during lockdown, increased innovations as a result of advanced manufacturing technologies, use of advanced technologies for social and media platforms to identify information, used to improve risk assessment and global health emergency of the pandemic. Additionally, telemedicine and remote health monitoring systems are supported by advanced digital

technologies creating improved support systems, applications, and education for remote and regional areas. For more specific information regarding particular technologies and their helpful use in fighting COVID-19 see Table 1 by Javaid et al. (Javaid et al., 2020).

Beyond manufacturing and health, Industry 4.0 and its advanced technologies are applicable to tourism and travel, hospitality, transportation systems, construction and engineering, education, and communities in general. COVID-19 has demonstrated that these technologies can minimise human contact and the potential spread of the virus in the delivery of goods and materials, disinfecting spaces, detecting temperatures, supporting safety and security, and treating patients (Zeng et al., 2020). Considering the numerous areas of application and benefits associated with them, advanced technologies such as robotics and AI will continue to be adopted and applied in more aspects of our living and working lives. Therefore, it is essential for HCI to inform the ethical development and deployment of such technologies that will increase productivity, create more jobs for the future, protect natural and cultural environments (Zeng et al., 2020), increase citizen participation and engagement, and protect human and planetary health.

Reflecting on the contribution of and opportunities for HCI researchers to inform, explore, and direct Industry 4.0 initiatives, the benefits and potential opportunities for uptaking and adopting advanced technologies are clear. Yet, a main challenge we have encountered when working with industry partners is their focus on technology. With hopes of solving all the problems through the technology itself, the needs of their workers, clients, and collaborators are often overlooked. These technologies are novel and rapidly developing, largely they are not plug and play. Time is required to better understand and apply a human-centred design approach to the development, implementation and evaluation of advanced technologies. 'Open innovation' describes how an organisation can purposely manage inward flows of external knowledge, and outward flows of internal knowledge to increase its ability to innovate in line with its business model (Chesbrough, 2003; West & Bogers, 2014). Open innovation as a theoretical position informing industry partners fosters open mindsets, collaboration, creativity, and knowledge sharing as key aspects to the adoption and implementation of advanced technologies (Brophy et al., 2020; Caldwell et al., 2019). HCI researchers collaborating with disciplines such as industrial design, robotic engineering, architecture, and the wider humanities are well placed to design, develop, and make user interfaces, systems and processes, artefacts, prototypes, and products within the realm of advanced manufacturing and Industry 4.0.

Our research experience aligns with Dalsgaard (2020) advocating for HCI methodologies, tools and methods such as participatory design, scenarios, and design fictions, which can help to address global challenges. More specifically, the area of Human-Robot Interaction (HRI) will need to expand to include more critical and ethical questions, particularly as collaborative robots become more accessible and safer to use across industries and eventually in everyday life. We may also have to re-think the role of robotics in managing

public health and infectious diseases (Yang et al., 2020). We agree with Feil-Seifer et al. who argue that:

> Researchers in the broader robotics community have hypothesized that one consequence of the pandemic will be to alter the conversation around robots by highlighting that while robotics and automation may be eliminating jobs and exacerbating income inequality, they are also critical for enabling a global economy that is robust to pandemics, by enabling work to continue while limiting human-to-human contact and potential spread of the disease (Yang et al., 2020). (Feil-Seifer et al., 2020, p. 4)

4. Post-Pandemic Cities

Design and cities have a long history of interaction (Foth, 2009; Mitchell, 1995), and the aforementioned dynamics and challenges come especially to the fore in urban environments. The different sub-fields of design that focus on urbanism – architecture, urban design, urban informatics, media architecture – have already produced a number of notable proposals for alternative, contestable, and desirable city futures. We want our cities and urban habitat to be more inclusive and participatory (Foth, 2018; Hearn et al., 2011); resilient and antifragile (Hespanhol, 2017); equitable and ethical (Daly et al., 2019; Mann et al., 2020), and; sustainable (Heitlinger et al., 2019; Paulos et al., 2008; Foth et al., 2009). Aspirations are for cities to be transurban (Thibault et al., 2020); post-algorithmic (Komninos & Kakderi, 2019); posthuman (Forlano, 2016, 2017; Smith et al., 2017), and; post-anthropocentric (DiSalvo & Lukens, 2011; Luusua et al., 2017; Yigitcanlar et al., 2019) and thus catering for more-than-human futures (Clarke et al., 2019; Foth & Caldwell, 2018; Loh et al., 2020).

What impact do cities and urban technology have on the coronavirus crisis, and vice versa, what impact does the pandemic have on cities? It is already clear that the pervasiveness of smart city technology plays a key role in health monitoring efforts, public communication, epidemiological assessments, and the implementation of outbreak control measures such as social distancing, quarantines and travel restrictions (Lai et al., 2020). Our previous discussion of the controversies surrounding contact tracing apps as an example of smart technology deployments has already highlighted that some of these smart city and urban intelligence measures come with a range of – intended or unintended – side effects, such as privacy and surveillance concerns, limiting a city's civic sovereignties due to obligatory corporate data governance structures, and constraints or even the temporary removal of the citizenry's civil liberties. COVID-19 management strategies employed by the Chinese and other national governments use existing IoT and smart city technology infrastructure as well as new appropriations of robotics, autonomous systems, and AI in an effort to control the pandemic (Z. Allam & Jones, 2020; Chen et al., 2020). The crisis presents an opportunity that governments and corporations do not want to waste, one that expedites and accelerates the

rollout and expansion of "urban robotics and automation in a new era of urban bio-(in)security" (Chen et al., 2020).

On the flip side, what can design learn from the way these technologies we designed are now used and appropriated? Can insights from the "viral city" give us new insights for better designing future smart cities (Sakellarides, 2020)? What will the post-pandemic city look like (Batty, 2020; Kareem, 2020) other than obviously showing heightened resilience to viral infections and pandemics (McCall, 2020)?

The inequalities and inequities inherent in not just the spread of the virus itself, but also the response and efficacy of control and treatment measures and capabilities across different geographies and populations have become stark (Dasgupta et al., 2020; Gilbert et al., 2020; Rose-Redwood et al., 2020). As a result, we need to study these implications and identify the design opportunities to promote equitable and just cities for all (Pineda & Corburn, 2020). Speculative design scenarios are a useful method for anticipatory urbanism, as it allows us to temper uncritical corporate smart city utopias with critical, realist, and value-driven scenarios that should make us not just weary but confident in our shared responsibilities as designers (Costello et al., 2020; Jackson, 2020; Nathan et al., 2007).

Finally, post-pandemic cities need to also continue the fight for climate action and urgently progress towards a genuinely sustainable future. Looking at how the twin disasters of climate change and COVID-19 could transform our cities, Bauman (2020) argues that, "the existential emergencies we face require a wholesale reimagining of how we live, work and play in urban spaces." This will require a continuing focus on food and agriculture (Blay-Palmer et al., 2020; Loker & Francis, 2020), as well as radically reframing our unhealthy relationship with nature and the planet towards a design agenda of revegetation, rewilding and more-than-human perspectives (Lewis, 2020; Mills et al., 2020; Searle & Turnbull, 2020). In "Cities Gone Wild," Lewis argues:

> Below the biopolitical management of human populations in cities there exists a biopower of occupation that subverts attempts to reestablish immunized, species-determined territorial boundaries. This biopower is immanently productive, introducing the possibility of zoomorphic rewilding as a new ethico-political foundation for a posthuman right to the city. To return to business as usual in a post-pandemic world would be to miss this opportunity to join with non-human animal city dwellers in a moment of environmental intimacy. (Lewis, 2020)

5. Conclusions

As a new decade dawns, society often reflects on the trials and tribulations of the past and looks towards the possibilities and opportunities the future holds. 2020 was meant to be the year that kickstarted the beginning of a new prosperous decade full of urgent reform towards a circular economy, social equality, and environmental regeneration. If we were to jump-back or jump-forward in time we would observe that local communities are forever

evolving and changing as a result of contemporary influences, social changes and political agendas (Fredericks, 2020). The lead up to the new decade has shifted discourse around important topics and issues that people want to see addressed and in many cases acted upon with urgency. The hopes, wants and desires around people's futures within local communities were starting to be heard through bottom-up movements, such as the global climate strike, protests against invasion of digital privacy, and opposition towards social injustices. However, 2020 has certainly thrown Australia a curveball with national crisis situations declared as a result of either natural disasters, such as the 2019-2020 'Black Summer' bushfire season, and now the COVID-19 global health pandemic.

From June 2019, Australia has experienced a heightened level of top-down government intervention and decision making across communities as a result of these declared crisis situations. Regardless of their popularity, restrictions have been placed on local communities in order to protect them for the greater good. This includes particular restrictions on travel, public gatherings, closures of schools and places of work and the introduction of specific social distancing rules. We acknowledge that these measures have been implemented to protect the safety and wellbeing of the wider community. However, we do question some of the top-down and draconian approaches imposed on communities during such crises. For example, Prime Minister Scott Morrison established the Australian National COVID-19 Coordination Commission, which is chaired by a former gas company executive and consists of high powered company directors with vested interests in gas projects, yet who have never declared a conflict of interest (Knaus, 2020). It appears Morrison also never wastes a good crisis to advance his party's ideology and policies.

Cities around the world experience bottom-up community activism in response to a variety of issues and causes. These movements encourage local communities to stand up and take action often in response to unpopular political decisions, imposed restrictions, opposition to injustice, social transformation and new opportunities. Throughout time, community activism has allowed people to voice their discontent, show power in numbers and to ultimately stand-up against top-down decision-makers, and design has already played a vital role in this regard (Foth, Brynskov, et al., 2015; Foth, Tomitsch, et al., 2015; Le Dantec, 2016a, 2016b). However, there is a significant risk of democratic values being jeopardised as a result of government opposition to community-driven activism in times of crisis, and a drive for legislative change to prohibit this. An example is the New South Wales supreme court ruling, which effectively banned an organised Black Lives Matter protest. This opened up demonstrators to significant fines or even arrest if found in breach of the ruling (L. Allam, 2020). The interpretation of this action could be viewed in two ways. Firstly, the government is taking these measures to protect communities from COVID-19 infection, which is completely valid during a pandemic. However, this could be communicated in a better way. Or, secondly, there is the option of fighting the action through judicial channels as a direct challenge to the defiance of government power and control. Valls (2020) argues that city (or countrywide) lockdowns have strengthened the need for social connection and in fact brought people and communities closer whilst fostering a new sense of activism:

> Activism is evolving, as movements and organisations are learning to adapt their tools and systems to build power, organising and mobilising people for action overcoming the physical distancing limitations. (Valls, 2020)

This brings us back to the argument of 'never waste a good crisis,' in both a positive and negative approach to community activism. There are significant positive opportunities to design and investigate tools that promote a common task by traversing across social and cultural divides (Light, Frauenberger, et al., 2017; Light, Powell, et al., 2017). The ultimate objective is to lead a process of discovering collective and personal purpose that brings top-down and bottom-up stakeholders together in a dialectical discourse – rather than in opposition (Frauenberger et al., 2018). However, this also provides opportunities for governments seeking to maintain draconian control and power, such as changes to legislation and suspension of human rights and civil liberties in the name of national security (Bagchi & Paul, 2020; Kitchin, 2020).

We are specifically interested in the opportunities design affords to community activism in facilitating more open, democratic and collaborative discourse during declared crisis situations. More specifically, there is an express need to investigate opportunities for designing technologies that encourage people to participate in declared crisis situations before, during or after the event. And most importantly, we need to improve how top-down and bottom-up stakeholders better work together for more open and collaborative discourse through middle-out engagement and design (Dow et al., 2019; Frauenberger et al., 2018; Fredericks et al., 2016, 2019). By drawing on a collective knowledge base comprising top-down decision makers informed by academic experts and local communities who bring rich domain expertise, a dialectical engagement and greater collaboration between these stakeholder groups can emerge that is required to learn from this crisis in order to avert the next.

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Acknowledgements: We thank Prof. Deborah Lupton (2020) and Prof. Peter Dalsgaard (2020) for taking the initiative to create meta-review documents and everyone who has contributed to those. We also sincerely acknowledge all those we lost during Covid-19 and those still struggling, pay our respects, and convey our condolences to families and friends.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A new way of perceiving the locality: economic growth, social inclusion, environmental protection

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Abstract | The Covid-19 health emergency has changed our social relations and approach towards studying and working. In this unpredictable context the role of the designer and artist coincides with that of the explorer who abandons his/her individual research to pursue a new shared mission for the future. Cities, parks, squares, agora-cultural spaces will have to deal with the changes that will affect the habits of citizens. Public spaces will be reshaped through projects that take into account social relations and environmental needs. By involving young people and researchers in the enhancement of the identity of an area it is possible to imagine a process of urban regeneration that can become an open operative model, to be applied subsequently in other urban areas. Rome tries to provide a first solution by creating a participatory design project that combines history and future in one of its iconic neighborhoods: San Lorenzo.

SOCIAL INNOVATION, PARTECIPATION, HARMONIZATION, CREATIVE DISTRICT, INTERGENERATIONAL

1. Introduction

1.1 Design as a response to covid-19

Design can be an answer to the challenges of our times, an engine of innovation and competitiveness, especially in those areas in which it is necessary to imagine new horizons, to cope with contexts characterized by profound and rapid social, scientific and technological transformations. In this process, strongly influenced by the consequences of the Covid-19 pandemic, the designer must act as an explorer, applying the working methods related to analysis, research and experimentation to support an approach to a design where the sense of community is at the center of the creative processes.

To understand how strategic it is for a designer to imagine the future and how historic the change of mentality over these last months has been; one can look at the past. The 1964 new hospital project of Le Corbusier (Boesiger & Girsberger, 1987) that should have been the first important post-war architectural achievement in Venice, but which was never built, is emblematic. On the third floor of the structure, the hospitalization of patients was organized in cells of various forms, with bed units that could be isolated if a new and contagious virus occurred, or connected to the nearby beds. Another example is the inflatable and transparent mobile office proposed by Hans Hollein (Pettena, 1998) in 1969, decades before technology made what is now called “smart working” possible. It can be seen not only as a mobile workspace, but also as a way of isolating oneself from others and from any pathogens, while keeping eye contact. If up until recent times the intention of a designer could have simply been to achieve an end, without a specific intention and a decision to work to achieve it, nowadays a systemic approach is adopted to solve the dysfunctions of entire communities that affect their members and their relationships.

The “key – word” that best defines the path that will be taken from here on is “harmonization”. The 2030 Agenda of the United Nations defines “sustainability” as the main way to meet the needs of the present, without compromising the lives of future generations, and to harmonize economic growth, social inclusion, public healthcare and environmental protection. For this reason it is necessary to invest in and support local communities through active and strategic policies, and by promptly launching public and participatory measures that can make a difference.

1.2 Post-pandemic education and re-construction

The creative industries, as well as the education sector, must raise questions about the future. In this re-construction process it is necessary to focus on cultural, personal and collective growth; making the art education - creative professional practice link even more

inextricable: from here emerge the "best practices" related first of all to social innovation and then to political innovation, that allow creativity to co-determine new solutions.
To rethink education, enhancing image education and the various forms of artistic expression, is a step to take to facilitate the affirmation of a concept that is in the DNA of art and design students: to interact with society; the so-called “Third Mission”, a fundamental objective that can be achieved through art education and research.
By contributing to the social, cultural and economic development of the host society, the Schools of Design can build bridges with industries, civil society and the local environment. Thanks to these bridges knowledge, perspectives and skills are disseminated in the area through institutional communication, “public-engagement”, “Start-ups”, “spin offs”, patents and consultancy.



Figure 1. All students of Design must interact with the society around them.

1.3 Evolved cultural districts

The consequences of the historical rift that Covid 19 represented for the global community will redefine the customer/citizen/user - locality relationships, and the cities will be at the heart of this transition.

Since the beginning of the millennium the definition “Evolved cultural district” has meant redefining the urban development policies of large cities and developing, as the main objective of political and administrative actions, policies to promote culture: a driving force capable of generating sustainable and growth economies. The projects have focused on

"social innovation", on placing the citizen at the center of the development policies. The citizen is not seen exclusively in terms of needs to be satisfied, but as a resource that must be empowered. Widespread intelligence, the ability to collaborate and creative businesses are all part of a system in which infrastructures, that enable these potentials to develop in urban settings, must be developed.

In 2002 Richard Florida published *The rise of the creative class* (2002), in which he described the future of cities as being that of "creative cities", systems capable of bringing forth and welcoming highly qualified creative professionals, the so-called hipsters, who embody the "3Ts": Talent, Technology, Tolerance.

However, the debate regarding the relationship between innovation, cultural events and the locality does not end with Florida: the publication of this volume caused a reaction to the idea of a marketing oriented city. For example, the model of creative cities developed by Maurizio Carta (Carta, 2009) adds a fourth T to the three Ts, which is the "Territory": without the involvement of citizens it would be difficult to build integrated and inclusive creative communities. Important documents have been published in this sense both by UNESCO and by the European Community in recent years.

In this concept of an evolved cultural District, culture (from cultural heritage to live entertainment) is not one service that the territory offers among many others. It is placed at the center of urban development strategies as an indispensable element to generate innovative and sustainable production chains, for example, the high quality agri-food supply chains, food and wine, traditional crafts, innovative design, tourism, recycling and reuse industries, building redevelopment.



Figure 2. The creative districts are mostly located in the suburbs. A network of artists has increasingly grown, producing wealth and promoting innovation.

2. San Lorenzo: urban and social regeneration and local identity

2.1 The San Lorenzo neighborhood in Rome

The San Lorenzo district is one of the first suburbs of Rome. It was created at the turn of the nineteenth and twentieth century and was immediately characterized by a population in which all working class activities were represented, in particular those related to crafts.

Identified from its origins as a "rebellious" neighborhood, between 1921 and 1922 it was the protagonist of three episodes of opposition to the first phase of fascism. This is why in the memory of its inhabitants and in that of the whole city, it is seen as an "anti-fascist" neighborhood. On the 19th of July 1943 the first allied bombing of Rome during the Second World War hit the neighborhood, an event that left more than 1000 victims and destruction in the area and is still commemorated.

During the second half of the twentieth century the district maintained a strong collective identity and became the favorite place for political and cultural youth associations in the seventies. During those same years the closure of the Verano Cemetery affected the artisans (traditionally marble workers), while the expansion of the nearby University made the need for accommodation and spaces for students increasingly urgent.

San Lorenzo is today in a state of partial degradation due to multiple factors. These include the weakness of the political-administrative governance of the area, speculative interests, the polarization of productive activities, the spreading of illegal activities.

But it is also a neighborhood characterized by countless creative, cultural, social and cohesive activities that make it a lively and vibrant area. A contemporary design culture of new normal cannot fail to set itself the goal of contributing to the enhancement of this incredible production sector, involving all of those who, for various reasons, cross or live in this part of the city.

2.2 Purpose of the project

It is exactly in this scenario that Rome, the Eternal City and inherent capital of the world, tries to trace a path today, launching the *San Lorenzo: urban and social regeneration and local identity* project. The goal of this venture, promoted by RUFA – Rome University of Fine Arts, is that of establishing an open operative model that can be applied subsequently in other urban areas. It is a project that does not intend to "decorate" a neighborhood that is full of urban and social layers through a design that is "imposed from above", but to engage a community by sharing specific objectives.

2.3 Methodology

In this context, the designer is the one who engages with public spaces to give voice to the local environment, enabling it to express its full potential: from the collective memory to a sense of belonging, including economic empowerment and social-related benefits. It is the designers who must provide the most appropriate means of expression and communication to the players in the field, to make sure that citizens can express their desires, their values, and find a sense of belonging.

The participatory methodology adopted in the design of the visual identity of the city of Porto sets the standard. The objective of the Lusitanian administration was to position Porto at an international level, since it had been declared "World Heritage City" by UNESCO in 1996 and "European Capital of Culture" in 2001. In these processes cities are usually represented through symbols that are useful to develop international tourism or attract investors, but completely ignore those who experience the cities every day and the fact that a locality is not a product. The identity of a city is very difficult to pin down. It is made up of history, architecture, memory, values, social ties, food, climate, language, emotions: all elements which, when combined, are intangible, difficult to define and not measurable. The real job for all designers is to represent this intangible, this indefinable.

In addition to the involvement of local actors, to achieve this vision the active involvement of students is necessary. Once they assimilate the apocalyptic experience of the pandemic students will soon become the new key players in design and creativity in an operation

aimed at creating symbols for the community, focusing on the sense of belonging, tradition and collective history; and at communicating outside of the community by redesigning the devices.

In Participatory design for the area and in evolved cultural districts **c**itizens/residents become the real protagonists of the development of the locality: it is they who must experience the projects as their own. It is not a matter of redesigning the neighborhood, but of imagining its future, of experimenting, through collaborative practices and social innovation (user-centered design), with new forms of coexistence, focusing on recreational aspects, as well as businesses, the environment and the economy.

Participatory co-design assemblies for the locality, but also meetings, discussions and conflicts: these are the grounds to implement projects, where “design identity”, sustainable cultural productions, reuse of abandoned spaces, site-specific projects, street art and everything that this research (that is very much a “work in progress”) can facilitate, are discussed.



Figure 3. The spaces of culture and of art encourage and develop a new "attractive" vocation for the area.

2.4 Purposes of the interventations

When the health emergency is solved, getting used to physical contacts again may not be automatic. So students, leave the classrooms! Citizens leave your homes, professionals leave your offices, shop owners leave your shops, local administrators leave your institutions! We are talking about the common good of all and not that of the individual. The goal is to give visibility to a journey towards the “right to the city”. By using the example of the European

experiences related to evolved cultural Districts, it is possible to create connections between the players of the local environment: public administration, entrepreneurs, educational systems and universities, cultural operators, associations and civil society.

From the experiences of the "old" industrial districts which created production chains not in the factories but directly in the localities, this model is re-proposed in the research, production and absorption of culture; that is the precondition and integral part of cities and societies viewed as sustainable environments.

The publication of the first report of the World Commission on Culture and Development of UNESCO related to creativity and culture dates back to 1996. It is interesting to note that in the document creativity is considered as a tool to empower local administrations. To tackle large cultural industries (publishing, cinema, etc.) administrations must support important creative processes to map in a systematic manner the social and technological resources available in the local area (local capital), establishing alternative development models and new public policies.

It is necessary to rethink time and space of production in terms of the vocation of the locality; environmental, economic and social sustainability, with a hyperlocal approach. The valuable resources of these new cultural district models are the demographic, ethnographic and anthropological heritage which includes live entertainment, the production of contemporary art, film, television, publishing and multimedia industries, typical local products, fashion and design. An area designs its own district model around its most valuable assets and its vocation, both in terms of the services offered and of its collective intelligence which can attract investments for specific production lines.

The goal is to encourage and develop a new “attractive” vocation for the area of San Lorenzo focusing on culture and art in general, entertainment, socialization and cultural production. The backbone of the project is the use of innovative design techniques to promote the culture of the locality, its developments and the protection of its cultural heritage, as well as the aggregation and mobilization of people and energy to achieve this purpose. A project of this magnitude can be achieved in Rome, that has always been characterized by fragmentation and discontinuity that define the urban landscape of many global metropolises. In the representations of “smart cities” each element and each function seems to be placed in a continuum that is as coherent as it is taxonomic. The vision which gives order is the one that has already translated and identified reality through the categorization of data that can be “read” by artificial intelligence. Data collection, storage and querying is not for everybody. Those who have invested in these sectors require a reconfiguration of space and time that is useful for the processes they implement: they require not a community but an interconnected community, the opacity of algorithms, that the citizenship right be linked neither to soil, nor to blood, nor be universal, but that it would depend on the transfer of personal data by individuals.
But this globalized city, this smart city, suffers a crisis when the plague spreads in Thebes, when Covid-19 empties the territory of those actors who apparently animated its economy: platforms for short-term rentals, tourists, non-resident students, minimarkets, food & drink and entertainment activities related to nightlife.

The city is now like a bone stripped of flesh, there is apparently nothing left to extract value from. But the value is there, and it comprises all of the resident citizens left to live in the neighborhood, the elderly, the migrants, and above all the social groups, voluntary associations, local gyms, those who have occupied abandoned spaces to regenerate them, to transform them into places of culture, socialization, experimentation, solidarity, that are free of charge and open to everybody.

To start again, the best elements of our communities will be able to interact with each other through three guidelines: research, exchange and operativity, creating a connection between resident citizens and students, researchers and experts in the management of cultural districts, to exchange information and experience.

This possibility is facilitated by the positive benefits that the pandemic has highlighted such as the possibility of communicating from a distance, of tackling a problem from all over the world, thus favoring discussions that have multidisciplinary approaches, facilitating the mapping of stakeholders in an area and defining the KPIs that must be analyzed, studying the local environment, processing the data obtained and sharing the results through participatory design sessions where projects, ideas, theoretical and practical activities are shared.



Figure 4. Art: yesterday, today and tomorrow. Example of the Classika project in San Lorenzo.

2.5 Ongoing activities

The activities in the field feature different projects and show just how much an educational institution such as RUFA can bring to the development of an area and how the perspective of the new generations can generate new possible worlds.

Art: yesterday, today and tomorrow.

- Sculpture: *Classika*, a homage to the decadence of Rome through a series of busts of contemporary characters of the San Lorenzo district, interpreted according to the stylistic features of classical Roman portraiture;
- Site specific: lights and sounds of memory, to actively redevelop abandoned spaces, looking into and enhancing the "dark" areas, such as the *Casa della Memoria* (House of Memory) in via Tiburtina through the light of art;
- Audiovisual project: the stories and characters of the neighborhood, the voices of the artists who "rest" at Verano, from Vittorio Gassman to Alberto Sordi;
- Multimedia: video installations, sensitive maps, participatory museum of the area;
- Videomapping: shows in the squares that create a narrative and visual scene focused above all on the neighborhood today and its future liveability.

Culture: being reborn after the apocalypse.

- Multimedia exhibition: interactive installations that tell of the evolution and transformation of San Lorenzo from a working-class district to a University district, including the bombing of the 19th of July 1943;
- Documentary film: the symbolic thread that links the tragic death of the young Desirée with the myth of Iphigenia, the sacrificial victim who atones for the sins of an entire society. The humanity that populates San Lorenzo becomes the protagonist of the making of an imaginary film about a modern Iphigenia;
- Photo reportage: a research focused on spaces and people: squares, streets, gardens, rooms, but above all communities, associations, gentrification, marginal situations, social degradation, memory;
- Publishing: a print and digital magazine for San Lorenzo: the places, the characters, the history but above all the current affairs and events, told through "profound" and vernacular designs and signs.

Design: participate and connect.

- App design: applications designed to connect people and places using specific key words, such as "art", "together", "economy", "local currency", "security", "discovering the neighborhood", "sustainability", "Urban décor", "gaming": the Apps are a way to promote socialization, meetings and exchanges that are not only virtual;
- Neighborhood signs & wayfinding. Paths that connect places through the multiple interpretations of the space from the point of view of those who pass through it. Unconventional signage and interactive exhibits;

- Creative design: research groups for the production of posters, art books using risograph printing, board games featuring the characters, places, and imagery of the neighborhood;
- Place design identity: A participatory city branding project of a multifaceted district, vital and traditional at the same time. Indispensable tool to make the area grow and stand out both in terms of attractiveness and social cohesion;
- Type design: a font, a typeface dedicated to San Lorenzo which will bear his name, an identity defined starting from the typography to describe the neighborhood;
- Advertising: a “call to action” to involve businesses, associations, cultural institutions and citizens to plan together events, performances, festivals, apps useful for redeveloping the territory;
- Virtual reality: San Lorenzo in 2030. A “non-place” where large digital platforms will have taken over the city and residents will not have a soul. Virtual reality shows the main street of San Lorenzo completely immersed in this dystopian future;
- Gamification: *Zombies in San Lorenzo*, a video game for the neighborhood. From the Verano Cemetery an army of zombies moves to conquer the neighborhood, allied with Roman crime and drug dealers. But the few remaining residents that are the non-resident students and the cultural and social entities of the area fight them;



Figure 5. Design: participate and connect. Example of the "Fluxus" project, digital wayfinding at San Lorenzo.

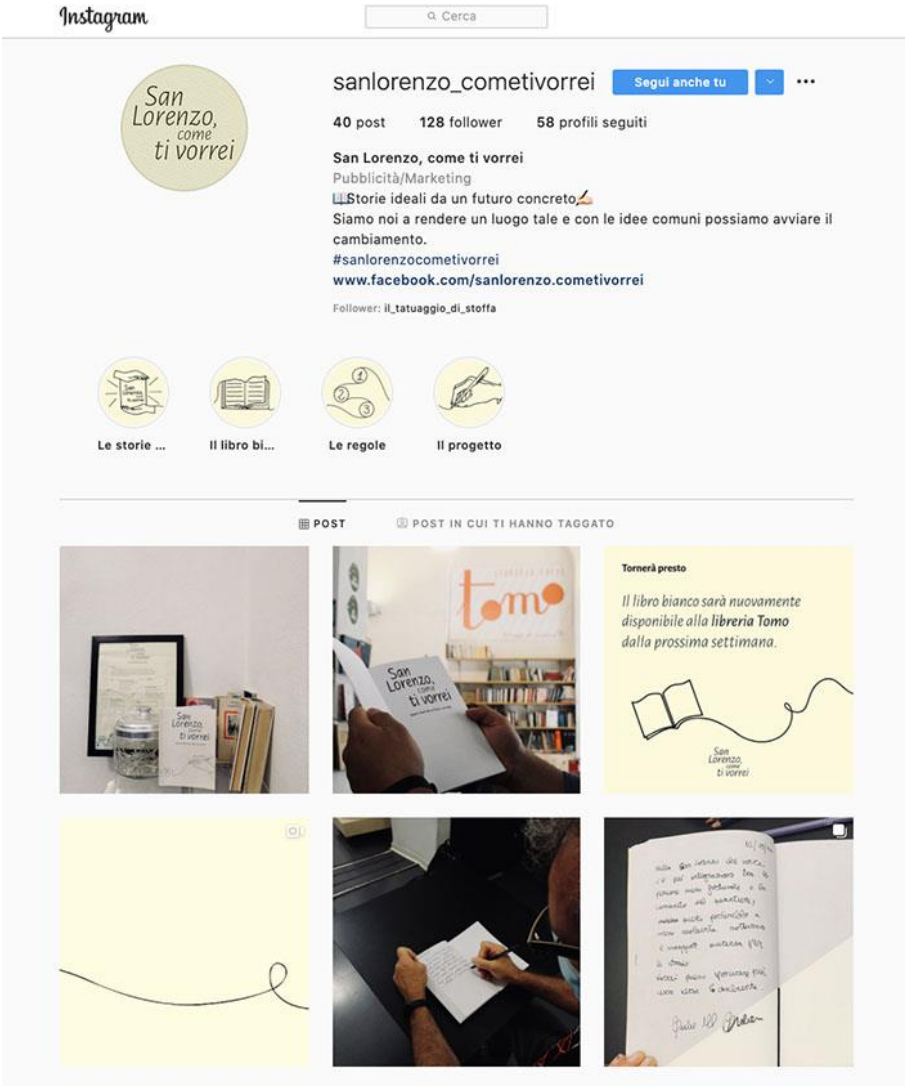

Figure 6. Design: partecipate and connect. Example of the app design project (Instagram page: sanlorenzo_cometivorrei).

2.6 Synergies

The project involves local public institutions: the Municipality of Rome II and DiSCo Lazio (regional body for the right to an education), which has its headquarters in San Lorenzo. These institutions have a direct and concrete interest in the area.
Regarding the voluntary associations and the nonprofit world, focusing strictly on the local and urban networks, a collaboration has been created with CNA Rome (Crafts National Confederation) and with Arci Rome, a long-standing association for social and cultural development.
In terms of businesses, the Intesa San Paolo banking group is involved. It has contacted a network of local businesses with the aim of creating networks and collaborations between entrepreneurs.
At an educational and University level, a successful collaboration has been created with the IT department of Sapienza University of Rome, which has its headquarters in San Lorenzo.
Another strategic player is the crowdfunding platform “Produzioni dal basso”, that helps provide support to specific projects**.**

2.7 Expected results

Various results are expected from the project, both in terms of academic education and innovation in the approach towards urban policies. First of all, a new framework for commissioning should be defined, which is not necessarily represented by a contract provided by a Public Administration. These types of activities are increasingly financed by the European Community through specific programs such as Creative Europe.
Another result is represented by the development of the students' abilities to deal with complex systems, such as those of the city. Place identity design has been strongly developed. The most forward-thinking local administrations have realized that design fails if it does not involve participatory policies and local key players.
This type of approach will be strategic especially during the post-Covid-19 reconstruction phase. The New European Bauhaus and the declaration of Ursula von der Leyen are significant in this sense:

> “I want NextGenerationEU to kickstart a wave of restructuring across Europe and make the Union the leader of the circular economy. But it's not just an environmental or economic project: it must be a new European cultural project.”

Culture as an engine for development. Sustainable and inclusive development as stated by the 2030 Agenda for Sustainable Development (SDGs), specifically in point 11: "Sustainable cities and communities".
And finally interdisciplinarity. Such an articulated project requires many professionals (graphic designers, videomakers, artists, product designers, set designers, social media managers, etc...) who interact, discuss and act in a coordinated manner on the basis of a common project and objectives: the distance between the different disciplines has increasingly decreased and this allows us to train a new creative generation that has

multiple skills.

3. Post-pandemic conclusions and discussions

Not only are artists and professionals formed in Academies and Universities, but also new citizens: they are places where very important experiences occur that influence our future, they are laboratories in which we learn and at the same time develop our critical thinking skills, they are places of culture, where the generations alternate, acquiring an identity, finding a meaning for their actions. The designers and the artists are not simply technicians who uncritically operate in mainstream communication, but people able to find new directions and explore new areas; where a new symbolic, deviant and unexpected order can always be defined.

Academies and Universities participate in the contemporary cultural debate as promoters of new approaches and new visions. Only by giving cultural and operational tools to the new generations, as well as concrete opportunities to follow specific research paths, can we fully examine the contemporary through the living eyes of our children.

In conclusion, the sudden unavailability of public spaces has shown their importance, as well as that of sociality. The loss of places and opportunities to meet and for cultural growth, even if temporary and motivated by the need to contain the spread of Covid-19, has been particularly felt and suffered by the younger generations who, as direct witnesses of the pandemic, could be the key to change. The new generations of students, now immersed in a blended existence between physical spaces and virtual meetings, will play a key role in society for the social relations of the future.



Figure 7. Planning from the area, for the area. To awaken consciences, to combine theory and practice in design, to bring together different generations.

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Acknowledgements: My special thanks go to Professor Enrico Parisio, coordinator of the San Lorenzo-Urban Regeneration project, and to RUFA students and lecturers for their dedication towards finding innovative design solutions.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A Sustainable Jewellery Design Practice for Psychological Health after Covid-19

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Abstract The reasons why human wear jewellery are more intricate than a basic motivation to adorn themselves, one of which is to convey their sentiment. No matter pleasing pieces as tokens of affection or mourning jewels in remembrance of someone who has died. Heart-broken to hear millions of people were dead of Coronavirus last year, the author created a series of mourning jewellery for people who lost their family members and close friends in the disaster. The author hopes the work could help to ease their grief to some extent and contribute to the recovery of their psychological health. The research project is also for compassionate people who have willingness to support the victims as well as for the entire society to commemorate this event.

KEYWORDS | JEWELLERY DESIGN, MOURNING, PSYCHOLOGICAL HEALTH

1. Introduction

“Is there a possibility that people can use an artistic or poetic way to express their emotions after a disaster like Covid-19, so that their agitated mood can be recovered more quickly? Is jewellery an ideal medium? Is paper a suitable material choice for the mourning jewellery?” The research project started with these questions.

The miserable condition of Covid-19 at the beginning of last year is too hard to forget that thousands of people died in very short time and everyday news reported the updating statistics as well as people were requested to stay at home and any gathering was forbidden. The whole society remained stagnant at that moment.

While the factories, the schools open again gradually, and the economic and life order could be recovered in a short time, people who lost their family members and close friends in this disaster could never feel easy to stop the suffering and heartbreak. Money can be earned again, but the deceased never return. Bereavement is one of the most unacceptable and sad experience in one’s life. Not only the victim’s families need assistance of relief money from the government or charitable institutions, but also the bereaved need solicitude from the society. The trauma, if not being handled properly, could be lifelong. No matter how greatly we are distressed, the deceased have already gone. However, the influence on their families or close friends has just started. Human beings seem never capable of averting the natural disasters, but what we can do is to show solicitude for the bereaved, to use some proper means to help them get rid of sadness as much as possible. According to psychological points of view, the most important one is to let them express their sorrow adequately rather than suppress or try to remove these moods.

This project has explored quite a few possibilities of paper used as a main material to make contemporary mourning jewellery. While traditional materials like gold are rare and with ‘original sin’, paper is an everyday material widely found and easy to recycle which have value of ecological ethics contributing to environmental sustainability (Cappello, 2009). The rich properties of paper (both physically and optically) such as easily shaped and translucency enable it to be a proper story teller (Coan, 2009). Moreover, the ephemera of a man’s life can be appropriately represented by paper due to its fragility. The light weight of paper and its intrinsically perishable quality can be seen as a symbol of man’s intangible soul and biodegradable body after death. Besides, in Chinese culture, people burn different paper craftwork to memorize lost loved ones.

Several objectives that constitute the aim of this project are set and achieved. They are at least one satisfactory piece of final outcome in each of five paper manipulation skills which are papier mache, origami (folding), stitching, layering and encasing. All the final outcomes should be closely answered the research question which is to help people express their emotions related to Covid-19, including the sadness of loss, the desire for remembrance and the prayer for reborn.

At the beginning of this project, in order to initiate the research and get familiar with the context, literature reviews on historic mourning jewellery and modern paper jewellery have been conducted along with re-examining a visit to the jewellery gallery in V&A Museum that the author once made. Followed by the first design prototype, a quantitative and qualitative survey of people's thought and understanding of mourning jewellery has been conducted by the form of questionnaire both offline and online. These feedbacks were used to inform the project proposal. Then the author did case study of relevant precedent work as well as collated textual and visual resources related to paper jewellery design concepts and making techniques. In addition, an interview with a psychologist, whose expertise is in bereavement after disasters, has been studied to get a knowledge of how valid psychological intervention is carried out for people after suffering from a huge natural disaster, which has been taken into consideration of the design process. Then the author moved on to the practice-based approaches to develop the project, i.e. sketching and modelling. Both of them serve as essential actions throughout the making process. Design and Make Paper Jewellery (Kelly, 2011) has been carefully studied to acquire instructions of applying different techniques of making paper jewellery. Simultaneously, throughout the entire project, continuous reflecting on finished exemplars is conducted.

2. Mourning jewellery

2.1 Historical Context (gallery visit & literature review)

After re-examining the visit to William and Judith Bollinger Gallery in V&A Museum, the author started to realize how many different functions jewellery has been involved in since the very beginning of human civilization. It is regarded as an accompaniment to a man's whole life from cradle to grave. From birth and fertility to childhood and survival, to love and fidelity, to beliefs and superstitions, to wealth and status, to death and mourning. Jewellery adorns and protects the wearer on the journey through life. It could be a way to pray for something such as good luck, romance; could be an amulet to protect against illness or evil power; could be an object to express love and affection; could be a sign of faith in some beliefs like a certain religion; could be a mark of authority or social status. Also, jewellery could be a medium to express grief and remembrance.

Historically, mourning jewellery was very popular in the reign of Queen Victoria. Some special materials such as fine carved jet and woven human hair were widely used in these types of jewellery. A considerate amount of symbolism was applied in the choice of stones and motifs. For example, a ring that set gems with the order of diamond, emerald, amethyst, ruby, emerald, sapphire and topaz represented the meaning of 'dearest'. The language of flower patterns also inspired a large quantity of design. For instance, ivy represents friendship while lilies of the valley stand for the return of happiness. These mourning jewellery were not only used to express grief feelings about the dead, but also used as an

affectionate remembrance of the loved ones. However, mourning jewellery didn't regain its popularity in the 20th century except after the Titanic was submerged in 1912 and World War I (Luthi, 1998). Both saw the substantial loss of life.

2.2 Contemporary Context (survey & case study)

In the modern day, wearing mourning jewellery becomes a more personal choice and differs from culture to culture. According to the answers from the author's questionnaires, Chinese wear a piece of black textile or a white fabric flower on arm to mourn for the dead while some of British wear a chain with the loved one's ring around their neck as a remembrance. Other British may have amulets with some items related to the dead person, such as the ashes. Sometimes, they wear lockets with photographs of loved ones inside. In Ukraine, most people wear jewellery of national colours (yellow & blue) to express sorrow over dead soldiers and revolutionaries. In East Asian cultures, people burn joss sticks and paper-made objects in front of tombstone and the photo of the deceased. It is common in many countries that people wear or keep the item of jewellery from the one who had passed way.

Although there is not much prevalence of mourning jewellery today like hundreds of years ago, contemporary mourning jewellery has been effectively used to express sadness and show public concerns about loss in disasters, making the bereaved feel supported and lessening their sorrow. It becomes a rallying point to raise money for the victims afterwards, such as Poppy Appeal for World War I in the UK and Yellow Ribbon Campaign for Ferry Sewol Sinking in 2014 in South Korea. Also, special jewellery was designed to raise money to relief organizations by celebrities, designers and retailers after the Japan Earthquake in 2011, a major disaster that led to the meltdown of Fukushima Nuclear Power Plant.



Figure 1. The special jewelleries designed for World War I, Ferry Sewel Sinking 2014 and Japan Earthquake 2011.

3. Paper craft and sustainability

3.1 paper and ecological sustainability (material)

Paper, as a material of commonplace nature, seems everywhere around us. It could be newspapers, product packages, used booklets or old phone books. Contemporary paper artists recycle the widespread substance and instil it with new value, turning waste into treasure. An ecological subtext is at play here. Manheim (2009) suggests, “seeing potential in the overlooked is something artists and designers have long been accomplished in”. In today’s society, mountains of short-life, obsolete products are manufactured every day. After their brief “object-hood”, there could be the continuing lives of the original materials if they are recycled or reused. Take newspaper as an example. On the one hand, the daily newspaper is the representative of ephemera: the contents are soon outdated by the end of the day because tomorrow’s publication has already been printed and ready. On the other hand, the physical matter of newspaper takes a long period to resolve, even expose it to the weather. So, using second-hand or discarded materials rather than virgin materials to create new items is a great way to push forward ecological sustainability in our society. As “sustainable development” is defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs, we do not tend to leave our future generations only rubbish without any useful resource and a broken ecosystem as a legacy. We should avoid waste matter to be left on the earth as much as possible now.

3.2 Paper jewellery and cultural sustainability (value)

Siliakus (2012) states that the unique characteristics of paper that sturdy yet flexible simultaneously enable it to be manipulated in a number of ways. Creased, cut, folded, bent, engraved, painted, written on, printed on, …, the list is by no means exhaustive. It can create sublime projects, such as paper jewellery. Contemporary jewellery questions the value of traditional jewellery from forms to materials: often done by adding, removing, or superimposing traditional values onto materials which are not usually considered valuable in the context of jewellery (Manheim, 2009). Paper jewellery is an epitome of that: it sweeps clean the excessive commercial needs in our society currently and calls for a return to the origins of creativity. Danieli (2009) announces that it is merely in terms of originality, construction skill and aesthetic result that make art valuable. Paper jewellery challenges the mechanical concept that it is the long-lasting intrinsic value of the precious raw materials that supports the quality of a piece of jewellery which live the daily nature of our lives. Paper jewellery meets the industry’s urgent need to go beyond the values and limits of the metal or fabric so as to claim the priority of invention and manual skill in current situation. It reminds us the original and intrinsic characteristics of jewellery are ornamental, symbolic and body furnishings rather than acts as property proof for safekeeping or passing down (Morozzi, 2009). It refocuses attention to the value of the conceptual idea rather than that

of the material. Moreover, the lightness of paper is well-matched with the physiology of the human body whereas metal jewellery very often implies the hardness and ruggedness. Thorpe (2007) states that cultural sustainability asks designers to create evolving artifacts which help people connect to the past while also being mindful of the future, not only considering the present but also the long term. These evolving artifacts meet people's emotional and expressive needs intrinsically rather than extrinsically—the latter are driven by commercial connotations. Thanks to paper's poetic nature and versatility, it's an artistic medium properly to tell stories and make evolving artifacts, especially jewellery, which stays close to people's daily self-decoration and emotion expression.

4. Design ideas and making

Thorpe (2007) highlights that 'stories' are a good way of making sense, or making meaning since they draw us in emotionally. Designers can concern from the past and collective knowledge or examines scenarios of the future. Based on this concept, the author tried to propose a concise name which represents a story or a feeling, for each piece in the series of mourning jewellery she designed while combining five different techniques of paper making. They are the pair of "Star in the night" bracelets, using papier mache; the set of "Revive by love" rings, using layering; the "Solidarity" bracelet, using stitching; the "Pray for being strong" brooch, using encasing and the set of "Flower blooming" necklace and bracelet, using folding. Aside from the author's own design ideas, she also got quite a lot inspirations from the questionnaire's results which she asked respondents to write their feedbacks on the first design piece and the key words that came to their mind. The first two pieces are for the bereaved to long keep so they are packaged in delicate boxes, while the last three are for the public so they are in portable envelopes. According to an expert in post-disaster psychological intervention, both the bereaved and the sad public need express their mood by some concrete behaviors.

4.1 "Star in the night" bracelets | Papier mache

The bracelet consists of several beads. The number of beads represents the age of the dead person. The material to make the beads is recycled newspaper. Except the eco-friendly factor, the reason why the author chose newspaper is: to most of the public, the natural disaster is just another piece of news that would be forgotten like outdated newspaper soon being tossed into a bin. However, to people who lost their loved family members, that would be an unforgettable event and it is impossible to forget the victim throughout the rest of their life. Newspaper can be a carrier to hold and preserve their memories with the deceased. The shape of the beads is designed and handmade to be roughly round. Firstly, it resembles pearl, which represents the tears, associated with sorrow. Secondly, in the countries or regions where Buddhism is the main religion, the round shape also resembles Buddha beads used for praying. Thirdly, the round shape resembles the heavenly body in the

universe which appears to be star we can observe in the dark night. Also, the color and pattern the author chose is from an idea based on a beautiful old story: one person who passed away on the Earth will fantastically transform to a star in the universe. Our loved one never left us; they just became another form of existence. When we look up at the starry night, the shining stars are they looking back to us, let us know they are fine.



Fig 2. "Star in the night" bracelets (originally designed as a necklace) and an early sketch.

The author got not a few feedback via her designed questionnaire. And some of them are quoted below:

- "Colour is nice.";
- "Colour is dark so I feel more serious than normal silver accessary. Looks like rock.";
- "Earth-like. Special. Feeling it's made of natural stones.";
- "It's similar to juzu. Also, it looks like fortune stone bracelet. But I can feel what you wanna show after I read your explanation.";
- "The form makes sense. Can't comment on materials though without looking at the real thing.";

- “I like the fact that not all the beads are the same, representing that all tears are not the same and unique. The colour used is nice and has a very earthly feel.”;
- “I think it is a lovely design with a beautiful meaning behind it.”;
- “It’s beautiful, very balanced and calm. I can definitely see the reference to the tears.”;
- “I really like the inspiration behind it and the concept of people’s souls becoming stars.”;
- “I think it is a nice concept and it is practical.”;
- “Like a Buddha beads. Colour looks like star.”;
- “It is quite nice because it reminds me of universe.”;
- “Its look already makes me think of legends (probably because of material and shape used). It looks simple and lyric, I would love to have one, especially if it conveys special meaning.”;
- “It’s beautiful. I love the idea that our loved ones become star dust.”;
- “Without the explanation, I might not have understood the meaning of the piece, but the explanation makes it clear. The colour is intriguing and it makes me wonder what dyes were used to make it. I feel maybe the beads could vary in size to represent different people/souls and could have different hues of colour for the same reason.”;
- “It does make sense, a beautiful sentiment.”;
- “Your words above help me to understand the meaning of the necklace/bracelet. It makes sense.”.

The comments suggested to change is in common:

- ” I really like the colour and your idea of this accessary but when I wish to buy, I would want to have a bit smaller, it may be easier to wear in daily lives.”;
- “a little big”, “It’s too chunky for me.”;
- “Personally, it is too big for me. Because I prefer something small which is meaningful and can relate to our loved ones.”.

After reading the above feedback, the author tried to figure out target users of this project. Since this piece is for the victim’s family to mourn, it’s different from giving the public to commemorate the event or wear as a daily jewel. However, the global respondents’ feedback expanded my thinking that I could design some pieces like yellow ribbons for Ferry Sewol Sinking which has been mentioned before or national colour jewellery for Ukrainian Revolution. Those pieces can raise the public’s awareness of the tragedy that could turn to spiritual and financial support for the bereaved families.

Respondents’ answers of “If you wear a piece of jewellery to mourn for the dead, what type of jewellery would you like? And, what kind of look would you prefer it to be? Why?” further inspired me for the following jewellery designs.



Fig 3. The following jewellery designs' outcome.

4.2 "Revive by love" rings | Layering

It was made by wasted tissue box. The pink color represents love. The layers mean people can gradually rebuild their life order and make a recovery from the emotional wound step by step.

4.3 "Solidarity" bracelet | Stitching

This bracelet was plaited with newspaper stripes and a green wool. Green represents hope for reborn. The form of it means only be together can we conquer the difficulties. Without the wool, the fragile paper stripes are so easy to broken.

4.4 "Pray for being strong" brooch | Encasing

The two-triangles shape represents mountain, which always give the feeling of strong power. The colors are from pray flags. Sewing simple and natural lines at the back of the brooch, it can be easily worn with a simple safety pin.

4.5 “Blooming” necklace and bracelet | Folding

Like flowers blossom each spring, there are always new hopes. The way to connect paper flower and the band has changed several times. Finally, in order to achieve utmost eco-sustainability and easy to massive produce for the public, I chose the simplest way of cut and insert and paper itself as band material. Additionally, the fragility of paper flowers reminds people of cherishing the evanescent life.

5. Summary

After a couple of weeks’ research, idea exploration, experimentation and refinement from the initial intent, a series of paper jewellery has been produced as a response to the research proposal.

On the one hand, the positive features of this project are:

- It creatively combined the emergent paper jewellery with a practical mourning function;
- It was enriched by the conducted questionnaire’s feedback;
- The outputs of it are meaningful, related to great love and care for human beings’ common destiny: be united and face the unavoidable huge natural disasters together.

The author has gained a great deal of new knowledge and skills through the research activities done:

- Her understanding of jewellery has been deepened, e.g. its multiple functions, its various styles and materials among different cultures in the history;
- Studying interview script of an expert in post-disaster psychological intervention broadened her horizons;
- Paper manipulating techniques have been studied and tried along with other materials such as brass and foam;
- The author has experienced how to design an online survey and how to appoint an archive visit in University, which could also be used to assist her future research projects.

In addition, the author feels her critical thinking skill and self-direct study ability have been strengthened through the process of doing this project. The author feels more comfortable and confident to present her work and ideas. These research skills are used more flexible than before.

However, on the other hand, due to the time limitation, this project certainly has further aspects to enhance:

Firstly, the author has not managed to contact the bereaved family directly to get their feedback about her design yet, who are the first group of her target audience. Unfortunately, the time was run out as the follow-up project development work occupied the author's subsequent effort and time. That means the final testing stage is missed. The experience teaches the author again the importance of time management. Do pay attention to time-limitation and self-evaluate the project plan constantly.

Secondly, the author's initial intent of incorporating psychological knowledge could be more in-depth. That is to say, conduct qualitative interviews with psychologists and people who suffered from losing family members about her ideas and design work. Then improving with clear aims.

Thirdly, the target audience can be defined more clearly and practically at the beginning of the project when producing the statement of intent. If so, the direction that the project should work toward could be clarified more, the relevant analysis and evaluation about how the outcomes accurately answer the research question could be easier. Further understanding and well-use of methodology are needed.

When referring to the making part, if time is allowed, each technique can be explored more adequately. To achieve a more environmentally-friendly result, even paper and pigment could be handmade, using some natural components. Ways of dyeing, finishing and packaging could also be taken into consideration to accomplish a more complete project and its visual proposal and portfolio.

Last but not least, to add sustainable factors to the project, the author can take into account the possibilities of the jewellery that is revealed by wear and tear, and use it in a constructive way. For example, use layered finishes. Similar to the way blue jeans fade, new colors might be thrown up when top layers wear off. An exemplar of this is the mourning rings designed by Miriam Verbeek (1993), which are made from silver covered with fine black silk crochet. As the rings are worn, the crochet begins to unravel, revealing the silver rings beneath. It symbolizes the grieving process from the blackness to the lightness and the lasting part represents the memory of the dead person. Verbeek also made another piece in this vein: *Tears Collar* holds tiny glass balls in a fragile nylon membrane. When the nylon is worn, the frill of nylon disintegrates so that the necklace will cry tears. The author identifies strongly with Verbeek's concept behind the series of her mourning jewellery: "Dying is a part of life and it is as natural as being born. Yet, in our culture we are not familiar with it. For my jewellery I worked with fragile materials, to depict the transience of life. The moment of saying goodbye and the process to give your sorrow a place, are things I used in my work." (Verbeek, 1993). Another idea, suggested by the author's tutor, is to contain flower seeds inside the paper jewellery. When it was used and thrown into soil, the paper part can be bio-degraded gradually thus providing nutrients for the growth of the plant.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Autopoietic design; seven components for a sustainable future design model

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Abstract | Maturana and Varela in 1973 declared that an autopoietic unit is the one that creates, reproduces, and repairs its own components and organization. The last two hundred years, humankind has generated an unprecedented technological development. Unfortunately, it has broken the balance of the biosphere, leading to a new geological change, the Anthropoccene. Design must assume its share of responsibility. It is clear that the practical theoretical model assumed so far is not working, it is necessary to make a paradigm shift. By appropriating a methodology born in biology and created to determine whether we are facing an autopoietic entity, design seeks new ways of understanding oneseed and thus being able to have a more sustainable action. This research suggests that contemporary sustainable design, understood as a systemic model anchored in the theory of autopoiesis, will constitute a methodological theoretical tool that will allow a more harmonious link with the environment.

KEYWORDS | SUSTAINABLE DESIGN, AUTOPOIESIS, DESIGN COMPONENTS, DESIGN, FRONTIER, DESIGN ORGANIZATION

Presentation

The 2019 Global Outlook Report stated that in the next 10 years, one million species could disappear due to human actions (UNDP and UNDFCCC). In 2018 the World Wild Fund for Nature had released its biennial Living Planet Report and it documented that since 1970 the average vertebrate population has declined 60 percent (WWF, 2018). Like these, there are hundred, thousands of papers and research. No wonder the Anthropocene, is here to stay (Cumulus Think Tank, 2016), and it's no news designers have been in part responsible for what's going on with our environment. We must find new ways for Design´s development, the model must change. What was normal has become the unnormal, the unnatural, the unpresentable. The old model must go.

Giorgio Agamben (2009), French philosopher, declares that being contemporary with someone, does not rely on spatial or temporal factors. Rather, it's given by the possibility of a true dialog with your counterpart based on the possibility to interexchange ideas. If the possibility of a dialog does not exist, you cannot speak of contemporaneity. Contemporaneity will be related to the capacity of relating to the moment of history on which you live, but above all, in the capacity of taking distance from it. You can't question something if you're not fully immersed in it and at the same time have a distant, objective view of it. You can only dialogue if there are dissimilar positions with whom to confront your ideas, where you can be listen, listen to others to and try to understand them. Otherwise, doctrines and dogmas arise giving absolute truths the possibilities to conquer the sea of knowledge. (Agamben, 2009) "An intelligent man may hate his time, but he knows he belongs to him irrevocably anyway, he knows that he cannot flee in his time" (Agamben, 2009, p. 1).

Today's design must assume its share of responsibility for environmental deterioration. It therefore requires questioning the disciplinary legacies it has accumulated, especially in structural and organizational terms. It is, from the maturation of the discipline that a structure has been defined in design. And many of its characteristics have its origins in the foundation of the Weimar State Bauhaus, 100 years ago, under a totally different reality (Raineri, 2017). It is this fact that has led to a continuous limitation of a disciplinary evolution and preventing the ultimate purpose of design from being fulfilled in a sustainable way. Design's tradition, like that of other disciplines, has maintained a mechanistic view of its constituent components, defining a partial view of its operations and links. However, a systemic gaze could manage to clear and illuminate areas that up to this day have been partially visualized, isolated, or strictly ignored.

As a way of thinking design in a more harmonious relation with its environment, this paper proposes an approach from the world of biology. Not as a practice of biomimetics, but as a first and second order epistemological observational tool. Specifically, using the work of Humberto Maturana and Francisco Varela as a framework. They developed the concept of Autopoiesis, which initiated a new paradigm in the definition of what characterizes living beings. For them, autopoietic systems are those that create, reproduce, and repair their own

frontiers, components and organization (Maturana, 1980). They have stated that molecular autopoiesis is a characteristic which is unique to living systems. Nicolas Luhmann (1991), for the formulation of his theory of a functionally differentiated society, makes use of the concept of autopoiesis and applies it to social sciences. Luhmann's usage of the concept, relates it to how social groups internally produce the elements and relationships that constitute them. Likewise, he argues that there is a differentiation between the world of practice and that of science, that is, presents the coexistence of two parallel systems as a result of differentiated functionality (Riis, 2013). This same discussion has been in vogue since the early stages of modern knowledge, even way back with Jonathan's Swift 1704 satire "The battle of books". Where Neoteric and Paleoteric knowledge confront, just the same discussion we found in design today: theory and/or practice.

We know that design is a discipline that has been specializing and concentrating its field of action into ever narrower aspects of the challenges it encounters. Self-imposing partial views of its actions and surroundings, has made design lose the holistic capacity it once had. Design has become totally alienated from his environment and its time; design is no longer contemporary and is no longer sustainable. So, it's time to put in action one of Buckminster Fuller's famous mantras: "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete" (Buckminster Fuller Institute, 2016).

A new model has to be built, and we need some giant's shoulders. Biology, with Maturana and Varela's theory of autopoiesis, is the logic way to go. If autopoiesis has worked for living beings for the last thirty-five hundred million years, it should help design become more sustainable. This paradigm turnover would lead design to be understood as an autopoietic entity. If we could understand and start reconfiguring design as an autopoietic systemic discipline, maybe we could have a chance for a more sustainable future.

Procedure

The absence of a prior link between design and autopoiesis required recognizing the absence of categories that had known correspondence between the two. During the evolution of this research, the absence of existing references between autopoiesis and design was a constant. That is, in this study theory and data were developed simultaneously, as they present mutual dependence. Juan Samaja defined this methodological approach as ternary: "According to which both theory - expressed as a hypothesis plot - and data - conceived as schemes of intellect of the facts - are involved in the models" (quoted by Ynoub, 2015, p. 41, translation by the author). In order to do so a three-stage methodology was created, that involved the following steps:

- A first stage focused on visualizing whether we could find traces of certain primary concepts used for the construction of autopoiesis theory. The initial

concepts originated from the General Theory of Systems-TGS (Bertalanffy L. , 1989), but where reformulated by Varela, Maturana and Uribe (1974), in order to avoid equivocally generalist or transdisciplinary definitions. A design bibliographic review was conducted, and the same concepts were illuminated in design. The first correspondences were found.

- The second stage made an exploratory sweep of the disciplinary tradition and state of art, in search of components that could be identified, and that have persisted the transformations that arise from the disciplinary becoming. This is when certain ideas arise, because generally they were not expressed and that nevertheless lied underlying in the academic theoretical discourse.
- A third stage was to take the above concepts and expose them to a six-step method published in “Autopoiesis: The organization of living systems, it's characterization and a model” (Varela, Maturana, & Uribe, 1974), in order to determine whether or not we were facing an autopoiestic system. Based on it, a questionnaire was developed to highlight certain situations and elements defined in the two previous stages and see if it was feasible for the design community to account for them. The questions were organized so that they could separately illuminate the components and organizations present in design (Raineri, 2021).

In this third and last step, a worldwide survey was carried out in search of evidence that would allow for a characterization of design and its frontiers, components and organization. The survey involved more than one hundred and sixty certified designers that were filtered from a universe of over than three hundred individual that took the survey, coming from 35 different countries. The criteria for filtering were decided based on their design educational background, in order to guarantee a disciplinary perspective with internal observers. The purpose of this selection was to avoid distortions from non-design educated professional or autodidacts who usually conduct a “protodesign” form of action. The term protodesign comes from the conjunction of the greek term πρωτο prōto 'first' and the word design (Jurado, 2010). As a result of the conducted research the following outcome was evidenced.

Design Components

During the process, seven essential components were identified in the observed evidence. Its organization gave rise to a systemic design framework. The components are:

Human component or the referential dimension

Design takes place within the sphere of “heteropoiesis” or the human actions (Maturana y Varela, 1994); and as such is an exclusive activity of humans. Anything other than within this

sphere, even if it is a creative process like a bird's nest, should not be considered design. This definition has to do with the fact that, for design as a discipline, it is necessary to be able to set limits. The designers surveyed, defined it and stipulated it. For them, humans are the ones that become design's soul. They are the ones who make decisions and for whom we design. Any decision made within or through design is referenced to humans. Within the answers given, three instances for humans relations related to design could be observed:

- **Users**; this is where the reason for the existence of the design arises, and where the problems, challenges or opportunities of which design takes charge appears. It usually is external to design as a discipline, but could be temporally incorporated into it as an input, as in participatory design.
- **Client / Manufacturer**; this couple moves at the border of design. The client usually (but not always) is an agent who prioritizes his interests over those of the end user. Neoliberal capitalism arises. The manufacturer is the one who materializes the design output. It can also be the same customer or the designer, as is the case with author design or when using digital manufacturing.
- **Designer**; the designer himself is a component. They are the ones that define the boundaries of design as a discipline. It is their decisions and its limitations that define how far design goes. The continued re-relief of the members of the discipline, is constantly introducing new ways and perspectives to address the problems that arise. Each new designer will generate a new way of designing. In general, everyone will carry out their work within fairly standardized and accepted parameters (the seven components here stated), but there will be those who will decide the path of research, innovation and experimentation beyond what each project requires, so they will be the ones pushing the boundaries of the profession.

The complexity of human beings makes it impossible for design to define it in its entirety, just thinking about it is a nonsense. Other disciplines must come into action and help design do so. We must remember it is possible to see the humans as a single individual and as a social, collective entity. In addition, every individual has a physical side and an intellectual-psychic side, full of intersecting facets from which it is possible to observe it. The arena where design works is probably the most complex one confronted by any other discipline.

Teleological component or the causal dimension

Every action in design is born in the human being. Its origins are born in the cognitive capacity that humans have, differentiating it from the rest of the species in the sphere of the biotic. Humans enter an internal questioning of the proper actions and the consequences that his actions could have. It has ethical questionings. The collective of designers defined three variables that could be identified in which the Teleological Component or the Causal Dimension manifests itself, namely:

- **Desire / Need**: desires and needs are given outside of design, in the ecological niche or the space where design acts. They can be from the end user or the client and reflect their interests; is where the initial conditions of any design project occur. A designer could become a dual actor, become de user at one moment and the designer in other, maintaining his role specificities.
- **Negotiation**: the border becomes the point of exchange between design and its ecological niche. This is where external inputs are received, and outputs produced by design are delivered. In this way there is a negotiation between the wishes and needs present in the users and those of the clients and manufacturers. Designers should act as a mediator among the expectations of each, seeking an equitable and harmonious balance within desires and needs.
- **Opportunity / Problem**: through the negotiation and as a result of the interaction of the other six components, the designer is able to transform those initial desires and needs into opportunities and design problems. This, in order to be able to face the challenge that is presented to him, is the way to establish a path of action to hold on to.

This questioning leads design to define priorities that generate needs. Those needs are what design seeks to meet. If there is a situation where a creative process lacks a teleological component, as perhaps can occur in art, we are not facing design as declared by the observed community.

Operational component or the procedural dimension

The third component (as all others) is the conjunction of the remaining six components, and this is based on the dialogue that occurs within the discipline. Designers are the ones who define their ways of operating, of doing things, and they do this through consensus and group agreement. The methodologies, procedures, the way of operating inside design were manifested in the following variables, according to the observed evidence:

- **Own**: originally all design methodologies, at some point were configured from those that were developed externally in other disciplines or that originated from the interaction with them. Each design project will require modifications to the way it operates, as the result of the particular needs and decisions that designers must make. Subsequently, the consensus arising from the evidence from the empirical experience will lead to define and establish methodologies in the collective. Making them constituent of design, after they have been considered appropriate and have been validated by the community.
- **Experimental / shared**: Design has limitations. Design has limited capabilities and is able to take care only of what its ways of operating allows him. For everything else you must dialogue with other disciplines and partner with them achieving a synergy necessary to face complex problems. If there are no possibilities of association, design experiments.

- **Commissions**: there are situations in which design does not participatie in portions of the process, because it is not constituent of the project in which it is working or is unable to perform them. It only requires the output of that process. In these cases, it will carry out a commission for another discipline in which the process will be defined and executed. Design will only participate as a client and will receive the result of such operation. This may also be the case in which, once the design process is finished, the mass production of the result generated by design is executed.

Every process is dynamic, which involves a before, an after and the set of actions that makes it up. There are many ways to achieve a goal and design is constantly looking for more efficient ways to achieve this.

Transitional component or the temporal dimension

Design has been defined as a projectual discipline. Projecting is to throw forward, into the future, towards a better future that should eventually come to our present. What is projected comes from an origin, prior to the moment it is projected, is nourished by what was before, from what was designed beforehand. The concept of discipline implicitly brings the fact that it is a progression from a rudimentary beginning, where knowledge has been accumulating, generating greater complexities. Design has a past, a today and a tomorrow:

- **Past**: it is known that it is essential to look for giants on whose shoulders should we stand, in order to see beyond our predecessors (Eco, 2001). Disciplinary tradition is here to teach us what to do and what not to do. Even having the evidence of its negligent past actions, design continues to act in the same way, especially on environmental issues. It is from the past that design should project into the future.
- **Present**: the present serves as a turning point between the past and the present is where design happens. Being able to anticipate what is about to happen and generate the conditions for it to happen in the way you want or need it to happen, is what design does in the present.
- **Future**: the future doesn't look promising if nothing is done. At this moment it is necessary to remember a quote from Carnegie Mellon School of Design:

  > “Fundamental change at every level of our society is needed to address the issues confronting us in the 21st century. Climate change, loss of biodiversity, depletion of natural resources and the widening gap between rich and poor are just a few of the ‘wicked problems’ that require new approaches to problem solving (2017, p.1).

In those moments when it has stopped questioning himself, stop evolving, design has given the worst answers. When he starts cloning himself, he begins to deliver "answers" per mold, without considering the particularities of each case. Fashions appear, pollution rises.

Relational component or the spatial dimension

Since its disciplinary origins, design has associated with other crafts and disciplines. The work of designing on the one hand is increasingly open and exposed to external influences and contributions. These swings shape the type of relationships that occur inside and from the design, which configure the following variables:

- **Disciplinary**: the term discipline has been used in design to differentiate it from other fields of knowledge. Making it especially difficult, when design is being used in so many different ways. Sometimes is an artefact, others a process, an attribute and sometimes it's a system.
- **Interdisciplinary**: it's the process where diverse disciplines work in conjunction with design. Blurring at certain moments their boundaries, provoking an enhancer synergy.
- **Transdisciplinary**: Usually related to problems that can't be solved by the sole presence of design.
- **Multidisciplinary**: it's a group of professionals, each with its unique disciplinary characteristics, working together in a common project (Erlhoff & Marshall, 2008).

The variety of ways in which design relates, allow him to face the complexities present in the human being and in the complex problems it faces. The elasticity of these relationships allows him to face changing and diametrically different realities, without losing its integrity, it's state.

Observational component or the cybernetic dimension

It is from the results of a profound observation of the environment and especially of the human being, that the necessary foundations for informed decision-making can be found; not doing so, is not design and your decision will be guided only by assumptions or personal tastes. First Order Cybernetics is where you see your self performing an action. Second Order Cybernetics is where the observer, observes not only a phenomenon, but also observes the developer and/or who observes that first observer all at the same time (Bateson, 1972). Both of them are present in design and leads it to present three ways of observation set out below:

- **Introspection**: Design can only observe itself with the tools available to it, either by external adoption, reconfiguration or inner creation.
- **Dialogue**: it is at the frontier of design that dialogue takes place, which is the form of communication and transfer of information between it and its ecological niche. It is by observation were the fluctuations and variables that each project needs are verified, making design a dynamic discipline.
- **Learning**: Design must always have a holistic look, because it needs a general overview of all the components for a proper decision-making process. However,

> at the same time it suffers from selective blindness, lacking the necessary tools for certain type of observations, and that is where it requests external assistance.

Umberto Eco (2001) noted that "it is difficult to move in a vacuum and institute an ab initio reasoning" (p. 31), and design requires these unique, specific, accurate views of the necessary variables for a correct resolution of the increasingly complex challenges it faces.

Allopoietic component or the physical dimension

This last component refers to those elements, with which design materializes its responses in the form of larger and more complex systems. It is important to note that these materials are not only raw materials such as wood or plastics. They can also constitute more complex systems such as an electrical circuit or non-corporeal elements such as light. They can even be tools that participate and condition the production process, or the spaces where a particular project is located. They are small gems that come to enrich the lexicon on which the designer can work. You can define them according to their origin by the following variables:

- **Own**: design performs research to create materials in different ways as stated by Pontis (2019), pointing out three modalities: research for design, research through design and research by design.
- **Shared**: design is a discipline that permanently interacts with its environment. This dialogue can occur in the creation of new materials in an associative manner with other disciplines or it may be the case that in two or more disciplines they are used in parallel. The use it is given, may be identical or diametrically different.
- **Outsiders**: just as in the other components, design interacts with its ecological niche and appropriates what has been generated in other disciplines, crafts for example. It also resorts on bringing materials or those elements that may be useful to achieve its goals.

The use of material should not be defined in advance, however it is necessary to remember that materials incorporate certain conditions of their own, which make them more susceptible to one type of use, above others. "Materials are already in form (in-formed), since they have characteristics that make them suitable to become a particular object" (Bevilacqua, 2019, p. 34).

Design as an autopoietic unit

Design is a discipline that is circumscribed within heteropoiesis, which means that it is a human activity. The human being, as a collective entity that defines his actions through collaborations. And even though there is freedom of action, the permanence and settlement

of behaviors is produced by collective consensus. Design is the product of a group of individuals, who for a period of time have dialogued with each other. And together they have decided that a certain set of components and the way in which they unfold, constitute the system that has been called Design. The autopoietic systems, according to Humberto Maturana, are those that are "organized in such a way that their processes, produce the same components necessary for the continuation of these processes" (Mingers, 1995, p. 11).

The internal processes of design and its historical development generates a dynamic that configured certain components which had not been previously identified or illuminated by the design community. Subsequently, this research was able to confirm through internal observers the existence of these components. It is feasible to assure that we are facing a composite unit.

It is well known, from what has been observed, that design has been in a process of continuous transformation and has been constituted from the relationships it has managed to form. It is possible to ensure that design is a mechanistic system, where the interactions and transformations that occur in it are the product of the relationships that have constituted its components.

It is design based on its own actions, who defines its limits, its components, its organization and its structure. Since it is design that builds itself, it is in this act, that he defines his limits. Preferential relationships in design are the ones that define and provoke the decisions it internally makes. That manifests in its interactions with its ecological niche, giving rise to its limits, and constituting himself as an autopoietic independent system.

This new understanding allows design to define clear disciplinary boundaries. Regulating its response within those parameters in order to guarantee a continuity in its operation through the generation of an output that is integrated into its ecological niche. A deep understanding of design ensures sustainability. Knowing the presence of these concepts in the collective discourse makes it possible to think that a design disciplinary detachment from their immediate ancestors is feasible. A free flight is necessary to be able to guarantee the generation of new instruments that allow the evolution and maintenance of the discipline. It is in the act of self-determination and differentiation, where disciplines reach maturity.

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Gonzalo Raineri Bernain Designer, Architect & M.Arch., PhD in Design candidate at the moment of this paper, now probably full PhD. Rethinking Design from an environmentally harmonious paradigm, needs new foundations. Components, organization, structure, and relations within design and its ecological niche must be refunded. Our children need the change.

Acknowledgements: Design is a collective enterprise, so I must thank everyone who has collaborated in its development, and I mean everyone. Alejandra and Raffaella, you are the reason of my work.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Community-led design capabilities during the COVID-19 pandemic and beyond.

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Abstract | COVID-19 threats have been impacting disadvantaged communities even harder. This paper looks into challenge areas and community responses to those in Brazilian informal settlements during the COVID-19 pandemic. These were identified through online roundtables with community members and representatives of NGOs in five Brazilian informal settlements. Our findings show how community members unconsciously design, deploying community-led (or diffuse) design capabilities to tackle COVID-19 challenges. These capabilities have been critical to coping with the immediate effects of the pandemic in communities. However, they are limited to short-term and reactive strategies. We argue that these natural problem-solving skills can be enhanced through a transition from diffuse to co-design capabilities to further harness community creativity towards better futures; extending community-led design capabilities into challenges and opportunity areas in a more strategic way for communities. This research contributes to filling the gap in design studies on how and to which extent communities unconsciously design.

KEYWORDS | COMMUNITY-LED DESIGN CAPABILITIES, CO-DESIGN, COVID-19 PANDEMIC, COMMUNITY RESILIENCE

1. Introduction

This paper looks into key challenge areas that the COVID-19 pandemic has created or exacerbated for informal-settlement communities in Rio de Janeiro and Belo Horizonte (Brazil) and identifies the design capabilities deployed by community members to tackle those. We call these as community-led or diffuse design capabilities (Manzini, 2015a, 2015b). Our analysis shows community-led design capabilities that sheds light on *how communities unconsciously design*. We discuss how these community-led design capabilities can be extended into co-design capabilities to build a resilient and better future for communities, harnessing their creativity and potential.

In the literature on resilience, community resilience is mostly related to natural disasters. Design skills, approaches, processes and methods are still under-researched in this context, although the COVID-19 pandemic has recently attracted attention in emergency and recovery contexts in design practices and research (e.g. BBC, 2020; Marchese, 2020; ED-UEMG, 2020; UFMG, 2020). Resilience of communities is related to building or enhancing community capabilities throughout *co-development processes* of self-organising, accessing resources, strengthening network, harnessing collaboration, and creating mechanisms that contribute to holding community-led plans and efforts accountable (Berke, et al, 2011). Recognised worldwide, guidance on hazards mitigation and recovery are approached from a risk management perspective (UNISDR, 2015; UNISDR, 2016) often neglecting sociocultural determinants and livelihoods' diversity.

This paper presents barriers, challenge areas, and adaptive strategies of communities during the COVID-19 pandemic. It analyses, frames and defines how community members have been deploying their natural design capabilities to tackle these challenges in Brazilian informal settlements.

1.1 Context and problem

Around six per cent of the Brazilian population lived in favelas in 2010 (IBGE, 2010). The largest population living in informal settlements is in Rio de Janeiro city with 1.4 million people in 763 agglomerates. In Belo Horizonte, 307,000 people lived in 169 agglomerates. Although the 2020 census was not concluded due to the pandemic, the figures for households in 2019 show that around eight per cent of Brazilian households were in informal settlements, Rio de Janeiro and Belo Horizonte had respectively over 19 and over 11 per cent of households placed in informal settlements (IBGE, 2020).

The characteristics of informal settlements vary across Brazil. However, there are similarities between these areas related to the historical migration from countryside to cities that unfolds the emergence of informal settlements, particularly favelas in the 1940s in Brazil. Informal-settlement conditions are generally related to the limitations of the physical infrastructure of cities (e.g. water and sanitation grids' extension), including geographic features that are not favourable to regular and safe urbanization, the lack of basic services

(such waste collection, sewage treatment, water and energy supply, etc.) and the absence of a formal address (IBGE, 2010). Populations are predominantly composed of black people with low levels of formal education (Musumeci, 2016). Income sources are usually based on informal or low-income activities (e.g. cleaning, construction work, and waste picking and collection), and families are often female headed (Musumeci, 2016).

On the 11th December 2020, there were 68,845,368 confirmed COVID-19 cases worldwide and around 10 per cent of these confirmed cases of COVID-19 (6,728,456) were in Brazil, with 178,995 deaths (WHO, 2020). In Minas Gerais, 453,364 cases were registered (with almost 10,499 deaths). In the State of Rio de Janeiro, there were 381,644 confirmed cases, with 23,546 deaths (Microsoft, 2020).

There is a significant underreporting of cases of COVID-19 infection (Monteiro, 2020; Prado, et al, 2020; Veiga e Silva, et al, 2020) in Brazil. The actual number of cases is estimated to be about 10 to 11 times higher than the ones shown in official figures (Monteiro, 2020; Prado, et al, 2020). Low testing rates and diagnostic difficulties have contributed to underreporting and to keeping the disease spread (França, et al, 2020; Oliveira & Araújo, 2020), leading (in Minas Gerais) to a projected sub-notification of around 42 % by the end of the year (Amaral, et al, 2020).

The Brazilian situation is also aggravated by the current government health policy which includes scientific denialism; ethical-political issues linked to human rights; and biopolitical strategies influenced by neoliberal reasoning (Caponi, 2020). Although the first COVID-19 cases in Brazil (as of February 2020) were related to white upper-, middle-class people returning from Europe, the virus was quickly transferred to the favelas. By the end of May 2020, there were a total of 260 deaths in the Rio de Janeiro's large favelas, while in São Conrado, an upper-class neighbourhood bordering the Rocinha favela, only three deaths were recorded by the middle of the same month (Oliveira, et al, 2020). Nevertheless, minority groups' disparities prevail not only in Brazil (see for instance Milam, et al, 2020). They are especially impacted by the COVID-19 pandemic.

In response to this, communities have deployed their strategies to mitigate COVID-19 immediate impacts. We analyse those in the context of 5 informal-settlement communities in Brazil. Although design capabilities have been explored to a certain extent in design domains and organisational studies, there is little empirical evidence of diffuse design capabilities deployment determining to which extent the lay public unconsciously design.

2. Capability, democracy and design

The term 'capability' relates to people's knowledge capital, skills, competencies and prior experiences. It is also seen as what someone or a group of people can do/make in order to achieve a (shared) aim. It refers to the ability to adapt prior knowledge to new purposes. For

this study, we adopt the Sen's capability approach as a starting point to discuss design capabilities for community resilience in this research context.

Sen (1999) defines capability as the potential of people to lead "the kind of lives they value - and have reason to value" (p. 18). He argues that the extent to which capabilities are deployed are influenced by interconnected factors such institutional arrangements (see also Acemoglu & Robinson, 2012) that determine economic opportunities, political liberties, social powers, enabling conditions of health, access to basic education, and by an environment that fosters initiatives.

Therefore, citizens ideally have the liberty to participate in social choice and public decision-making, being a fundamental agent of change through participation in economic, social and political public life. Sen highlights the need for the "effective use of participatory capabilities by the public" to influence "the direction of public policy" (p. 18) in a two-way relationship, pointing out participation as a key factor in democracies. Participatory design is the design field dedicated to the public participation. In this domain, Sanoff (2007) emphasises the importance to provide participants "with the information they need to (1) participate in a meaningful way and (2) be informed how their inputs affect the decision" for effective participation (p. 59). These aspects are also emphasised in post-disaster situations (Vahanvati & Rafliana, 2019).

Participation is a means to establish a dialogue between citizens and public officials (Sanoff, 2007). Active participation goes beyond voting and choosing amongst pre-set options, being related to citizens' critical role in creating and shaping the future of their environment and influencing public decision-making (Sanoff, 2007). Participatory design that aims to foster and deploy collective intelligence is a potential means to empower communities, citizens, and democracies, providing enabling structures for integrating communities into public decisions that affect their lives and contribute to shaping their future.

2.1 Design capabilities

> "Design is all around you, everything man-made has been designed, whether consciously or not" (Hunter, 2014)

Manzini (2015a, 2015 b) distinguishes between three typologies of design capabilities: expert design, co-design, and diffuse design. Expert design concerns the use of design by the design community who has specific design skills and culture. Co-design is the design process resulting from the transdisciplinary interaction between different stakeholder groups, including, for instance, expert designers and the lay public. Diffuse design concerns the natural human ability to design based on creativity, critical and practical sense. Although found in a fragmented literature, design capabilities can be identified in design research and organisational studies taking as a reference Manzini's framework: from expert to diffuse design capabilities.

Expert design is often approached in design management (Acklin, 2013; Borja de Mozota, 2011; Bruce, et al, 1999; Chiva & Alegre, 2009; Jevnaker, 2000; Mortati, et al, 2014) and policy (Maffei, et al, 2014), organisational studies (Boland and Collopy, 2004; Michlewski, 2008), product development and engineering (Baxter, 1998; Pugh, 1991; Ulrich & Eppinger, 1995), service design (Morelli, et al, 2021). Participatory design and co-design capabilities are found in participatory design (Huybrechts, et al, 2018; Sanoff, 2007), co-design (Sanders & Stappers, 2008), service design (Morelli, et al, 2021), social innovation (Murray, et al, 2010), design for policy (Bason, 2014; Julier, 2017; Junginger, 2014; Mortati, et al, 2016) and business fields (Brand, 2017; van der Pjil, et al, 2016). Diffuse design capabilities are discussed in social innovation (Manzini, 2015a, 2015b, 2019; Murray, et al, 2010), urban design (Dong, 2008), design management (particularly Gorb & Dumas' [1987] silent design). However, there is a lack of empirical evidence on diffuse design capabilities, specifically on how communities *unconsciously design* (strategise and act to solve their problems, envision opportunities and shape their future).

Design capabilities of the public (or diffuse) were discussed by Manzini and D'Elia (D'Elia, 2018; Manzini, 2015a, 2015b, 2018, 2019). They suggest that a design culture (*cultura del progetto*) will be the next basic competency of communities - as literacy was in the past, becoming a community patrimony. On the other hand, the need to bring design capabilities into policy-makers' skills set is also stressed (e.g. Bason, 2014; Julier, 2017; Junginger, 2014; Mortati, et al, 2016) to capture the needs of communities in policy-making processes (Junginger, 2014). Participatory design serves as a bridge in this context, building dialogues and actions through collaboration between citizens and stakeholder groups.

2.2 Who is willing to exploit creativity?

Community creativity plays a critical role in co-design processes. However, we cannot take for granted that communities are prepared to go through a collective creative process related to complex problem-solving or setting visions for the future. Although human beings are creative by nature, different levels of co-designers' involvement in creativity processes are identified ranging from 'doing' to 'creating' (Sanders & Stappers, 2008).

Furthermore, throughout life, the way we are educated and schooling tests are framed as "wrong-answer-right-answer" hinder our creativity or divergent thinking capacity, affecting our ability to solve complex problems that do not fit in the "right-wrong" answer framework and inhibiting us from taking the risks involved in innovation processes (Sternberg, 2006, 2012).

Hence, creativity is not seen as an inborn trait of human beings by some scholars in the psychology field. It relies on external environment and personal factors that contribute to the decision to hamper or to harness our creativity use (Sternberg, 2006, 2012). Creativity is at the core of design processes, involving exploration and deployment of divergent thinking to establish connections between ideas not related to one another before, so they are often controversial when innovative. Innovation is facilitated when people with diverse

backgrounds participate and also involves failures and the ability to timely learn from those and persist (Poirier, et al, 2017). Thus, there is a tendency to "follow the crowd" and not to step out a "comfort zone" rather than investing in the effort that creativity deployment requires (Sternberg, 2006, 2012).

3. Methodology

Our research reasoning is inductive, and the approach is qualitative and exploratory. We first listened to community members to understand how they unconsciously design. The case study was built upon triangulation of methods (Eisenhardt, 1989; Stake, 2000; Yin, 1994) and analysis of multiple data sources.

Primary data was collected through three online roundtables with community members from five informal-settlement communities, two in Belo Horizonte and three in Rio de Janeiro, and representatives of NGOs who have been engaged in solving COVID-19-related issues in these communities. The following tables describe the online roundtables composition:

Table 1. Belo Horizonte online roundtable.

Roundtable role	Gender	Related Community / Role
Participant 1	Male	Community A / NGO representative and community member
Participant 2	Male	Community A / NGO representative
Participant 3	Female	Community B / Kindergarten teacher, community member and volunteer
Participant 4	Male	Community B / NGO representative and community member
Mediator	Female	Lancaster University / Research Associate
Time moderator	Male	UFMG / Master student
Observer 1	Male	UFMG / Professor
Observer 2	Female	UEMG / Professor
Observer 3	Female	UEMG / PhD candidate

Table 2. Rio de Janeiro online roundtable.

Roundtable role	Gender	Related Community / Role
Participant 5	Female	Community C / Nurse, doula and community member
Participant 6	Female	Community D / Journalist and community member
Participant 7	Male	Community D / NGO representative and community member

Participant 8	Female	Community D / Educational project founder and community member
Participant 9	Female	Community E / Social movement representative and community member
Mediator	Female	Lancaster University / Research Associate
Time moderator	Male	UFMG / Master student
Observer 2	Female	UEMG / Professor
Observer 3	Female	UEMG / PhD candidate

Roundtables were run in the first language of participants. The talks of participants were transcribed and translated. Conversations were drawn around the following topics: sources of information, communication means and impacts on routine; prevention; diagnosis and treatment; support, and change. The researchers mapped speeches of participants using Affinity Mapping (Service Design Tools, n.d.) to identify problems, adaptive strategies, needs and the related areas of challenges regarding each topic through cross reference. The maps were validated by community members during a third roundtable, enabling reflection and further discussion in a participatory process.

Secondary data collection included public data (from NGOs' and community members' Instagram and Facebook posts, websites, press news) and literature review focused on: design capabilities; participatory approaches to community resilience-building in emergency and recovery contexts; COVID-19 in the world and in Brazil with focus on the disparities and demographics of favelas in Brazil.

The results clarify barriers, challenge areas and diffuse design capabilities which were identified and mapped according to each area of challenge. The next section describes those. Our discussion shows the community-led strategies underpinned by diffuse design capabilities in community practices.

4. Challenge areas and community-led design strategies

4.1 Communication

The language used in COVID-19 public messaging is misleading and confusing for community members. Hence, access to COVID-19 information occurs mainly through television and social media (e.g. Facebook and WhatsApp) although access to the Internet is still a barrier. Furthermore, who is communicating the message defines whether the information will be considered by communities. For instance, if a distrusted politician communicates the information, people will not listen to their message. Community members rely on messages from WhatsApp groups, local community leadership and personal relationships.

In response to these, communities have created rap lyrics that are disseminated by a car with a sound system; children created educational videos talking about prevention which are disseminated amongst communities through Facebook and WhatsApp.

4.2 Education

Brazilian public schools remain closed although an official national lockdown has not been declared and decisions regarding restrictions have been usually made at the local level by municipalities and state governments across the country. The lack of access of children, teenagers and other students to information technology resources (e.g. laptop, tablet, Internet) in informal settlements exacerbates the learning conditions, in the absence of the physical infrastructure, services and staff support from schools. Children at risk are also an important issue.

Two community strategies were adopted to cope with this situation: a project dedicated to improving home-schooling conditions, providing children with materials and activities, and the reformulation of the school planning.

4.3 Employment and income

Community members often work on elementary services or businesses, such as supermarkets, hospitals, pharmacies, healthcare centres as informed by participants. As such, they do not have options for remote work. Many others lost their jobs and those, who did not, needed to continue commuting and working to provide for their household. The lack of access to the Internet also hampers the possibility of remote work for community members. Besides, informal workers that offer, for instance, cleaning services and earn on a daily basis and local businesses in informal settlements, such as small grocery stores, have been suffering the effects of the crisis. This situation is aggravated by the businesses' practice of overpricing hygiene products and food.

Social Assistance Reference Centres (CRAS) provided benefits to residents such as voucher cards that enable them to buy food parcels in businesses close to the community, reducing the economic impact. However, these services were closed in Belo Horizonte when this study was conducted and the access to these were through Internet and telephone. This hindered community access to those.

As a response to these, local NGOs' representatives helped community members access benefits, for example, filling out electronic forms and providing food-kit donations and hygiene products as a result of partnerships with private companies and solidarity of citizens. Hand sanitizer and masks were distributed to workers at dawns. Grated soap and water mixture stored in reused oil cans was also a strategy, however, the effectiveness of the latter was not assured.

4.4 Culture, leisure and behaviour

Social distancing and other preventative measures are influenced by the street culture and games that prevail amongst children, young people who keep partying (especially the “Funk Parties”, typical of favelas), adults that often go to bars to have beers as usual, and older adults who want to keep their habits as before the pandemic and have difficulties in adopting preventive measures. The COVID-19 virus was seen as an invisible threat contributing to people’s disbelief in the disease.

In addition to communication strategies, handwashing and hand sanitizer check points were implemented at entrance and exit of community areas.

4.5 Public administration and politics

Public information systems which enable citizens to access benefits failed to reach everyone in need. Sometimes, citizens data that should be transferred from one Government department to another are not making some citizens invisible.

The access to some benefits depends on the access to the Internet. Otherwise, people should get these in person at banks. This potentially generates overcrowded banks and long lines. Besides, it is common amongst communities, people who have not a bank account and will need to handle values in cash and still use cash for transactions as well as others in need of Emergency aid (600.00 BRL) who have not it approved. The Social Assistance Reference Centres (CRAS) that could help citizens with these issues were closed in Belo Horizonte during this study and NGOs were replacing their roles and facilitating community members communication with CRAS and other public bodies.

Police officers are usually associated with violence against community members and vice-versa although their initiatives to encourage preventative measures were recognised at the beginning of the pandemic in one of the communities. Their absence in favelas is felt throughout the pandemic evolvement. For instance, warning and hindering parties as they usually did before the pandemic. Notwithstanding, community members wish to build dialogues and collaborations with them.

The lack of politicians’ initiatives against COVID-19 disease is noticed in communities as stated by a participant: “The State did not arrive to beat COVID-19”. Their presence in informal settlements is often directly related to poll objectives (e.g. bribing community members for votes). Disbelief in the COVID-19 virus is also motivated by political instability involving power disputes and corruption as mentioned by a community member: “Is the virus an invention motivated by political interests?”.

In some communities, there is also the lack of access to water and sanitation grids or the provision of those basic services does not work well.

Social organisation has underpinned most community strategies to cope with these challenges even though it is considered challenging amongst community members. These

strategies involve mutual help amongst households, design and manufacturing of masks which are made and distributed by community volunteers, the establishment of a community leadership unity known as collective mandate composed of community members actively engaged in solving community problems, the donations of food parcels and hygiene products by citizens and socially responsible organisations. The problem of lack of access to water is still being solved with the purchase from a water tank truck.

4.6 National Health System

There was the lack of protective gear for health professionals in the public sector and COVID-19 tests were not available for free at the time this study was conducted.

People did not trust the public health system's diagnosis in the absence of tests due to the confusion between COVID-19 and other diseases' symptoms, such as dengue and chikungunya. Also, the need amongst healthcare workers for access to reliable information and knowledge to provide diagnosis and treatment was mentioned. Additionally, there was the distrust in medical appointments made on the phone.

Recommendations are often not suitable for informal-settlement communities since measures such as to 'self-isolate' are not possible to be followed in overcrowded and intergenerational households and high-density areas.

In order to tackle these, some communities raised money from their own members to have a diagnosis, or to provide healthcare workers with protective equipment. Traditional knowledge was used to improve immunity, such as lemon, ginger and saffron teas and sunbathing to strengthen vitamin D. Other adopted strategies in the absence of access to proper healthcare include private medical appointments and harmful ones, such as self-medication based on media speculation and prescriptions' sharing.

These areas of challenges are often interwoven. For instance, employment and income problems aggravated by the COVID-19 pandemic also influence the ability to access hygiene products and food as those were overpriced and the government benefits did not reach everyone in need. Hence, affecting the ability to follow preventive measures globally recommended.

5. From diffuse to co-design capabilities

Community members unconsciously design when translating information, empathising, self-organising, developing and implementing strategies to tackle the pandemic issues. They create, plan and implement feasible and viable actions to deal with barriers related to infrastructural, political, public policy and/or service, behavioural, cultural and socio-economic determinants (Figure 1).

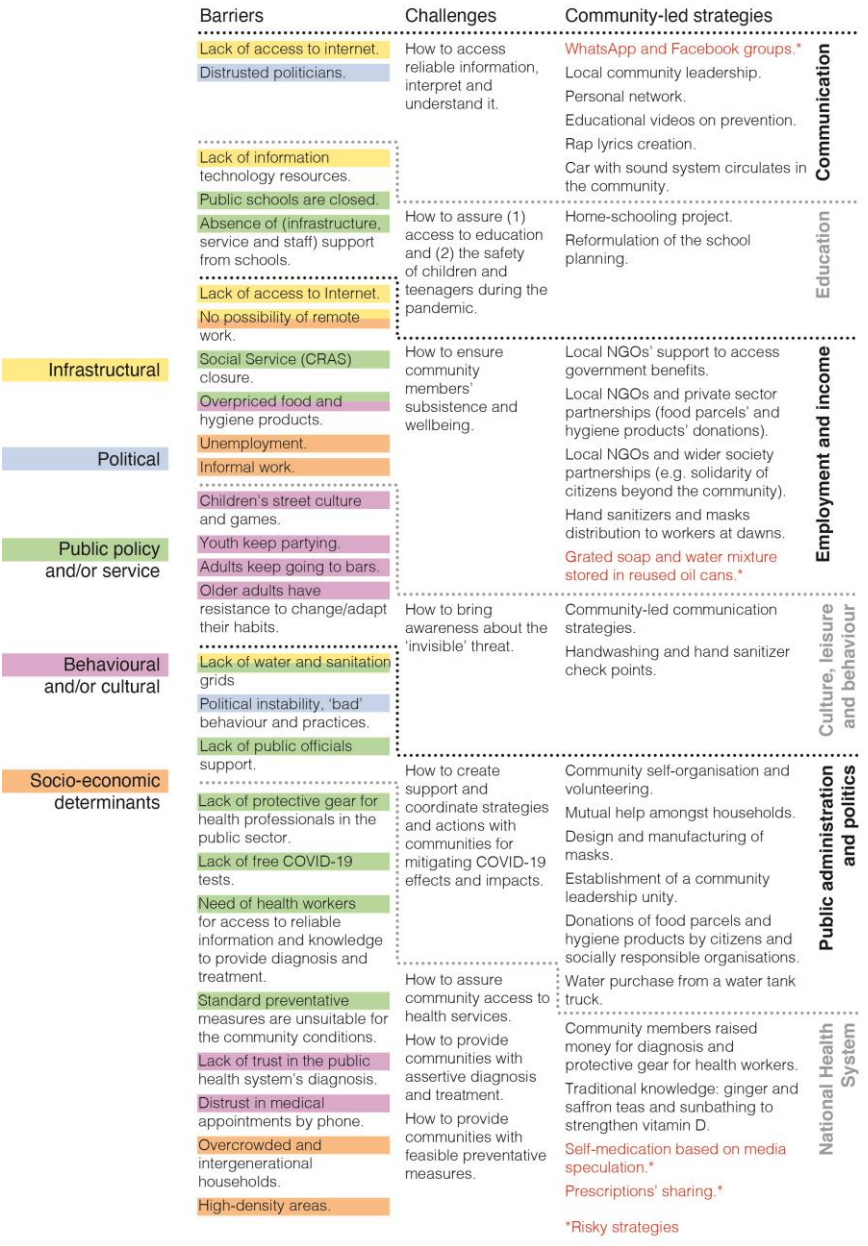

Figure 1. Barriers, challenges and community-led strategies for tackling the COVID-19 pandemic.

Many barriers and challenges are part of the lives of communities even before the pandemic. For example, communities have their socio-economic conditions aggravated by the COVID-19 threats, but these were already persistent problems in communities.

Most community-led strategies were critical to tackling the immediate impacts of the pandemic. However, as recognised by community members, there is the need to sustain and scale up those, making them sustainable. Furthermore, a few strategies mentioned are risky and can harm community members or may not be effective in preventing COVID-19 contamination.

These risky strategies can benefit from co-design. For instance, involving health experts to check information before disseminating it through WhatsApp and Facebook groups, and designers to 'translate' complicated messages into accessible communication. This can contribute to beating false information which leads to medicines' misuse, bringing awareness of potentially harmful practices (e.g. prescription sharing and self-medication) and of the prevention importance.

Also, there are problems that are beyond the current possibilities and control of communities (e.g. infrastructural, political, public policy's and service's access and quality), requiring (from short- to long-term change in) co-operation, collaboration, commitment and interest of public officials. Community members demonstrated the will to build dialogues with public officials despite the feelings of abandonment and disappointment which were exacerbated during the pandemic evolvement.

Co-design at the political and policy-making levels can contribute to putting scientific knowledge and community needs, voice and livelihood diversity in policy-making processes and in the political agenda. Designers are facilitators in these co-design processes, empathising with community members, understanding community needs, translating scientific knowledge into accessible messages and stimulating their creativity and potential. This contributes to building *bridges* (*dialogues*) between and *strategies* and *solutions* with communities and different stakeholder groups.

This is a mutual learning process. On the one hand, community-led strategies are reactive and can benefit from designers' forward thinking, extending community-led problem-solving skills into future-oriented strategies that can bring long-term benefits. Reflection and learnings from these co-design cycles can be better shared and discussed in communities, building a legacy of community-led design capabilities. On the other, designers and other stakeholders can learn from communities especially regarding their ability to establish partnerships, quickly finance and implement strategies in uncertain and complex environments.

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Acknowledgements: We thank Lancaster University support, all community members and NGOs' representatives who provided us with their meaningful insights into their realities during these difficult and uncertain times. We also thank Lorena G. Ribeiro de Oliveira and Isadora Paloma L. Ribeiro for their participation and contributions to this research.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Cross-Team Brainstorming and a Comparison of Online to Physical Version

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Abstract | Brainstorming is a method commonly used in design thinking workshops. As a representative method for idea generating, brainstorming has been evaluated and modified in order to achieve better performance. As for workshops, the concern of lacking diversity of ideas have existed. Therefore, the article proposes the Cross-Team Brainstorming approach. Based on a combination of the Crazy Eights and the KJ method, the idea is to let teams in a workshop brainstorm over each other's topics, in pursuit of expanding the breadth of ideation. An online version is further tested in comparison to the physical version. The findings suggests that the approach does bring changes to traditional brainstorming, and the online version shows advantages that matches former researches.

KEYWORDS | DESIGN THINKING, BRAINSTORMING, ELECTRONIC BRAINSTORMING, DESIGN THINKING WORKSHOP

1. Introduction

Design thinking has been known as a mindset or tool that could be learned, practiced, and, developed by anyone (Cross, 2001). Today, companies and governments are importing design thinking into projects (Brown, 2008); Academies of all domains and levels of education are including it into courses' syllabuses as well (Matthews & Wrigley, 2011).

Over these years, models and theories proposed by scholars and designers have been pushing the application of design thinking forward. Methods, tools, and techniques are used to support problem defining and solution generating.

Among the tools and methods, brainstorming, as Jonson (2005) described as "a matter of generating, developing and communicating ideas", stands out as a representative method to generate creative ideas. As brainstorming being widely tested and evaluated in pursuit for better performance, studies and experiments have revealed the benefits, dominant, and possibilities of this iconic method, as well as its disadvantages.

Based on the lack-of-breadth in brainstorming, which appears in time-limited conditions such as workshops, the article proposes "Cross-team brainstorming" as a refinement to provide more diversity. And finally, as electronic brainstorming being more widely used (especially under the cause of COVID-19), an online version is compared to the physical version.

2. Brainstorming

As Schmid (1996) points out that creativity requires constructing and reconstructing of knowledge, the basic concept of brainstorming has been generating creative ideas through the collision of thoughts, knowledges, and perspectives. Proposed by Osborn in the 1954 publication, *Applied Imagination*, brainstorming has been phrased for its high face-validity, simple rules, and an increase of "synergy" in the team (Gallupe, Dennis, Cooper, Valacich, Bastianutti & Nunamaker, 1992).

Listed to be one of the key gains of brainstorming (A. R. Dennis & Williams, 2002), synergy is a reaction which a team member's idea activates another member to generate new ideas. Further studies proposed the concept of "idea pool", claiming that synergy comes from the pool of ideas exchanged by team members conducting brainstorming (Nagasundaram & Dennis, 1993). With team members outputting the ideas to the "idea pool", other member may be stimulated thus produce more ideas, and the continuing stimulation would thus increase gain in synergy (A. R. Dennis & Valacich, 1999).

Similar statements can be seen in the study proposed by Nelson, Wilson, Rosen, and Yen (2009), listing 4 criteria for evaluating brainstorming:

- Novelty: the degree of unusual of ideas.

- Variety: the degree of dissimilarity of ideas from single individual.
- Quality: the degree of feasibility to put ideas into practice.
- Quantity: the number of different ideas generated by individual.

Despite other factors should as well play a part, the number of ideas is indeed the key to a good-qualitied brainstorming with diverse creativities.

2.1 Brainstorming in workshops

Originated from Staatliches Bauhaus, workshop is a form of educating that emphasizes learning through practicing. Design Thinking, in many ways, welly fits workshops. The form of workshop provides the environment and instruction, which are especially needed since implementation plays a key part in design and design thinking (Wrigley et al., 2018). Taking a project-based foundation further provides a target for the theories, tools and knowledge to be practiced.

In a Design Thinking workshop, the process mostly follows from problem-defining to solution-generating. While problem definition is a process of converge, solution generating seeks for divergence through ideating, which is where brainstorming takes place. Brainstorming in workshops stands for the key point to explore the view.

However, the fact that workshop is a refined structure including with receiving knowledge, digesting information, and applying theory all included, the time spent on each stage is limited. Under limited time-spent, teams may lack of enough understanding and knowledge that are essential for generating creative ideas. Another concern is that solutions may pop out during the problem defining phase. Chances are that the team, especially when team members are not familiar with design thinking, might stick to and certain solution too early and not being able to jump out (Howard-Jones & Murray, 2003).

Therefore, to fully bring brainstorming into play, the task falls in expanding the diversity of ideas.

2.2 Electronic brainstorming

As technology being developed, brainstorming no longer requires to stick in verbal form. With the support of hardware and software, electronic brainstorming (EBS) has become the second stream of brainstorming (Gallupe et al., 1992). Moreover, even in traditional verbal brainstorming, EBS tools can be used to support in recording and analysing. In fact, Kay (1995) proposed the advantages of EBS, being:

- Parallel entry of ideas: thoughts could be expressed at the same time.
- Anonymity: expressing without the worry of criticism.
- Novelty: faster information processing, more passion, and less time spent.
- Size: a higher maximum in the number of people participating.
- Proximity: flexibility in time and space.

- Memory: results could be recorded more accurate and efficient.
- Equality: members' voices are equally expressed and treated.

One main difference between EBS and traditional brainstorming lies in synergy. (Valacich & Dennis, 1994). As mentioned above, synergy is related to the number of ideas produced and the size of the group. Dennis and Williams (2005) further pointed that a significant factor of the performance between EBS and traditional brainstorming is the group size. According to their findings, EBS groups shows a better performance than verbal groups when group size reaches four people.

With the advantages, EBS has been accepted increasingly. The COVID-19 brings another upheaval to EBS. As campuses being shut down one by another, students are sent back to their hometown, turning all courses online. Courses that requires implementations such as studios turn out into a virtual-workshop-similar form, thus resulting in an increase in the use of EBS.

3. Methods

3.1 Cross-Team Brainstorming

The need of improving the breadth of ideas being the existing task, the problem falls into "how to achieve the goal without expanding time-spent". Therefore, the "Cross-Team Brainstorming" approach is proposed.

Since brainstorming is a technique of gathering the strength, knowledge, and intelligence of a group of people, the Cross-Team Brainstorming approach is to further expand the size of the "group". The concept is simple, by letting the teams, the small groups of people, brainstorm over each other's topics, each team may receive extra ideas form other teams.

The whole process is based on a combination of three rounds of ideating and two rounds of categorizing (see Figure 1). During the three rounds of ideating, each team will take turns ideate over two other teams' topics. This is to ensure that in the end of this approach, every team may receive three sets of ideas, including one set from themselves and two sets of "extraneous ideas" from other teams. The topic of each round of ideation will come from the two teams ahead and each team's own one (see Table 1). To exclude the effect of proficiency (through rounds of practicing), the the last round would be each team's own topic.

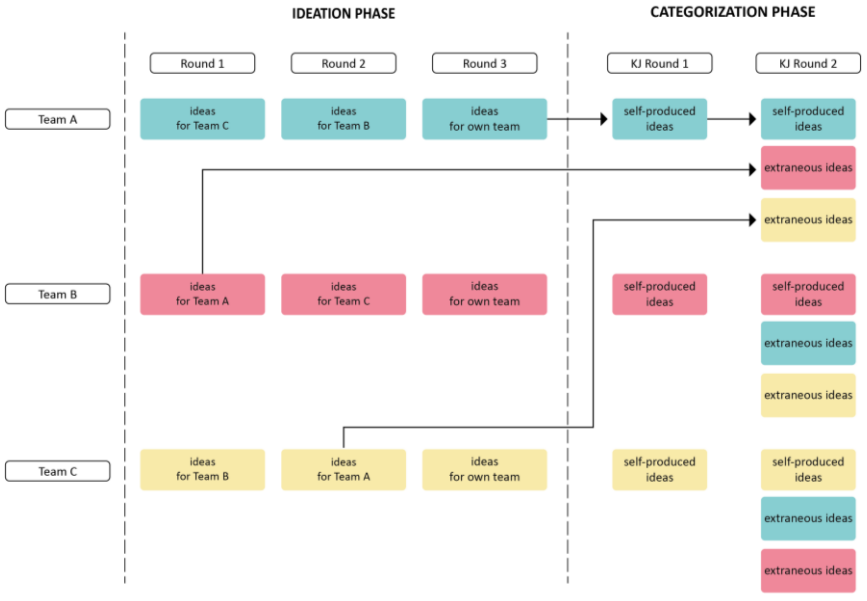

Figure 1. The Process of Cross-Team Brainstorming. The colour represents "from whom the ideas comes". The concept is that by the end of the approach, each team will receive not only ideas generated by themselves, but form others as well.

Table 1. Topics for each round of the ideation phase. If 5 teams were to participate, Team 5 would ideate over topics of Team 3, Team 4 and their own topic; while Team 1 would ideate over topics of Team 4, Team 5 and their own topic.

round \ team	Team 1	Team 2	Team 3	Team 4	Team 5
1st Round	topic 4	topic 5	topic 1	topic 2	topic 3
2nd Round	topic 5	topic 1	topic 2	topic 3	topic 4
3rd Round	**topic 1**	**topic 2**	**topic 3**	**topic 4**	**topic 5**

A host is required to hold the time and condition. For equipment needs, post-its are used as carriers for single ideas, and boards (could be large pieces of paper or plastic boards) to carry the post-its.

To ensure that every team in the group has a basic understanding of each other's topic, each team is required to explain their topic and answer questions from other teams before starting. Following that, is the ideation phase and the categorization phase.

Ideation phase

The ideating phase is based on the method of Crazy Eights. The fact that the technique encourages divergent thinking (O'Leary et al., 2018), as well leave a visual output needless of additional recording, are the reasons why the method is chosen.

Within each round, three steps are included:

1. 8 minutes of drawing
2. 2 minutes of noting
3. 5 minutes of sharing

The first step is to output the ideas by drawing rough and quick sketches on post-its. If the idea is hard to visualize, writing is allowed as well. The goal of this step is to produce as many ideas as possible, despite any concerns such as feasibility, usability, or costs (O'Leary et al., 2018).

The second step, "noting" is a preparation for the categorization phase, which is not in the original Crazy Eights method. Due to the fact that the rough sketches from step one could be hard to understand, there is the need of brief instructions. In this step, "keywords" are to be added to the ideas, such as the core concept, used technology, or references that help describe and explain the ideas, so that others are able to understand them at first sight. Whether the keywords should be written on the sketched post-its or new blank ones is open to option, while they should be stuck together if choose the latter.

The last step is to share the produced ideas with the team, which is one of the main purpose of brainstorming, to seek for inspiration and generate creative ideas through divergent thoughts and perspectives. Another purpose of this step is to double check the legibility of the ideas. Despite the noting step is to ensure legibility, this is in case that the ideas are still hard to understand. The five minutes provides a chance to patch the ideas as well.

The three steps together makes one round of ideation. While new ideas may pop out during step 2 and 3, they are allowed to be added at any time, as long as it is still in the same round.

To distinguish whom the ideas are from, each team is assigned a colour of post-it, and is only allowed to use that colour (see Figure 2).



Figure 2. The Crazy-Eights Method. Normally the method uses an A4-sized paper, divided into eight blank spaces, as carrier for the sketches. For the ideas to be movable in the categorization phase, this approach uses post-its as idea-carriers in replacement. By limiting to one per team, the colour helps identifying the origins of the ideas.

Categorization phase

Following the ideation phase is the categorization phase (with a break time between the two phases). Based on the KJ method (Kawakita, 1991), the aim of this phase is to classify and group the outcomes of the former phase, in order to see how many "types of ideas" are in fact generated. Though the original KJ method should require repeating in order to create layers that are more general thus revealing the cause and effect, this approach simply borrows the feature of analysing, thus finding connections and similarities (Ohiwa et al., 1990) to create categories for the ideas.

Two rounds of KJ method will be conducted in this phase of categorizing. The first round follows right after the last round of the ideation phase. For this round, teams only requires to categorize the "self-produced ideas", which is the ideas the team generated over their own topic (see Figure 3).

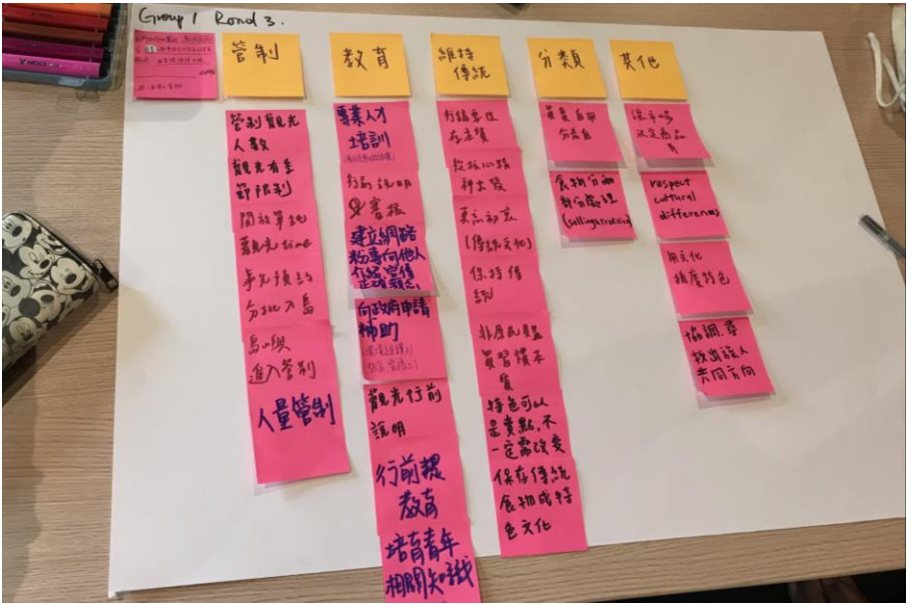

Figure 3. First round of KJ method. The KJ method is a technique of classifying through analysing the similarities, connections, and patterns of information, in this case, the generated ideas.

The second round is based on the result of the first round, but with the "extraneous ideas" from other teams (first two rounds of ideation) joining in (see Figure 4). For this round, it is not necessary to abandon the existed categories and start from scratch. Whether the extraneous ideas should be classified under the existed categories, or should some of the classified ideas be extracted and open new categories with extraneous ideas, the strategy and basis is up to the teams.



Figure 4. Second round of KJ method.

A fourth and fifth colour (other than the three colours representing each group) of post-it is needed for the categories and popped-up ideas during classifying.

For the categorization phase, both rounds are set for 15 minutes. However, the time-spent could be adjusted depending on the actual situation.

Criteria of outcomes

This approach is aimed to increase the divergence of ideas, in order to expand the breadth of ideation, thus generate better creativity. Therefore, the focus is on how many kinds of ideas are generated. As the KJ method being used to classify ideas, in this case, the number of categories produced in the categorization phase stands for the divergence of types of ideas the research seeks for, which is the quantitative data to be collected.

Qualitative observation is as well conducted, such as the content under each category, from whom are the ideas generated, the difference between two rounds of KJ methods, and conversations or questions from the participants.

3.2 Data collection

Physical version

In order to have a further understanding and applying of this approach, a physical version and online version is compared.

For the physical version, data was collected from one course and one workshop, with 6 teams in total (3 teams from both). The team size varies from 3 to 5 members. Each teams were given 30 to 60 minutes to define and present a topic. The rest follows the process of the cross-team brainstorming approach.

A camera is used to record the production of each round of ideation and categorization.

MIRO: the online version

The online version uses MIRO as the platform, with 3 teams participating.

MIRO is a website support different kinds of electronic brainstorming. By joining in the "team", team members may have the access to the tool boards such as "Mind map" and "User Story Board". To conduct the Cross-Team Brainstorming approach, the "Brainwriting" board (see Figure 5) is chosen.



Figure 5. The "Brainwriting" board of MIRO. The board works similar to cloud documents, anyone with access is able to edit the board. For the research, colour yellow, blue, and pink each represents Team 1, 2, and 3, while the purple ones are categories. Written on the big post-it is the team's topic. In Figure 4's case, this is team 3's board.

Several adjustments of the work flow are made to fit the function of MIRO. First, each team is assigned to a board (i.e. Team 1 is assigned to Board 1) and write down their topic. As the ideation phase begins, they will visit each other's boards in a round-table way and conduct Crazy Eights on that board. For example, for the first round, Team 1 heads to Board 3 (team 3's board), while Team 2 goes to Board 1 (team 1's board) and Team 3 to Board 1 (see table 2)

Table 2. Process of the ideation phase for the MIRO version.

round \ team	Team 1	Team 2	Team 3
1st Round	board 3	board 1	board 2
2nd Round	board 2	board 3	board 1
3rd Round	board 1	board 2	board 3

Once the participants are clear with the process of the approach, a demonstration to the function of the website and the "Brainwriting" board is given. Same as the physical version, the teams are given 30 to 60 minutes to define and explain their topics.

To imitate the condition of virtual workshops, the three teams are respectively assigned to different rooms. Team members may have conversations and move around, but are not allowed looking and pointing directly to each other's screen.

The host, in this case the researcher, will give instructions of the start and end of each round and phase. At the end of each round, screenshots will be taken to record the outcomes.

4. Results

For the results, the number of categories as well as the amount of ideas for each round were calculated, with team size being noted as well. Table 3 and 4 each shows the result of the physical version and the MIRO version.

For the physical version, the number of categories for each round is 4.7 and 7.5 in average, as 2.8 more categories were added in the second round of KJ method. As for the MIRO version, an average of 8.7 and 11.3 categories of ideas is generated in each round of KJ methods. The increased number of categories is 2.7 in average.

Table 3. Results of the physical version.

Course	Team	member	Ideas generated (round)			Amount of categories		
			1st	2nd	3rd	1st	2nd	increased
A	Team 1	3	26	24	26	6	8	2
	Team 2	3	22	27	24	6	7	1
	Team 3	3	24	22	24	5	7	2
B	Team 1	4	33	33	29	6	10	4
	Team 2	4	18	24	22	4	5	1
	Team 3	4	36	28	24	1	8	7
average						4.7	7.5	2.8

Table 4. Results of the MIRO version

Course	Team	member	Ideas generated (round)			Amount of categories		
			1st	2nd	3rd	1st	2nd	increased
C	Team 1	4	26	24	26	11	14	3
	Team 2	5	22	27	24	9	10	1
	Team 3	4	24	22	24	6	10	4
average						8.7	11.3	2.7

Table 5 presents a comparison of the numbers of classified categories between the physical version and the MIRO version. The average number of the teams of the MIRO version does seem to be more than the teams using physical version in both rounds of categorizing. However, the average increased-number of the two versions are nearly the same.

Table 5. Comparison of the two versions in number of categories.

Version	Amount of categories		
	1st KJ	2nd KJ	Increased
Physical	4.7	7.5	2.8
MIRO	8.7	11.3	2.7

5. Discussion

Tested in actual courses, the approach of Cross-Team Brainstorming took around 1 hour and 20 minutes to complete. Although a few participants appeared to be slightly tired as reaching to the end, the teams had shown quite commitment during practicing. In fact, several participants had replied the approach to be “fun” and “enjoyable”. Generally, the approach received positive comments.

While the efficiency of this approach requires further testing and evaluations, notable findings have been discovered. The findings will be discussed in two parts: 1) the effect of the extraneous ideas, and 2) the comparison of the MIRO version to physical version.

5.1 Extraneous ideas and new categories

The result of testing shows that in both versions, the categories of ideas increases by around 2.8 categories as extraneous ideas being imported.

As expected, new categories were added when extraneous ideas were brought in. To be clearer, the added categories basically fell in two types: sub-categories and brand new categories.

Sub-categories are generally more detailed and specific. For example, in one case, category “Events” was put in the first round, but divided into “Good Events” and “Bad Events” in the second round. Such findings reflects that the extraneous ideas may have provided resource for more detailed categorizations.

Compared to sub-categories often came from large categories in the first round of KJ method, under the brand new categories were usually ideas that could not be classified or even absent in the first round. Aside from the “isolated” ideas, popped-up ideas during classifying was another source of brand new categories. In this case, two new ideas were added under the same category during the first round of KJ method, however, they were respectively moved to new categories in the second round as it turned out that there were plenty of similar ideas from other teams.

Another finding the brand new categories reflected is worth noting. According to a participant during the second round of categorizing, there seemed to be different tendencies in the types of ideas for each team. In this case, the topic is “Encourage elder family members to keep the habit of exercising through interactions on smartphones”. While the topic-proposed team generated mainly ideas about operating and devices, many of the extraneous ideas were about increasing motivations and interaction with people.

5.2 MIRO as platform

The comparison of the two versions in number of categories (Table 5) shows the MIRO version to come up with more categories in both rounds, but not in the increased number.

Further findings in the content shows that the difference between the physical version and the MIRO version is mainly in the process.

In the test of the MIRO version, the discoveries mostly matches Kay's (1995) claim of the advantages of EBS, such as a better quality in recording, more efficient tools in evaluating, and parallel movements at the same time.

First of all, in the MIRO version, there's a significant difference in step 1 of the ideation phase. Due to the limitation of MIRO's function and hardware, in step 1, "drawing" is replaced with "typing", which leads to the loss of visualizing, one of the main features of Crazy Eights. However, without a clear image provides ambiguity and flexibility for interpretation, which is one factor of creativity. Furthermore, from the process's perspective, the fact that typing requires much less time than drawing, resulted in reduction of time-spent in the MIRO version.

The adjustable screen size gives flexibility between a detailed and overall look of the ideas. Being able to have a holistic view, it may be easier to find patterns

From the host's perspective, the MIRO version gives convenience in recognizing the situation and each team's performance by simply switching the screen. This brings another advantage in qualitative observing. Thanks to the immediate update of the changes made on the boards, the more detailed content and process are much easier to observe and even record. However,

In general, the approach of Cross-Team Brainstorming is 1) well accepted and commented by the participants. 2)

5.3 Conclusion

This article proposes Cross-Team Brainstorming, an approach based on a combination of the Crazy Eights and KJ method, aims to expand the amount and diversity of ideation by providing "extraneous ideas" together with "self-produced ideas".

With the extraneous ideas importing to the ideal pool, more detailed categories and new categories were expected to appear, which had been found in the collected data. By comparing to rounds of categorizing, the approach allows the teams to 1) have more detailed look to the ideas and 2) look at the topics from perspectives they did not think of.

To explore the use, the approach was further tested in an online version. Using MIRO, a virtual meeting imitating test was conducted. Generally, the MIRO version shows advantages in:

- Accuracy and completeness in recording the outcomes
- Convenience in operating
- Immediately and holistically recognizing the condition
- More fluent and less time-spent in the process

The result appeared to match scholars' study for electronic brainstorming, with other findings suggesting that the approach could fit well in the form of electronic brainstorming. As more data being collected, the effect of group size, level of proficiency, or even the topic and members' backgrounds are expected to be revealed.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design Education in a Pandemic Context

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Abstract | The Covid-19 pandemic has constituted a global health crisis which influence our professional activities, including the operation of academia and higher design education. When the pandemic struck, we -as educators running a master study of design- experienced how the external regime of infection control forced us to change our teaching and tutoring procedures of running our curriculum almost overnight. We wanted to investigate this new situation from the students' point of view. Through a qualitative survey, we asked our design students how they experience the new regime of their everyday study, and we also asked for new and radical ideas to reduce the negative impact from the pandemic, aiming at damage reduction - or even improvements - of our teaching and tutoring. The outcome of this survey has gained new knowledge and proved fruitful to enable us to reorganize and adapt to a new normal.

KEYWORDS | DESIGN EDUCATION, PANDEMIC CONTEXT, QUALITATIVE SURVEY, RADICAL IDEAS, IMPROVEMENTS

1. Introduction

After the Covid-19 pandemic evolved from its origin in Asia towards Europe in the beginning of 2020, Norwegian health authorities issued all-encompassing restrictions in all sectors of society at the point when the massive breakout of the pandemic hit Scandinavia. In our academic institution, we experienced a rather sudden shut-down in mid-March 2020.
Due to the major infection restrictions being issued, and as a consequence of the sudden shut-down in the higher education sector, teaching and tutoring activities were moved over to digital platforms providing online learning, while still allowing some few critical courses - amongst them our diploma candidates - to attend campus.
As our school was largely closed down, staff were forced to utilize digital tools in order to run our curriculum. This situation led to major practical challenges relating to how to execute our teaching and tutoring methods while still maintaining responsible infection control procedures. This regime included constraints on the physical location of students, restricting the concentration of students within our studio and workshop spaces, as well as forcing us to radically reorganise all student activities. Lecturing, tutoring and evaluation activities were carried out using the digital platform Zoom, which all staff were asked to implement in their daily routines.
Retrospectively, we acknowledge that the way we as educators have been forced to reorganise our educational methods, have influenced the way our students learn. Exactly how this manifests itself is yet to be evidenced, as we assume that the effects take some time to fully understand, and it is likely to assume that the effect depends of the duration of the pandemic. Furthermore, as we do not know the time-span of the pandemic, we cannot completely assess the advantages and disadvantages retrospectively until the pandemic is terminated. Our ambition is to investigate how this process has evolved until today through a case study, in order to understand the effects of this methodological shift.

We have searched for empirical research work on the covid-19 pandemic and its implications on higher design education. Due to the recent outburst of the pandemic, and the fact that this is an on-going crisis, there is yet a limited number of comprehensive academic research papers constituting a solid empirical body of literature discussing the implications of the pandemic in higher design education. However, we have found some sources that have been useful in our research on the topic. Regarding the challenges of predicting the effects of Covid-19, The Lancet (2020) states that:

> "…Considering health research and education as a system, rather than focusing on individual components, can help build a more complete picture of the challenges and opportunities ahead. Many of the effects of COVID-19 on health research are likely to be difficult to predict and could produce a combination of desirable and detrimental outcomes. Online learning, for example, could make education more accessible for some students, while disadvantaging others if an equitable approach that takes a system-wide view is not implemented." (Editorial, Volume 396, Issue 10251, P583, August 29, 2020).

This quotation aligns with our view on taking a systemic approach to develop the best possible learning tools for students, especially if a prolonged pandemic becomes a reality.

ACE, American Council on Education (2020) states that it is the executive leader's responsibility to respond to the pandemic, and that those responses to the crisis will make an imprint on their institutions for years to come.

To establish a backdrop for our case study, and to fully understand the magnitude of the pandemic in academia and its implications, we found it relevant to refer to a survey that examine the health-wise impacts from the pandemic. In April 2020, Active Minds surveyed 2.086 college students in the US regarding the impact of Covid-19 on their mental health. The survey concludes that:

- 1 in 5 students say their mental health has significantly worsened under Covid-19
- For 80% of students Covid-19 has negatively impacted their mental health
- 76% have trouble maintaining a routine
- 73% struggle to get enough physical activity
- 63& find it challenging to stay connected with others
- 85% say that focusing on school and work despite distractions has been the most difficult thing about the stay-at-home orders.
- More than talking – especially about Covid-19 – students say the number one way parents can support them is simply spending time with them.
- More than half of students (55%) say that they would not know where to go if they or someone they knew need immediate professional mental health service.
- Students are finding tools that promote social connection most helpful for caring their mental health. These include video call, digital social gatherings, phone calls and in-person conversations.
- Despite Covid-19, 79% of students feel hopeful about achieving their school-related goals and their future job prospects.

In the same survey, according to students, the most important thing for school leaders to be thinking about in the short term and long term for student mental health during and after the pandemic include:

- Increased academic support: Leniency, accommodations and flexibility.
- More mental health resources: Increased investment in counselling and coping resources.
- Focus on soft skills: Empathy, compassion, communication, understanding, and validation for the burdens students are experiencing.
- More opportunities for social connection: Replace cancelled events, services, and classes with virtual ones.
- Engagement in long-term planning: Colleges need to be prepared to help students heal and recover when they return and put in place improved practices and protocols to more easily pivot to remote learning in case of another similar crisis.

This feedback resonates with findings by Horne (2020), providing a study of Healthy Campus Awardees, where five campuses highlight the importance of:

- Moving services online
- Meeting student's basic needs
- Proving workshops and discussion groups
- Clearly communicating the college's / university's response
- Supporting marginalized students
- Infusing wellbeing into the curriculum
- Elevating student-led organizations' activities
- Showing empathy and compassion to students

Recent surveys of college presidents in the US indicate that over 90 percent of these reported being very or somewhat concerned about student mental health during the COVID-19 crisis, making it their top concern, Lederman (2020).
As the link between students and staff is crucial in a university, it is also important to consider the working conditions on campus for the staff, as not only students, but also staff seem to be highly influenced by the pandemic. According to Inside Higher Ed (2020), professors in academia are stressed from Covid-19 related changes to teaching and from dealing with student's mental health, with implications for their own mental health. Amongst staff, faculty worries about the pandemic have morphed into chronic stress. According to the results from a survey by Course Hero (2020) in the US, half of college faculty report signs of professional burnout, with 40% of these considering leaving their current jobs. The data likely reflects presidents' fears about how the disruption and uncertainty of school closings and distance learning will affect students' already-rising rates of anxiety and depression.
In our own institution, the practical organising of infection control measures constitutes a major challenge. Currently, all of our studios and workshops are subject to restrictions regarding the number of students being present at the same time. The infection control routines have changed frequently, and as one example, all teachers were asked to wear masks when tutoring students closer that one meter, but not when giving lectures. This principle easily leads to enhanced feeling of security, but limits the level of communication due to hidden facial expression and reduced vocal clarity.

1.1 Risk factors

According to CDC, Centers for Desease Control and Prevention (2020), the highest risk of virus infection in higher education occur in these situations:

- Use of public buses, campus buses/shuttles or other high occupancy enclosed vehicles with limited ventilation and/or that require students, faculty, or staff to have sustained close contract with others.
- Students, faculty, and staff are not required to follow steps such as proper use of face masks, social distancing, hand hygiene to protect themselves and others.
- Students and faculty regularly engage in in-person learning, activities and events.

- Students, faculty, and staff attend large out-of-class social gatherings and events.
- Students and faculty freely share objects.
- Irregularly scheduled cleaning and disinfection of frequently touched areas.

During the pandemic, our local health authorities have issued restrictions that focus on personal transport as well as physical density of people. These largely comply with the risk factors stated by CDC.

1.2 Scope

Through a case study this paper aims to investigate how a pandemic crisis influences the operation of our teaching and tutoring methods seen from the student's perspective, and to gain knowledge from this feedback. In addition, our paper aims at stimulating new ideas for improving students' situation in their everyday study, in order to obtain a responsible and robust operation of our curriculum despite these extra-ordinary circumstances.
The scope of this case study is the total of 230 design students participating in our curriculum. Our master of design degree constitutes five years, consisting of three year's foundation study in BA level, in addition to two years on master level.
We believe that all experiences gained since the pandemics' impact -starting in March 2020- are crucial in order to learn, and we decided that the most effective approach was to take the student's perspective using a questionnaire, in order to obtain individual feedback in a concrete and realistic manner.
At present time, our scope reflects a quit dramatic combination; A doubled number of students -from 30 to 60 students in the first year's introductory course in design- combined with a widespread pandemic, and this happening at the same time.

1.3 Context

In order to contextualize this case study, we need to establish an overview of our student mass, and the distribution of students throughout our curriculum. In table 1, the gender distribution is displayed, in addition to the total number of students. As the gender distribution comprises 83 male and 147 female students, there was a substantial potential overweight of female respondents in our questionnaire.

Table 1. Student gender distribution and total number of design students at AHO, Fall 2020

Course categories	*Male*	*Female*	*Total*
Foundation courses	39	80	119
Master courses	29	51	80
Self-programming, Diploma, leaves, international exchanges	15	16	31
Total	83	147	230

To establish a backdrop for understanding the level of student satisfaction in our institution under normal conditions, we refer to national statistics on study quality produced in 2019, as a reflection of the normal 'pre-covid-19' situation.

The study barometer 'Studiebarometeret' (2019) is a national survey that is distributed to students in higher education each year. The survey monitors students' perceptions of quality in study programs at national colleges and universities. Table 2 describes some of the findings in the most recent questionnaire from 2019, providing student's answers to a list of qualitative questions, reflecting to which degree they feel satisfied with different aspects of our school. The total percentage of respondents in the questionnaire is 36,4. The score 1 = not satisfied, while 5 = very satisfied.

Table 2. 'Studiebarometeret', student satisfaction survey with focus areas

Main area	*Description*	*Institutional score*	*General score, visual arts and crafts in Norway*
Teaching	Dissemination and teaching	4,4	3,8
Feedback	Feedback and guidance from Professional staff	4,4	3,8
Expectations	Academic staff's expectations of students	4,5	3,7
Learning environment	Social and professional environment, facilities and equipment	3,8	3,6
Organization	Information, administration and professional context	3,5	3,0
Inspiration	Whether the study produce challenges and engagement	4,4	3,7
Overall assessment	Overall satisfaction with the study program	4,3	3,9

Given the time of capture, these data reflect a pre-Covid-19 situation and must be assessed in that view. Our institution scores higher than average, however these questions are - being part of a national surveil - quit general, as they are given to all institutions within the visual arts and crafts sector, without questioning or considering local aspects that may be specific to each institution.
In order to monitor a current Covid-19 state of student satisfaction, we need more specific input from the students based on our daily routines and local considerations concerning the way we practice teaching and tutoring, and how student's well-being is experienced.

2. Research methodology

Before boarding this case study, we found it necessary to plan our approach on how to receive robust and qualitative feedback, aiming at personal feedback from individual student experiences. Considering the magnitude of the pandemic and its all-encompassing implications, we found it important to receive feedback from the largest possible student body to maximize the number of respondents, in order to build the most describing picture possible of how the students regards their own situation. As personal feedback reflecting individual experiences from a pandemic is likely to be of a sensitive character, the principle of ensuring anonymity is crucial, and therefor the process of data collection has been

designed to prevent any personal identification. In accordance with current GDPR regulations, we developed the questionnaire based on full anonymity, ensuring all student's privacy rights in accordance with current GDPR legislation. We reported our questionnaire in advance to The Nation Centre for Research Data -NSD- providing extensive documentation required, of how to maintain privacy measures, and awaited their approval before launching the questionnaire.

2.1 Hypothesis

Our hypothesis is that the covid-19 pandemic has negatively influenced students' every-day study in our institution. Therefore, our questionnaire asks for response from how the pandemic has influenced their student life, having the academic arena as a demarcation for the questions.

2.2 Structure of the questionnaire

In order to obtain a highest possible qualitative value of the feedback from the students, we chose to divide our questionnaire (table 3) into two different sections.
The first section comprises questions about how the students feel that the pandemic has influenced their own student situation until now. A set of multiple answer options enables qualitative response to our questions. In order to capture different nuances of opinions, some of these questions invite additional free-text answers.
The second section invites free-text answers providing new ideas for future change and improvement. The original survey is multi-lingual, written in both Norwegian and English, to reach all students at campus. Four answer options are chosen to prevent a 'non-indicative' mid-option, and to make the student take a position.

2.3 The questionnaire

1. To what extent have you experienced an increased feeling of isolation as a result of Covid-19?

Table 3. Student questionnaire (separated into 10 sections)

Answers	*Number of respondents*	*Percentage*
To a large degree	8	**15,7 %**
To some degree	29	**56,9 %**
To a small degree	11	**21,6 %**
Not at all	3	**5,9 %**

2. Do you feel that Covid-19 has led to reduced contact with teachers?

Answers	*Number of respondents*	*Percentage*
To a large degree	5	**9,8 %**
To some degree	24	**47,1 %**
To a small degree	15	**29,4 %**
Not at all	9	**17,6 %**

3. Have you experienced that reduced contact with fellow students has been a problem?

Answers	*Number of respondents*	*Percentage*
To a large degree	14	**27,5 %**
To some degree	18	**35,3 %**
To a small degree	11	**21,6 %**
Not at all	9	**17,6 %**

4. Have parallel lectures (physically on the big screen + digitally on Zoom) worked well?

Answers	*Number of respondents*	*Percentage*
To a large degree	7	**13,7 %**
To some degree	30	**58,8 %**
To a small degree	11	**21,6 %**
Not at all	5	**9,8 %**
Not relevant, not been done*	2	**3,9 %**

** If it did not work well, please specify why.*

5. Have you experienced that infection control measures reduce your outcome of lectures?

Answers	*Number of respondents*	*Percentage*
To a large degree	4	**7,8 %**
To some degree	16	**31,4 %**
To a small degree	25	**49 %**
Not at all	9	**17,6 %**

6. Have you experienced that infection control measures reduce your outcome of tutoring?

Answers	*Number of respondents*	*Percentage*
To a large degree	5	**9,8 %**
To some degree	19	**37,3 %**
To a small degree	21	**41,2 %**
Not at all	10	**19.6 %**

7. Do you find that infection control in the classroom is adequately practiced?

Answers	*Number of respondents*	*Percentage*
To a large degree	7	**13,7 %**
To some degree	23	**45,1 %**
To a small degree	15	**29.4 %**
Not at all*	9	**17,6 %**

**If not being adequately practiced, please specify how.*

8. Do you find that your home / dormitory / apartment works well for long-term self-study?

Answers	*Number of respondents*	*Percentage*
To a large degree	9	**17,6 %**
To some degree	13	**25,5 %**
To a small degree	21	**41,2 %**
Not at all	8	**15,7 %**

9. Have you experienced that the pandemic has brought something positive to your everyday study?

Answers	*Number of respondents*	*Percentage*
To a large degree*	1	**2 %**
To some degree*	17	**33,3 %**
To a small degree	25	**49 %**
Not at all	11	**21,6 %**

**If yes, please specify what.*

10. Suggestions for improvement.

You are hereby challenged -as a designer- to suggest improvements that can make your own every day study during covid-19 better or more efficient. Think outside the box. As a designer, we seek opportunities! Feel free to think radically and untraditionally, innovative and visionary!

4. Findings

Due to different technical reasons, our invitation to the 230 registered students only reached 206 students. Of these, 51 students responded and answered the questionnaire. This makes a participation rate of 25%. This rate is quite low, therefor we must assess the answers having an indicative view. All free-text answers are written in Norwegian, so we may assume that all respondents are native students. When assessing the percentage bars, some questions indicate a quit even distribution of response without any clear indication. We have chosen only to comment specifically those bars that stand out with high percentage scores providing significant responsive concentration, or otherwise being alarming.

4.1 Multiple choice section

- In question 1, a large group of 72,6% reply that they to a large or to some degree have experienced an increased feeling of isolation as a result of Covid-19, resonating with our assumptions.
- In question 2, a group of 56,9% reply that Covid-19 to a large or to some degree has led to reduced contact with teachers, resonating with our own concerns.

- In question 4, a group of 58,8% reply that parallel lectures (physically on big screen and digitally on zoom) to some degree has worked well. This has been one of our practical concerns.
- In question 7, a group of 47% reply that our infection control to a small degree or not at all is adequately practiced, indicating that our infection control routines should be improved.
- In question 8, a group of 56,9% reply that their home / dormitory / apartment works to a small degree or not at all for long-term self-study, indicating that student housing is less appropriate and does not fulfil students' needs in a pandemic situation.
- In question 9, a group of 70,6% reply that the pandemic to a small degree or not at all has brought something positive to their everyday study, indicating a strong negative feedback.

4.2 Free-text sections

- Connected to question 4 regarding parallel lectures, the students specify the following problems:

- Inadequate technical know-how / expertise amongst the teachers for facilitating clear sound and picture based on the physical constraints of the studio.
- Teachers' lack of using appropriate microphones and cameras, and teachers lacking experience from using these devices in the right manner.
- Poor quality of communication while using zoom, as the dialogue often loses rhythm and continuity caused by technical / audio-visual delays.
- Tendency to neglect those students being at home on zoom, as they often feel not being part of or not included in the conversation in the physical auditorium. This is often caused by that questions from the audience are not repeated into the mic, so those students being at home on zoom do not hear the questions.
- Teachers tend to forget to follow up questions in the chat in zoom.
- Hard to concentrate when taking part in digital lectures on zoom, caused by poor working conditions at home; poor space, bad air, lack of movement.

- Connected to question 7 regarding infection control, students report these observations:

- Too many students in one space
- too short distance between students because they forget themselves
- inadequate cleaning of surfaces

- Connected to question 9 asking if the pandemic has brought something positive, students argue for:

- freedom and flexibility in their everyday life
- less monotony
- better sleep
- stronger awareness on personal hygiene
- learning digital communication tools - like zoom

- the possibility to seeing things from a new perspective

• The final question 10 led to considerable engagement. Apart from the majority of ordinary ideas -like more frequent cleaning routines- the students suggest these ideas:

- Wearable tech; a measuring device that alarms when people get too close to each other.
- VR-tech building holograms in meeting rooms, using virtual reality technology to make absent students 'appear' in the room.
- Introducing infection tracking system utilizing the student's admittance card to register movements in and out of campus.
- Compulsory zoom-courses to all teachers to make them skilled zoom users.
- Establish trans-course colloquium groups enabling more discussion and contact.
- Providing a starter-kit to those working at home, covering needs and comfort.
- Compulsory walks outdoors for more fresh air and general restitution.

5. Conclusions

Overall, our findings suggest that Covid-19 has produced a negative impact on student's study life, confirming our hypothesis. Amongst other, the pandemic seems to have triggered an increased feeling of isolation, which causes mental health concerns. One other aspect we should seriously take in consideration, is that 47% of students reply that our infection control routines are inadequate. Furthermore, a large group of students struggle with their home as workplace, indicating that we should facilitate presence at campus as much as possible. When a group of 56,9% students report that Covid-19 has led to reduced contact with teachers, we also must find ways to strengthen this contact. However, in the current situation of very strict infection control, it seems that only online solutions are possible to utilize in order to reduce or eliminate this problem.
We acknowledge the obvious need to establish better audio-visual facilities that may enable efficient hybrid solutions for students being present and digitally for those being at home. Regarding technical challenges when practicing parallel physical and digital lectures, there are many problems to be solved, but primarily the main challenge is to build experience and competence from utilizing digital learning platforms as effectively as possible.
Although we find the majority of the suggested ideas maybe less radical than expected, we find the mentioned ideas fruitful and inspirational, and valuable for consideration when discussing how to optimize our future practice.

6. Discussion and future challenges

When doing research on qualitative issues related to health and well-being, we acknowledge the importance of accepting that any given feedback in a survey reflects individual, subjective experiences, not necessarily objective facts or conclusions. Therefor we must

assess the answers given in our survey as indicative feedback allowing a certain amount of interpretation.
In the big picture, we assume that our efforts in reducing negative impacts from Covid-19 largely depends on the duration of the pandemic. If the pandemic continues over long time, we assume that we will experience a large portion of classes working from home, as they are reluctant to attend campus due to personal health and infection risk.
The pandemic situation raises many questions. Suddenly our ordinary class-rooms become audio-visual studios. How should this be managed? Due to overloaded IT-support staff, should teachers spend a substantial amount of working hours trying to become audio-visual experts rather than spending their time teaching their profession? These are amongst the questions we would like to invite discussing at the approaching Cumulus conference.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design for Sustainable Healthcare. Cutting the impact of medical products through disposable packaging

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Abstract | The pandemic emergency has highlighted a critical issue in the health sector: the environmental impact caused by the use of disposable products, currently based on the use of plastic polymers, which are difficult to recycle and not compostable. According to the National Institute for Environmental Protection and Research, the numbers generated by the Covid-19 emergency would amount to between 150 and 450 thousand tonnes (ISPRA Report, Waste consisting of used PPE, May 2020). Researchers at the University of California, San Francisco Medical Center, estimated the waste of $2.9 million in neurosurgical supplies in one year in one department alone (Allen, 2017). The incompatibility between the health need to use these devices and the environmental need to reduce products with a high polluting potential, poses the Design Discipline with a challenge that research must be able to meet through the development of real and sustainable solutions.
In an attempt to respond to these critical issues, this paper reports on research conducted on single-use surgical products, in particular on the redesign of a single-use procedural kit, with the aim of rethinking design from a systemic sustainability perspective.
The research was conducted through desk research, based on a literature review of reports and documents demonstrating how to achieve sustainable healthcare. At the same time, through field research and the HCD approach, using a number of specific tools in the different phases of the design process, it led to the definition of a product capable of satisfying both the needs of healthcare professionals, doctors and nurses, who are the direct users, and the needs of hospitals and companies responsible for the disposal phase. The result is a framework for identifying the most challenging surgical departments.
The research required a multi-disciplinary approach to develop new sustainable layouts starting with the details, requirements and needs for the design of an adaptable and versatile procedure kit were highlighted.
The design solutions that led to the realisation of the prototype are: design of a biodegradable EPP tray, functional for disposal by incineration; design of a recyclable PETG tray, divided into

3 compartments. The first one contains instruments that need to be ready to use. The second contains instruments at risk of falling/breaking. The third compartment contains instruments that are not always used. The three compartments are fixed on a cardboard layer that replaces the individual compartmentalisation per instrument, making the kit customisable for any type of single-use procedure, as well as being able to make the PETG tray sterile. The project will reduce production costs by using less plastic material to be thermoformed and a single negative for the production of the customisable tray, leading to the creation of a new product/service flow, centred on: returning packages to the manufacturer, placing them in the additional instrument tray, so that they are not necessarily ready for use; reducing the amount of biohazard waste burnt in the incinerator. The use of an organic-based tray minimises pollution; advantageous recycling of trays and procedural tools that were previously discarded in general waste or even biohazard.
From an environmental point of view, there are benefits to be gained from reducing incineration by reducing unused waste. A biodegradable tray to handle infectious supplies and disposal in an incinerator can minimise air pollution. Other time-saving benefits come from the individual packaging of additional customisable instruments. This solution has reduced the possibility of having to open a second kit to obtain a duplicate instrument.

KEYWORDS | HEALTHCARE, MEDICAL PACKAGING, SUSTAINABILITY, CIRCULAR ECONOMY, PROCEDURAL KIT

1. Introduction

Healthcare represents one of the most critical sectors for the development of society's well-being and it involves not only the development of new treatments and new drugs, but also the development and innovation of products and services aimed at "preventing, diagnosing, curing, rehabilitating"(Italian Ministry of Health Declaration). The current situation due to the Covid-19 emergency has shown that alongside treatments and devices with a high technological impact, a series of medical devices called "soft medical devices" are equally crucial. In terms of the market, these are identified as "disposable and medical consumables" and accompany every medical device for treatment in hospitals but are also widely used for treatment in the local health center and in the home environment as well. A clear example of "disposable and medical consumables" are the surgical masks which are one of the essential factors for proper prevention and treatment of the epidemic in the current emergency due to Covid-19.

In the very first phase of the epidemic, among other things, the enormous demand worldwide for these devices led to a great scarcity and the European Commission was forced to turn to trade associations (from the textile sector to that of materials plastics, to the additive manufacturing sector) asking to reconvert their productions and allocate them to the medical consumables sector.
Furthermore, the pandemic emergency has highlighted one of the critical factors in the sector: the environmental impact that determines the massive use of "disposable" products,

which at the moment are mainly based on the use of plastic polymers, which are difficult to recycle and not compostable.

Regarding the projection of the quantity of such medical waste, according to the Italian National Institute for Environmental Protection and Research, the numbers generated by the sanitation emergency due to Covid-19, would amount to a number between 150 thousand and 450 thousand tons (ISPRA Report, Waste consisting of used PPE, May 2020).

Waiting to know what the final balance will be, according to Ecocerved, a consortium company of the Italian Chamber of Commerce system, in 2018 the Italian production of medical waste stood at around 180 thousand tons.

For the most part, such waste is hazardous with infectious risk (78% of the total), mainly coming from public hospitals, especially medium-large sized ones (almost 60% from public centers with at least 150 beds). At a national level, medical waste has no other destination than incineration, for 65% of the total, and activities aimed at disposal for the remaining 35%, with percentage differences between region and region (Ecocerved, 2020).

The evident inconsistency between the health need for the use of these devices with the environmental need to drastically reduce the use of products with a high pollution potential places the Design Discipline in front of a challenge that research must be able to grasp through the development of real and sustainable solutions.

In an attempt to respond to these critical issues, this paper reports research conducted on the case study of surgical disposable products, in particular surgical trays, with the aim of rethinking the design with a view to systemic sustainability.

Through the Human-centered design methodologies, the research aimed to meet both the needs of health workers, doctors and nurses, who use the product directly, and the needs of hospitals and companies responsible for the disposal phase.

1.1 Research summary

Background: The ever-increasing costs associated with health care are leading economic decision-makers in all developed countries to look for ways of reducing waste costs and maximising hospital efficiency. In the case related to "A new sustainable perspective for disposable procedural kits", the role of surgeons is fundamental for the evaluation and redesign of procedural kits that contain all the necessary instruments that are then used in a specific procedure. The aim of the research is therefore to assess the costs and reasons for discarding materials as part of the activities carried out in operating theatres, which are the primary source of hospital waste. Inspired by recent publications, reducing the operational costs associated with the purchase, packaging and transport of unnecessary supplies can lead to considerable savings.

Objectives: The primary objective of the research work is to reduce the waste of disposable surgical instruments, contained in the trays that are usually used in the course of surgical

interventions of various nature and that are often discarded without being used completely, exclusively because they are no longer sterile and cannot be recovered for use. Future perspectives, which have emerged from the literature research, suggest innovating/transforming the packaging of surgical supplies, achieving the same safety expectations/results while saving on products, transport and waste production.

Methods: The study was conducted, firstly through a quantitative research that consisted of the study of healthcare articles and the most recent publications concerning the waste in the healthcare sector and the possible reduction of unused disposable healthcare supplies in multiple procedures. Secondly, a qualitative research was developed by submitting a questionnaire to surgeons and instrument nurses working in the different sectors, in which all the peculiarities, both positive and negative, of disposable surgical supplies were highlighted. This resulted in a framework for identifying the most challenging surgical departments. A multi-disciplinary approach was required to carry out the research, which made it possible to develop new, sustainable layouts from the details.

Results: At the conclusion of the research, a single-use tray was redesigned, containing the necessary instruments, all in one package, customisable with single-package instruments. The tray is optimised by selecting the instruments used, only in special situations or overused and therefore at risk of falling/breakage. The advantages are economic, environmental, time and safety.

2. Challenges and opportunities for Sustainable Healthcare

2.1 Healthcare waste

Approximately 85% of the total waste produced by healthcare activities is generic, non-hazardous waste comparable to household waste. The remaining 15% is instead considered hazardous material, which may be infected, of chemical or radioactive origin (Chartier, 2014) . It has been estimated that in high income countries, on average up to 0.5 kg of hazardous waste is generated per hospital bed per day; while in low income countries, on average 0.2 kg is generated (Chartier, 2014). However, in low-income countries, medical waste is often not separated into hazardous or non-hazardous waste, which makes the actual amount of hazardous waste much higher (Ranasinghe, 2020). In 2012 the National Academy of Medicine estimated the U.S. healthcare system squandered $765 billion a year, more than the entire budget of the US Defense Department (Allen,2017). Researchers at the University of California, San Francisco Medical Center, for instance, recently estimated that in a single year the hospital wasted $2.9 million in neurosurgery supplies alone.On wasted supplies in just one department (Allen, 2017).Considering the carbon emissions produced by the health care sector: if healthcare were a nation, it would be the fifth largest emitter of greenhouse gases on the planet, according to the non-profit organization, Health Care Without Harm. It

is a carbon contribution equal to the emissions of 514 coal-fired power plants, or 4.4% of global net emissions (Ngo, 2020).

Operating theatres are, from an economic point of view, those facilities that generate the greatest revenue and at the same time they are the most of the waste comes and consequently "the greatest costs for disposal, accounting for 30% of the total amount of hospital waste" (Babu, 2019). In the management of medical waste, there are tools that have to be disposed of immediately, while others can be recycled over a longer period of time, with the help of specialized organizations. One such organization is Stryker, a recycling company for the medical industry. Materials that are accepted by these organizations include laparoscopic devices, wristbands used for blood pressure measurement, surgical product casings and more. For supplies or equipment that are no longer useful but have not expired and are still in working order, they are collected by organizations such as Med Share who, after collecting them, distribute them to medical facilities that cannot afford to purchase these items probably due to cost (Tine Health, 2017).

Medical products are often wrapped in plastic, cardboard boxes or blue polypropylene plastic wrappers. Since these products are opened outside the operating room, to avoid the risk of contamination, they can be recycled by NGOs to be transformed into aprons, tote bags or other by-products. The disposal of biohazard hospital waste costs about 0.62 cents per kilogram (Tine Health, 2017). Their recycling can certainly reduce the overall cost of waste disposal. At Johns Hopkins Health System in Baltimore, the Neurasthenia Division was able to save $5 million in 2010 and 2013 for its reprocessing program. But recycling is not always applicable for all items in the operating room; especially if there is a risk of infection. Patient safety is more important than sustainability (Tine Health, 2017).

The key to minimising and effectively managing medical waste is the separation and identification of waste. Proper handling, treatment and disposal reduces costs and is very helpful in protecting public health. The most appropriate way to identify categories of medical waste is to sort the waste through the use of colour-coded plastic bags or containers. Do not forget to use the biohazard symbol on the packaging so that medical waste can be immediately identified.

2.2 Medical packaging

As a result of the numerous studies carried out, a number of critical issues in waste management within the hospital environment were highlighted. It was therefore decided to focus the study on two parallel aspects that have a strong impact on the hospital economic system.

The first part of quantitative study aims to highlight which and how many materials are most unused in an operating theatre, where up to 70% of hospital waste is created, and up to 90% of operating room waste is improperly sorted and sent for costly and unneeded hazardous waste processing. (Lee, 2012). In particular, a Nederland Circulair initiative of the Dutch

Ministry of Infrastructure and Environment contributed to the overall objective of creating a single stream of plastic packaging in hospitals by analysing the typical plastic waste streams of the OLVG hospital. The largest category of plastic products found in OLVG hospital waste bags is single-use packaging, which accounts for more than 50% of the total plastic waste. The largest estimated types of plastic used in disposable packaging by weight are Polypropylene (PP), followed by Polyethylene Terephthalate (PET), High Density Polyethylene (HDPE) mixed with medical grade coated paper, and Polyvinyl chloride (PVC). The second largest plastic product by weight is bubble wrap - which makes up 25% of the total plastic waste - and the largest single mono material plastic product - made from a single material, low density polyethylene (LDPE) (Netherland Circulair, n.d.).

The second part of the research paid attention to what may be the biggest economic wastes within operating theatres. The research is based on multiple academic publications on various online platforms in the sector, in which the waste stream is no longer assessed from a quantitative but a qualitative point of view, going on to identify real waste of disposable instruments that are not always used during certain surgical procedures and consequently create a significant burden on healthcare costs. Specifically, in a study published in the Journal of Neurosurgery, Dr Corinna Zygourakis, a leading neurosurgeon at the University of California, San Francisco, said in February 2017 that "accounting for the different case distribution in the 58 selected cases, the authors estimate approximately $968 of OR waste per case, $242,968 per month, and $2.9 million per year, for their neurosurgical department" (Zygourakis, 2017).

The waste Dr. Zygourakis refers to in her study is the result of a mentality that brought disposable surgical instruments into the operating room "just in case" the surgeon needed them. In such situations, however, at the end of the surgical procedure, even if they were not used, they would be discarded as they had been removed from the sterile packaging and would therefore be considered contaminated (Allen, 2017). Dr Zygourakis and a team of colleagues contacted 58 neurosurgeons with the aim of analysing what and how many supplies were present in the operating theatre, which, if not used, were subsequently discarded. Out of 26 surgeries performed, it turned out that all the blood clotting materials had not been used, at a total cost of $3,749. A similar result was found in 16 operations in which an expensive tissue adhesive was not used, at a cost of $3,495. Another example was surgical screws, which were also not used on several occasions, at a total cost of $3,144 (Allen, 2017).

In addition, the majority (85%) of OR waste comes from individual disposable items, rather than items in larger packs. This indicates that if we educate surgeons and nurses about OR waste, clean up preference cards, and encourage communication at the beginning of each case about what items will be needed, we may be able to significantly reduce OR waste without having to completely overhaul our entire supply packs (Zygourakis, 2017).

2.3 Towards a circular medical design

During the Virtual Engineering Week discussion, 'Recycling & Circularity in Healthcare Plastics' it was highlighted that the global medical packaging market has almost reached £15 billion. It is expected to grow by 5% per year to reach £18 billion in 2025, explained Peylina Chu, executive director of the Healthcare Plastics Recycling Council (HPRC)(Shepard, 2021). Chu discussed recycling challenges and opportunities with industry experts Nick Packet, MD&M specialist and packaging engineer at DuPont, and Bob Render, business development manager for sustainability at Ravago Recycling Group. The panel also discussed the challenges and opportunities in recycling healthcare plastics during the COVID-19 pandemic (Shepard, 2021). Chu asked Packet to remind planners of some practices that make recycling packaging easier and more attractive to recyclers. Packet acknowledged that it is a hard challenge to switch materials in a regulated market, but that there are some opportunities. "Designing a package made up of one type of polymer would be ideal because it creates a cleaner flow of materials than having different types of polymers," he said. Size also matters and looking at packaging that can be compressed easily is key (Shepard, 2021).

Healthcare Plastics Recycling Council (HPRC) has led projects to develop hospital waste diversion strategies, but single-use plastics still dominate in healthcare environments. At last count, about 2,800 to 3,500 tonnes of plastic packaging and plastic product waste from US healthcare facilities is generated daily, according to the HPRC. Most of this goes to landfill or is incinerated (Danigelis, 2020).

Medical waste should be managed with the aim of reducing its hazardousness; reuse, recycling and recovery should be encouraged; collection, transport and disposal should be optimized (Tine Health, 2017). To this end, it must be encouraged:

- the organization of training courses for the staff of health facilities, on the proper management of medical waste, especially with the aim of minimizing contact between non-infected materials and potential sources of infectious waste, thus reducing the production of waste that needs incineration procedure costs;
- the separate collection of non-hazardous health care waste, which is assimilated to urban waste produced by health care facilities;
- the rationalization of the supply and use of reagents and drugs in order to reduce the production of hazardous health care waste at infectious risk and non-hazardous health care waste;
- the preferential use, where technically possible, of products and reagents with a lower content of dangerous and polluting substances;
- the use of technologies for the treatment of medical waste, aimed at promoting the recovery of materials and energy. The health facilities must, therefore, provide for the management of waste produced according to safety criteria.

Elizabeth McLellan, a registered nurse from Portland, USA, conducted a study on hospital waste disposal. She was shocked to find that waste was being discarded in her hospital, so

she asked the Health Department of her hospital if she could pick up the waste herself. In 2009, she founded Partners for World Health, a non-profit organisation, which currently has four warehouses in various parts of Maine in the north-east of the USA. Currently, Ms McLellan and hundreds of volunteers collect medical equipment and supplies considered to be waste from a network of hospitals and clinics, ensuring they are sorted and shipped to lower standard countries (Allen, 2017). "This is money", said Elisabeth McLellan, referring to the wide range of supplies wasted. Providing a further note, addressed to her compatriots, stating that "this is one of the reasons why your health insurance is so expensive" (Allen, 2017). Elisabeth McLellan called this range of products, considered to be waste, 'gold junk' and it includes a whole series of categories:

- discarded equipment for model upgrades
- supplies discarded after changing suppliers; unused medical supplies donated by families of deceased patients;
- materials that have passed their expiry date or have been declared unusable by strict control procedures but can be used safely.

Once items are opened in the patient's room or surgical suite, they can't be reused in the hospital. Every day her organisation collects 10,000 to 20,000 pounds of unused material, not including durable medical equipment, from healthcare facilities in the Northeast. Their collections range from unused exam gloves and wound care supplies to unneeded anaesthesia machines (Kaplan, 2021).

3. ECOPACK. A new sustainable perspective for disposable procedural kit

3.1 Research Methodology

From a methodological point of view, the research was conducted through the Human-centered Design approach, basing the activities on the involvement of operators in the different phases of the design process and considering different conditions (from efficient materials to usability, from high operational performances to safety of the environment).

Through this methodology it was possible to consider the needs of constituents in new ways, create innovative solutions to meet these needs, and deliver solutions with financial sustainability in mind (Ideo, 2011).
The research activities were approached following 4 steps:

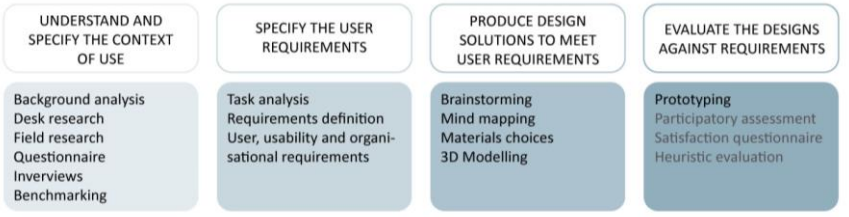

Fig 1. Methodology and Tools

1. *Understand and specify the context of use*

As a result of the numerous studies carried out, a series of critical issues in waste management within the hospital environment have been highlighted. It was therefore decided to focus the study on two parallel relevant aspects, which have a strong impact within the hospital economic system. The first part aims to highlight which and how many materials are most unusable in an operating theatre, where up to 70% of hospital waste is created. The second study pays attention to which is the most spread economic waste inside the operating theatres. Substantial problems have thus emerged, which can be tackled with design methods, with the aim of optimising waste in such a delicate area. Quantitatively, a study has been carried out, through a variety of organisations in the industrial sector that have come together to jointly identify methods to make the economic activities of hospitals more efficient and less impacting on the environment. Qualitative research is based instead on multiple publications on various online platforms in the sector, where the waste flow is no longer evaluated from a quantitative but qualitative point of view, identifying real waste of disposable instruments that are not always used during certain surgical procedures and consequently create a significant burden on health care costs.
The user research was initially carried out with an overview of the different roles of nurses within the operating room. Subsequently, the user requirements were defined, which were obtained by submitting a questionnaire to surgeons and instrument nurses working in the different sectors, in which all the peculiarities, both positive and negative, of disposable surgical supplies were highlighted. The questionnaire was completed by some 11 surgeons from different hospital departments, including general surgery, urology, ophthalmology, gynaecology and bariatric surgery. Procedures requiring disposable kits were highlighted including Endoscopy, Videolaparoscopy, Orthopaedics, Prosthetics, Colon Cholecyst, Craniotomy and Ophthalmology. The questionnaire asked which instruments were most and least frequently used in the specified procedure. In all 11 cases, it was noted that unused single-use instruments were disposed of and that each specific tray always contained the same instruments. The amount of disposable instruments at risk of breakage/fall was considered to be value 3 on a scale of 1 to 5. In addition, suggestions or considerations were asked about the problems submitted. One general surgeon, specifically in the gallbladder procedure, advised to "open only what is necessary to start the procedure, and then the

rest". Another surgeon from obstetrical traumatology suggested "bagging the disposable material individually, so that it can be opened when needed".
The aim was to identify the areas of use and any waste that occurs within an operating theatre, regarding disposable instruments that, although opened within the operating protocol, are not used, paying particular attention to those instruments that have a greater risk of falling/breakage.

The benchmarking has been carried out by collecting data on the different types of packaging for medical devices and disposable instruments with the aim to highlight interesting specific characteristics, functional to develop the product (Fig.2). The latter defined the various needs and showed how some of them respond to certain needs, often suppressing others, such as considerable waste and safety priorities.

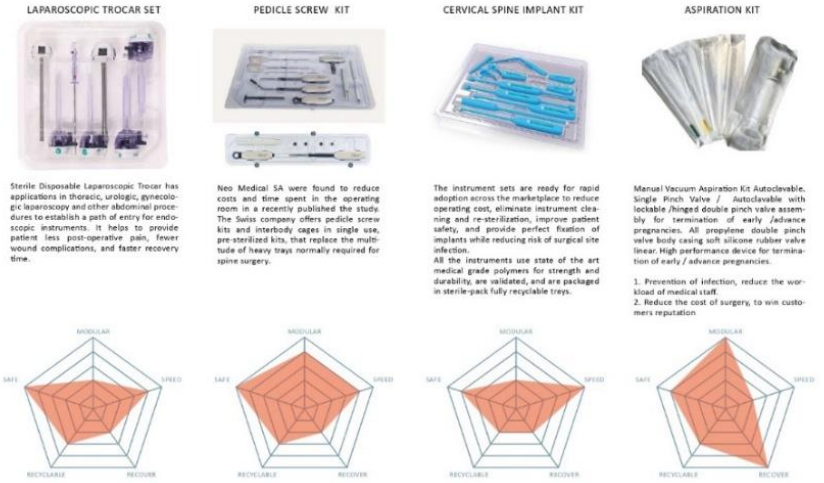

Fig. 2 Benchmarking

The research was then carried out in the field through visits that led to observations within the operating block of Orthopaedics at the [Hidden for blind peer review] (Fig. 3). An interview with the head of the operating theatre department and a neurosurgeon trainee allowed a comparison of which procedures could be optimised and suggestions on how to identify instruments that, based on previous surgical operations, were more or less used and more or less at risk. In addition, the interviewees were open to future collaboration for evaluation and implementation.



Fig. 3 Incorrect disposal of hospital waste at S. Andrea Hospital

2. Specify the user requirements

Prior to defining the requirements, a task analysis was carried out to identify the sequence of actions that operators perform during a surgical procedure using disposable kits (Fig. 4).

- It was ascertained that on several occasions the following dynamics occurred:
- Fall of a disposable instrument, leading to the opening of a second kit for the rapid continuation of the procedure
- Breakage of a disposable instrument, leading to the opening of a second disposable kit for a single instrument
- Non-use of some instruments in the disposable kit in most of the cases analysed.

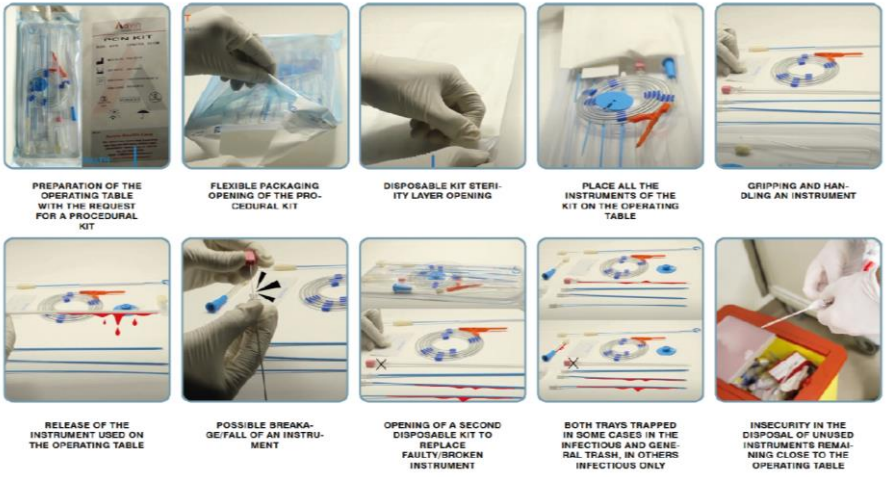

Fig. 4 Task Analysis

Subsequently, the following were identified specific requirements adaptable to many different procedures:

- smart labelling, that describe the product use and the proper disposal;
- shelf life efficiency, identifying possible packaging system failures and addressing them proactively during early design phases greatly increases the chance of successful validation and patient safety;
- packaging choice, where there are to consider questions like:
- Do you need a single or double barrier?
- Would a pouch or tray be better?
- What packaging type and material would be most compatible with the sterilization/incineration process required?
- What label requirements are needed?
- Shock resistance, package distribution test samples must contain a product or representative product (dunnage/simulant) that has been sealed at equipment worst case conditions and sterilized;
- proper sizing, the incorrect sizing of trays, boxes, and kits comes from noise or a lack of communication within the supply chain;
- integrity efficiency, done by documenting that the SBS system has no detectable path through, channels or punctures that may allow the introduction of microbes into the system.

3. Produce design solutions to meet these requirements

During the research phase, requirements and needs were highlighted for the design of a procedural kit adaptable to various procedures.

The design solutions that led to the creation of the product are: the design of a biodegradable EPP tray, dedicated to disposal by incineration, the design of a recyclable PETG tray consisting of 3 compartments

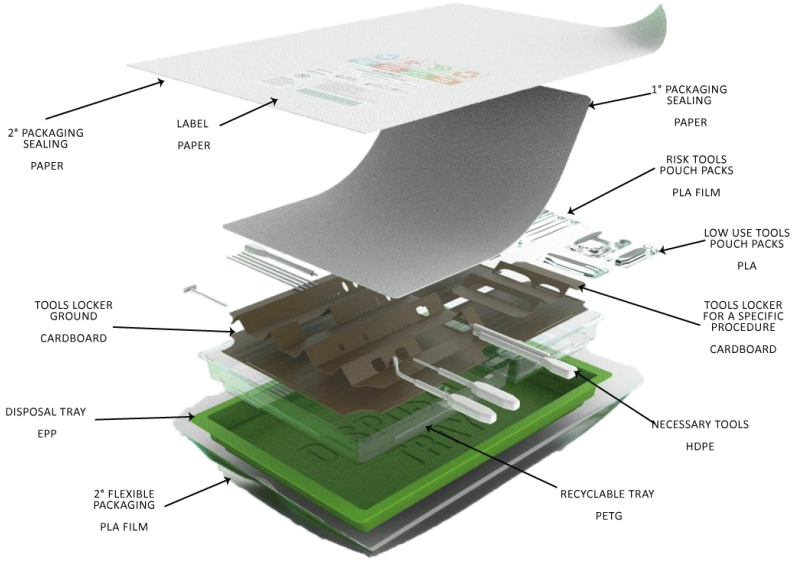

Fig. 5 Render

Regarding the usability aspect, one compartment of the kit contains all instruments used above 20% of the cases analysed in a specific procedure, therefore needing to be ready for use.

A second compartment dedicated to instruments that are at risk of falling/breaking in at least 15% of the cases analysed in a specific procedure, therefore needing to have two extra twin instruments in addition to the one in the compartment of the necessary instruments.

The last compartment contains instruments that have not been used more than 20% of the cases analysed in a specific procedure, thus needing to be packed individually and opened if necessary (Fig. 5)

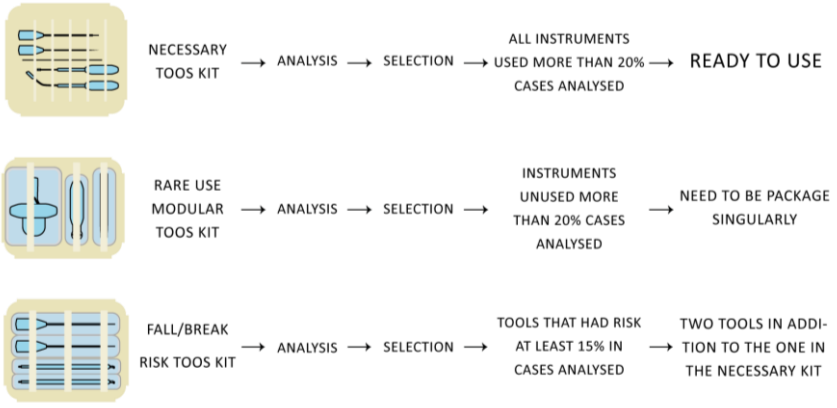

Fig. 5 Usability

All three compartments do not have additional individual compartments but are instead fixed on a cardboard layer that allows them to be removed from the PETG tray. The purpose of the cardboard replaces the concept of individual compartments for each instrument, making the kit customizable for any type of single-use procedure, as well as preserving the infectivity of the PETG tray. The new concept thus allows lower production costs, less plastic material to be thermoformed and a single negative to produce customizable tray.

4. *Evaluate the designs against requirements*

The design of this medical packaging would result of a creation of a new product/service flow focused on:

- returning the packaging to the manufacturer of those packages by locating them in the additional tool tray, so they are not necessarily ready to use.
- reducing the amount of biohazard waste burned in the incinerator. The use of an organic- based tray aims to minimise site pollution
- advantageous recycling for trays and procedural tools that were previously rejected in general waste or even biohazard waste

In particular, product aims to achieve the following expected results:

- Reduction of incinerator cost. The incineration costs of disposable incineration kits would be greatly reduced by maximising resources and reducing waste.
- Reduction waste. Significant is the reduction of infectious and general waste with a consequent increase in recycling activity. The less waste is produced the less hospital costs will be.
- Reduction of climate damage. A disposal biodegradable tray has been designed to minimize the environmental pollution generated by the incineration of

infectious waste in the operating theatre. Burnt bioplastics produce less CO2 and zero dioxin emissions than non-bio-based polymer trays.

- Increase supplies saved. Individually packed items, which were previously thrown into the generic and infectious, are now recycled or even reused if they are individually packed.
- Increase visual info. Intuitive graphics help to understand how the various components of the designed packaging can be disposed of, avoiding the previous insecurity of disposal of hospital personnel.
- Increase in operating room efficiency. The operating room needs ready-to-use equipment in an extremely short time. EcoPack offers additional kits useful for risky instruments and instruments rarely used in each procedure.
- Increase time during surgical operations. Product developed optimises time by offering, according to the needs of the moment, all the necessary equipment, anticipating risks and unnecessary use.
- Increase training staff. A better understanding and implementation of the waste disposal activity by the operating theatre staff is the first step towards an effective sustainable turnaround.

4. Results and next developments

At the conclusion of the research part, a single-use tray was redesigned, taking as example the Neo Pedicle Screw System™, Neo Medical S.A. (Abdalla, 2020). The concept developed is a kit containing the necessary instruments, all in one package, and customisable single-package instruments. The tray is optimised by selecting the instruments used, only in special situations or overused and therefore at risk of falling/breakage.

The advantages are economic, due to the reduction of hospital costs, incineration costs and time waste. Environmentally, multiple advantages could be achieved from the reduction of incineration process use due to the reduction of waste unused supplies. A biodegradable tray to handle infectious supplies and disposing it in an incinerator, could minimize the air pollution. Others are advantages in time, thanks to the single packaging of additional customizable instruments. This solved the problem of having to open a second kit to get a duplicate instrument.

At a later stage has been had the opportunity to get in touch with a resident neurosurgeon and the head of the operating block at [Hidden for blind peer review] hospital in Rome, who provided with precious elements for the realization of the prototype, offering his experience in the operating theatre and allowing me to optimize the functionality of the product made.

In the opinion of many of the people involved, the feedback and interest received are likely to be developed in subsequent stages.

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Author contribution statement:
The article is a product of a concerted effort. All authors contributed to the writing, with responsibilities as follows: Section 1 A.G., Section 2 A.G. and G.M.C., Section 3 and 4 G.M.C., Section 4 G.M.C..

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing new learning experiences in pandemic time: how digital can support a new didactic in Service Design.

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Abstract | The Covid-19 pandemic had a strong influence on several aspects of our lives. Among these ones, the didactic experiences had been impacted and the limits of traditional education emerged. In particular, the design field, based mainly on a design-studio based didactic, has been affected. In the last period, many teaching teams struggle with the challenge of translating course planned to be deployed in-person to remote didactic. The common question that arose has been: how to develop proper didactic experience for designers in a time of remote teaching and learning? To address this question a small experimentation using a digital platform has been designed to comprehend how digital could become a tool to enhance the learning process rather than creating barriers.

KEYWORDS | SERVICE DESIGN, EDUCATION, DIGITAL, LEARNING

1. Introduction

During 2020, the pandemic has affected how we were used to interacting, forcing us to rethink several aspects of society. If we look at the educational context, UNESCO estimated that over 1.5 billion students in 165 countries are out of school due to the worldwide health emergency (United Nations, 2020). The consequence of this situation is that universities are going through a series of considerations on how to adapt to this context and develop new strategies for the future.

These reflections come in a time of transformation of the educational context in which already previous pedagogical models are put in discussion, and several attempts, to understand how digital affects the learning process, are put in place (Radcliffe et al., 2008). The Covid-19 pandemic pushed on this last aspect, obliging universities to experiments with new model and activity that make use of digital platform. These experimentations sometimes proved to be ineffective given the short time to properly design the didactic activity and sometimes proved to be successful, allowing teaching teams to efficaciously deliver didactic contents to the students.

The paper aims to illustrate a digital learning experience developed during the covid-19 pandemic and draw some reflections on the feedbacks received. In particular, with this paper, the intention is to present a didactic initiative that investigates how remote teaching and learning could take advantage of digital platforms, elaborating and building something which didn't limit just to the digital replica of an in-person event, but use as well the virtual space with its potential.

The article is divided into four parts. The first section aims to provide a theoretical background for the experimentation, focusing the attention on the evolution of pedagogical models. Following, the second section illustrates the methodologies, illustrating the structure of the format of the didactical activity proposed and the structure of the surveys used to gather feedbacks upon the initiative. Subsequently, the third section outlines the analysis of the results of the survey. Finally, the last sections are dedicated to the discussion of these results and conclusion are drawn on those, highlighting the limits of the experimentation, and the possible future developments.

2. Theoretical Background/Framework

Literature of Service Design illustrates how it emerged as a research field during the last decade of the XX century (Erlhoff et al., 1997; Hollins & Hollins, 1991; Manzini, 1993; Pacenti, 1998). During the first years of 2000, some design agencies start to work specifically with SD, such as Livework and Engine, and it started a period in which the research around SD explored how it could integrate its tools into the design practice (Sangiorgi & Prendiville, 2017). From an educational point of view, it can be seen that SD appear as a subject in a design curriculum at KISD in parallel to the first research into the field, and later as a Master

degree course in 2005 at Politecnico di Milano and in 2009 at Laurea University of Applied Sciences (Ojasalo, 2012). Since then many other courses in Service Design emerged.

Nevertheless, the research on Service Design Education has been fragmented and not rigorous. In fact, the previous studies on the topic tend to consider, with a narrow frame, specific educational programme. Moreover, many contributions on this topic come from Touchpoint-The Journal of Service Design, a non-peer-reviewed journal, in particular the volume 3. No. 1 (2011) "Learning, Changing, Growing" and the volume 9, no. 1 (2017) "Education and Capacity-Building". The first attempt in the direction of a comparative study on service design programme has been developed by Ferruzca et al. (2016) however the criteria in selecting and collecting the data do not consider the development of the field and are based on the course provided by the best universities considering the World University Rankings 2015-2016. Later a wider effort to map the courses has been developed within a research project with the production of Service Design Map developed for ServDes aiming at building a database containing the educational offer in Service Design worldwide. Building on this, and integrating with other resources, Becermen and Simeone (2019) proceeded in comparison of the several courses offering Service Design programme, observing common educational threads and differences in the educational approach. Focusing our attention on the common aspects it emerges that the degrees in Service Design tend to combine "hands-on" project work with lectures and seminars, often accompanied by collaboration with external organizations, with the aim of exposing the students to a real situation to practice their ability to develop a service design project throughout the different phases. The teaching and learning methodology through which these objectives are achieved is usually the Studio-based Learning (SBL), traditionally considered the educational approach for the Design discipline, which combines different learning pedagogies, such as social constructivist, problem-based, and active learning to mimic real-world working experience (Kumar et al., 2020). At the base of SBL approach is the shared learning environment of a studio (Burroughs et al., 2009) which enable the learners to engage both among peers and with experts (Schön, 1985). The pandemic situation required universities to change the modalities of teaching to reduce the chance of transmission of the Covid-19 virus. Therefore, it has been missing an essential component to the learning process according to the SBL approach. Given the situation of the emergency, several actions have been put in place (Crawford et al., 2020). These can be cluster into two main areas, first, those actions that have been structured to guarantee the didactic and can be considered as temporary and emergency solutions. Secondly a cluster composed by those initiative aimed at researching and experimenting new activity, which does not limit themselves into moving online and remotely the teaching activities but try to take advantage of the digital to create new possibilities for students to learn. These second cluster of actions have accelerated the research in the intersection between digital and education and has been built on the knowledge of the recent research in innovative didactics models (Sancassani et al., 2019). This paper, although is based on a small experimentation, try to fit into this area of research, considering as field of application the discipline of Service Design.

3. Methodology

This paper is based on the didactics experience the author had during the 2020 (Taverna, 2020) in the M.Sc. course of Product Service System Design in Politecnico di Milano (Italy), which due to the Covid-19 pandemic has been translated remotely during the early part of the year, and then in the second part has been structured in a blended setting, where students could follow both in-presence or connected remotely, and finally moved again all remotely, when the situation required to take precautions. Specifically, the considerations are built on the DE-BRIEF initiative, in particular taking into account observations of the students during the process, and a set of two surveys submitted both to the students taking part and to the larger audience participating in the final public event.

3.1 DE-BRIEF format

The DE-BRIEF format considered in this study is a didactic experience developed for students participating in an event. The outline of the initiative is made of four phases: students' application, source event, elaboration, and final event. First, it has been requested to the students to present a motivation letter to participate in the initiative, once selected they took part in the source event, which in the case considered has been the SDN conference "Virtual Service Design Global Conference 2020 – Embracing Change", later some meetings have been held to arrange the work of synthesis of the conference and give ownership of the topics to the students and, in the end, the participants illustrated to a broader audience a series of conceptual maps representing the contents of the conference in a final event.

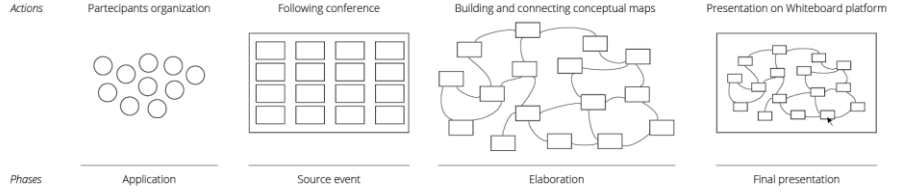

Figure 1 Phases and actions of the format DE-BRIEF

The activity aims to make students reflects upon the talks provided in a conference and to be able to present those to the rest of the course who did not follow the event. The main didactic component of the initiative is the reflection on the topic presented during the conference event. Students are requested to synthesize the themes into a conceptual map and to create a link among the various talks. The workflow of the activity has been designed considering the limits as week as the opportunities given by the actual context of the pandemic, in which in-person interactions are limited. Therefore, the challenge is deployed by using a collaborative digital tool which can support the interaction and is versatile to create and connect conceptual map. The tool of choice, in this case, has been Miro, an

online collaborative whiteboarding platform that enables distributed teams to work together. The peculiarity of the format is that the final event was managed using the same board on Miro as the one used to elaborate the topics. The board was shared with the participant who could navigate on their own and interact with the contents.

The learning outcomes of the didactic initiative expected for the students participating in it are to be able to select the important contents to explored in the conference, being able to take notes on the major elements, build a critical reflection on these topics and synthesize it in a conceptual scheme. Throughout the activity, it is requested for the students to interact with colleagues and take responsibility over some thematic areas in order to present a portion of the contents to a broader audience of students.

3.2 Surveys

Both the forms had the aim of understanding how the format used in the pilot could be improved in the following iteration during future events. The survey is structured to contain a mix of quantitative and qualitative question, the first ones, quantitative, in order to have a comparison scale among the answer and for future initiatives, the second one, qualitative, in order to deeper some understanding and receive insight by the people taking part in the initiatives.

Both the survey contains a series of question which aimed to understand how the initiative performed and it has been promoted, in order to comprehend the area in which future iteration might need an improvement. The first form directed to the students taking part in the initiative had the objective of comprehending the effectiveness of the experience in term of didactics. The second form directed to the audience had the goal to analyse the value of the output event.

4. Results

The DE-BRIEF results here illustrated are collected through direct observation, to describe the initiative, and the analysis of the survey, to understand the value for students and the audience that participated in the final event.

The analysis of the results has been developed by reading the answer provided to the form and discussing those with a student that took part in the initiative and support the whole process.

4.1 The Initiative outline

The DE-BRIEF initiative took place between October and November 2020. The selected participants to the initiative were 10, nine were students from the second year of the master course and one an alumnus. The group of participants had a first meeting to organize and

distribute the ownership of the conceptual maps referred to the talks followed in the conference. During the meeting, each student took the responsibility to synthesis one or more talks and to review the conceptual maps of other students.

Later the working group held two meetings to discuss the advancement of the conceptual maps and to co-design the final event structure. In the first one, students focused on proposing for each intervention of the conference a set of keywords and quotes in the second presenting the conceptual maps (Figure 2) and connecting the talks between them (Figure 3).

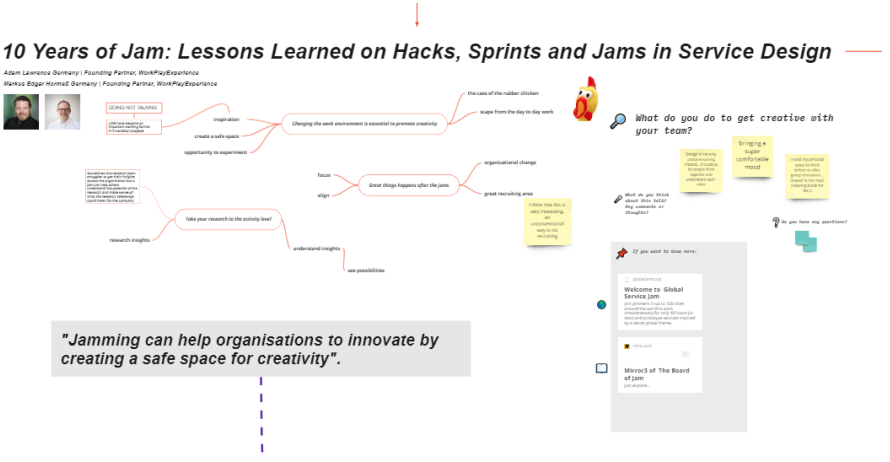

Figure 2 Example of a conceptual map produced during the initiative

Each conceptual map synthetizes a talk of the conference and it has been built following a semi-structured template co-designed with the participants of the DE-BRIEF initiative. It is composed of the following elements:

- Title of the talk
- Author and affiliation of the speakers
- Conceptual map
- Quote
- A question for the audience
- A space for question from the audience
- A space for deepening the topic of the talks with link to extra resources

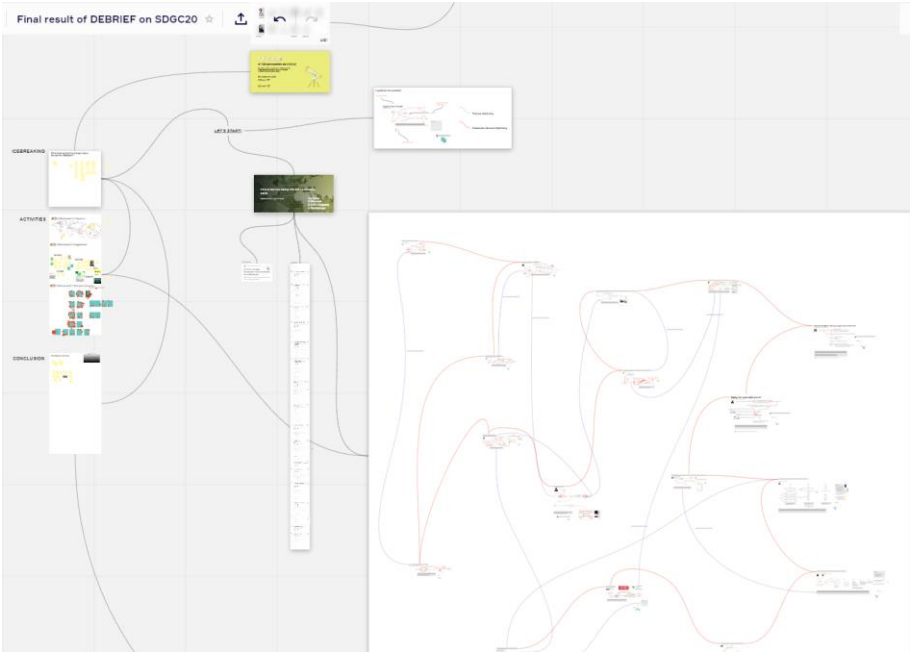

Figure 3 Overview of the whiteboard, with the proposed path and the connections between the different conceptual maps

Once the various conceptual maps have been developed, the students connected the topic of the talks to create a network of conceptual maps.

Before the final presentation, two sessions of rehearsal and review of the presentation material have been held in a collective moment where the working group took actively part in providing peer-feedback.

In conclusion, the final presentation has been held sharing with the audience the digital whiteboard through a twofold way: the audience was connected via web-call to the event and could see the shared screen, which followed the narration of the various talks or could simply navigate and explore the multiple connections and interact with the contents. This enabled an interactive approach to the presentation of the synthesis.

The final event has been developed dividing the explanation of the conceptual maps into two blocks and complementary activities have been designed to entertain the public. The activities aimed to create and facilitate interaction. The icebreaking activity consisted of asking a question regarding the theme of the conference: “What does embracing change means for you as a Designer?” and take confidence with the use of post-it in the virtual space. The other set of activities focused on recreating the informal conversation happening

in a coffee break during physical events, in particular proposing a set of question and leaving a space for a suggestion of books, movies, events and other various elements.

4.2 Students involved: survey analysis

The students directly involved in the didactic activity have been 10, selected to represent various years in the educational path of the master course, and involving an alumnus as well. The survey has been answered by 8 of the students. The first set of questions aimed to understand if there were any weakness in the process, and it was asked to the students to scaling the elements of the experience on a Likert scale from 1 to 5, where the 1 means that the element needs significant improvement and the 5 means that the element was excellent. From these first answers, as we can see in the graph (Figure 4), we can consider the initiative a success, where no elements have a considerable negative note. The highest positive peak is on the communication with the working group and the lower on the ownership of the topics.

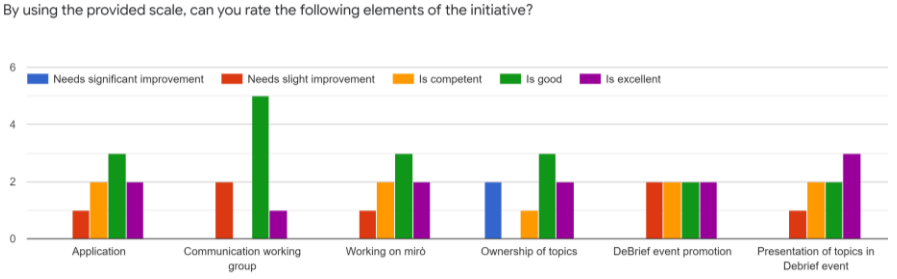

Figure 4 First set of questions

Considering the digital platform used as a working place for the elaboration of the conceptual map an important matter of the inquiry regards the interaction between the students. As shown in the figures (Figure 4Figure 5, Figure 6) there is a difference between the actual interaction compared with the desired one.

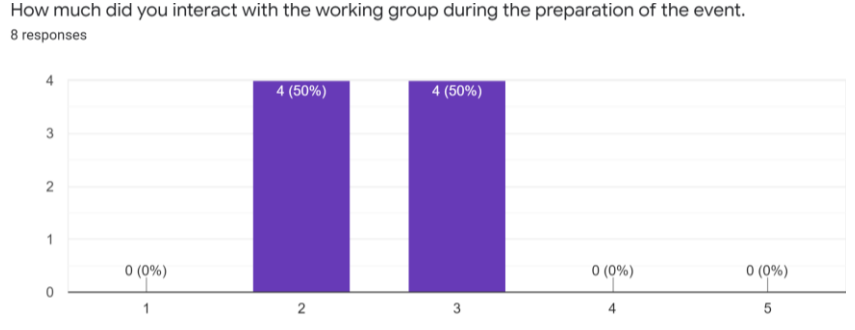

Figure 5 Interaction during the activity

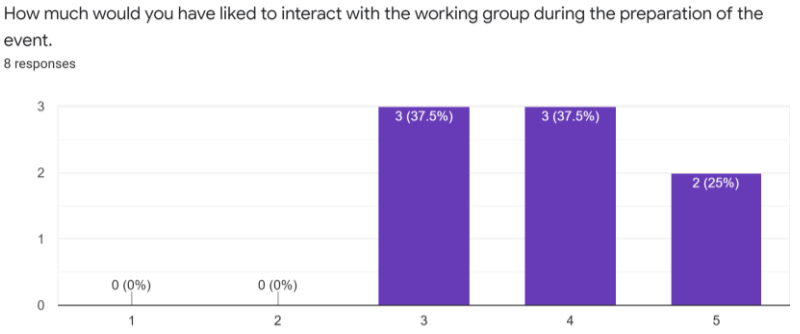

Figure 6 Expected interaction during activity

All the students considered that the De-Brief format adds something to the comprehension and the understanding of the conference contents. To understand how the experience enriched the participants, it has been used an open question; the answers provided converge on one main insight about the elaboration, which has been an opportunity for them to reframe some aspect of the talk and build a personal point of view on the matter. The main set of questions posed to the students focused on comprehending which among the expected learning outcomes were the most achieved with the format and which others were not considered fulfilled by this experience. Also, in this case, it has been used a Likert scale from 1, which corresponds to "This experience didn't teach me this", to 5, which is equivalent to "This experience absolutely helps me to improve this".
Looking at the graphs (Figure 7), we can say that the students generally perceived that the experience meets the expected learning outcomes.

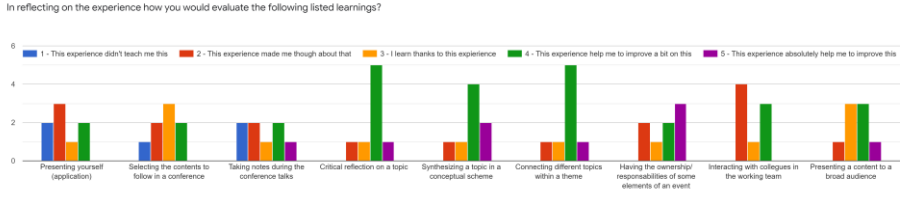

Figure 7 Evaluation learnings

The learning outcomes which scored the lowest score, therefore considered the less achieved, corresponds to the first three: Presenting yourself (application), Selecting the contents to follow in a conference and Taking notes during the conference talks. On the other hand, the learning outcomes which gained the highest value are the one corresponding on the elaboration of the topic, hence: Critical reflection on a topic, synthesizing a topic in a conceptual scheme, Connecting different topics within a theme.

It is as well interesting, considering the need for improvements on the ownership elements in the figure, to see that the learning outcomes regarding the ownership of the topic have scored a positive score.

4.3 Audience: survey analysis

The feedback from the audience has been gathered in multiple ways, the main and more structured one has been the form shared with the participants at the end of the event, but as said given the digital medium used during the final presentation, some unstructured feedbacks has been provided on the board used for the event.
The audience was composed of students, professors, and alumni of the Master course, for an average number of people connected of 70 (highest peak of 78), only 6 answered the questionnaire. To evaluate the final event, it was asked to the audience to scaling the elements of the experience on a Likert scale from 1 to 5, where the 1 means that the element needs significant improvement and the 5 means that the element was excellent. Looking at the graphs (Figure 8), it can be observed that none of the elements has a negative aspect, considering that the highest score has been considered the schemes produced by the students and their presentation, and the welcome part and the questions and answer (Q&A) element collected the lowers score.

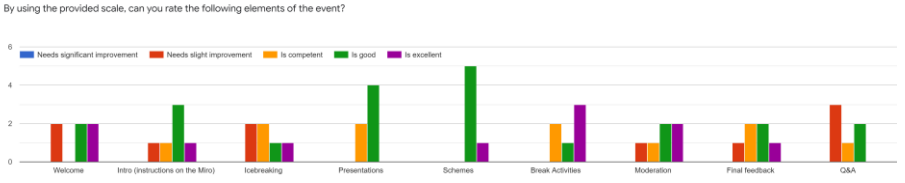

Figure 8 Evaluation elements of the event

5. Discussion

According to the feedback received, the initiative can be considered a success in term of experimentation of a new approach to didactical activity. It highlighted the strength of the format, such as the potential of achieving the learning outcomes and the positive response from the students taking part in the experimentation to the format.

In general, the versatile use of the virtual whiteboard, not only as a tool of design but also as a medium of presentation, prove to be an innovative way to use digital instruments to overcome barriers given by the distance. Furthermore, the choice of using an unconventional medium to present, such as a digital whiteboard, allow the audience to have a freer approach to the presented contents. Built on this aspect and on the development of complementary activities the format enables to perceive the event as a conversation rather

than a frontal lecture of the synthesis bringing stimulus reflection to open up discussion and create a connection with the audience.

The results of the survey directed to the audience provided a set of metrics as well to understand the value of the initiatives and to compare with future experimentations in this direction. In particular, the highest scores collected in the core contents of the final event underline the efficacy of the digital tools for delivering a set of conceptual maps, on the other hand, the lowest score (the welcome and Q&A), the elements that imply an interaction (Icebreaking and moderation) and the elements that relate to the presentation of the tool itself present some limits of the virtual environments. Moreover, the difference between the desired and the expected interaction during the activity highlights that digital can sometimes limit natural interaction that might happen if the activity would take place in a classroom.

6. Conclusion

Taking into consideration the presented experiments and its result the following conclusion are drawn. The use of a whiteboard digital platform, besides the web-call, can support didactics, when dealing with complex themes, on three aspects: collaboration, non-linearity and asynchrony.

Considering the limits of the SBL approach when translated remotely, the possibility to emulate a virtual shared environment thanks to the digital platform can provide a major connection over a simple web-call, when it comes to collaborative work. The use of a digital whiteboarding platform with a potentially infinite space provided a medium in which the complexity of some topics could be represented taking into consideration all the non-linear interconnections. Moreover, the possibility to access asynchronous to the virtual working space made it possible for the students to adapt the working time to their schedule, enable them to customize the activity according to their needs, and not forcing the whole didactic process in a specific time and space.

The experimentation presented is a small initiative, therefore, is not immune by limits, therefore it is important to follow up with iteration of the initiative and new experimentation to inquiry unexplored research space and digital tools to strengthen the didactic process.

Acknowledgement

The author would like to acknowledge the M.Sc. course of Product Service System Design of Politecnico di Milano, its coordinator Anna Meroni for the support in the development of the PSSD DE-BRIEF initiative. Furthermore, a thanks go to the students taking part in the initiative.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Ecosystem Framework for Community Life Circles based on Life Projects in the Post-COVID-19 Era

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Abstract | The COVID-19 pandemic has created an urgent demand for proximity life services. However, there is a lack of platforms that are designed by communities themselves that allow residents to take part in larger conversations and build life services together. Therefore, this study seeks to propose an ecosystem framework that allows people to build their own community life circles. We summarize the design strategy for developing enabling ecosystems through analysing communities of practice and community cases. This paper introduces (1) a Community Operating System (COS) framework, (2) a life project process, and (3) community life circles for incubating life projects that satisfy people's daily needs. The above three parts constitute a life project-centred ecosystem framework that seeks to cultivate a design culture and responds to complex problems through collective reflection and co-creation.

KEYWORDS | ECOSYSTEM FRAMEWORK, COMMUNITY LIFE CIRCLES, LIFE PROJECT, COMMUNITY OPERATING SYSTEM

1. Introduction

The sudden COVID-19 crisis has not only placed a great burden on global society, but has also deeply impacted our lifestyles. Therefore, it is necessary to examine our living environments and comfort levels. During the pandemic, while using digital technology to assist daily life, we also began to rethink the convenience of surrounding communities. In the post-pandemic era, the demand for this kind of proximity community services will increase. Therefore, we need to know how to integrate online and offline collaborations for supporting local residents in building their own community life circles. This paper introduces an ecosystem framework for local communities based on the life projects. That is, this paper seeks to promote the collaborative lifestyles and the establishment of sustainable community life circles by setting up a platform for collective conversations. An enabling ecosystem can help foster a hybrid community with an environment where physical and virtual spaces co-exist and interact. The key design strategies are extracted from the literature review of the communities of practice (CoP) and case studies. Based on these strategies, we designed an enabling ecosystem, which can help foster a hybrid community with an environment where physical and virtual spaces co-exist and interact. Democratic participation that is centred on life projects offers new meanings for community spaces and facilitates various creative efforts.

2. Community life circles based on life projects

Community life circles usually centre on residents within a specified radius. These circles cover a variety of spaces where services necessary for daily life are provided. For example, the mayor of Paris, Anne Hidalgo (Hidalgo, 2020)(Hidalgo, 2020) proposed the “LE PARIS DU 1/4 HEURE” (a quarter of Paris), which aimed at changing the daily lives of Parisians and the organization of the city. The mayor of Barcelona, Ada Colau (Colau, 2016), introduced the concept of “SUPERBLOCKS” to encourage the construction of small democratic sites designed to alter city space. The Shanghai government (Shanghai Government, 2016) proposed the “15-MINUTE COMMUNITY-LIFE CIRCLE”, which proposes providing basic services and public activity space within a 15 minutes walking distance of residents. Although they are all based on common ideas, the designs are also different, which depend on the local environment and people's living habits. Assuming that local residents participate in community service design according to their own life trajectory, the adaptability of problem solving and feedback may be stronger. These interventions could include development of services that, using resources in communities, create new social and operational values for them (Manzini, 2009). In the process of community design, the voluntary formation of bottom-up collaborative organizations by local residents based on consensus is the main force to ensure the implementation of life projects.

3. Related Studies

3.1 Communities of practice (CoP) from the bottom-up

In this section we briefly review literature on the role of communities of practice (CoP) in cooperative projects and the principles of cultivating CoP, as well as methodological clues sought to improve community collaboration capabilities. Wenger introduced the concept and research scope of CoP, which describes groups of people who share a concern or a passion for something they do, and who learn how to do it better as they interact regularly (Wenger, 2011). Three characteristics are essential in CoP: domain, community and practice.

> "**The domain:** A community of practice is not merely a club of friends or a network of connections between people. It has an identity defined by a shared domain of interest. **The community:** In pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other. **The practice:** A community of practice is not merely a community of interest. Members of a community of practice are practitioners." (Wenger, 2006)

An effective community self-organization requires voluntary organization based on a common and intentional topic, and each member actively contributes knowledge and skills and learns in practice. The goal of community design is to bring out the community's own internal direction, character, and energy, i.e., community DNA. In Cultivating Communities of Practice, seven design principles are introduced to promote the development of CoP:

1. Design for evolution;
2. Open a dialogue between inside and outside perspectives;
3. Invite different levels of participation;
4. Develop both public and private community spaces;
5. Focus on value;
6. Combine familiarity and excitement;
7. Create a rhythm for the community.

We are particularly interested in the first five points, which inspires our attention to the self-organizational collaboration approach in community design. Usually, dialogue and collaboration based on problems in a specific scenario can be more effective. With continuous project practice, rich knowledge and experience can be accumulated for the community. The services provided by members involved in collaboration bring value not only to the members themselves, but also to the overall welfare of the community. On the other hand, participants need interoperable, flexible and specific collaboration tools to support their work (Liliane & Romain & Frederic, 2006). We find that digital community platforms can provide resource information and organize management activities. However, the limitations and difficulties of CoP are reflected in the lack of trust, time and leadership among its members.

> "Although participants are somewhat familiar with the tools, they mostly seem content with receiving and accessing information, not searching for a more active participation […]The fact that members come from different organizations, are not as strongly bound by the same objectives, and need time to build trust between them explains the difficulties in creating a CoP […] they need to build trust relationships, to get to know each other, to also try to function in the same timeframe…it is true that partners tend to be more active in specific research projects than in the general knowledge sharing which is one of the objectives of the CoP/research project." (Tremblay & Psyché, 2012)

To sum up, creating the vitality (or motivation) of collaboration in CoP is a real challenge. We believe that the real motivation comes from the rigid demands of local residents. These demands can achieve resource matching and organizational management through a platform. On the one hand, local residents organize and practice around the demands under the specific scenario, on the other, they rely on community online platforms as flexible tools to participate in community design to achieve resource expansion, knowledge sharing, and project management. In short, building a bottom-up life-oriented socio-technical system requires not only active collaborative practices among members of physical communities, but also a digital technology platform to support the construction of community ecosystems. The following is a comparative analysis of case studies.

3.2 Case studies for community design

The following three cases are "Nextdoor" in the United States, "Dingdong Community" in China and "Sungmisan Community" in South Korea. Through comparative analysis, it puts forward design strategies to rely on local residents to build sustainable community development. Nextdoor is an online social networking website launched in early 2011, connecting residents of specific communities. Each community has its own Nextdoor website, which can only be accessed by community residents. New users can only join the community after confirming that they actually live in the community. In addition, Nextdoor requires the use of real names instead of pseudonyms, and is visible to other users throughout the system. It aims to create a safe, trusted environment where neighbours can connect with each other. Further, Nextdoor provides advice on that content, with "Frequently Asked Questions" that suggests users post about service recommendations, crime reports, lost pets, event promotion, and so forth; it also explicitly states that self-promotional messages are inappropriate and will be deleted (Masden & Grevet, 2014).

Dingdong Community is an online neighbourhood social platform launched in 2014, claiming "social", "Online-to-Offline (O2O)", "life link" as its three major characteristics. It is an APP for daily community life services, which calculates residents' social data and recommends surrounding business and community services. The product mainly provides three functions: fast delivery (express delivery, water delivery, fast food), community life (second-hand trading, carpooling, payment of utilities), home service (housekeeping, nanny, tutor).

Table 1. Case analysis and design strategies.

CASE STUDIES	NEXTDOOR	DINGDONG COMMUNITY	SUNGMISAN COMMUNITY
Focus on	Private neighbourhood social network	Social media attributes and business	Resident problems and needs
Content	Passing along crime statistics, notices of lost pets, and upcoming community events	Fast delivery, community life, home service	Co-parenting centre, K12 education, multiple life cooperatives
Advantage	Trust and safety	Extensive service information	Diverse community life
Disadvantage	"Islanding" effect Not conducive to the flow of community resources	Lack of attention to the real needs of users	Lack of an effective management platform after expansion
Key elements	Trust, local community	Social attributes	Endogenous development
Design strategy	1. Project design is based on the real needs and life trajectory of residents. 2. Support the development of solutions based on local community resources. 3. Provide a platform for dialogue that facilitates self-organization and collaboration among local residents. 4. Specific scenarios are more conducive to promoting collaboration. 5. Providing multiple role positioning for residents is conducive to dynamic adjustment of power and responsibility structure. 6. The perfection of community service is a process of gradual self-growth based on real needs.		

However, many factors ultimately led to the failure of the project. The main reason is that it is not centred on the real needs of users, but that of developers who define the needs of users, resulting in low resident participation.

The Sungmisan community is another success case. The Sungmisan community began in 1994, when about ten couples formed the Woori Co-parenting Centre, the first cooperative in South Korea to provide childcare services for neighbourhood families, because they were dissatisfied with the education provided by the public and private sectors (Yoo, 2010; Wui et al, 2013). People interested in co-parenting moved to the Sungmisan community. This implies that the Sungmisan community is a sort of post-conventional community formed out of "the reciprocal networks utilizing cooperative relationships" rather than any fixed conventional boundary (Lee, K., 2010, p.145). Five more cooperatives and one after-school care program have been established with the increase in demand. What community members do together has attracted the participation of new members, thus beginning a virtuous circle. As the children graduated from co-parenting to go to primary schools, after-

school programs were established; and as the children went to middle school, the need for an alternative school was brought up, and an alternative high school program was established in 2004. (Han & Shim, 2019, p.22). Sungmisan continues to enrich community services around the needs of residents, including co-housing, car sharing, food cooperatives, community restaurants, credit cooperatives, handicraft workshops, radio stations and theatres. It is worth noting that the Sungmisan community does not focus on online social platforms, but more on issues and needs than the first two cases. Cooperatives and participants that form the Sungmisan community network may best be understood as "a network of life communities"(Wui, 2013, p.61). Naturally, with the expansion of the community scale, it is necessary to establish an online platform to jointly manage community information and resources.

Based on the above analysis, we have refined some key elements and design strategies (see Table 1).

4. Ecosystem Framework - COS

Digital technology is particularly suited for promoting citizen activity, and it specifically helps citizens find their voice. Therefore, it is advisable to integrate online platforms and share researches, as well as mobilize community projects and promote broadcasting design experiences and culture. The various social services of digital social innovation as well as distributed production and consumption (Dekker, 2006) reflect a collaborative relationship between people. Within this network of individuals, personal and integral benefits can be realized at the same time. Manzini pointed out “a community too may be described as a mesh of interweaving conversations, and its nature will depend on the types of conversation taking place within it and what sparks them.” (Manzini, 2019). In other words, encouraging community members to find their own solutions by providing a conversation platform is advantageous. Therefore, we interpret a community to be an opportunity for exploring collective intelligence. The ecosystem framework for building COS can facilitate various conversations and promote cooperation, while also encouraging residents to build their own community life circles.

Online platforms have the unique ability to realize this aim. There are many platforms that provide social services, but the majority of them cannot cultivate a community for sustainable, collaborative living. This is due to people’s limited experience with adopting bottom-up collective solutions, and the relatively insufficient skills of participants. Through "Life Projects," members can conduct dialogues and experiments around themes of common concern in their life. On the one hand, stakeholders form designing coalitions (through self-organization) can analyse and solve common problems using low-cost practices. This allows them to continuously gain problem-solving experience. On the other hand, participants can be assigned different project roles based on individual skills and conditions in order to

encourage synergy between members and utilize collective intelligence. On this basis, we designed a COS framework and life project process.

4.1 COS Framework

COS takes community resources as infrastructure support, combining digital technologies to optimize the sharing of local resources and promote communication and collaboration. This can become a platform for supporting creative projects focused on life. COS understands the community to be a living organism, and uses an endogenous development model (Tsurumi & Tadashi, 1989) to incubate life projects. Through the transformation of resource at all three layers, COS activates local resources in order to nurture self-renewal and promote the sustainable development of the community. The diagram below demonstrates the operation framework of COS (Figure 1).

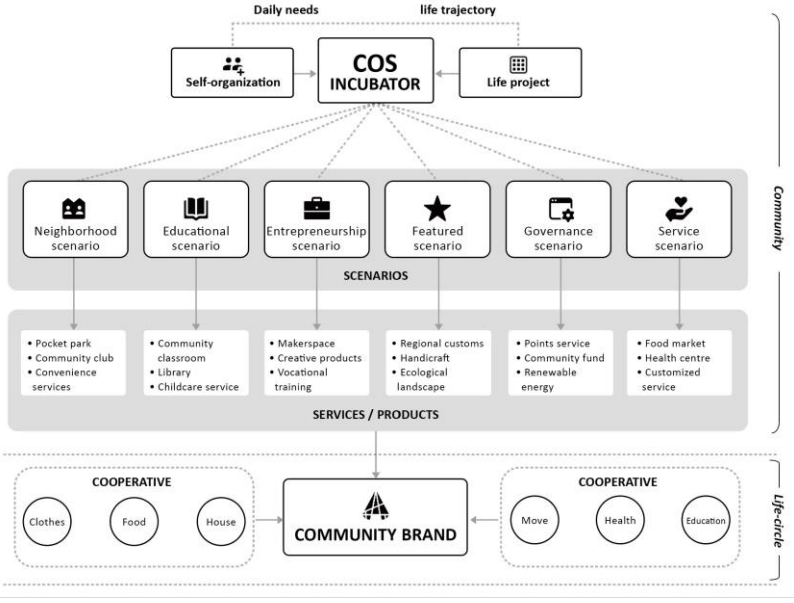

Figure 1. The COS framework. Using COS as a platform, we integrate community resources and promote cooperation among residents. This, in turn, gradually promotes the improvement of community services and lifestyle change.

The enabling platforms under this framework make the undertaking of new cooperative projects possible. Details are as follow:

- **The self-organization of members is established based on common problems and issues.** Life projects are planned by groups and incubated after gaining

support from professionals, policymakers, and residents. New resource values can be generated during this process. These are secondary resources.

- **Improve and perfect the service scenarios by combining the community life trajectory and daily demands.** It is necessary to make more accurate designs targeting project details based on life trajectories. It is also necessary to test these designs in real life.
- **The projects that fit the real demands will be transformed into actual products and services**. The project income belongs to participants and the community.
- **The majority of potential products and services can be regarded as belonging to the community brand and should be accurately managed through cooperatives.** It is necessary to promote community business start-ups and employment through the platform economy. Diverse community brands can satisfy the daily demands of the community, forming a life circle in close proximity to residents.
- **Diverse community brands enrich the ecosystem of regional services within the life radius.** Once the ecosystem is formed, the productive and consuming lifestyle of people will be changed.

The value of COS is that it facilitates a collaborative lifestyle. All people, families, neighbours, and cities can self-organize to carry out projects and share services. Each person is a node in a collaborative network, solving individual problems and, in turn, increasing the overall benefits for community services. COS can transform the experiences of the participants and teach them the value of sharing (Manzini, 2019). Once the number of users increases, the value of a project will grow as (Shapiro & Varian, 1999).

COS can create a hybrid environment, and all these life projects can operate in three dimensions: human society, the physical world, and cyberspace. This is different from pure online interactions that lack the possibility of being realized offline. However, in our view, offline face-to-face dialogue and action are indispensable. Interaction in the physical dimension and close proximity to others are the catalysts that can bring the project to the final stage of transformation. Online, big data can be gathered and analysed as a resource, and knowledge and skills can be shared. Offline, members live in the same space and are familiar and trusting with one another, as they empathize with each other over daily problems. Members self-organize around common problems and goals, and can publish their project proposals in COS. During the process, it is possible to combine collective intelligence to create a suitable solution.

4.2 Framework application - Life project process

A good enabling ecosystem is comprehensive and open, as this allows different people in the community to participate differently and take on different roles and responsibilities during the collaboration process. Participants can be divided into seven roles according to the processes of the project, which are shown in the Table 2.

Table 2. Seven roles in the process of a life project.

ROLES	RESPONSIBILITY	ACTORS
Seekers	Challenges	Residents;
Solvers	Solutions	Residents, Organizations, Government, Business;
Voters	Votes and comments	Residents, Experts, Others;
Experts	Feasible solutions	Residents, Experts;
Funders	Investments	Residents, Business, Government;
Co-producers	Production	Residents, Business;
Traders	Sales or Purchases	Residents, Business; Government

The overall design process of the life project includes four stages (Figure 2): challenge, integration, project, and operation. In the challenge stage, seekers raise questions in order to identify a challenge. These challenges mainly derive from the problems that seekers face in daily community life and corresponding life scenarios. These challenges form the data that is integrated into COS.

During this Integration, COS gathers problems raised by seekers. First, platform experts filter these problems to confirm that they are appropriate. Then, solvers come up with solutions, most of which derive from the solution paths built from experiences of everyday life. Seekers and experts select the solutions with the most potential to be developed into design opportunities. This is carried out according to the principle that feasibility, viability, and desirability are crucial to the life project.

In the project stage, voters cast votes and comment on life projects. The project that gets the most votes is regarded as a potential solution for raising funds and gaining support. Funds come from government subsidies, community funds, and investors.

After securing funds, the project enters the operation stage. At this point, local factories, communities, designers, enterprises, and craftspeople join the project as co-producers. Then, the given products and services are delivered to traders. Throughout the process, projects are iterated according to the use situation in the pursuit of development. During this process, roles can be changed to fit the process. The key is to determine the effect of reallocating roles and relations as well as the potential energy, and to encourage participants to create new values.

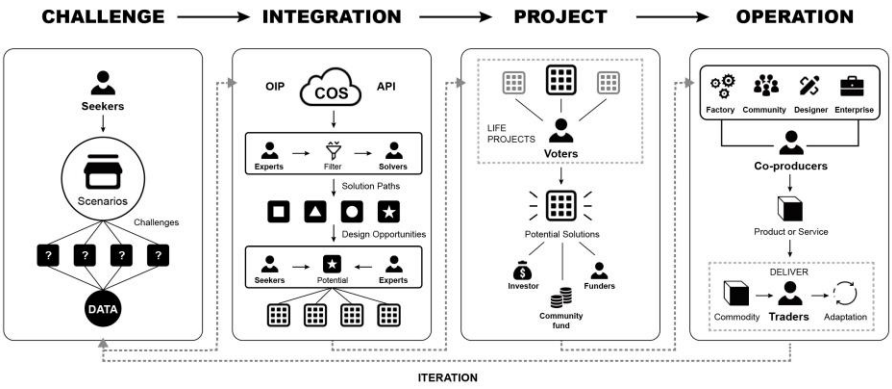

Figure 2. The Life project process. These four stages form a community of interest and reflect the values and responsibilities of the multiple roles in the process of cooperation.

We all possess and have access to design. “However,” as Manzini states, “like all human talents, it must be stimulated and cultivated” (Manzini, 2015, p.31). Therefore, through the framework design, COS aims to enable members to spontaneously create and enrich social systems of community relations through life projects, so as to realize people's own community life circles.

4.3 Community life circles

Diversified life circles form a distributed urban network. Complex urban systems were redistributed among network nodes that form a community. These nodes allow residents to best utilize existing local resources and learn from experiences (Murray, 2009). These experiences are part of the life trajectories of citizens. Therefore, it is necessary to encourage local residents to participate in building a community. As Manzini states, “Ultimately, this means that it is the people directly concerned who must have the power to decide what to do and how to do it” (Manzini, 2019, p.117). In other words, a community must be built by local residents. This approach allows residents to allocate basic services based on their life trajectories and the demands of daily life, e.g., 15-minute Community life circles (Figure 3).

De Certeau calls this activity productive consumption, according to which the consumer is the producer of new meanings (De Certeau, 1984). However, to realize the benefits that come out of people designing their own lives, a platform that promotes community dialogue and co-creation is necessary. For this purpose, we propose this ecosystem framework.

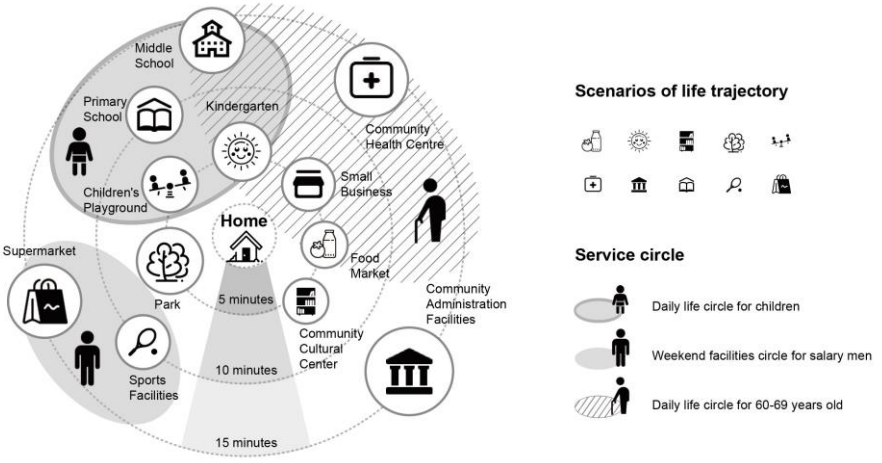

Figure 3. 15-minute Community life circles. According to the life trajectory, the circles can be divided into life services accessible at 5, 10, and 15-minutes distances. The circles can be divided into many spheres. In the children's daily facilities circle, various schools serve as the core, and the circle features many facilities, such as playgrounds and training institutions. The office workers' weekend facilities circle features places of entertainment, shopping malls, community cultural centres, sports facilities, and supermarkets. This circle helps office workers participate in community life on weekends. The elderly daily facilities circle includes vegetable gardens as its core, and adjacent to these gardens are green spaces, small businesses, training institutions, and other facilities. Source: Shanghai Urban Planning and Land Resources Administration Bureau, China, 2016.

5. Conclusion

As a vital basic unit of social governance, the community has shown new trends in community-oriented design. Local residents, as the main participants in the design, have gradually gained attention for building community life from local culture through bottom-up collaborative activities among their members. In some respects, this embodies a project-centred democracy that is achieved through participating in collective conversations, activating the public resources of the community, and building life circles. However, relying on the residents to achieve projects of common concern, the key is to transform community members into communities of practice (CoP), thus creating "functional" social conditions through practice. To this end, we provide the dialogue platform COS that facilitates the self-organization and collaborative practice of local residents. As an ecosystem framework, COS enables community members to connect with each other and actively participate in the community to create value through life projects. Our main contribution is two-fold. First, we planned a COS framework from within the community itself, revitalizing local resources,

designed life projects based on the real needs and life trajectory of residents, and obtained resource support and management through online platforms to gradually improve community services. Second, we demonstrated the roles and responsibilities of stakeholders involved in the life project process, and specified problem scenarios to stimulate the enthusiasm of the population and dynamically adjust the structure of authority and responsibility. We believe that improving the community life circle based on life projects is a biological growth process. As a preliminary study, this paper provides a theoretical framework for the future development of comprehensive web services and design toolkits for community life circles. Based on life projects, COS can activate the potential of collaborative creation and rebuild public services of the community in a low-cost way. In the future, it has the potential to build community life circles that are more adaptive to the daily demands and behaviours of residents.

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Acknowledgements: This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2019S1A5C2A04083375).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Expansive Video Capture – Up close, personal & specific tutoring "performances"

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Abstract | Moving fully or partially online during the pandemic has exposed challenges in appreciating the nuances of sociomaterial design work in the design student / tutor encounter, while also offering opportunities for introducing "new" practices to otherwise resistant students and tutors. This paper explores a simple format for and practice of video capture that encourages students to provide detailed descriptions of up-close visual material, giving tutors a comparatively expanded view of the student work and the student or student-teams relationship to their work. By framing the video capture moment as a form of performance for both the tutor(s) and the student(s) involved in the video capture, the paper argues that the video-making process is a productive practice in and of itself, and a collaborative, dialogic one in concert with the tutor as audience, as well as its use as representational practice for tutor consumption.

KEYWORDS | ASYNCHRONOUS TUTORING, VIDEO CAPTURE, CO-PERFORMANCE

1. Introduction

The ongoing pandemic in the post-COVID-19 world has disrupted the way we organize taken-for-granted uses of space, physical and digital materials, and even interactions with each other, including ways of greeting, being together, and parting. What is deemed as acceptable and unacceptable behaviour is in flux, and how we view the individual in relation to different collectives, including governmental and institutional level initiatives and directives. This has great impact not only on how we organize education, but on the world the students we are responsible for educating engage in and will contribute to. The uncertainty of short-term restriction cycles and the unpredictability of course planning has caused a high level of distress and pushed many of us into new ways of organizing education. Along with the increased stress from abruptly moving teaching online in "Emergency Remote Teaching" (Green et al. 2020), the pandemic offers an opportunity to rethink what is possible, looking at past activities and experiences in a new light, and discovering new forms of engagement while imagining what is to come. This paper zooms into the spaces of the student/teacher tutoring encounter, where students present the progress of their work, receiving constructive feedback for further developing their work and their design practice. Moving fully or partially online during the pandemic has shifted how design educators engage in the progress of student work. In many cases, the spaces used by students and tutors to share and discuss have changed dramatically, changing the tutor's ability to rely on developed rituals for understanding, assessing, and contributing to student learning, and the material, spatial and bodily characteristics within these encounters. In describing the difference between Emergency Remote Teaching (ERT) and effective online learning, Hodges et al. (2020) and Jones (2020) warn that it is not possible to merely transfer what we have done while co-located to an online format. While ERT can produce innovations, they argue, effective online learning is the result of thorough systematic, iterative instructional design. Underlying this argument lies a position that the formats we use may be deceptively similar, but fundamentally different in how they support our intentions. In line with this sentiment, it is also important to remember that students not only learn the intended content of a course, but, in a Bateson sense of Stage II and III learning, students learn how they are taught (Engeström 2001). In this sense, it may not be enough to merely get by with given tools, but to find opportunities to explore and challenge the direction the tools we use push and pull us and our students. The changes in visibility of what students may be doing and may be needing, and how they are responding to their circumstances demands reconsidering the roles we play or can play in relation to student learning. Jones (2020) stresses the importance of developing simple and effective methods for checking in on students and their work progress when creating distance design courses.

Now a year into pandemic teaching, in our industrial design-based educational environment, it appears that ERT is giving way to some forms of a new normal, and effective online learning. Zoom video encounters and the use of Miro boards or shared screen presentations have become common place. The diversity in the physical, material engagement with sharing physical spaces where students work predominately in groups and teachers often

enter their workspaces for sharing and discussion, has given way to new practices of using digital-mediated, software-mediated spaces. Increasingly, tutoring activities are mediated by the opportunities and constraints of a video platform (Zoom or Teams) with face-to-face discussion allowing for verbal descriptions and visibility through the camera, and the use of screenshare options for showing material available on the computer whether organized sequentially in a PowerPoint presentation using text, visuals and video, or other software such as Miro, and the text-based comments, questions, discussions in the video platform chat box. In contrast to these types of synchronous interactions over distance, this paper puts forward asynchronous uses of video capture to replace or augment synchronous activities. This form of video capture, I argue, is expansive in two senses: it expands the spaces and material practices that become visible in the tutoring encounter, and the video capture performance puts students in a position to rehearse and put on display how they could demarcate the territory of their project, while enacting the narrative of their project in both its detailed specifics, and the relation of those specifics to the whole. Drawing on my own teaching and both informal and formulized discussions about new practices with colleagues, and a long history of exploring collaborative design practices and the use of video capture, here I draw on the diversity of two common tutoring scenarios to introduce and discuss the use of video capture, video viewing and feedback.

2. The Tutoring Encounter

In order to look at the tutoring encounter and the spaces for dialogue between students and teachers in relation to the ongoing project work, I use the notion of world-making. In project work, students develop a physical, visual, and conceptual relational world around themselves. It is this relational world they expose to their tutors and tutors support them in shaping one way or another through dialogue. In Schön's (1992:132) terms of a reflective conversation with materials of a design situation, whether virtually or on site, "the designer constructs and reconstructs the objects and relations with which he deals, determining "what is there" for purposes of design, thereby creating a "design world" within which he functions." In linguistics, contextual anchoring of self-in-space and time at any one moment puts the speaker at the intersection of the spatial and temporal *deixis* of a language, a ground zero that allows for the use of orienting language for those sharing context (Cairns 1991). That is, within a communicative event, the speaker is located at the center and refers to you and I, mine, yours and theirs. This one rather than that one. What happened before, where we are now, and what is coming next. It is in relation to this gestural, action world of design, the practice of designing, that I refer to "pointability" within the context.

Drawing on *ethnomethodology,* Goodwin (1994) provides a concrete set of criteria by which to analyse professional practice and understand what people are trained to see and do. By looking at the ***coding schemes*** people use to make sense of the world (what sticks out for them), what they *highlight and mark-up*, and how they *create, describe and use material representations*, we can understand the relevant perspectives of that practice.

> The shaping process creates the objects of knowledge that become the insignia of a profession's craft: the theories, artifact and bodies of expertise that are its special and distinctive domain of competence. Analysis of the methods used by members of a community to build and contest the events that structure their lifeworld contributes to the development of a practice-based theory of knowledge and action. (Goodwin 1994: 606)

Verbal and visual interactions using software such as PowerPoint allow for a combination of verbal interaction with close proximity to the imagery. While design work uses a wide variety of physical and digital materials depending upon type of design and the focus of any one class, introducing work-in-progress via presentation software such as PowerPoint is common in education and in design work in industry. Wakeford brings a Science and Technology Studies perspective to argue that ethnographic research presentations using PowerPoint are "'thick' social events" where it is precisely the combination of storytelling and showing that brings its value. At the same time, she argues that this type of software and event raises conflicts in masking the analytic work involved in selecting and sequencing these visuals, deeming analysis misleadingly invisible. "Crafting" a PowerPoint presentation affords certain styles of sharing in sequence and making available the work presented.

The sequential progression is not only for moving in one direction, as it also allows for returning to specific slides during discussion, creating a shared referential, pointability. Miro boards, a type of software whiteboard, provide a virtual space that can be populated without linear ordering. Rather, the space is much more similar to navigating a physical space with material located in different places. If we consider the "pointability" of material, where the student is able to point, both physically with a finger or cursor and verbally with the words that are used, to the area of interest, while speaking about the content. When logged into a shared Miro board space, participants can click onto the icon of the presenter, and "piggyback" on their view, allowing the presenter to dictate what the viewer sees within the space. Similarly, the presenter can click a function that brings all the participants in the space to their own location. These functionalities allow different types of practices to emerge for supporting the tutoring encounter.

While the pandemic has increased familiarity with the software formats and the emergence of valuable forms synchronous engagement online, Video platforms such as Teams and Zoom and collaborative spaces such as Miro boards are generally accessed while in a sitting position, navigating with mouse on a screen. They require that all material is either generated within the digital device or transferred to the device in order to "craft" the world narrative. Over the last year, a few colleagues and I have attempted to promote new ways of exploring the physical spaces we occupy before, during and after our distributed encounters. While using multiple cameras and turning the cameras away from our faces to open up our spaces has been a rather uphill battle in relation to synchronous activities, the use of video for asynchronous interaction has become more widespread.

2.2 One-shot video capture

In this paper I focus on the introduction and practice of a specific style of video capture that I have come to call one-shot video, with emphasis upon how the video is made, where it is made physically and what it shows physically, and the temporality of the video-making process. Much like the Danish Dogma 95 movie making movement that started as a specific purposeful format with strict rules for film production arising as a reaction to the overproduced state of movie making, I have been working over the years with a set of purposeful guidelines for video capture in the service of collaborative design activities and ethnographic work. Dogma 95’s set of rules stated that all filming must be done on location, without adding extra sounds, without time jumps but in the here and now using handheld cameras without giving credit to the director (Heckman 2020). Without such rigid rules, one-shot video was meant to be an easy-to-use style of video capture that uses a handheld camera to structure a summary of ongoing work by combining overview and detailed description, while pointing to relevant material. At the same time, the one-shot video making practice arises out of a specific set of concerns and interests in the authenticity of improvisational performance and the processes of collaborative enactment (See Clark 2014 for an instructional video). In May 2020 as the pandemic took hold, I introduced one-shot video as a “recipe” on the Distance Design Education blog for tutoring students with simple set of instructions. While the steps may appear straightforward recipe, to view one-shot video as an example of “expansive video capture” requires a more elaborate argument demonstrating its link to the learning and development of professional practice, the elevation of ordinary activities to a form of performance, and an interventionist approach to video in design.

Prepare: Choose your material, identify who will speak about what, and what path the camera should take.

- Have an outline script or core message
- Have something you will film as you talk about it
- Think about where the camera will go

Film in one take while describing what you are showing:

- Overview: Outline the topic and the purpose of the video
- The details: Talk through the specifics you wish to share. Give examples! Point to the material!
- Conclude: Repeat the most important point(s) to remember. Describe what happens next?
- As you film:
    - Hold the camera horizontally for best viewing
    - Get close to the content
    - Point at what you are talking about
    - Keep it rough
    - Dare to rehearse

Upload & send: Upload to your online learning system and share the link.

Figure 1. One-shot video recipe

When looking at the use of one-shot video in relation to student tutoring, there are three main components that may be separate in asynchronous interaction or combined in synchronous activities: the video capture activity of making a video, watching of the video, and feedback response to the video.

I. Individual student task and one teacher (Asynchronous): A student either is instructed or voluntarily sends a one-shot video to the tutor for feedback on their progress. The tutor watches the video and responds via email text, via a one-shot video, and/or during a synchronous discussion. For example, during the Spring term, students at the BFA and MFA levels work on their degree projects. Samuel spontaneously sends a video to Patricia the teacher asking for input on her user study strategy. The one-shot video shows a piece of paper with the sketched-out process visual with Samuel's finger pointing to the parts he describes. "At the first two interviews where I mapped out their urban gardening rituals…I created this tool for exploring the emotional journey of when they were contributing to their urban garden." He plans to return to the same people and re-engage them with his visualization of their activities. The teacher prints out the sketch, marks on it and creates a one-shot video asking if he considered using photos or sketches in return sending it back.

II. Team task and teaching team feedback (Asynchronous + asynchronous & synchronous): A project team creates a one-shot video ahead of the upcoming tutoring session with multiple tutors or teachers involved. Some give written feedback, the others wait until the tutoring moment. For instance, during a 10-week project involving 3 main tutors (two internal

teachers and one industry-based tutor), each student team is asked to send a one-shot video of their progress the day before each tutoring. All three teachers watch the video, but only two join the tutoring over Zoom. The student team is working together in a shared space. In the video, there is one main narrator, with the three other members describing one part of the work. Sonia starts the video showing her own face, saying hello to the tutors, and giving a short overview about their status. She then walks to each person on her team prompting that person to show and tell what they are working on at present. The video moves close to Vilma's computer screen showing the details of a 3D-model as she explains. Then over to Mathias, where he describes two cardboard prototypes, then to Hamed on a table with a city map, with cardboard and paper cut-outs. After each person presents, Sonia moves close to the whiteboard where they have done a brain-dump and grouping of the potential areas of focus. After watching the video, the teacher not joining the tutoring gives written feedback via e-mail on both the content of the project, and the one-shot video making process, and sends it to the student team and tutoring team.

The concept of performance brings focus to both the past and the future in the present, and offers a strong frame for re-assessing the past in relation to the future. This can be emphasized through the perspectives of Richard Schechner and Victor Turner. Schechner (1985:36) suggests that performance is "restored behaviour or twice-behaved behaviour." People draw upon their repertoire of behaviour as they enact a new version.

> "Restored behavior offers to both individuals and groups the chance to re-become what they once were—or even, and most often, to re-become what they never were but wish to have been or wish to become. (Schechner 1985:38)

There is an almost magical quality to a live performance. Once it starts, there are generally no timeouts. It unfolds unpredictably. It is bound by the social constraint that to break the situation has social consequences. This tension, or uncertainty, of an open frame gives cause to an original quality to performance.

> "…The rules may 'frame' the performance, but the 'flow' of action and interaction within that frame may conduce to hitherto unprecedented insights and even generate new symbols and meanings, which may be incorporated into subsequent performances" (Turner 1982:79)

Turner suggests that performance concludes a process. It is a type of curating mechanism for what took place previously in the process. The interaction between the performer(s) and the audience bring previous speculations to conclusion. "*To perform is…to bring something about, to consummate something…"(*Victor Turner 1982).

The video performance can be seen as a demarcation of the current state of the design world narrative. Students are coached to give specific detailed descriptions of selected material to exemplify their statements and connect to the whole. The moment the one-shot video is completed, unless the authors wish to re-shoot, the video is ready for sharing. The opportunity for editing falls before the video filming begins, based on how the room and materials may be set-up and/or identified in preparation for a live performance.

3. Expanding world making practices

Donald Schön (1983, 1987) focused on the difficulties of preparing students for the realities of professional practice. It was his conviction that successful professionals required, and rely upon, a kind of knowing ("reflection-in-action", Schön 1983, 1987) that most Western institutional educational settings were ill-prepared to provide their students. Reflection-in-action is a kind of bricolage. It is the designer's (or other professionals') skillful conversation with the unique problematic situations that frequently arise in practice; such problems are characterized by "uncertainty, uniqueness and value conflict" (1987:6). To be equipped to act within such situations, designers require an artfulness of practice that enable them not just to solve problems, but the ability to frame messy, real world, indeterminate situations as problematic ones, to improvise, to take uncertain actions toward their resolution, and to evaluate their own progress as they proceed. Schön frames this as a dilemma for the professional schools of 'rigour or relevance': institutions may choose to hold on to a traditional, formalizable, (academically) rigorous curriculum, but must do so at the expense of cultivating the skills on which able practitioners necessarily depend (1987:312-313). These are skills that are not taught, but 'coached' out of students' own experience of engaging in murky situations *before they know how to remedy them.*

From this perspective, a goal of design education is to provide occasions for students to rely upon and develop the improvisational practices of reflection-in-action, as performances available for teacher coaching. This is complicated by the trends of digitization, the use of sequencing software such as PowerPoint as a main communicative tool, and the overall favouring of crafted output rather than improvisational material explorations. As one colleague commented after one year of pandemic education, while his students are improving their presentation skills, he sees that they are neglecting the tangible design work and rather focusing on crafting design presentations. It is here that exploring expanded forms of engagement in material spaces and explorations in the multiple uses of video can play a role.

3.2 Video in research and design

Video has long been used within research and design (Blomberg, Giacomi, Mosher, Swenton-Wall 1993, Brun-Cottan & Wall 1995, Buur & Soendergaard 2000, Suchman & Trigg 1991, Ylirisku & Buur 2007). Drawing from the tradition of conversation analysis, interaction analysis demonstrates the value of video recordings to capture "naturally occurring interaction" among people, and people with artefacts in the context of use (Suchman & Trigg 1991, Jordan & Henderson 1995). Using video has predominately been hailed for the ability to capture what takes place in the wild of everyday life for multiple viewings and analysis (Jordan & Henderson 1995). In this tradition, generating long periods of video recording provides a data set large enough to find valuable sections for detailed analysis. The majority of the analytic work takes place after the exemplary sections have been identified and a detailed transcript has been prepared.

The value of video as representation often relies upon the up-close and intimate sense of being somewhere else that can be used to provoke an audience experience. Video in the use of re-presenting users has two main consequences: it brings the user into the design process, albeit through proxy of the video medium, and it establishes authority of researcher as having captured the authentic truth of the people out there in the wild (Nafus & Anderson 2006). In this version of video capture, the researcher is often edited out of the footage for effect. In contrast, *participant intervention* refers to the active role of the researcher as a "participant in the co-construction of meaning" (Karasti 2001:81). The researcher does not necessarily suppress their presence, but rather celebrates their view as one of many within a group.

Buur and Soendergaard's (2000) video card game is an example of using video to engage participants in design activity. This was part of a movement of turning selected video output into a form of design material (Buur, Binder & Brandt 2000). Moving "beyond video as hard data" to a playful design material that could allow for access of anyone sitting around the table. What did you see? It was precisely the format of inconclusiveness of the material that Buur et al. sought to employ as a prompt for engagement.

- Video to represent the user (Brun-Cottan & Wall 1995, Suchman & Trigg 1991)
- Video fragments to engage (Buur & Soendergaard 2000)
- Video as design material (Buur, Binder & Brandt 2000)
- Video as fieldnotes (Blomberg, Giacomi, Mosher, Swenton-Wall 1993)
- Video recorded design scenarios (Halse, Brandt, Clark & Binder 2010)
- Video capture as a design tool (Ylirisku & Buur 2007)

Figure 2. Uses of video in research and design

In collaborative design and participatory design prototyping activities, Mackay and Rayard (1999) and later Ylirisku & Buur (2007) demonstrate how the act of taking video shapes the collaborative design activities. It is used purposefully and tactically as a tool within the facilitation of ongoing activities, often to capture the flow of action of design concepts. It can therefore move the design process forward and trigger reflection activities for designers to make concrete the functions and use characteristics of the design. However, there is something different between using video as a playful intervention tool in design activities, to using it as an intervention tool in ongoing activities that do not fall under the playful umbrella of collaborative design. It is this link to professional practice that nurturing a new form of video capture practice seeks to nurture.

4. Conclusions

This paper makes the case that the simple tools that we adopt and the practices we develop can constrain and expand the collaborative potential of design world making practices. Project-based design educations provide opportunities for students and tutors to explore the messiness of everyday life even through our own practices. Virtual and physical studio spaces are sites of rich sociomaterial interaction. It is increasingly important for design students to learn how to engage in the complexity of dynamic everyday life through performing in that world, tackling the messy challenges of contemporary society. The current pandemic has prompted extreme changes in how daily life is organized, bringing emphasis to the need for and opportunities to rethink and explore the nuances of sociomaterial interaction. The tutoring encounter is one example of how students and teachers can codevelop new practices.

The use of one-shot video as a tool in the tutoring encounter was shown to relocate the student presentation of their current work from the synchronous activity in the presence of one or more tutors to a two-step or three-step process of student video creation and tutor viewing and response. Rather than the students expending time and effort in carefully crafting a world narrative about their work through selecting materials and sequencing the material for synchronous engagement with tutors, a hand-held camera can be used to structure a collaborative material performance curating shared reference, through moving through different locations and temporalities in the workspace, defining through selecting, highlighting, and representing aspects of available resources. The video capture format was shown to support students grounding their world making in the zero position of reference, a practice of locating self in space and time. Introducing the constraints of an expansive video capture, video made in a single sequence rather than merging or editing, occasions an open performance frame that suppresses negotiation of what will be said, introducing pressure to fill the frame, and to keep the flow moving prompting designers to demarcate the current state of their world-in-the-making. This practice re-orients video capture and production from a time-consuming crafting practice, to an interventionist tool for provoking world making performances. This use of video is a radical departure from the more common uses of video in design, demonstrating possibility for exploration and preparedness for professional practice.

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Acknowledgements: A special thank you to all my colleagues and students for the sharing your challenges and optimism through these unique times.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Gamified e-Learning approached through Emotional Design in the Post-Covid-19 era.

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Abstract | In response to the Covid-19 crisis, this article proposes a theoretical framework that combines e-learning, emotional design, and gamification on reviewing the three areas to meet the new need for a changed paradigm in education and e-learning. This research concludes that education needs to explore a new paradigm of gamified e-Learning. For this, the authors propose an education research model that provides an overview of three components impacting future learning. These are (1) the new importance of distance-education as a knowledge production platform, (2) the influence of emotional design on positive learner experiences, and (3) the role of gamified engagement for sustained learning motivations. This theoretical framework provides directions for education leaders on how schools should adapt to the 'new normal' of the Covid-19 era.

KEYWORDS | GAMIFIED E-LEARNING, GAMIFICATION, EMOTIONAL DESIGN, LEARNER ENGAGEMENT

1. Introduction

As the world is struggling with the effects of the Covid-19 crisis, many aspects of life as we knew it are questioned for their practicability. Among many other fields, Covid-19 has fundamentally affected education and challenges us to rethink, explore, and innovate how we will learn in the future. Thus, this paper answers the call for a 'new normal' concerning education, and that there is a need for novel learning formats. E-Learning is one of the disruptive new forms of teaching that brings many opportunities but also faces many challenges. On the positive side, e-learning has allowed us to keep schools and universities running during the Covid-19 crisis by shifting face-to-face classes to online meetings and increasing overall participation in Learning Management Systems (LMS). On the negative side, however, e-Learning still has to solve the problems of how to be engaging through a screen, how to facilitate social learning processes when it is hard for individuals to maintain motivation in isolation, or how to support studio classes and experiential learning that rely on physical & embodied interactions and experiences. Making e-Learning become the 'new normal' requires us to improve our understanding of its full potential. Yet, to do so there is a need for proposing targeted theoretical frameworks and new design methodologies.

To have a clearer view of the current state and future perspectives of e-Learning we propose a paradigmatic understanding of how education has changed throughout history. In the various generations of educational technologies, the way knowledge is conveyed has transformed from pushing teacher-defined content from a single source (e.g. the classroom) to having the learner actively pull learner-centred content from diverse sources (online and offline).

The Education 1.0 paradigm was about 'downloading information.' Similar to the early Web 1.0, which was the first evolution stage of the internet, the Education 1.0 model can be defined as centred around a top-down approach to delivering content. Keats et al. provide a comparison to Web 1.0: "Education 1.0 is, like the first generation of the Web, a largely one-way process. Students go to [school] to get education from [teachers], who supply them with information […]. Students are largely consumers of information resources that are delivered to them, and […] activities are for the most part undertaken in isolation or isolated local groups. Rarely do the results of those activities contribute back to the information resources that students consume in carrying them out" (Keats & Schmidt, 2007)

Education 2.0, in contrast, has highlighted 'open access.' As Web 2.0 is known as Participatory- or Social Web that emphasizes user-generated content, Education 2.0 is about new interactions among people and represents new ways of technology-enabled shared knowledge. It supports open discussions that take place directly and rely on peer guidance and mentoring. Similar to Web 2.0, Education 2.0 allowed more interactions among students, teachers, and learning content. With the use of cooperative and global learning, Zoom video conferencing, collaborative wikis, and blogs, education has shifted to a more connected, innovative Education 2.0.

Table 1. Education Paradigms

	EDUCATION 1.0	EDUCATION 2.0	EDUCATION 3.0	EDUCATION 4.0
CHARACTERISTICS	Downloading information	Open access to information	Personal knowledge production	Innovation production
COMMUNICATION	Static / teacher to student	Dynamic / teacher & student to student	Dynamic / teacher & student to student & teacher	Real-time / everybody to everybody
TEACHER'S ROLE	Source of knowledge	Guide to knowledge	Mentor to knowledge production	Collaborator for knowledge production
STUDENT'S ROLE	Passive receiver of knowledge	Active collector of knowledge	Active owner of knowledge	Responsible author of knowledge
E-LEARNING	Almost none	Blended	Mostly online	Ubiquitous
LEARNING OUTCOMES	Grades	Academic knowledge	Practical knowledge	Life competencies

Building on this, Education 3.0 was based on the premise that content is openly and readily accessible. It has expanded the idea of open access to include the new focus of 'personal knowledge production.' With a focus on structural changes, Education 3.0 pursues the breakdown of boundaries between teachers and students, in which the difference between the teacher and student roles, as well as space and time distinctions, become blurred. Education 3.0 has emphasized self-directed, interest-based learning where education is motivated by problem-solving, innovation, and creativity.

We have now arrived at the Education 4.0 paradigm, which is about 'innovation production' and in which a student grows into a dynamic knowledge and innovation worker who is a creative, imaginative, and inventive person working with anybody, anytime, and anywhere. In Education 4.0, knowledge is produced in practice by individual and team-driven activities. Communication technology is always evolving with learners as a source of development and creativity, while teaching is achieved in all stages of living, studying, and working by real-time feedback loops that are continuous and ubiquitous. There are no predefined teacher positions anymore as everybody, everywhere becomes an innovation production source. Accordingly, schools are situated in the globally networked human mind, innovatively supplementing and replacing classrooms. Table 1 offers an overview of how Education 4.0 compares to its predecessors.

Despite all the enthusiasm for Education 4.0's innovation, it struggles from a lack of social learning experiences, as individuals sitting in front of a screen will find it hard to maintain motivation in isolation. Therefore, we focus our research on ways to overcome this lack of engagement and motivation by learning from research insights in the field of gamification. The purpose of using gamification design in e-Learning environments is to extract game

elements that make learning efficient and fun and adapt them to the e-Learning process. In this way, learners can acquire knowledge easily and joyfully. Kapp defined gamification in the learning context as the use of game mechanisms, game aesthetics, and game thinking to attract learners, stimulate action, enhance learning, and solve problems (Kapp, 2012). Although gamification has brought some encouraging results, design approaches have brought significant risks, According to Browne and Urh (Browne et al., 2014; Urh et al., 2015) nearly 80% of all gamified applications would not achieve their targets due to poor design. We found that the main reason for these failures is that gamification as a new attempt in the e-Learning environment is still at the early exploration phase, most of the related research and designs over-emphasised the simple stacking of game elements and mechanisms while lacking a targeted theoretical framework and systematic design methods.

In this regard, the present study aims to firstly reveal the potential positive and negative impact of existing gamification practices on e-Learning, and on this basis, to propose a theoretical design framework for solving gamification design flaws for the Post-COVID-19 era. Our main research method involves a literature review and a subsequent theoretical modelling of gamified e-Learning.

2. The Impact of Gamification for e-Learning

In the past decade, gamification has received extensive attention in e-Learning. People are increasingly interested in its potential as a motivational learning strategy and the improvement of the learning experience.

2.1 Positive impact of gamification

Existing literature shows that gamification has advantages in improving learners' emotional, cognitive, and behavioural output.

The emotional benefits of gamification in e-Learning are mainly reflected in the learners' motivation, satisfaction, enjoyment, and even flow experience. Buckley (Buckley & Doyle, 2017) reported that the learners' extrinsic motivations can be successfully resolved by using game principles as external incentives or rewards. Adukaite et al. even contend that it can increase both the intrinsic and extrinsic motivation thereby inspiring learners to experience gamified learning (Adukaite et al., 2017). Scholars also have confirmed that applying gamification elements to training systems had a positive impact on the user's satisfaction. (Alcivar & Abad, 2016). In addition, gamification has provided a positive contribution to the enjoyment and flow experience (Zichermann & Cunningham, 2011) of learners. Research has shown that learners enjoyed the gamified learning context more than other training methods (Baxter et al., 2016).

Furthermore, previous studies showed that the behavioural benefits of gamification were reflected in the impact on engagement, interaction, and social connection. The results of

some empirical research revealed that the use of gamification elements is positively correlated with learning engagement (Çakıroğlu et al., 2017; Ding et al., 2017). Some scholars also proved that gamification design should rely to a large extent on the interaction support and social connection between learners to promote changes in learning behaviour (Abou El-Seoud et al., 2014; Chang & Wei, 2016).

Finally, cognitive achievements and learning outcomes are the most explicit purpose of using gamification in e-Learning, and some studies have also confirmed its positive benefits. Doyle (Doyle et al., 2014) found that gamified learning intervention produced a positive impact on learning achievements. This is similar to the results of another empirical study which showed that gamification can improve participants' academic performance and results. In addition, gamification can reinforce critical thinking and probe learners to examine problems from diverse perspectives (Paraskeva et al., 2010; Tan & Hew, 2016).

2.2 Negative issues of gamification

We can see that the benefits and potential for improving education in e-Learning have been praised in many studies. Nevertheless, this is still a controversial educational issue and has increasingly received much criticism in that gamification design for e-learning may not always be beneficial.

Some reports pointed out that gamification could not successfully increase learners' emotional benefits such as the need for satisfaction and intrinsic motivation, compared to those in a non-gamified learning environment (Hanus & Fox, 2015; Kyewski & Krämer, 2018; Mekler et al., 2017).

Under the theme of behaviour, gamification has obvious negative effects on self-engagement (Fitz-Walter et al., 2017), community support factors, and peer collaboration (Phung, 2020).

Other scholars have also proved the negative impact of gamification on cognitive learning achievement. They pointed out that not all learners can benefit from gamification and achieve the desired learning outcome, and even learners who engaged in the gamification context had lower test performances (Hanus & Fox, 2015).

3. Proposed Design Framework

From the previous review we found that although most researchers have proved the potential benefits of gamification in e-Learning, in many cases, gamification has not achieved the expected learning results. Therefore, this study aims to propose a new theoretical framework for combining e-learning design elements with Werbach's gamification model and Norman's emotional design theory to help guide the implementation of gamification design in e-learning.

3.1 Design Action's Three Elements in the e-Learning Context

The design action should at all times include three elements: person, process, and place(Chang, 2020). When designing for e-Learning, these elements would translate to learners, learning engagement, and e-Learning environment. The relationship between them is highly interdependent. The interaction among these three elements produces the e-Learning experience. We can regard these three elements as a three-layer relationship from the inside out. The learner in the dominant position is at the core. In a learner-centred context, the needs and learning goals of the learner will be the primary concern. Learners generally have stable characteristics, such as their identities, physical and sensory requirements, motivation, experience, and personal preferences (Beetham, 2007). Engagement is regarded as a direct pathway to learning (Lamborn et al., 1992; Skinner & Pitzer, 2012) and is interpreted as the psychological input and effort of learners to learn or acquire knowledge and skills. As an e-Learning learner, focusing on engagement is the most important key to success. The e-Learning environment is an external condition for learners to participate in the learning process, and it can support (or limit) learners' interaction. The e-Learning environment generally includes tools, resources, and artificial affordances in virtual and physical learning environments (Beetham, 2007).

3.2 Gamification Model

Kevin Werbach (Werbach & Hunter, 2015) proposed the top-down pyramid structure Dynamics, Mechanics, and Components (DMC) gamification model, which divides the gamification elements into three structural levels according to the role of each element in the gamification system. The dynamics layer determines whether the gamification can meet the user's internal needs and stimulate users to produce targeted behaviours. The mechanism layer is the process of advancing the game and user participation and is the context of the game. The Game Components layer is the external manifestation of Dynamics and Mechanics. Widely used game elements in gamification like PBL (points-badges-level) belong to this level. The different layers' gamification design for e-Learning should be based on e-learning design action's three-elements and combine them organically.

3.3 Emotional Design Theory Model

Donald Norman defined emotion as a special form of a person's reflection of objective reality, which is the experience of a person's attitude towards whether objective things meet human needs. Emotional design refers to the integration of emotional elements into the design process to meet the physical and psychological needs of users (Norman, 2004). Based on this, Donald Norman proposed a three-level emotional design model: visceral design, behavioural design, and reflective design. The visceral design refers to the immediate emotional effect, that is, the most intuitive and instinctive first feeling brought by a design, which is the starting point of emotional processing and aimed at the shape of artefacts to meet the needs of the senses. Behaviour level design is the play of design in the entire

behaviour, including the emotions generated during the entire use and interaction process, and focuses on product functions and performance. The level of reflection refers to the continuous thinking brought by the design to meet the higher level of human emotional needs. It is a non-intuitive emotional design and is affected by the other two levels. Emotional design thinking provides strategic guidance for product and system design, and it also applies to the gamification design of e-learning.

3.4 Proposed Framework

Therefore, this study combines the above three aspects to propose a new theoretical framework of gamification design for e-learning, as seen in Figure 1.

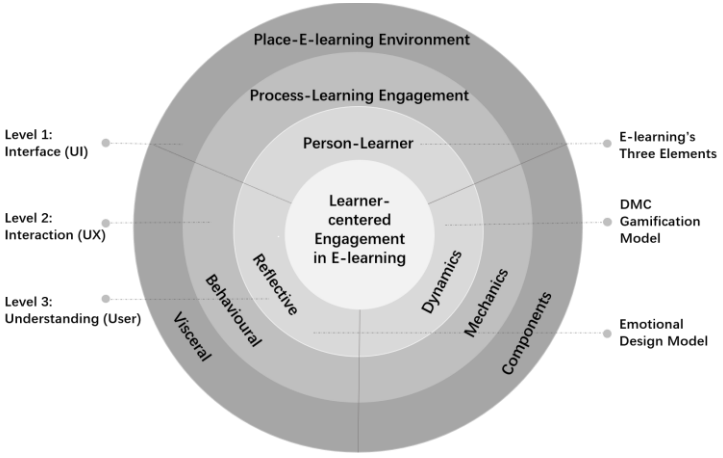

Figure 1. Theoretical framework of gamified e-Learning based on emotional design

- Level 1: Interface (UI). The first emotional design level emphasizes the game components, which refer to the learners' need for an intuitive user experience in the e-Learning environment. A clear hierarchical structure, simplified interface, real and vivid visual presentations, and other intuitive requirements are the concerns of this layer.
- Level 2: Interaction (UX). The second emotional design level aims at the construction of interaction between the mechanics of learning and gamification on applying scientific-educational methods and appropriate learning contents for design so as to help learners achieve their expected learning outcomes.
- Level 3: Understanding (User). The third emotional design level focuses on the user's benefits such as the learner's emotions, needs and goals. The gamification design should pursue a flow-state of gamified e-Learning to realize the

satisfaction of learner-centred needs and the stimulation of learning through intrinsic motivation.

5. Discussion and Conclusion

This article reviewed the research and practice of gamified e-Learning of the past ten years and discovered the possible benefits and barriers of gamification for education. On this basis, we put forward a guiding theoretical framework from a design perspective. This is a gamified three-level framework that takes into account the core needs of learners and the interaction with the e-Learning environment to obtain a good learning experience. This education framework provides an overview of the three components impacting future learning. These are (1) the new importance of distance-education as a knowledge production platform, (2) the influence of emotional design on positive learner experiences, and (3) the role of gamified engagement for sustained learning motivations. This framework contributes to the theoretical guidance for education and education leaders on how schools can plan e-learning and how they should adapt to the 'new normal' of the Covid-19 era.

As this study only covers a small selection of reviewed papers on gamified e-Learning of the past decade, further theoretical and observational experiments on the needs and engagement of e-Learning learners as well as the gamification design methods and processes for e-Learning are needed for future studies. The future research direction will be about how to support physical interactions over a distance: Face-to-face education in studio classes has the advantage of experiential and behavioural learning that teaches practical skills in natural rather than in GUI-mediated settings. Future work will have to answer the question of how to compensate for the lack of physical feedback and interactions in e-Learning through design methods.

Secondly, another research direction will be to understand further unintended consequences of Gamification. In our preliminary review, we found issues such as a lack of satisfaction and intrinsic motivation, negative effects on self-engagement, and an undesirable impact on cognitive learning achievement. However, the proposed framework needs to consider more topics regarding the ethics of gamification design. For example, we have to ask how to solve more advanced negative issues such as addictive behaviours, exploitative practices, and undesirable physical impairments (e.g., high sensory or cognitive load) and how to prevent them when applied to e-learning. The focus should not just be on the external reward elements of gamification but rather on the internal motivations that make the learning experience itself become the reward.

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Acknowledgements: This work was supported by the Ministry of Education of the Republic of Korea and the National Research Foundation of Korea (NRF-2019S1A5C2A04083375).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Healthcare innovation during the pandemic time: digital technologies to enhance clinic 4.0

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Abstract | The ongoing Covid emergency has highlighted some criticism in the Italian healthcare system, evident in the differences in access to care and in the difficulty of managing hospitals, overloaded by the number of patients: it is necessary to propose alternative models to overcome these problems.
The enhancement of outpatient clinics can contribute to a process of de-hospitalization of the system, making the infrastructure more sustainable, inclusive, democratic and widespread and adding value in a new normalcy.
The paper proposes a new approach for a vision of a decentralized and distributed healthcare, based on blockchain technology; it explores the potential of a new ambulatory format, where 3D printing and digital technologies contribute to the delivery of more targeted services; it shows a device designed following the hypothetical guidelines of an ambulatory, to describe its operational model. It seeks to highlight what the role of design might be in unstable contexts.

KEYWORDS | BLOCKCHAIN, DIGITAL FABRICATION, EXTENDED REALITY, DESIGN FOR TRANSITIONS, HEALTHCARE

1. Introduction

The pandemic has demonstrated the urgent need to rethink and modify our lifestyles, our development and consumption models, to find a balance with the world we inhabit: new approaches and new management methodologies, which deal with the creation of value and on with the use of digital technologies, are necessary to activate greater levels of coordination between the various stakeholders and to promote the development of services in the medium and long term.
The project presented in this contribution is part of a research still in progress. The expected developments will lead to the definition of management guidelines and to the formalization of a mvp of the product described later, to create an integrated model of socio-digital innovation.
The aim is to nurture critical thinking through the conceptualization and visualization of systemic and complex design hypotheses, which highlight the urgency of changes and transitions, and can contribute to the development of new paradigms of normality; to demonstrate that there is the possibility of hybridizing the current health system with alternative models of organization and management of welfare. In this way, it will be possible to promote inclusive and democratic processes, as well as to ensure the creation of value chains parallel to the traditional ones.
Design, in this scenario, can certainly act at different levels, take on various roles with different approaches, methodologies and tools: in this contribution we want to highlight how it could be a catalyst for processes of transition to new paradigms, able to cope with growing, distributed, widespread and global problems; how it could take on the traits of facilitator of processes of dissemination and democratization of certain types of knowledge. Similarly, certain technologies can have a disruptive social impact and create new relationships between the actors involved. The integration of blockchain, extended realities and digital fabrication in the system can help in generating solutions to emerging issues.

2. Motivations and goals

There are several reasons that led to carry out an applied research activity in this area: the first, as already stated, is represented by the ongoing emergency and the consequences that it is having in the health sector with the inevitable and contextual emergence of new challenges. Facing common challenges and identifying opportunities for improvement leads to define a sort of transversal platform on which to operate, allowing the valuable sharing of transferable skills from different disciplines and actors, to enhance the quality of life in all its facets.
The aim was therefore to reflect and devise a possible alternative model of healthcare, which can accompany the traditional ones, in order to make local structures more effective, encouraging a process of de-hospitalization and capillarity of personal care services. These services could then become more targeted and customized, generating benefits for both the

patients and the doctors, who will have the opportunity to build a more human and, therefore, more effective relationship.
Another motivation, closely related to what has just been stated, lies in the awareness that greater integration of certain technologies in the reference sector can foster systemic innovation, improving the current healthcare system and, consequently, the well-being of people.
Finally, it is believed that design should be able to support and to help processes of transition to alternative models able to cope with new and growing distributed, widespread and global problems (Irwin, 2018).
Furthermore, we want to demonstrate, through the project subsequently described, how this should be possible, applying methods and tools belonging to different areas of the discipline.

3. Context

The Covid19 pandemic is an event that has undermined our health and changed our daily lives, our work, and the way we interact with the outside world. It is also contributing to affect the ability to maintain life standards, causing important issues for the economy and, consequently, for social well-being.

3.1 Italian healthcare system

Since 2008, the Italian National Health System has undergone a progressive evolution and transformation towards a coordinated regional system based on collaboration and centralized planning, which limits the repetitiveness of delivery structures and certifies skills and needs; in this way it is possible to centralize management, to process functions and to standardize certain clinical and care practices (Babusci, Giachi, 2018).
Current legislation has allowed for greater regional self-sufficiency, in part by reducing the number of ASLs/AOs. On the other hand, the differentiation of business objectives across the territory has strengthened a systemic vision and unified planning (Giorgi, Pavan, 2018).
These factors favoured the adoption of co-planning methods and collaboration between actors, reducing the competition between public and private providers (Sarchi, 2016).
The Lombard model is an example of the effects of the legislation in place, which seeks to integrate the health system to the social welfare system, because they pertain to a single category of undifferentiated need (Sarchi, 2016).
In the Lombard case, the integration between hospital and territory is implemented in the adoption of care pathways based on the interconnected action of various professionals, with roles defined by their competencies (Cajazzo, Longo, 2018).
Institutional actors have the task of constituting a supply of services focused on the needs of the patient. The role, therefore, of the Lombardy Region, carried out through the Agencies

for the Protection of Health (ATS in Italian), is to plan and manage the system constituted by the different actors (Cattaneo, 2018).
On the guidelines provided by these institutions, the Presidi Socio-Sanitari Territoriali (PreSST) were established, which offer medium and low health and social-health services, both at outpatient clinics and at patients' homes; within these centres, it is possible to activate periods of hospitalization for simple inpatient stays, with little pain and little need for assistance.
Individual, appropriate and continuous care, creation of connections between hospital and territory, in order to reduce hospitalizations, and contribution to the economic sustainability of the welfare system are among the objectives of these places. They are configured as spaces of integration of knowledge and as models of organization and as flexible tools, able to connect the different territorial services.
They are effective in overcoming a model of care based on individual services integrated by the patient; in shifting the focus from the disease to the human being and his/her peculiar problems and disorders; in providing systemic services of care, which are fundamental especially in some cases; in building a network that enhances each professional operator (Curry, Ham, 2019).
The ideas presented in this contribution arise from the recognition of a potential effectiveness of models such as the one of Lombardy, and from the conviction that the introduction and integration, within them, of different technologies and knowledge, can contribute to a faster achievement of the objectives highlighted, also aware of the consequences that a health emergency may cause.

3.2 Enabling technologies and case studies

The role of digital technologies in nurturing innovation is undoubtedly transversal to all areas: those discussed in this paper, mediated by a design-led planning process, have an important and disruptive value in defining scenarios with a strong social impact, guaranteeing, at the system level, an unprecedented, but much sought-after fluidity in processes, especially in the health sector.
If applied and introduced more pervasively in the relevant sector, they may be able to change the traits of the current healthcare system and to create a range of opportunities and solutions in response to the critical issues highlighted. More specifically, the technologies are blockchain, digital fabrication and extended reality.
The blockchain can be defined as an alternative to the architectural infrastructure of the traditional web and constitutes the ecosystem of several applications, including cryptocurrencies, such as, for example, Bitcoin.
It has three main characteristics: the decentralization of the system, the security and immutability of the operations carried out within it and finally their transparency.
The first is guaranteed by the fact that each user is, at the same time, server and client of the network, since there is no central server, and, in addition to being able to consult them, has a copy of the registers containing all the data; the security and immutability of the

operations are instead allowed by a double-key encryption system, by a hashing system that transforms each type of data into an alphanumeric string and by a validation system that has the task of confirming and writing each new transaction in the next block of the chain; finally, transparency is guaranteed by the structure of the blockchain itself, articulated in blocks that contain information about itself and the previous block, viewable by every user of the network and potentially unalterable, due to the fact that the modification of a single one would make the whole subsequent chain invalid (Razzaq, 2019).
A key application is the smart contract, a digital contract based on an algorithm that certifies its execution, which automates bureaucratic processes, eliminating the need for a guarantor (Attico, 2018).
Most blockchain applications pertain to decentralized finance (DeFi): these include stablecoins, cryptocurrencies that have a unit value relative to the dollar; currency exchange platforms; lending and credit platforms; lottery systems; payment systems; risk insurance; and derivative instruments.
The blockchain infrastructure enables the creation of entities or groups that recognize value in something other than money: D.A.O.'s (decentralized autonomous organization) are organizations that define themselves, by their very nature, as autonomous with respect to traditional bureaucratic processes, and eradicate the concept of pyramidal organization, de-centralizing the power of governance and distributing responsibility to all members.
They make it possible for users to interact in internal activities and decisions through an e-voting system that, operating on a web 3.0 architecture, overcomes the risk of low security of operations carried out on similar 2.0 platforms.
The D.A.O. system is articulated on the delivery of digital tokens, not fungible, which are obtained by actively participating in the life and management of the organization and, proportionally to merit, give decision-making power to each user (Sims, 2019).
The difference between cryptocurrencies or coins, used in DeFi, and tokens, used in D.A.O., can be found in the type of applications accessible through the two tools: the former enable the user to participate in economic and financial dynamics, while the latter in social and organizational dynamics, since the assets given value within the reference blockchain are different (Sims, 2019).
Below, we are going to present a case study of blockchain application for the medical sector, to facilitate the understanding of its potential: Medicalchain, developed by Electronic Health Record, which aims to create electronic clinical records.
It enables users to give access to their data to doctors and other professionals, recording the interactions that occur with this data on the chain.
Medicalchain is working on developing two applications that can be accessed from the platform; a telemedicine service that connects patient and doctor, for a small fee, and a health data marketplace, in which users can negotiate commercial terms for the use of their data by third parties.
From the patient's perspective, the time taken for a consultation is massively reduced because there is no need to be seen in person by the doctor. By providing a telemedicine

service, Medicalchain is able to improve the patient experience by facilitating consultations from a visual perspective and by making the relationship with the physician more effective. In addition, the telemedicine service allows users to select the specific date and time for the visit; furthermore, they will be able to choose the doctor who will conduct the consultation, allowing them to establish a personal relationship with them, no matter where they are both located.

There are several benefits brought by the service for the doctor as well, such as, for example, the ability to conduct the visits from wherever they are; Medicalchain will also provide doctors with access to patients' medical records during the visits.

This case study is useful to show the potential of blockchain applications in the medical sector, capable of securing patient data, deepening the relationship between doctor and patients, and empowering them to not be passive about the care they receive.

Shifting our attention to the other technologies of reference - 3D printing and extended reality - they too, in their peculiar areas of reference, can bring a number of improvements and open up the creation of new dynamics, processes and relationships capable of producing solutions targeted to the needs of different users.

An interesting case study involving the 3D printing sector is represented by the Easy project by Isinnova, a company based in Brescia, in northern Italy.

During the first wave of the pandemic, the company was contacted by a former primary physician who submitted the idea of creating a 3D printed element to repurpose a snorkeling mask already on the market into a C-PAP, for sub-intensive care.

The company, together with the doctor in charge, got in touch with Decathlon, manufacturer and distributor of the Easybreath snorkelling mask, who immediately provided the CAD drawings; the product was then disassembled and studied to understand the shape of the new component, a fitting called Charlotte, immediately tested at the Chiari Hospital, with excellent results, although it did not receive any certification.

The company Isinnova therefore decided to distribute the digital model of the component free of charge so that any public or private structure equipped with 3D printers could produce the component and distribute it to those who needed it.

This case study is indicative of the opportunities offered by 3D printing and digital fabrication technologies to create solutions that are easily accessible and distributable in a short period of time.

The last case study highlighted, regarding extended reality technologies, is SIMNOVA, an interdepartmental centre of the Medical University of Eastern Piedmont, which deals with the provision of training for medical professionals.

The structure, as well as being equipped with a series of physical elements, such as mannequins, deputies to the simulation of physiological aspects of the human being, has inside spaces set up with a series of hardware, and managed by software, where learners, in small groups, can participate in various training sessions, aimed at obtaining and strengthening hard and soft skills.

The room used for training, called simulation room, is a white room on whose walls are projected images or videos at 360°, where there are physical elements and characterizing

tools, with which users interact in order to complete different tasks. The practice carried out in this room is observed by the instructors in the control room, through a system of video cameras. Instructors can act on the simulation by introducing new variables. At last, determined by the practice, students and instructors find again in the room of debriefing, where it comes to discuss what just happened, in a way to favour the processes of learning. This final case study shows the possibility to set up a more immersive space, where different activities can take place in order to improve capabilities or to address complex issue regarding behaviours.

4. Project

The project here discussed, which aims to be a system in which an articulated service component and a "multilevel" component of artefacts integrate and interact, can be divided into two parts: the first consists in the conceptualization of a local health system that integrates and implements the one currently present on the Italian territory, starting from the model of PreSST; while the second consists in the development and implementation of a medical device produced with 3D printing technology. The realized product is functional to make evident the potentialities of the hypothesized integrated model.

4.1 Clinic 4.0

The outpatient clinic will be located within urban areas (neighbourhoods), in order to relieve hospital facilities on an operational and bureaucratic level.
The blockchain infrastructure has to be integrated to decentralize and, therefore, to secure the data of different users. The activation of this ecosystem will depend on the collaboration with the current public health system, which is required to ensure the decentralized and closed structure, to be sure that the data will not be accessible to anyone. It will then be certified entities that allow user access to the network.
The D.A.O. system will instead regulate the voluntary relationship of the users with the clinic, who will be able to contribute to the activities of the same, obtaining tokens that can be used to propose new projects or management changes.
The clinic will be managed by doctors belonging to the public health circuit, in collaboration with health personnel and a network of volunteers, established among the users of the clinic. These, according to their skills, will perform different tasks such as, for example, contribute to the management of activities and projects of digital fabrication, take care of patients or spaces.
Through the volunteer activities carried out and according to the level of skills required, each user will accrue tokens that will enable him to become part of the D.A.O. dynamics.
The users of the clinic will interface with the structure and the services provided through an application that will also serve as their medical record and can be linked to that of the public health system. Access to the app will be through a SPID account, which will also integrate

credentials to access the decentralized web and blockchain infrastructure. The public health system will ensure the protection of sensitive data, as well as the activation of servers to enable the operation of the blockchain infrastructure.
Moreover, in this way, in case of hospitalization or need to access the hospital facility, the user will have the ability to share their medical records with doctors.
In addition to the more traditional spaces, it will integrate an area dedicated to digital fabrication with 3D printers and scanners that will create prostheses and instruments for personalized post-traumatic rehabilitation, produce consumables, and experiment with bioprinting.
The projects developed within the clinic will be free distributed to users and shared on the network, to encourage open innovation processes.
The figures involved in this area will be designers, biomedical engineers and technicians, who can be hired or work as volunteers.
Inside the structure will be set up an immersive room, with video projectors, screens, sensors and actuators, to increase knowledge and awareness of health, activate the possibility of carrying out rehabilitation therapies both physical and emotional and psychological, as well as give the opportunity to update the professionals of the clinic, through learning by doing and simulation.
The room can, for example, be used to allow elderly people to perform gestures and activities that they are now precluded from doing and to live certain experiences again, such as taking a walk in a park.
Still in a smart healthcare perspective, a service that the outpatient clinic will guarantee is the monitoring of patients through smart devices interconnected to those of the referring physicians.
One of the cornerstones of the outpatient facility is the concept of open innovation, evident in the "blockchain" management and operational area of digital fabrication, to be reflected also in the smart healthcare model, using open hardware and software.



Figure 1. Smart healthcare systems

Figure 2. Clinic 4.0

4.2 Model PT-1

The developed product, Model PT-1, is a class I medical device that enables the user to measure his/her own body temperature, to check the oxygen saturation in the blood and to communicate the collected data to the clinic doctors. The measurement of the parameters is enabled by an infrared thermometer and a pulse oximeter.
The shells and joints were produced through 3D printing, using PETG, a material that is easy to process; the hardware was purchased from online retailers and the control software was programmed ad hoc for the functions required.
In the most recent version, the device has been made simpler because some details were complex to print; for this reason, the joints between the shells have been replaced by inserts, which allow the object to be disassembled for maintenance and replacement of components.
The product has a simple and usable interface, consisting of a screen that communicates temperature and saturation parameters and buttons for power and navigation.
Using Bluetooth technology, the device connects to the smartphone and to the app where the user's medical record is stored.

Users, in addition to sharing data with physicians, will be able to decide to send it to the decentralized blockchain infrastructure to create a statistical base that can be used by the national health system.



Figure 3. Model PT-1: product view

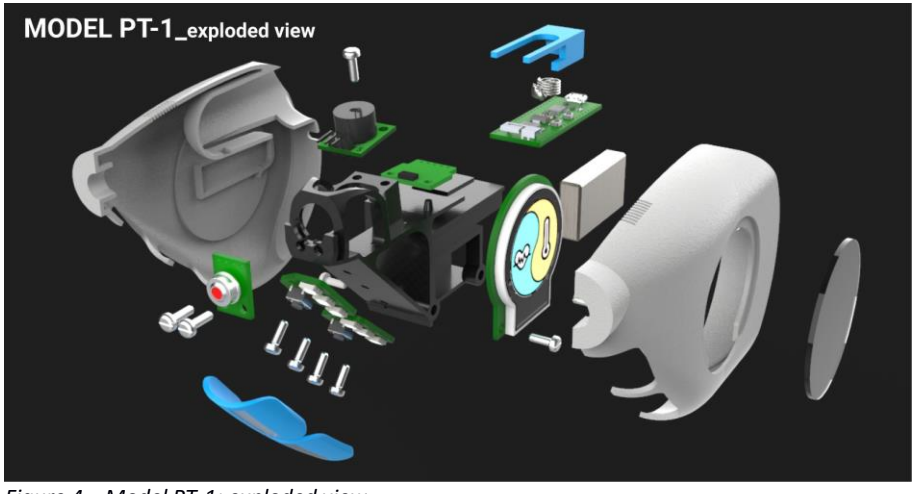

Figure 4. Model PT-1: exploded view

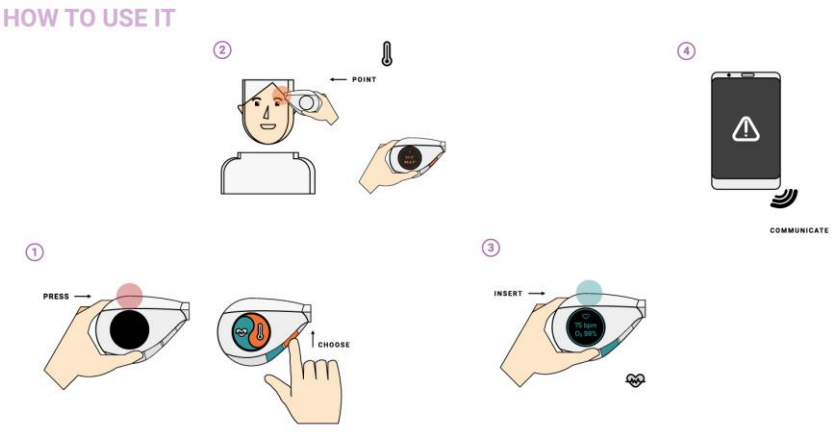

Figure 5. Model PT-1: user experience

5. Conclusions

The hypothesized system has the potential to change the current health structure, encouraging a growing process of adherence to more inclusive, widespread and democratic dynamics.

We want to reiterate how fundamental is the integration of the technologies taken into consideration, in order to allow, on the one hand, the streamlining of bureaucracy and an increase in the degree of security of certain sensitive data; on the other hand, to guarantee greater accessibility of personal care services.

As for the device actually produced and previously described, it is the vehicle of the expression of the potential that some technologies may have in being actors of a change in the logic of production and distribution of certain goods.

For these reasons, once the final version of the device and its digital interface are completed, the goal is to upload the entire project on open sharing platforms, such as Thingiverse and Github.

On the first platform the files to make the shells, the supports and other plastic parts will be shared: making these contents available to the public allows other people to intervene on the project, making changes and implementations, providing the community with a product in constant evolution and improvement.

On the second platform, instead, the firmware and the operating system of the sensors for the collection, storage and comparison of data will be shared.

Design is a complex discipline with many facets and applications. Several experts, such as Manzini, state that the role of the designer is that of a catalyst and director of complex and

systemic social innovation processes, which require the integration of vertical and different knowledge and a design methodological approach (Manzini, 2015).
In this project, design has the function of fluidizing the processes necessary for the establishment of the enabling structure, which involves the integration of a large number of interlocutors and actors: operators, guarantors, entities – public and private – potential users. An inclusive approach turns out to be naturally applicable to the dynamics and ecosystem hypothesized and could be declined in the creation of processes that involve a large number of social groups around issues of fundamental importance, trying to promote systemic transformations and high impact (Gheerawo, 2016): design therefore stands as an activator for the dynamics of reference.
Design had the role of understanding the nature of an innovation and, therefore, the possible degree of acceptance of it by the users identified; to interpret these aspects and to demonstrate to have mediation skills, not only between the actors involved, but also of the innovation process itself.
Two must be the fundamental characteristics of the designed model, based on a young, but potentially disruptive technology, such as blockchain: to be initially scaled on a local dimension, such as an urban district or a small centre; not to radically change the existing systems, but to hybridize them with features and functions referable to blockchain ecosystems.
Regarding the issue of open source and open knowledge, models of dissemination of projects and knowledge closely related to the digital sphere and 3D printing, it is argued that design can play the role of facilitator of the above, acting at the intersection of different knowledge and disciplines and having a set of tools and methods capable of fluidizing the necessary operations (García-Peñalvo, 2010).
An interesting and open question we want to briefly propose and partially answer to refers to the role of Design in tackling the negative aspects of the aforementioned technologies: can Design tune down these threats? In which way should it act?
We believe that Design processes should be guided by intentionality principles (La Ponte and Fishbane, 2019) in order to identify what attributes need to be prioritized at the expense of others: even before the implementation of technologies, potential social impacts and the misuse should be deeply analysed and understood, to prevent possible negative consequences due to their implementation.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Hospitals' decision-making regarding infrastructural adaptations in response to Covid-19

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Abstract | During the first months of the Covid-19 pandemic, crisis management and fast decision-making regarding infrastructural adaptations were key as hospitals faced major challenges while attempting to ensure optimal care. This study aims to gain insight into decision-making processes regarding infrastructural adaptations. Interviews were conducted (in July 2020) with representatives of technical services, facilities and planning departments in six general hospitals in Flanders (Belgium). Interviewees illustrated changes made with building plans, photos and other supportive material. Based on the collected data we identify four main factors affecting decision-making about infrastructural adaptations: enforced measures, demand and supply 'on the ground', knowledge acquired over time, and stakeholders' identities. Whereas the initial approach was predominantly top-down, insights gained into the type of cross-departmental collaboration that was necessary and possible during the Covid-19 crisis may also have value under more regular circumstances to swivel between top-down requirements and design contexts 'on the ground'.

KEYWORDS | COVID-19, DECISION-MAKING, HEALTHCARE, HOSPITALS, INFRASTRUCTURAL ADAPTATIONS

1. Introduction

When the Covid-19 crisis was first labelled a pandemic in March 2020, public health advice urged people to stay at home as much as possible. In hospitals, interactions initially intensified, making it necessary to urgently curate activities taking place in and around these buildings. Activities in many sectors were put on hold or drastically diminished. In Flanders (Belgium), this was also the case for regular healthcare as the government instructed this be put on hold between March 16th and May 3rd. For healthcare organisations, this allowed focusing resources on the immediate crisis and simultaneously entailed re-organising care at multiple levels as (use of) the infrastructure was adapted. As such, the first phase of the Covid-19 pandemic can be seen as a time where new public behaviour and crowd practices were produced (Shields et al., 2020).

In this paper we focus on decision-making that took place within hospitals as they sought to respond to Covid-19, in particular by adapting their infrastructure. We consider this response to Covid-19 a design project with design decisions being made 'in house' and 'on the spot'. A key observation is that the various spatial strategies adopted by hospitals, to make distinctions in the use of space between potentially contagious people and 'stuff', affected the usability of these environments.

For the notion of usability we align our understanding with Van Kuijk et al. (2019). Usability is not an inherent quality of a design outcome but is defined as a function of the context and involves specifying use and user (Bevan & Macleod, 1994 in Van Kuijk et al, p. 140). Van Kuijk et al. develop a framework consisting of 'drivers of usability' which are each collections of factors that affect usability. Important for our use of the term is that the success and impact of usability practices is highly dependent on the organisational context (van Kuijk et al., 2019). User-centred design principles central to the notion of usability and the importance adhered to design methods that introduce knowledge about use and users, form a point of departure to consider 'ad hoc' design in a healthcare context.

Where it concerns architecture and design in healthcare there is a growing understanding that design and designers play a critical role in establishing medical ideas, ideals, roles and practices (Bromley, 2012; Martin et al., 2015). Both construction and experience offer angles to consider the design of healthcare environments and how they change 'in use' over time. Hospitals' response to the Covid-19 crisis offer a unique opportunity as - within a variety of building types - they all faced similar situations. Design quality of physical healthcare environments has been strongly linked to the social interactions and connections the environment facilitates (Anåker et al., 2017) and it is therefore particularly interesting to look closely at situations where spatial strategies are employed to separate Covid from non-Covid within healthcare environments.

A relatively recent shift towards person-centred healthcare entails that patients are addressed as people rather than approached from a strictly biomedical perspective (Lines et al., 2015). While patient-centred care incorporates the aim for a functional life, person-

centred care is seen to aim for a meaningful life (Håkansson Eklund et al., 2019). These types of developments in healthcare in turn affect the built environment (Bromley, 2012) while pandemics of the past have also resulted in shifts in hospital design.

2. Research approach

To gain insight into decision-making processes regarding infrastructural adaptations during the first months of the Covid-19 crisis, we made use of interviews with representatives responsible for these infrastructural adaptations in six general hospitals in Flanders. During these interviews we aimed to capture the culture of practice and professional situation in the respective hospitals.

In order to allow a rapid entry into the organisations to capture adaptations when they were still fresh in mind, hospitals were selected based on convenience in combination with pre-existing connections between the researchers and hospital boards. With this selection, we aimed to cover a broad range of hospital types: both urban and suburban, brand-new facilities as well as older ones, both centralised and dispersed organisations. Table 1 provides an overview of the hospitals, their spatial organisation and location, and the profile of the respective interviewees. Hospitals A and F inhabit brand new buildings taken into use less than five years ago. The other hospitals' infrastructure is older and has, to various degrees, been refurbished and added to over time.

Author 1 and 2 conducted the interviews online (in July 2020) while meticulously taking notes. Some of the interview questions focused specifically on how decisions regarding infrastructural adaptations were taken. Interviewees provided architectural plans, photos and other supportive material to illustrate changes made 'on their watch'. All interviews were recorded. These recordings were used to complement the notes taken in the moment. The notes and provided material formed the basis for the analysis focusing on themes related to the sources of information, people involved in the decision-making process, and prioritising.

Table 1. Overview of the hospitals included in the study.

hospital	interviewee	location	(spatial) organisation
A	director of care supporting services	sub-urban	1 central campus
B	technical and facilities director	urban	1 central campus
C	manager of engineering, infrastructure and master plan	urban	multiple campuses
D	director of facilities	sub-urban	1 central campus
E	manager of technical services	urban	multiple campuses
F	director of quality and strategy	sub-urban	1 central campus

3. Findings

3.1 Enforced measures

A primary factor that influenced decision-making, and how it was organised, concerned measures enforced by the government. In each of the six hospitals a central crisis cell or task force was established to communicate updates and briefings to all other staff. This cell was made up of various key figures and ensured uniformity in carrying out measures. It took responsibility for evaluation and control, and coordinated the hospitals response. Most decisions about infrastructural adaptations were coordinated at this level. Decisions made here were in turn informed by meetings with consultative regional or provincial governmental bodies, external to the hospitals' own organisation.

> "The hospital's Coordination Cell met daily throughout the critical phase and that's where all issues were discussed and communicated. Of course, in these meetings the expertise of the people on the ground was used and a cohort ward was thought through with hospital hygiene colleagues and staff on the ground, in terms of 'where do I enter, where do I get changed, what's clean, what's dirty?'. Nursing staff thought along but decisions were always made under central supervision."
>
> (interviewee in Hospital F)

A mandatory postponement of regular care allowed the various hospitals to repurpose (part of) their buildings and redirect staff to work elsewhere, the latter also affecting how spaces were used. Hospital E initially closed multiple campuses and redirected Covid patients and staff to a single location where both Covid and (a limited amount of) non-Covid care was offered. In other hospitals, entire units were freed up, thus enabling extra doctors to stay overnight, or care professionals to use an empty ward for rest and recuperation. Care professionals on the floor were often not involved in the decision-making regarding the temporary closure of their departments and units. For some, this closure resulted in different tasks and responsibilities and sometimes a new place of work. For example, the catering staff in Hospital D were retrained to work as cleaners when the canteens were closed. Also, for staff working on Covid wards many decisions were communicated in a 'top-down' manner by the head of a department, or through briefings resulting in tasks to carry out or new procedures to follow.

Priorities set by the healthcare organisations (i.e. the 'cells') to a large extent determined where (the focus of) resources were directed. Covid-related concerns 'overruled' many others and the examples illustrate how a 'top-down' enforcement was linked to policy guidelines and was deemed necessary to quickly and effectively roll out measures. Not all measures could be adhered to, as one interviewee illustrates. In their aged buildings, it was impossible to enforce the guideline that (Covid and non-Covid) flows of patients and staff be separated from each other.

3.2 Supply and demand 'on the ground'

The decision-making process necessitated a certain degree of improvisation from those involved, which was partly driven by supply and demand (questions from the ground). Supply refers to both the informal and tacit sources of knowledge, ideas and resources interviewees called on to respond to challenges at hand. Additionally, it points to both tangible 'stuff' (e.g. stocks of personal protective equipment, increased volume of waste, gifts of food for staff) and space (e.g. temporarily empty wards or adjacent buildings available due to renovation plans) which required decisions. Even though hospitals had crisis response plans prior to the pandemic, various interviewees noted that they were unprepared for the crisis to affect the entire region simultaneously. Also, few scenarios envisaged a crisis that would last for months and consist of multiple phases. The coordination of a response by technical services and planning departments were therefore also driven by the questions and demands they received.

> "A unit would hear that they had to start up again and everything had to be done really quickly, well then multiple people jumped into action to organise things. In the very beginning, that wasn't yet 100% coordinated and streamlined … So yeah, that's why people were organising things themselves as much as possible, which was good, right? But then it became really important that it was channelled and assessed by the same group of people, coordinated and only then realised."
>
> (interviewee in hospital C)

Many of the questions from the ground concerned the deployment of 'stuff'. For example, in Hospital C, they were cautious responding to requests for plexiglass screens because they were unsure whether they could keep up with the demand and provide these throughout the hospital. Elsewhere, doctors asked for screens and extra tables in order to distance themselves from patients in consultation rooms, but these were generally not granted as the personal protective equipment they were issued was deemed sufficient. In Hospital E, another example was given regarding a limited number of HEPA filters available to deploy to improve air quality. In theory, the hygiene department advised where these were best placed and the crisis cell made the decisions. However, in practice, they were occasionally deployed to 'show that they were doing something' and 'boost morale'. This resonates with how a technical and facilities director explained that the risk of exposure for staff and the associated fears played a major role in what kept him busy.

> "In those first weeks, we only did Covid, right? For a while there was nothing else … There was a lot of fear. For example, the food that came down from a Covid ward, for the people in the kitchen, yeah, you had to be able to handle that. For people who cleaned, who had to go and clean those rooms, it was similar. Not that obvious. So, that's what you're focused on and nothing else."
>
> (interviewee in Hospital B)

'Carefully listening to what was being asked for' led to new collaborations, often tapping into *what* and *who* was available. Most hospitals entered into intense partnerships with general practitioners to organise emergency departments' triage (Figure 1). One of the nearby university hospitals was considered an important source of practical guidelines and some initiatives were taken based on ideas that came from seeing (in mainstream media) what other hospitals were doing. Also, cross-departmental collaboration within the hospital was a way in which interviewees responded to needs expressed within the organisation. Within Hospital C, the interviewee had taken on additional responsibilities to support the logistics department concluding that a better understanding of another department improved her abilities to function within her own position.



Figure 1. Temporary infrastructure was taken into use extending existing emergency departments with triage facilities (left: Hospital D; right: Hospital C).

3.3 Knowledge over time

Initially, decisions were made under a significant amount of pressure, anticipating worst case scenarios. For most interviewees, the start of the pandemic was a busy and hectic time during which they were adjusting procedures continuously. Developing insights and knowledge that was accrued over time affected subsequent decisions. When the interviews took place, hospital organisations were collecting lessons learned and preparing scenarios in case of a second wave of Covid-19 patients. Interviewees highlighted the value of taking time to consult a diverse group of stakeholders before moving ahead, mainly to avoid making unrealistic or flawed plans. One interviewee explains:

> "The only thing we noticed, not that it was a huge problem, I want to emphasise that, but the only thing is that sometimes because of the acute nature [of the situation] we would work kind of independently. Then care would've gotten started already saying 'OK, we're going to do this and that', while facilities got involved in the second instance and found that we did have to set certain things straight and say, 'OK guys, be aware, you didn't think of this and this. We can resolve that but it's not ideal.'"
>
> (interviewee in Hospital A)

Knowledge that equipped decision-makers in their response was sometimes related to particular experiences gained prior to the pandemic. For example, in Hospital F, the interviewee indicated that they were organisationally well-prepared for the crisis, partly due to their recent move (less than 2 years ago) from 3 separate campuses to a single newly built facility. Coordinating the move (3 years of planning in order to move within 3 days) was considered an ideal preparation for dealing with the pandemic. In his specific role of director of quality and strategy, he described having close and good working relationships with medical, nursing, communication and administrative departments, and that they were accustomed to responding to unexpected issues.

This can be linked to the lifecycles of hospital buildings as recurring theme throughout the interviews. For example, at Hospital C a new building project was in the early design stage. The pandemic was therefore considered 'worthwhile input' as lessons learned could be incorporated in their plans. In Hospital B, planned renovations allowed spatial flexibility that would not have been available under regular circumstances. A number of (already) empty buildings were easily repurposed for use as triage stations and extra storage (Figure 2). The manager of technical services in Hospital E indicated that during the crisis, certain mandatory maintenance tasks were postponed, including the scheduled maintenance of elevators and medical equipment.

Interviewees commented that their own involvement as representatives of technical and spatial planning departments would have been more effective had they been involved early on and preferably within the crisis cell, alongside medical and nursing staff.

> "They were fully engaged with preparations in a medical sense, with logistics and cleaning. They had started up a lot but the infrastructural component was actually not taken into account from the start. You know, of course, once the crisis came 'round then yes, we were of course involved and very able to key into additional demands. Maybe, yes, we were still involved in time but we were less prepared than they were in other areas."
>
> (interviewee in Hospital C)



Figure 2. On-going renovations were interrupted to create a (temporary) waiting room (Hospital C, left). A former crematorium (empty) is taken back into use (Hospital B, right).

3.4 Stakeholders' identities

Finally, the various actors that were mentioned explicitly in the interviews shed light on hospitals' decision-making process. Types of people, groups of users and other stakeholders were labelled. Often the circumstances that interviewees were speaking about necessitated a variety of categorisations, some of which were common (i.e. patients, doctors, visitors). Others were newly introduced due to Covid-19. The specific circumstances of this crisis highlighted the existence of subgroups or brought new characteristics to the forefront. It was remarkable that an important way to distinguish between different types of patients, and users of the healthcare services generally, was entirely new, namely, based on one (being suspected of) having (or not having) the virus (Figure 3).

Interviewees expressed an active involvement in providing services oriented towards creating safe environments for staff and patients. Patients were spoken about as being somewhat at a distance from the daily practice of the interviewees, but were actively linked to infrastructural adaptations when distinctions were made between a) patients with a fever or Covid-suspect patients, b) confirmed Covid patients (seriously ill and more minor symptoms), and c) non-Covid patients. The Covid diagnosis and associated identities trumped any other diagnosis. An interviewee explained that specificities of patient groups were not always sufficiently taken into account.

> "What we perhaps had too little concern for was the differentiation in adult care … Because we repeatedly needed to shift wards to make room for Covid patients we sometimes didn't stop to think about where patients were being shifted to. And yes, at a certain moment we had to say, 'hey guys, the oncological patients need to stay far enough away from the Covid ward'. Because you start shifting that which is adjacent to the Covid ward [to expand it], we ended up with oncological patients coming too close to it, if you know what I mean ... In that sense we didn't have enough of a plan with respect to the patients that are most at risk if they were to come into contact with Covid, to keep them at enough of a distance."
>
> (interviewee in Hospital D)

Care for paediatric Covid patients was challenging in that being accompanied by a parent meant that zones with rigid separations between Covid and non-Covid non-staff persons could not be maintained. Also other patient groups were put forward as having required particular consideration e.g., for gynaecological, geriatric and psychiatric care. Furthermore, no visitors were allowed into the hospitals during the crisis phase of the pandemic. Exceptions (particularly in Hospital D) were made only for a single visitor or family member visiting a palliative ward or other (non-Covid) patient at the end of life.

Staff were separated as much as possible from non-staff. Any shared use of entrances or canteens with other hospital visitors was avoided. Doctors and heads of departments were repeatedly mentioned as being stakeholders who voiced concerns. Cross-departmental collaboration within the healthcare organisations increased and was supported by (cross-campus) thematic working groups. The persons the interviewees often referred to as being

at risk were the cleaners, those engaged in meal preparation and logistics workers. During the crisis certain maintenance technicians were in short supply.

New demands made of the hospital infrastructure required identifying new stakeholder identities. These helped define the aims and outcomes of infrastructural adaptations and in many ways, they co-determined the environmental qualities that were prioritised in the process.



Figure 3. A waiting room in Hospital A was split adding 2 additional spaces: a separate waiting room for (potential) Covid patients and a triage space (left). A nurses' station indicating only those who have not had direct (Covid) patient contact may enter (Hospital F, right).

4. Discussion and conclusion

To gain a better understanding of decision-making processes regarding infrastructural adaptations made in hospitals during the initial crisis phase of the Covid-19 pandemic, representatives of technical and spatial planning departments were interviewed. We identified four factors that shed light on the dynamics between the coordination of adaptations on the one hand, and input from a variety of stakeholders on the other. They are: enforced measures, supply and demand 'on the ground', knowledge over time and stakeholders' identities. Measures issued by the government were enforced in a top-down manner. If we connect this to the usability framework proposed by Van Kuijk et al. (2019),

the prioritisation of usability in our study seems closely linked to safety (from Covid contagion) as guiding value, co-defining outcome priorities and project priorities.

In the hospitals, adaptations were required in response to rapidly changing needs and a changing supply and demand (of space). On-site and ad hoc infrastructural adaptations made in hospitals can be considered 'design in use' (Redström, 2008), where an open-ended design process extends into what is commonly understood as 'use'. This complements related research in healthcare contexts such as Halpern and Anderson's (2020) analysis of an intensive care unit following the completion of a formal design, where on-going adaptations are necessary to rectify (design) flaws and extend the operational life of the unit. The time-frame is different but the processes have similarities. As we have found in previous research (Jellema et al., 2019), a diversity of perspectives is equally valuable to ensure the quality of this ad hoc type of design (outcome) as when it concerns a more formal and demarcated design process. Alongside these diverse perspectives our findings should be seen to complement varied research on e.g. spatial strategies employed to separate flows in hospitals (Annemans et al., 2021; Augustin et al., 2020); construction and furnishing of field hospitals (Ribeiro et al., 2020); supportive design collaborations in response to crisis (Rebola et al., 2020) and indoor air quality (Morawska et al., 2020).

Certain lessons can be drawn from this study for (decision-making in) design in general:

- Firstly, the reasoning behind decisions taken is diverse. As we have pointed out some decisions are directly related to measures enforced 'from higher-up' and the resulting supply and demand. However, alongside actual spatial needs, immediate concerns of users play a role and will sometimes 'accumulate' to result in adaptations being made. Examples include both effective, tangible interventions and initiatives addressing user perspectives but motivated mainly to change perceptions (e.g. to alleviate fear of contagion and boost morale). See Mattern, 2020 for a discussion on plexiglass as 'security architecture'.
- Secondly, the hospital context comes with a wide diversity of stakeholders, from those outside the organisation (e.g. government) and within, to those affected by adaptations, with and without a say in decision-making processes (e.g. staff, patients, visitors). The shifting nature of how these groups are defined raises a concern for a usability approach in terms of who may be overlooked. Nurses, for example were rarely mentioned in the interviews while some sources suggest that in the past they have been a vital link between management and work 'on the ground' but are no longer sufficiently represented in management (Van Merode & Brouwer, 2020). Although largely outside of the scope of this study, our findings also resonate with concerns about decisions to (temporarily) shut down select medical services impacting on some patients disproportionately (Chu et al., 2008). Further research is needed to investigate whether (permanent or semi-permanent) infrastructural adaptations employed during the Covid-19

pandemic have made physically accessing healthcare services more challenging for particular user groups.

- Thirdly, this study highlights the importance of reflection during and on design. Attitudes towards users can change over the course of a design process (Van der Linden et al., 2018). It may be relevant to keep in mind that knowledge has more value to a design team when available earlier in the process (even if considered less reliable) than when provided at a later time (van Kuijk et al., 2019). For crisis situations and ad hoc design, the urgency of the situation demands on-going reflection and incorporation of methods that can further support cross-departmental collaborations.

Limitations of the study include the lack of opportunity to explore experiences of the realised infrastructural adaptations, which could have potentially offered a more nuanced view on how user perspectives were addressed in decision-making. Furthermore, alongside the interviews, interviewees were invited to share relevant documents. The quantity of material provided differed significantly between hospitals and a more systematic approach could have enriched the analysis.

The insights presented may inform day-to-day healthcare facility design and may help to improve collaborations between design practitioners and (within) hospital/healthcare organisations. Supporting bi-directional communication is an important aspect of this. The crisis cell or task force that guarded the uniformity of infrastructural adaptations within hospitals and across campuses required intense communication throughout the organisation. Furthermore, actively anticipating the stakeholders that add particular perspectives or know-how to planned infrastructural adaptations can enhance outcomes. This study suggests that the type of cross-departmental collaboration that was necessary and possible during the Covid-19 crisis may also have value under more regular circumstances in order to swivel between top-down requirements and design contexts 'on the ground'.

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Acknowledgements: With thanks to all who made themselves available to participate in this study. This work was supported by FWO (postdoctoral fellowship Margo Annemans) and the KU Leuven Industrial Research Fund.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Identifying Factors for Designing a Successful Interactive Telemedical Training System for Remote Pediatric Physical Exams

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Abstract | During the 2020 pandemic, telemedical consultation became a core tool for continuous access to healthcare. However, the skills required of medical teams to provide pediatric healthcare through telehealth are new and undeveloped. To address these issues, our pilot study focused on the interaction between the nurse, patient, and provider with telehealth technology. This study sought to provide evidence that training protocols for operation of a telemedicine system such as a telemedicine cart and its corresponding attachments are highly effective. Based on our results, users (nurse and provider) need to be familiar with the functions of the cart and its components. This suggests that an interactive training system consisting of hands-on learning and augmented reality can elevate a pediatric telemedicine visit, from a video call to a comprehensive physical exam. This research received a "Pilot Translational and Clinical Studies Program" grant from the US National Institutes of Health in October 2020.

KEYWORDS | INTERACTION, APPLIED COMPUTING, INTERACTIVE LEARNING ENVIRONMENTS, TELEMEDICINE, USABILITY, USER EXPERIENCE, HEALTHCARE, PEDIATRIC, AUGMENTED REALITY

1. Introduction

With telecommunication becoming more accessible, advanced, and affordable, telemedicine is emerging as a mainstream approach to increasing access to healthcare (Wooden, 2001). Telemedicine can broadly be defined by the delivery of healthcare services via telecommunication platforms, such as a smartphone or computer. The healthcare services provided by telemedicine are rapidly expanding and can include everything from a phone consultation with one's physician to sending health data to one's medical provider via a smartphone app. The use of this technology has increased dramatically since the 1990s in order to make healthcare more inclusive to marginalized populations (Perednia, 1995). There are various medical fields, such as psychiatry, cardiology, dermatology, surgery, ophthalmology, genetics, oncology, gastroenterology, dentistry, and geriatrics, that have utilized a telemedicine/telehealth approach frequently (Di Cerbo, 2015). During the 2020 pandemic caused by the novel virus SARS-CoV-2, telemedicine and telemedical consultation have become a core tool for continuous access to healthcare. Almost all clinical units, from hospitals to private practices, have adjusted their services to address the need for a low-contact healthcare delivery method required during the pandemic. While patients who once were only familiar with in-person medical consultation quickly became comfortable with teleconsultation, the rapid transition to telemedicine has left health care providers using a very limited version of this technology due to lack of experience or knowledge of telehealth capabilities.

A prime example of this dilemma is evident with the challenge of incorporating telemedicine carts into a nurse's routine. Telemedicine carts are an emerging technology that integrates traditional medical examination tools, such as a stethoscope or otoscope, with the telecommunication capabilities of video call and image transfer. Telemedicine carts often consist of a monitor and camera for video conferencing, with medical examination tools capable of transmitting images via video conference. Despite the extensive capabilities of the telehealth-compatible medical tools, most telemedical visits are limited to audio and general video communications. In the majority of cases, this is caused by the lack of proper training in using these sophisticated tools and equipment, especially for pediatric physical examinations. Studies show that employing a telemedicine approach can significantly improve the quality of pediatric care in a remote setting, and be greatly beneficial to distant clinicians (Makkar, 2018)(Noroña, 2020).

Also current telemedical equipment is generally adapted for use with school-age children and adults who can cooperate and communicate with the healthcare team during a patient encounter. The use of this equipment, typically configured as mobile carts, requires background knowledge of the devices and functions used during a patient encounter. Current available training is brief and occurs either offline or as part of a telemedical encounter. This approach may result in a less efficient process for encounters with preschool children, infants, and their parents.

Although augmented reality (AR) has been used as a training tool in many medical procedures, most existing systems are focused on highly trained practitioners (Albani, 2007). Examples include procedures such as neurosurgery (Tabrizi, 2015), laparoscopy (Leblanc, 2010)(Nicolau, 2011), and ventriculostomy (Yudkowsky, 2013). Recently there have been several research studies that have been looking into using Virtual Reality (VR) and AR in improving the clinical experience. For example, Mahesh B Shenaei et al. and Mariuna Carbone et al. have used virtual or augmented Interactive systems in their study for assisting remote clinical encounters. However, both their systems demand extensive funding to setup for the system operation. (Shenaei, 2011)(Carbone, 2016). For this reason, design concerns have been geared toward high precision systems and less emphasis has been put on user experience (Dey, 2018)(Smith, 2020)(Wang, 2020). While we are working to provide accessibility for rural populations with limited resources to make access to healthcare more inclusive, these types of setups and arrangements are not the best fit. Our hypothesis is that by understanding the context of the interaction between the telemedicine cart, its operator, and an infant/child during a pediatric examination, we can create an affordable and feasible multi-type interaction training system (combination of hands-on learning, online instruction and, AR) that not only can provide a reliable training at any time or location, but also can guide the operator through the examination procedures specified by the physician and the interaction with the cart equipment and interface (Privitera, 2015).

In order to use telemedicine to create inclusive access to pediatric healthcare in low-income and rural areas (Zachariah, 2012), a feasible training program for telemedicine cart operators can increase the quality and accessibility of care for young children and infants. Utilizing telemedicine, access to pediatric healthcare could be more inclusive in low-income areas and, considering the need for basic knowledge and understanding about telecommunication, young adults (parents) are an ideal target group for this technology. While the provision of telemedicine for adults is relatively mature, integrated telemedicine for the care of infants and children is undeveloped. Lack of training related to use of this technology for infants and preschool-age children leads to its limited use for this patient population. With the impact of the COVID-19 pandemic on online medicine, most of this population became familiar and comfortable to some degree with these telecommunications with their providers. Considering this population, and the special needs for physical evaluations, a reliable complete physical exam (e.g. including case management or detecting any possible condition) is needed (Zachariah, 2012). This physical exam consists of a multitude of steps and tools in addition to some level of technique, requiring the cart operator to repetitively practice to effectively interact with this especially challenging population. Much data needs to be clearly transferred between the physician, and the operator, using the cart and its parts, so seamless communication is critical for this information exchange. In this case study, we investigated the current status of a simulated telemedical encounter for infants and preschool-age children through a pilot study to provide the primary knowledge for a multi-type interaction training system for telemedicine cart users (primary and secondary user).

This transdisciplinary research was conducted at Carilion Clinic Center for Simulation, Research and Patient Safety during summer 2020.

2. PLANNING AND DATA COLLECTION

The pediatrician team member experienced frustrations related to communications and cart operation during encounters with school-age children, but completed them successfully. When asked by parents of infants and preschool children if they could participate in telemedical encounters saving up to 4 hours round-trip driving to appointments, he realized that additional training would be required, especially for the cart operator to interact with the parent-child dyad, and approached VT Industrial Design to address this need. We took the team science approach in forming a transdisciplinary team to address this problem that included design and usability evaluation, biomedical engineering, medical clinicians (physicians, nurses, and respiratory therapists), computer science, and psychology. We had access to the resources of the Carilion Clinic Center for Simulation, Research and Patient Safety; the Department of Pediatrics; and the Telemedicine Department; thus providing a rich simulated clinical environment and the equipment needed for design and testing within a clinical context. Complementing clinical access, we brought the technical resources of Virginia Tech's Industrial Design, Biomedical Engineering and Mechanics, Computer Science, and Psychology departments. This case study was conducted in four phases, 1) Observation and learning, 2) Experiment planning and preparation, 3) Data collection that included Simulated Telemedical Training and infant and preschool-age child clinical exam, and 4) Data analysis.

2.1 Current status of telemedicine practice in infants and preschool-age children - Observation and learning

In order to understand the current interactions between different stakeholders (nurse, provider, patient, etc) and the computational devices or systems involved in the telemedical encounter, our team participated in a hands-on experiential session with the Information Technology (IT) expert from Carilion Clinic to learn the technical and functional aspects of the telemedicine cart (Avizia CA750 Telemedicine Cart from American Well (Kim, 2017)). This investigation helped us to learn more about the device, its peripheral attachments, and their capabilities. This also gave a better understanding of all the entities and people involved in this hypothetical experience. In Figure 1., stakeholder mapping shows all the interactions and relationships between the stakeholders in this scenario. The arrow's direction shows the flow of information and interactions and the line thickness is the representation of the frequency of the interactions between them. During the primary data collection, we realized that the current training procedures themselves were still in the experiment phase, which influences the design of the experiment and data collection methods and tools. Figure 1. shows that the nurse (cart operator) is the primary user of the cart, and she/he needs to

have the most comprehensive understanding of the cart and its capabilities to create the most efficient communication with other persons involved.

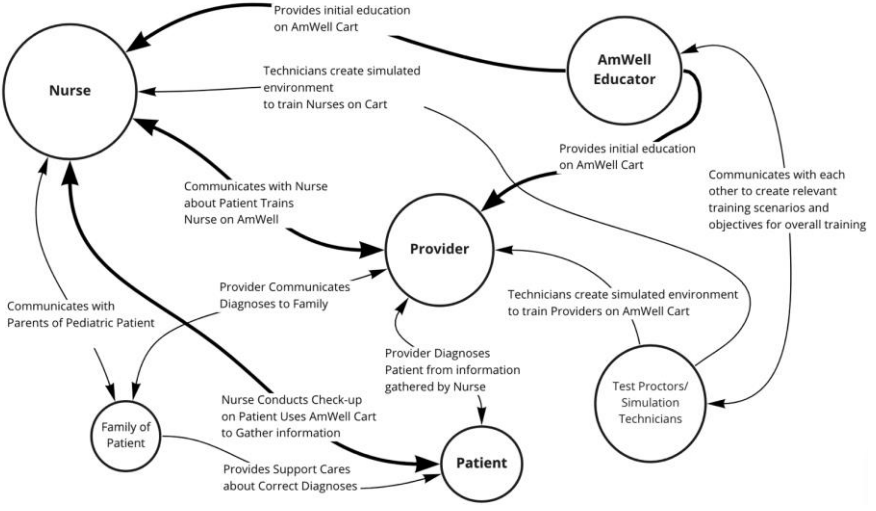

Figure 1. Stakeholders mapping for simulated clinical infant/preschool child evaluation completion during a telemedical encounter

The major components of the American Well Avizia CA750 Telemedicine Cart (Figure 2.a) consisted of an adjustable camera, a monitor, a navigation panel, a workspace, and drawers that housed the auxiliary medical scopes. The Avizia CA750 Telemedicine Cart served as the central unit for all tasks performed by the nurse. All patient information, collected by the auxiliary medical scopes, and communication were relayed through the Avizia CA750 to the remotely located provider. This cart also comes with four peripheral devices as attachments that expand capabilities for the operator, which are the main advantages of using this cart instead of simple video conferencing. Using this equipment can greatly assist specialists in early condition detection, and case management in teleconsultation (Zachariah, 2012). Our case study cart (Avizia CA750 Telemedicine Cart) peripheral devices consist of:

- Avizia Horus Scope and Charging Cradle Series 2 and “General Attachment” for collecting close up visual information from the patient. (Avizia Manual)
- Dermatoscope attached to Horus Scope for a magnified image of the skin.
- Otoscope attached to Horus Scope used for ear and nasal examination.
- Thinklabs One Digital Stethoscope, attached directly to the cart’s main stand to amplify heart, lung, and digestive tract sounds. (Figure 2.b)



Figure 1.a: (Left) American Well Avizia CA750 Telemedicine Cart, Figure 2.b: Peripheral attachment, (Middle top) Horoscope and General Scope, (Middle bottom) Dermatoscope, (Top right) Otoscope, (Bottom right) Stethoscope

2.2 Experiment planning and data collection

After preliminary data collection to understand the user journey analysis for primary (cart naive nurse) and secondary (provider) users, our team planned the experiment (including the training and physical exam) based on the available resources and specific needs of the stakeholder in a pediatric exam session. The goals and expectations for all individuals involved (telemedicine cart naive nurses and pediatricians, cart instructor, patient, guardian) were considered while forming this experiment and data collection (in a simulated infant physical exam). The experiment was planned in three phases:

1. *Training:* First, hands-on experiential learning of cart's functions (main components and peripheral attachment) was provided to both cart naive nurse and provider.
2. *Physician Routine:* Going through provider's exam routine prior to the patient's visit to enhance a feasible communication between the nurse and provider.
3. *Infant and preschool-age child physical evaluation:* simulated telemedical evaluation preschool aged child simulated telemedical evaluation.

Experimental tasks and data collection were also performed at the Carilion Clinic Center for Simulation, Research, and Patient Safety. The primary area of physical task performances conducted by the volunteer nurses and instructors consisted of a patient-centered observation room, equipped with three discrete cameras for recording the process. The recording center, a control room for the three cameras that also allowed real-time video analysis, was adjacent to the observation room, sharing a wall that included a one-way mirror. This enabled direct observation to take place without disrupting the workflow of the

nurse during the various telemedicine cart tasks or of the instructor giving the telemedicine cart overview.

In addition to using the patient-centered observation room to record behavior, interactions, and conversations, Tobii Pro II Eye-Tracker Glasses were used during the simulated child and infant exam by trained nurses. The Tobii Pro II Eye-Tracker Glasses track the wearer's eye and pupil movement as well as what the wearer is seeing and the length of their gaze time. The eye tracking data helped us gather information on how long it took participants to find each tool and button when operating the cart, as well as where they looked first if they were not able to immediately locate the correct location. This data can be used to improve the user flow and operation of the cart but indicating what features need to be emphasized within the interactive training system.

2.2.1 Research Tools and Methods

While reviewing the training for the cart functions and also physician routines, note-taking and observation were used, which was followed by thematic analysis. During the experiments, various qualitative methods such as fly-on-the-wall, discrete camera, and audio recording, and post-interviews were used for data collections by the research team. In addition to these more traditional data-collection methods, eye-tracking (Tobii Pro-II eye-tracking glasses) was used by the nurses during the child exam phase. Camera recording and note-taking were used specifically to comment on interactions between the nurse, physician, and telehealth cart. When applicable, close-up videos of the nurse and/or physician were taken to understand which components of the telehealth cart and software were either intuitive or difficult to navigate. Photographs were used to document the layout of the cart, individual room layouts with the cart that the nurses created, and ergonomics. The collection of data collected by these mixed methods were used to create thorough task analysis graphics with all the details about every step and breaking down the process into details, pain points. We chose various types of data collection which provided us with a mixture of data regarding, environment, interactions (human to human, human to devices and human to procedures), cognitive understanding and its relation to the interactions or actions that are happening in each stage.

Interviews were conducted at the end of the observational study of experiments, (including training stage, physician routine, and child exam) and audio recordings of each interview were taken for reference and clarity of information. These data provided an additional perspective on the challenges or advantages of the telehealth cart. Furthermore, by asking a set list of questions, we were able to compare answers across nurses of different demographics and also confirm our interpretations from observing their behaviors. All data were compiled at the end of the experiments and with thematic analysis tools we were able to turn them into trends, such as "successful communication," "points of technological difficulty," "specialist complications," "nurse complications," and "training forgotten." These trends were used to identify common points of success and difficulty.

2.2.2 Design Approaches

Prior to observational studies, a device breakdown of the Amwell Telemedicine Cart was conducted. The device breakdown categorized each component of the telemedicine cart into main component, component subset, physical description and ergonomics, function, and intuitiveness of use. With each component listed and described with the above qualitative marks, the research team was able to anticipate certain cart functions that may pose greater challenges to the user. The anticipated challenges helped construct the preliminary training protocol used during the observational studies.

Throughout the duration of the observational study, persona profiles were created and adjusted for the primary users of the cart, including the nurse (pediatric and non-pediatric), physician, child/infant, and parent. Profiles were created for a hypothetical user in each category, with the approximate age, education level, communication pathways, and barriers, and anticipated frustrations being considered for each persona. A preliminary draft of the persona profiles were created prior to any observational studies. These profiles were created based on literature review and anticipated trends from known demographics. After the preliminary draft was created, the persona profiles were updated after each observational study with the additional information acquired from in-person interactions with each user.

From the observations of the training and physician's routines, a user journey was created for the nurse and physician for each task. User journeys are characterized by the step-by-step breakdown of tasks, including the time to complete each task. With a user journey, a user's "pain points"(points where the user struggled to complete a particular task) and "gain points" (points where the user excelled at completing a task) can be identified. With gain and pain points identified, need statements were created to address areas of conflict between the nurse, physician, and telemedicine cart. These need statements helped guide the future observational studies and ideation of possible solutions.

3 CASE STUDY DATA ANALYSIS

The data collected during the experiments using different methodology and tools helped us to first, gain a better understanding of barriers to utilizing the telemedical equipment currently available for evaluation of infants and preschool-age children. Second, it identified the opportunities for education of personnel who evaluate infants and children, including the healthcare provider (physician, NP, PA) and the telemedicine technology cart operator (nurse, therapist, other). To identify the barriers in a hypothetical telemedical encounter that can create access to a full capacity pediatric visit, we mapped all stakeholder's user journeys (nurse, pediatric physician, instructor, infant/child, parents/guardian) and were able to identify pain points within the entire process of a telemedical encounter by task analysis. Here in Figure 3, you can see a brief for the task analysis of the infant/child evaluation completion during a telemedical encounter. Pain points discovered through this

analysis led us to actionable items for designing the interactive training program which can improve the entire experience for all stakeholders involved.

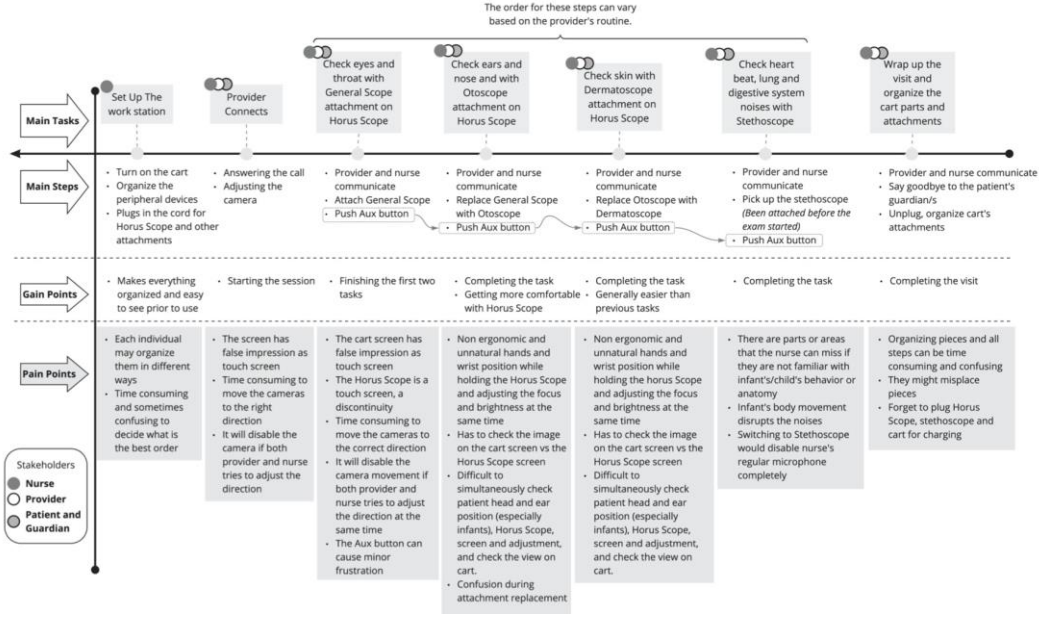

Figure 3: Task analysis for simulated clinical infant/preschool child evaluation completion during a telemedical encounter

In addition to the data collected through observation and interview, as mentioned before, the data collected by eye-tracking glasses (worn by nurses) was also used to measure the cognitive load during interactions with different parts of the computational system. The collected records were analyzed by Tobii Pro Lab software for each individual as well as all participants. In this case study, we chose to focus on two screens mostly used by the nurses, 1) Monitor on the main cart and 2) Horus Scope screen.

The monitor on the AmWell telemedicine cart provides the key interface for communication between the nurse and the provider. Over the duration of an exam, the nurse is tasked with answering the teleconference “call” from the provider, orienting the cart’s camera view to allow for a full-body image of the patient, navigating the auxiliary button on the cart panel for each digital tool, and ending the teleconference call. For each individual task, a numbered gaze plot on a reference image was created. After all tasks were recorded, a heat map was created for the entire duration of the patient check-up. These data provided a meaningful measure of the nurse's cognitive load that acted as complementary data in

exploring correlations between pain points revealed in task analysis and user's attention. For example, in Figure 4.a. you can see the heat map indicates some key areas of focus such as Auxiliary Button which was also repeatedly identified as a pain point during the observation and post-experiments interviews. The increased amount of focus time on the Auxiliary button indicates that this step in the process was not intuitive.

Also by analyzing the participant nurses' gaze patterns on Horus Scope and comparing them with the pain points gathered during task analysis we were able to validate the cognitive and physical interaction complications. These complications related to "Focus" or the "Brightness" adjustments, compromised the provider's ability to clearly assess the patient's ear and nose. (Figure 4.b.)

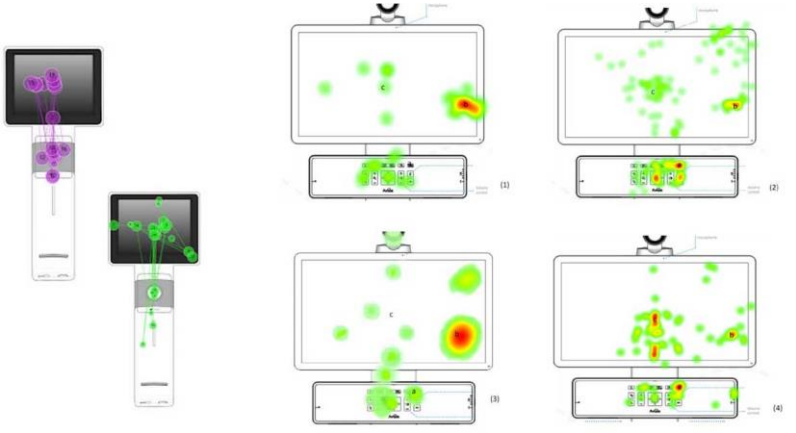

Figure 4.a: (Left) Horus Scope's gaze plot map for two nurse participants, Figure 4.b.: (Right) Cart monitor heat map for four nurse participants (All Reference images were collected from the user manuals for both the AmWell Telemedicine Cart and the Horus Scope II. For the workspace, a reference image was manually created in a simple design interface.)

Besides finding quantifiable trends through eye-tracking analysis to identify needs in training and protocols, these data also provide a series of infrastructural information for designing and prototyping our interactive training program (combination use of hands-on and AR) in order to enable an efficient and cost-effective education and training.

The suggested AR part of the training was decided as a result of a variety of findings during our pilot study. The need for accessibility at any time and location was one of the main reasons that makes AR a desirable alternative to an in-person training session provided by cart educators. Also, the possibility of programming the AR system based on the cart specifications or physician's routine makes this proposed training a customizable system. Additionally, the interviews showed concern about memorizing all steps to use the cart and peripheral attachments in the right order for the first time after the training and/or over

time. Overall this study suggests that integrating AR in this training system can be a great addition in providing inclusive access independent of a certain location or a person such as a cart expert.

3.1 Training System Design and Prototyping in progress

Currently, our team is working on confirming the plan for the training system steps with clinicians in order to provide an accepted level of reliability for different users' point of view. This Analysis will help us in designing and prototyping efficient and cost-effective education and training. Figure 5. shows a prototype suggestion of a possible AR view that a nurse sees through the wearable AR glasses. Although the identified current barriers in the telemedical evaluation of infants and preschool-age children clinical encounters can be overcome through education and training, this training program must meet the expectations for the successful completion of each element of telemedical encounters. For this matter, a reliable target threshold for successful completion of each element of telemedical encounters by identifying means to evaluate personnel as they perform simulated telemedical encounters tailored to the new training system needs to be established to evaluate the prototype.

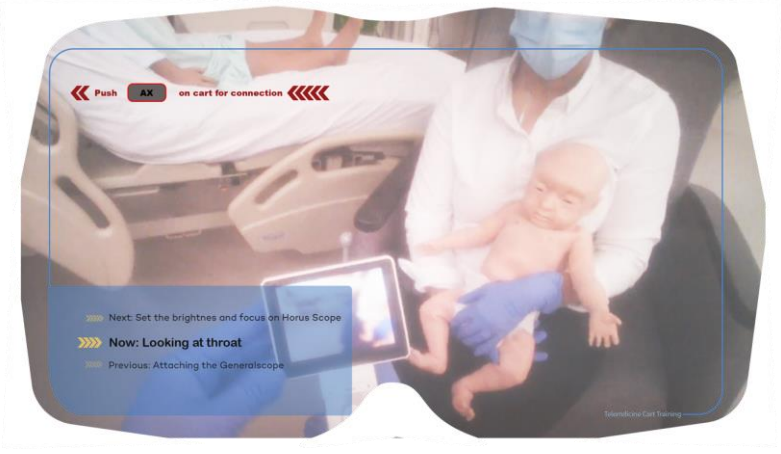

Figure 5: A Mockup of an AR screen as nurse's view (The background image is borrowed from preliminary testing during summer 2020)

4 CONCLUSIONS

Our case study demonstrated that a successful examination of an infant or preschool-age child requires the cart operator to possess additional skills related to working with both the parent and the child. Additionally, it is critical that both members of the provider and cart operator dynamic understand the technical aspects of cart operations thoroughly. In order

for this goal to be achieved, an interactive training program for providers and nurses can be designed. It is important that all participants are trained on the Telemedicine Cart functions and interactions and beyond general knowledge about apps that provide video-based telemedicine visits in a virtual office setting. This preparation can lead to a seamless experience for all parties involved, especially the patient. An understanding of both sides of the virtual interaction as well as a plan for the examination will facilitate effective communication between the nurse and provider in order to create a successful patient examination. To be properly equipped for this experience it is also critical that participants (nurses and providers) have the opportunity for hands-on learning with the screen of the cart and all accessory components, as they have a specific way of connecting and supplying the provider with patient information. By being familiar with the main cart, its attachments, and various functions, nurses and providers may assist each other in case they encounter difficulties during an appointment. To further facilitate smooth communication it is recommended that the nurse is familiar with the physician's routine and they take the time to set up a clear view of the patient in the environment before starting the exam.

This study suggests that creating an interactive system, using a combination of hands on learning and augmented reality, with the addition of labels and other organizational tools to the workspace can elevate a pediatric telemedicine visit, from a video call to a comprehensive physical exam.

In addition, within our case study multidisciplinary approach on various aspects such as forming the team, designing experiments and conducting the research allowed us to vet the efficacy of our approach from multiple aspects. Also community-based participatory research principles were critical additions in gaining a wide range of insights from multiple range of user groups and their needs in a procedure with a complex user experience process.

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Acknowledgements: This research was recently awarded by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number UL1TR003015.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Inter-University Design Workshop: plurality in design education

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Abstract | This paper presents the process to build and maintain a collective project between five design schools in Mexico City. In 2018, the Inter-University Design Workshop started as an "innovative education project that understands design as a mean for linking students and design faculty to the construction of open, diverse, and collective platforms for the materialization and testing of intentions and solutions to the complex problems of contemporary urban Mexican society". In the context of COVID-19 pandemic lockdown, the project continued in a digital format, keeping the initial intention of bringing students close to one other, by action and will, for the guild's sake and for their capacity to collaborate. From the strategies and outcomes that TiUD (Taller inter Universitario de Diseño) member students reached, we take valuable conclusions as clues for the new normal in education for our Workshop to secure its continuity the following years.

KEYWORDS | EDUCATIONAL INNOVATION, HIGHER EDUCATION, DESIGN ACTIVISM, DESIGN FOR SOCIAL INNOVATION, DESIGN FOR SUSTAINABILITY

1 Introduction

“The City belongs to its citizens. Is conceived as a physical space, that brings civilization, citizenship, secularity and habitable for the full exercise of its possibilities, the equitable enjoyment of its goods and the pursuit of happiness.”

Art. 12th Mexico City’s Constitution (2016, p.31).

Mexico City is the archetype of a complex unequal macro-city. Local government and inhabitants struggle and live through a time of multiple challenges and constant interrelated transformations, intensified in terms of scale, complexity and lack of resources as time passes. In this context, there's not much alternative than look for a space of civil freedom and power to create and transform the spaces we inhabit as the most important exercise of our urban life. Understanding freedom and ability as a possibility to thrive, in search of what we have in common as Mexican designers, is the Interuniversity Design Workshop's pursued goal.

Having to cope with the great defiance and urgency to build a "More Liveable Mexico City for All", design as a discipline and designers as citizens are confronted with the question of "How to contribute to the creation of an environmentally sustainable urban context and a fairer society in which living is worth living?". An additional challenge for this task is unifying perspectives, keeping the fundamental differences while enriching our collective interpretations of the surrounding reality. Bringing together design students from various socio-economical-cultural contexts represents the City's richness and complexity; using these representations as a powerful tool to communicate and understand has been one relevant outcome and incentive to continue this work.

From this stance, design practice and its guild present valuable resource to find transformative answers, transcending the sphere of aesthetics with a potential to explore. In Buchanan words, "the role of design in sustaining, developing, and integrating human beings into broader ecological and cultural environments, shaping these environments when desirable and possible or adapting to them when necessary" (1992, p.10).

The third opened an opportunity to behold those questionings answering with a new one: How can we harness the design student's collective talent to design a better city for all? Our response as a collective-academic group was presenting students the occasion of open dialogue, understanding each other through empathy -or sympathy- and acknowledging that this is the City of ours, in a time we have to live in it. Shared responsibility and desire kept us together through the last three years: a wish for a better future for our time being and generations to come. The COVID-19 pandemic lockdown offered an overlapped dare that we accepted, not without caution. We are sure about the need to find new ways to survive and collaborate, being truthful to our commitment.

2. TiUD Origins

2.1 Mexico City as World Design Capital

Mexican designer's guild is an energetic and vibrant yet unlinked community. Often, we ran into each other in events related to design; we are glad to meet, but those encounters do not usually lead to networking or beneficial collaborations. Although, we can be good friends or acquaintances. In 2016, World Design Organization designated Mexico City 2018 World Design Capital (WDC) as:

> "The sixth World Design Capital™ and the very first city from the Americas to receive this title, Mexico City has a powerful story to share on the world stage, as a model for other megacities around the world using design to tackle the challenges of urbanisation and ensure a more liveable city." (WDC, 2017).

Laboratorio para la Ciudad (City Lab) was the government entity coordinating the guild and programs. The planning started with worktables by topics, including the "Design-Education Worktable", formed in its origins, at least eight different design schools from universities located in Mexico City. As the first outcome, the University Passport was rapidly developed in a popular program to bring students to the WDC events. Design students would collect points for attending each event, and the "best attender" -the student who got more points- won as a prize a scholarship for a course at the European Design Institute.

The following significant proposal was to build an inter-university class for design students. During the first weeks, that idea was more like a recurrent joke; but soon enough, the idea turned into a dream and later became a provocation for the worktable members. Every participant was a faculty member at a design school; consequently, the challenge to bring together our students and expertise seemed possible yet difficult. The initial consideration was conceiving the workshop as a participatory design activity, framed on the Smith, Bossen, and Kanstrup intention (Thirteenth Participatory Design Conference), describing the participatory design as a tool "to engage not only with the public sphere but also with everyday life, and as researchers engage stakeholders in experimental practices of innovation through a long-term engagement in technology design, social innovation and future-making" (2017, p.66)

The planning for the TiUD's first edition, supported mainly by the City Lab, allow the conditions to discuss struggles that might appear when merging students from different universities in one single project. The design team summoned experts in education and collaborative projects from several countries and disciplines (philosophers, activists, lawyers, and designers). After a few months, we reached a common objective: gathering design students as design activists, promotors of collaboration, to activate Mexican society. The study objects were the City's social issues; participants would collaborate to bring their

attention to each university tradition's strengths and opportunity areas, understanding that we all need each other to get stronger and better.

Thus, the learning objectives for the students were:

a) Understanding design concepts and constructs to leverage social change.
b) Applying methods and tools to face complex problems, using a systemic approach and through design research.
c) Developing collaboration and communication skills to involve the diversity of stakeholders and multidisciplinary work for the collective conceptualisation and visualisation of diverse alternatives to bring the solution of social problems.
d) Analysing the impact of "what is designed" on social reality.



Figure 1. Road map of TiUD 2017- 2020.

2.2 Framework

This century demands specific skills to train professionals to perform effectively and broadly in both social and professional environments, as in their leisure time (Dede, 2010; Yelland, Kalantis, & Cope, 2008). Socioeconomic development requires competent and responsive individuals, and at the same time, active and imaginative members of a society, promoting change in the search for equality. Also, the forms of employment available for designers, today and shortly, are diversified in terms of roles, broadness and focus (Kaygan, Ilhan, & Oygür, 2020, p.15). Consequently, this consideration brings several implications for design education institutions, especially in countries like Mexico, with fewer companies that might hire an in-house designer.

From an academic perspective, design education challenges prescribe the importance of understanding adaptations and improvements in adapting the curricula to the present and

future reality of the employment market for designers. Hence the value in finding an opportunity for an open, refreshing and honest dialogue among the Design-Education worktable members. Every university focus and tradition bring the possibility of bringing together every and unique capacity of our students to solve the complex problem of our city.

Every edition of TiUD takes place in the fall (August to December); consequently, some universities have to adjust their calendars to match others. Then, one can imagine it represents a great effort of coordination for the Faculties. Every student enrolled in the course receive credits for it as an elective topic in their curricula. Moreover, students have to answer the selection process by presenting a video and a letter to expose their intention to participate. Being part of the TiUD as a student comes with significant responsibility and requires the best disposition, for the students are the face of their University. The approach methodology is through Participatory Action Research (PAR). Participants are researchers on the task, following a systematic process and analysis with a vast potential of strengthening horizontal relationships among professionals, colleges, and communities (Anderson, 2017).



Figure 2. Mapping in TiUD 2018.

In collaboration with the Design-Activism worktable and having a sustainable design approach, we assemble a conceptual frame as one single priority for every university representative. The framework includes empathy (Coleman, Lebbon, & Myerson, 2003), context (Alexander, 2012; Primitz, 2018), design activism (Fuad-Luke, 2013; Julier, 2013), connectivity and commonality in a systemic approach (P. H. Jones, 2014; Lurås, 2016; P. Jones & Kijima, 2018). An actual result of how we connected these concepts, a construct emerged: common circuits, which in the TiUD context means logical combinations of notions and knowledge that facilitate understanding and communicating conceptual definitions, finding convergent and relevant elements of each concept.

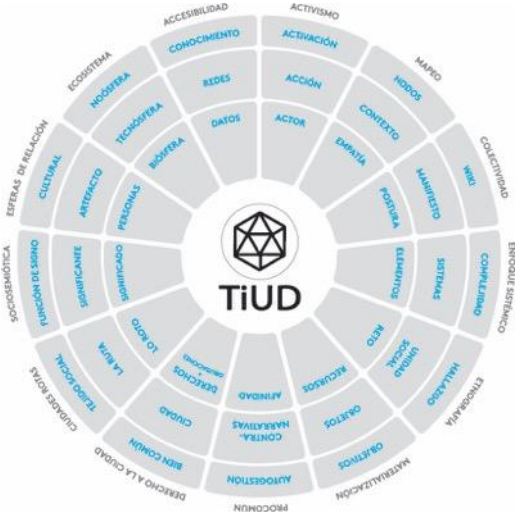

Figure 3. Interuniversity Design Workshop: Common Circuits.

The first edition took place in the context of Mexico City as the World Design Capital. As mentioned before, City Lab supported the project in logistics and promotion. On the other hand, Design Week Mexico™ offered their headquarters, Espacio CDMX[1], as a gathering place and a classroom. All along the course, it was a playful activity; 65 students and eight teachers from six different design schools found themselves discovering opportunities to learn and teach about design in a unique environment. Classes occurred in a garden or inside an old little train station that once was used to ride through Chapultepec park, and now is a memory of some teachers' childhood.

[1] CDMX is the acronym for Mexico City



Figure 4. Interuniversity Design Workshop at Chapultepec Park "Old train station".

The topic for the first edition was social activation; the instructions for students were to design an intervention in a selected local community to which they belong, engaging citizens to find solutions to the issues they faced in daily basis. In the first part, field research was relevant to gather enough information about the problem and the community in a neighbourhood or locality of the City. Eliminating preconceptions, misconceptions and prejudice, is the most challenging part for the group. As a result, we all succeed in identifying ourselves, first as humans, then as Mexican citizens and then as designers. Finding a common language, increasing communication skills and elaborating persuasive arguments were the students' gains up to this point.

For the project's sake and students' sense of achievement, it is always relevant to discuss the challenges that collaboration brings. On the one hand, communication should be fluent, constant and precise to promote equality and acknowledge diversity. On the other hand, as Fernández-Díaz, Gutiérrez, and Fernández (2019, p.80) explain, the promotion of links between contexts and reflections on participatory dilemmas, should be a priority. It means to set the question, "Is what is important for me, important for you in the same way?"

Through mapping the problems around the City, we were able to observe the dimension of the project. We all covered most of the metropolitan area, so we had the opportunity to bring a broth perspective into the analysis; finding the common elements might be the most relevant insights in searching for solutions. One significant case to show was the "Public Space Recovery" project at Iztapalapa. This municipality, located in the City's east area, is one of the most populated in Mexico City: it has more than 1.8 million inhabitants with a population density of 15 635,80 individuals per km² (Alcaldía Iztapalapa, 2019). A first edition participant is an area resident, so she invited her teammates to observe an urgent problem in her community. There was a park with infrastructure as a place for children to play, community members to gather together, close by an elementary school. Sadly, this place was used by drug dealers and for every possible illegal activity. The team members

interviewed some neighbours and discovered a recurrent answer: 'There are good people here ("Aquí hay gente Buena").

Iztapalapa's team came up with the idea of inviting the community to a public space intervention where they will paint the walls, plant some trees and play games with children and their families in the park. They choose to use the phrase taken from the interviews and use it as a model for other messages painted in the park: a reminder for the community of the people they live with – just good people. Community members responded gladly and participated the first weekend, asking for a second intervention the following week. So, the team did come back once more, and neighbours kept repeating the activity until the park felt it belongs to them again.



Figure 5. Aquí hay gente Buena. Public space recovery at Iztapalapa.

TiUD's second edition held 45 students and ten teachers from five universities; it followed five tracks: education, water, violence, food and migration. During an intensive boot camp to kick off the second edition, experts in these topics presented the context of the Mexican reality in these tracks. Students formed their work teams according to their interests and their curiosity in exploring these topics.

It is worth mentioning that talking and proposing discussions about their identity for this generation of students, as students from one University with its correspondent vision, was not challenging as it was talking about their ideology. The idea of representing their University's core capacities was obvious, so they showed no issues working with other school students. However, they found themselves very cautious about sharing political or religious ideas and stances. Providing a neutral space to talk, express themselves, find differences and common ground was the first challenge for this course.

One good example of this edition's outcome was "El Tortamundos"[2] a project about migration. The designed activity was to invite people from different nationalities to spend a couple of hours of their weekends in Parque México, in a central zone of the City. The invitation included the request of bringing any food or dish that belong to people's nation or cultural identity. Every plate should be shared by putting it inside a *bolillo* (a type of bread)

[2] "Tortamundos" is the combination of the word torta, a sandwich made with bolillo, a popular type of bread used in Mexico City, and the word *trotamundos*, which means globetrotter.

to divide the food and pass it among the guests. Once every person had a *bolillo* with a dish inside, visitors held in their hands a *Torta de Mundo* (a World Sandwich). Then, they get to talk about how they felt in Mexico as a migrant.

Valuable conversations occurred in that table; the community of locals -from different nationalities- shared a moment they had not shared before in the whole time they were living in Mexico. Some of the participants continued gathering during the weekends, bonding and assembling a supportive community among them.



Figure 6. El Tortamundos invitation and first test. Migration and lunch at Parque México.

3. TiUD 2020: A New Normal Education case

3.1 Planning

The emergence of COVID-19, for the first time in history, caused the whole of humanity to face the same set of challenges simultaneously (Dussel, 2020). The most evident state of emergency turned us inwards towards our communities. However, with the beginning of the pandemic and the lockdown, uncertainty became present in such a way that we felt compelled to reflect and extend the dialogue towards this issue so that we could be clear about the concepts through which we would build the third edition of our workshop.

To do this, we organized an online forum in which we invited international experts to share their views on how to identify, within what we denominated the "common emergency", what was worth sustaining after the pandemic. Based on the initial forum's information, we understood 'The Common Emergency' (*La Emergencia de lo Común*[3]), as the emergence of

[3] The word *emergencia* (emergency) has two possible interpretations, one referring to "urgency" and the second refers to "emergence". We used both meanings to explain what has been emerged as a shared value for our commonality.

shared values that we must sustain over time. We also know that some other elements we have in common that we should get apart from, to reach solid, integrated and responsible communities, in favour of fairness and equity. That which was common among us, arose at first in this group, as a disobedient will of the state of things and became what sustains us due to its repeated and renewed discovery in students' different rotation.

Thus, the 2020 edition observed civil society, searching for emerging creativity that arose from a crisis context due to lockdown. The design projectt focused on identifying "naive solutions", resulting from necessity and born from civil society. Consequently, opportunities arose where design can contribute to the development, dissemination and systematization of these initiatives. We have called these actions "Emerging Strategies", understanding that they arise out of necessity and will that they are, or could be, a source of inspiration for the design industry.

3.2 Development

Unlike the past two, the 2020 edition, was held entirely online: not an easy decision At the beginning we thought there would be at least a few sessions to face each other in the same space. In the end, we had to let that idea pass, or better, adapt it to the conditions that we considered most pertinent. One relevant concern we had was to bring the students to close since the beginning, so they felt a sense of belonging for they would be willing to bond as a community. To make that possible, we invite all the registered participants to an online breakfast, so we had time to know each other through the story behind the dishes. Some explained that they had their favourite mug that remembered of their grannie's coffee or those were the best tamales in the neighbourhood. By the end of it, we gain a bit of familiarity through those stories, to begin with, the collective work.

Instead of sharing a table, we shared ZOOM™ as a digital classroom and MIRO ™ as a digital board during this edition. These digital platforms were our tools to interact throughout the semester. While the conversation took place in audio and video with the first, the latter allowed us to create virtual idea boards to capture and share perspectives through texts, photos and videos.

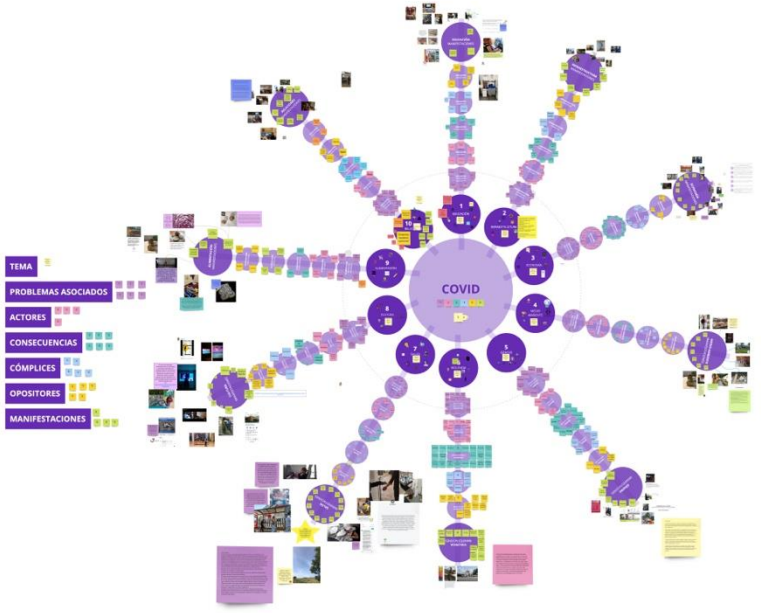

Figure 7. Miro Board. Emergent strategies analysis from Mexican civil society.

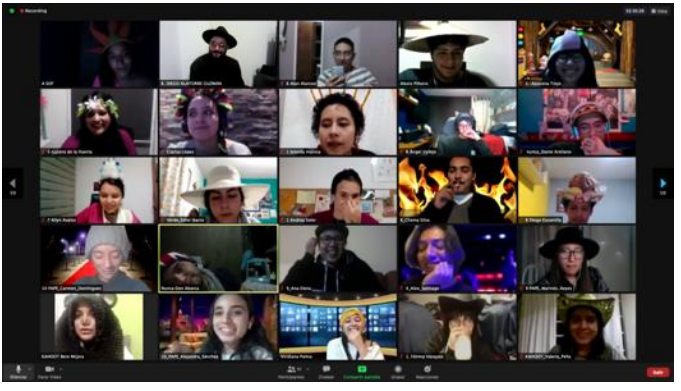

Figure 8. Zoom Party. Integration and bonding in 2020 TiUD edition.

The proposed methodology for this edition came from transition design approach (Irwin, Tonkinwise, & Kossoff, 2015; Kivimaa, Boon, Hyysalo, & Klerkx, 2019), with a vision that seeks the integration and diversity of multilevel perspectives (Geels, 2010, 2019; Moradi & Vagnoni, 2018). For this edition, we reinforce the theoretical framework by taking up

concepts such as the common (Carlisle & Gruby, 2019), sustainability (Garduño García, 2017) and activism (Narberhaus & Sheppard, 2015). We integrate causes-consequences of events analysis as a foundation from which they will make sense of their context and propose new narratives.

The project began in early September and lasted until mid-December, with interuniversity sessions on Wednesday afternoons brought together 65 students and ten participating professors from five design schools. In this edition, we added one extra day a week for professors from each university to meet with their respective students.

Two basic operations fixed the interaction throughout the process: exploring the systemic complexity from reality and fostering a dialogic interaction between participants. To simplify the collected information, drawings and visualization through diagrams allowed a glimpse of the complexity experienced. In such a way, when representing the knowledge acquired, they would make their position explicit concerning the event and, therefore, could communicate their discoveries, giving way to the next stage. The methodological process followed stages and steps in presenting the topics, developing a guided practice and applying the learning outcomes to students' project.

The following sessions schedule allowed us to set the pace and match rhythms between teachers and students. Topics were arranged through the course as follows: a) Problem mapping; b) Historical evolution mapping; c) Future views; d) Improvement stages; e) Designing ecologies; f) Call to action; and h) Presentation and final reflection.

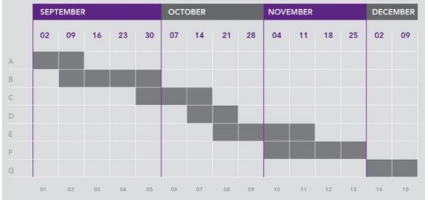

Figure 9. Sessions at 2020 Edition

3.3 Third edition results

The best ideas emerge from moments of crisis. In this emergency - and in others - the inhabitants of Mexico City demonstrated an enormous capacity for solidarity and great creativity towards offering solutions to the challenges that arose. Based on past experiences, this edition surged from the importance of activating our communities as a strategy to extend collective action.

In a virtual forum on December 5th, ten final projects were presented, divided into three conceptual blocks: education, equity and health. The students chose blocks according to

their concerns and the identified priorities. That distribution allowed us to interpret that the outcome brought to the participants to reflect on their situations.

Each outcome has the conditions to be implemented in the present conditions through social media or digital platform development. Students followed their initiative and focus on the result and impact these projects would have on people. It is still a question for us if the participants' commitment will remain after this edition ends.

The project "*México en Miradas*" (Mexico in gazes) presents the eyes' expressions as an authentic sight of emotions, as a side effect of the use of face masks. It invites people to share a selfie while wearing a facemask, describing feelings and emotions that they have experienced throughout this pandemic.

The project uses social media so visitors can find testimonies from other people to promote empathy. By sharing, they create content that fosters a sense of community and support among individuals to pursue the common good.



Figure 10. Mexico in Gazes. 2020's edition on-line project.

3. Conclusions

The Inter-University Design Workshop promotes a diversity of visions about the commonality: the guild of designers, the academic community and CDMX citizens. We have whiteness its manifestation in the shape of interests, purpose, values and, at the same time, dreams, wishes, emotions and commitment. From those manifestations, we hold a shared identity and the will to find solutions for our city and us citizens. As a group, we keep searching convergence, shared spaces and common ground, which sometimes are blurred, but when we reveal them, we get to define what kind of designers are we.

Each iteration brings learnings at different scales: from the progressive definition of the curricula to the diversification of roles. In the third edition, projects' complementarity is evident when observing the students' interconnection process beyond their teams through the coincidence of roles and concerns. During this process, professors guided the students, allowing them to choose their path. Results' quality was surprisingly clear, reached by commitment and compromise inside the teams. An important finding in this digital context was that students could perfectly navigate an ocean of ideas without losing their purpose.

For complexity visualization during the research stage, diagrams and digital boards were fundamental to synthesize, allowing the interconnection between multiple elements and ideas.

However, we did encounter several limitations, mostly related to the extension of the students work beyond the class, e.g., most projects were not linked to third parties nor external communities. These considerations open up new research areas for those interested: we suspect that the disappearance of our physicality withing online activities allowed for more intimate interactions to take place. In this *New Normal*, we founded what we were looking for since the first edition: a way to keep track in real time of the group's activities. By centralizing and recording the online interactions we can transcend time and space, making the context available for people all around the globe and at any time.

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Acknowledgements: Special thanks to the Inter-University Design Workshop members: students, teachers and collaborators; to the City Lab CDMX, Design Week™, UNESCO, and every support received from individuals, specialists, and participant Universities. TiUD professors at 2020 ed. are Itzaé García Vera y Omar Israel Mendoza Rosas from Escuela de Diseño del Instituto Nacional deBellas Artes y Literatura; Claudia Garduño García and Diego Alatorre Guzmán from Universidad Nacional Autónoma de México; Sandra Molina Mata, Ana Helena Hernández Palomino, and Edrei Ibarra Martínez from Universidad Autónoma Metropolitana-Azcapotzalco; Renee Harari Masri y Andrea Soler Guitián from Universidad Iberoamericana; Lucero Donají de la Huerta Santaella and Inés Alvarez Icaza Longoria from Tecnologico de Monterrey at Mexico City Campus.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Kids-centered Pocket Park design. Well-being for children in the urban post-covid context

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Abstract | The pandemic has played the fundamental role of catalyst, highlighting multiple challenges for the creative community needing to reconsider the human-being habits and environmental conditions, in order to rebalance the nature/artifice relationship in all its declinations.
Starting from consolidated and shared knowledge, the fields of design for kids, building physics and urban planning need to synergistically interact to respond to the renewed children's needs as a result of the pandemic, in terms of psychophysical well-being concerning their life in the built environment, with special attention to the urban context and its vulnerability. The research aims to outline an innovative approach identifying a series of actions to drive a new perspective on the urban spaces to better fit the kids-centric focus. The paper proposes a proactive strategy to combine interdisciplinary and multidimensional skills that bring together improved urban resilience and the mitigation capability of the urban environment for kids-centred design solutions. This strategy is applied to design innovative Pocket Parks for Kids.

KEYWORDS | POCKET PARK FOR KIDS, KIDS CENTERED URBAN DESIGN, CHILDREN'S WELL-BEING IN THE CITY, URBAN MITIGATION CAPACITY, URBAN RESILIENCE

1. Introduction and research background

The design aims to provide answers to extraordinary emergencies by turning limitations into new opportunities. The Covid-19 pandemic has forced human beings to rethink their habitat and redefine new forms of living and inhabiting in a multi-scalar perspective. All areas of the European Green Deal after COVID-19 pandemic emergency and within itself require considerable changes in societal practices and the behaviour of individuals, communities, and public and private organizations, from climate action to zero pollution, to anthropogenic pollution mitigation, toward hopefully a more healthy and resilient indoor and outdoor space for all the population groups and social contexts. These changes concern mobility behaviour, minimizing traffic-related emissions and energy/resource consumption, protecting or restoring biodiversity through holistic and nature-based solutions, etc. including changes achieved through collective and participatory processes or a sense of environmental citizenship and climate justice.

Special attention should be paid to the needs on kids' necessity for a high quality of living in the indoors and outdoors, especially in those urban contexts already compromised by huge concentration and densification, low air quality responsible for high sensitivity to respiratory diseases (Dixon, 2002) such as the COVID-19 pathology (Pastor Jr et al., 2002, Batterham et al., 1996), by urban over-heating and over-noising (Doyle et al., 2021, Huang et al., 2021, Kousis & Pisello, 2020). This is even more urgent while considering the United Nations report in World Urbanization Prospects 2018 (United Nations, 2018) which estimates that nearly 70% of the population will live in cities by 2050, and most of them will be under the age of 18.

Various researches in the field of medical sciences had already shown how contact with elements of the natural environment (trees, greenery, water, etc..) improves the health (physical and mental) of city dwellers (Hillsdon et al, 2006; Maas et al. 2008; Li, 2010; Schipperijn et al., 2013) and how staying in a green space produces an improvement in people's individual and social lives (Giles-Corti & Donovan, 2002; Browson et al., 2009; Baur and Tynon, 2010; Raanaas et al., 2011; Kardan et al., 2015; Lee et al., 2015). Epidemiological studies have highlighted the relationship between the presence of greenery in the proximity of the home and the overall health of the resident population, explaining how this phenomenon is due to the general strengthening of the immune system (Kuo, 2015). Other studies (Coley et al., 1997; CJC Consulting, 2005; Hartig al., 2014) have stated how high-quality green spaces encourage inhabitants to engage in outdoor physical activity and healthy behaviours in their everyday life.

Urban green spaces benefit all segments of the population, but especially children, by providing opportunities for intergenerational meeting and socialization. By encouraging physical activity in the open air, they also aim to implement policies to combat various types of disease (cardiovascular disease, cancer, chronic respiratory disease, diabetes, etc.), which are favoured by unhealthy eating habits and lifestyles, increasingly based on sedentariness and distant relationships. In this sense, an increase in physical activity corresponds to a 12%

reduction in the rate of obesity in children. In this sense, an increase in physical activity corresponds to a 12% reduction in the rate of obesity in children. Data (World Health Organization 2019) report that 23.5% of children engage in physical activity no more than 1 day a week, 33.8% of children engage in structured physical activity no more than 1 day a week. This is accompanied by an increase in sedentariness linked to the wrong use of technology by children.

On the other side of the issue, the urban environment has been affected by a variety of anthropogenic actions, producing detrimental comfort conditions, mainly due to air pollution, urban noise and urban heat concentration, dense urban areas with inadequate water bodies and green spaces (Jiang et al, 2021, Ngarambe et al., 2021, Wang et al., 2021, Pigliautile et al., 2020). These phenomena, that affect more vulnerable and exposed to stress and risks heat population, are typically framed under the umbrella of Urban Heat Island. Urban heat is generally counteracted through a variety of already acknowledged strategies, such as cool materials, greenery and water bodies, combined with sapient urban planning (Pisello et al., 2018).

A recent review of sustainability-driven innovations (Adams et al, 2016) showed how innovations for environmental and social benefits have evolved from a narrow technical, product and process focus to the holistic large-scale, system-level needed changes. For this reason, no single area of design is, by itself, sufficient to drive sustainable social development, but it is strategic design thinking that drives innovation. In this framework, a trans-disciplinary and cross-disciplinary effort needs to be implemented with the purpose to better focus the key issues and to propose pro-active, feasible and effective tools and solutions in urban resiliency design and urban wellbeing solutions kids centered. The paper aims to highlight how a solution can also begin with the design of urban parks for children, including appropriate equipment, the design of natural elements and integrating technology solutions for environmental sustainability and multidimensional comfort.

2. Motivation of the study

Urban parks and urban greenery in general, represent simple and effective solutions to face urban overheating and detrimental environmental conditions. In this framework, the COVID-19 pandemic has made the population all around the world more aware about risks we are subject to if environmental conditions are poorly resilient to any kind of positive and negative triggers, from climate change to other hazards, up to the pandemic conditions.

Indoor and outdoor space precise design strategies have become a crucial issue, especially in the framework of social and urban resilience. Disadvantaged and vulnerable social groups and communities most affected by this transition need special attention, that is the reason why this research is mostly focused on children requirements for keeping the high-quality of life and social and health (necessarily linked one to each other) wellbeing.

Several studies state that children who grow up in areas where there is a good presence of parks have a 55% lower risk of developing mental disorders as adults, and that green spaces create greater social cohesion, increases the level of physical activity and improves their cognitive development (Engemann, 2020; Vignati & Terenzi, 2019), also supported by the fact that the proximity to the parks can foster a better spatial working memory (Flouri, 2019) and greater problem-solving skills. Indeed, the playful activities within it promote the creativity of children, allowing them to play freely without any restrictions.

Besides, playgrounds allow better physical and motor development in children. Although physical movement is a natural aspect of human beings and their development, from certain age children are placed in a social system, starting from the school that does not encourage movement. Many studies show that good physical activity in children improves learning, increases concentration and attention, and reduces stress, anxiety, and depression. After all, the ability to practice healthy behaviours (walking, running, playing sports, bicycling, etc.) is directly related to the perception for safe spaces and self-confident behaviours.

Well-maintained green spaces can help educate children to respect the environment and public goods in general, but as the 2020 report of the National Environmental Protection System (Snpa) points out, in Italy, the percentage of public green spaces on the municipal surface is still poor and in two-thirds of municipalities there is a value below the average of 3%. Therefore, this is the moment to propose proactive and concrete tools and procedures to drive feasible alternatives.

3. Material and Methodology

In examining the methodology of designing spaces for children, is important to underline how the greatest ambiguity comes from a different way of seeing the world by children and adults (Day & Midbjer, 2007) but usually, the world is designed only by adults, including the products, services, and spaces that are used by children (Terenzi, 2018). For this reason, there is a need for a design that on the one hand declines the methodologies of UCD in a new kids-centered approach (Terenzi & Vignati, 2020) and on the other, operating in the field of urban design, highlights strategies, on different scales, that reinterpret the relationship between inhabitants and the urban context, including both social and natural ecosystems, with a sustainability-centered approach to public space (Fig. 1, Fig. 2, Fig. 3), ensuring appropriate levels of reception, protection and safeguard for all, that is, creating accessible places (Laurìa, 2017).

Within the holistic framework highlighted, this paper wants to propose a proactive strategy aimed at combining multidimensional skills toward better urban resilience and children-oriented urban design and comfort. This strategy is therefore triggered through innovative interpretation of Kids' Pocket Parks.

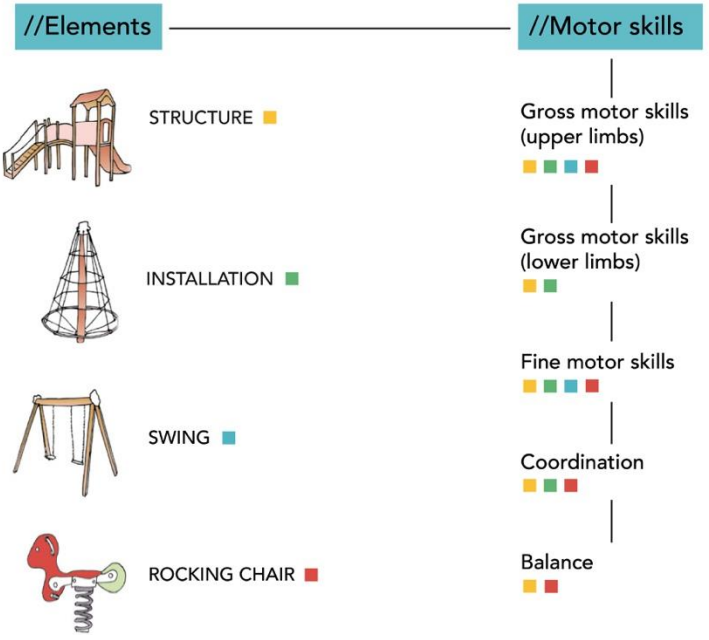

Figure 1. Analysis of traditional playground equipment according to effects on gross, fine motor skills, coordination and balance.

3.1 Pocket Park as innovative green urban area

The playground was one of the most promoted urban spaces in the mid-twentieth century. The playground is, without doubt, a significant space for the conformation of society and its transformative potential is unique. Historically, there have been two major proponents in the past century of this form of urban green space. The first was Robert Moses, Commissioner of the New York City Parks Department from 1934. He inaugurated the creation of nearly 700 new infant playgrounds in the course of 26 years. He defines parks are "the outward visible symbol of democracy" (Stutzin, 2015). The concept of vest-pocket parks was born in Europe after the Second World War as a way of recovering bombed-out urban areas located in spaces unattractive to other primary functions such as housing or commerce. Aldo van Eyck, the then debutant architect of Amsterdam's Public Infrastructure Department, would design in residual spaces and parks throughout the city in the following 31 years and that would become a central part of his career, giving the urban interiors, as they were used to say, a symbolic value in the Modern city they had in mind during the regeneration process.

Pocket parks are a particular declination of playgrounds. These are small public green spaces generally created by regenerating small residual or marginal areas within or adjacent to the most densely populated parts of the city (Bruce, 2017) and represent a viable strategy for the redesign of densified parts of the city.

In the 1950s the German landscape architect Karl Linn brought the concept of vest-pocket parks to the USA, where he coined the concept of "neighborhood commons on vacant lots" (Linn, 2007) intending to create neighbourhood connections in marginal lands to create new opportunities for city dwellers to meet and exchange ideas. Later Robert Zion popularized this new and different declination of the vest-pocket park through the Architectural League of New York's exhibition in 1963.

These “minor” forms of public spaces were designed as sharing and shared spaces aimed at fostering societal interaction, participation and democracy education. Pocket parks belong to different categories and their characteristics change in relation to their location, the privileged recipients (children, adolescents, adults, the elderly, etc.) and the facilities they house and their specific vocation. They can offer numerous benefits at the urban level, in both social and environmental terms, improving urban ecology. They can therefore represent today a new answer to the need for widespread green areas and under the house that large public parks often fail to meet (Laurìa, et al. 2020).

Having acknowledged pocket parks as proximity solutions, open to the public and democratic spaces for social interaction in smart urban contexts, this paper wants to bridge the gap between

1. urban space design for kids, after the pandemic,
2. urban environmental mitigation techniques,

promoting an innovative approach to identifying a series of actions to support the design of urban spaces for children. Starting from consolidated and shared knowledge, the fields of design for kids, building physics and urban planning get into system to respond to the renewed needs of children that have emerged as a result of the pandemic, in terms of psychophysical well-being concerning their life in the urban context.

3.2 Urban space design for kids, after the pandemic

Among the rights universally recognized to children, the right to play and free time is certainly of key importance. It represents one of the aspects that favour the psycho-physical well-being of the child, as a person with specific needs and requirements, autonomous from those of adults. The Convention on the Rights of the Child sanctions these prerogatives, in art. 31, par. 2 "States Parties recognize the right of the child to rest and leisure, to engage in play and recreational activities appropriate to the age of the child and to participate freely in cultural life and the arts". Unfortunately, these provisions meet daily obstacles that undermine the possibility of implementation, such as the social and economic condition of the family, or the educational disparity between families. But the presence of urban play

spaces for children, adequately equipped and usable by all, where it is possible to play a short distance from home, also becomes an element of great inclusion.

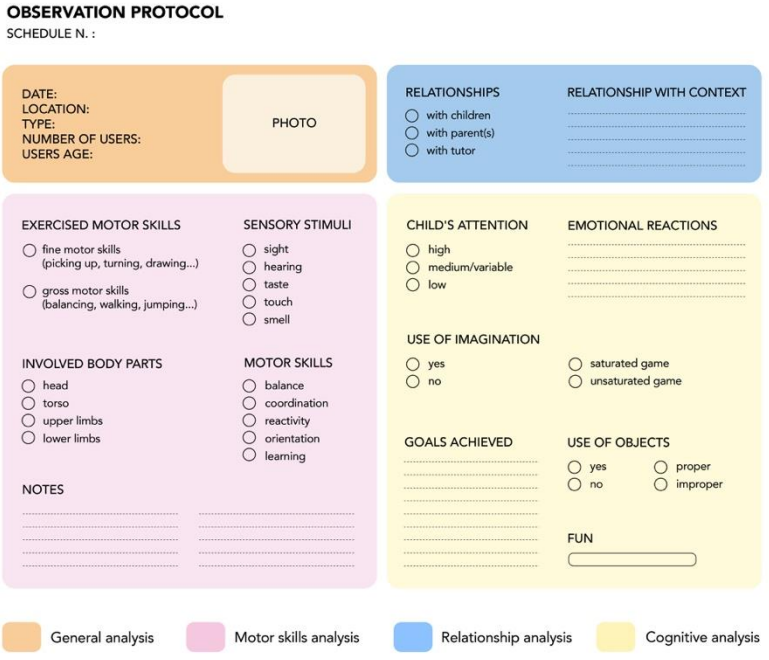

Figure 2. Canvas model for direct observation of children's activities during time spent at playgrounds.

The importance of the presence at the neighbourhood level of equipped urban spaces for children assumes a new value today, also in light of the restrictions implemented because of covid-19, but it was already present in art. 5 of the Charter of the Rights of the Child to Play and Work (1967): "In the community, free playgrounds should be provided, with convenient equipment and at a reasonable distance from homes, protected from the dangers of traffic and busy life, where children can carry out free play, cultural, recreational and sports activities, with the assistance of specially trained personnel and with the possible participation of parents and adults".

In this regard, during the period of restriction determined by covid-19, a normative act that offers considerable food for thought on this issue is attachment 8 to the D.P.C.M. 17 May 2020 (Presidency of the Council of Ministers - Department for family policies) containing the "Guidelines for the safe management of organized opportunities for sociability and play for children and adolescents in phase 2 of the covid-19 emergency".

First of all, the definition of the "right to sociability" in the binomial "sociability and play" is striking, underlining not only the need to guarantee socialization as an existential process, but also sociability that qualifies the person, as already outlined in the in art. 2, Italian Constitution and within the Convention on the Rights of the Child. The document reaffirms in various terms the right to time and space suitable for children and young people, as already stated in art. 2 of the Charter of the Rights of the Child to Play and Work (Rome 1967): "To carry out his activities of play and work, the child needs convenient human relations; as well as space, time, materials and instruments suitable for his age and adapted to his physical and psychic conditions".

From this document, it is clear that the Italian government has become aware of the need both to promote actions that guarantee a state of well-being for children and the role that public spaces and social relations play in this sense. In fact, this is in line with the "Create supportive environments" contained in the Ottawa Charter for Health Promotion of 1986 "Our societies are complex and interrelated. Health cannot be separated from other goals. The inextricable links between people and their environment constitute the basis for a socio-ecological approach to health".

3.3 Urban environmental mitigation techniques

Urban heat island and urban noise island are part of the same physical problem which consists of the local concentration of anthropogenic actions into a small territory, such as the urban environment (Kousis & Pisello, 2020). Most of the human actions and related emissions are indeed focused in such volume, therefore characterized by local overheating, bad air quality, noise and lighting pollution. These conditions are typically counteracted through a variety of factors. Urban overheating compared to the surrounding, also named as Urban heat island, is mainly imputable to low solar reflectance and impervious surfaces of the urban built environment, e.g. streets and squares but also building envelope. Therefore, the key passive cooling techniques are aimed at re-increasing solar reflectance of building envelopes and urban paving with “cool” material solutions, characterized by high solar reflectance and thermal emittance. On the other side, also evapotranspiration is used, with increasing greenery on building roofs, and in urban parks, for both shading purpose and also for remaking the groundless impervious in case of water runoff necessity. Water bodies represent also a further solution, typically implemented in the urban park also for microclimate mitigation (Pisello et al., 2018).

On the side of urban noise island, acoustic barriers concern the limitation of noise propagation from the source to the receiver, therefore they are much limited to a specific geometrical problem, in the case of localized acoustic pressure generation, e.g. due to piping systems, energy plants, etc. While urban paving systems are not much investigated to this aim, except for the urban roads, which are frequently designed with the purpose to limit vehicle-generated noise through rolling tires. Specific vegetation and trees are also conceived as acoustic barriers, with the purpose to visually and acoustically separate one

area from another, and therefore contributing to this urban pleasant layout which is still much needed.

The third uncomfortable condition is air pollution, counteracted using enhancing building energy efficiency, therefore reducing their CO2-equivalent emissions, and by using specific filtering systems around the emission sources. Recently also photocatalytic surfaces are under implementations, being able to exploit the photocatalytic triggered by Titanium dioxide to absorb NOx and other contaminants.

Despite the deep knowledge of all these elements, to date, there are no significant cases of urban green space design that take this knowledge into account in favour of child-friendly solutions, even if kids living the outdoors are maybe the very first population group to need such solutions in order not to create further morbidities, which may trigger to pandemic exacerbation, as shown during the COVID-19 crisis.

That is the reason why the new Kids' Pocket Park we propose through a pro-active roadmap is the place where combining such advanced cross-disciplinary effort.

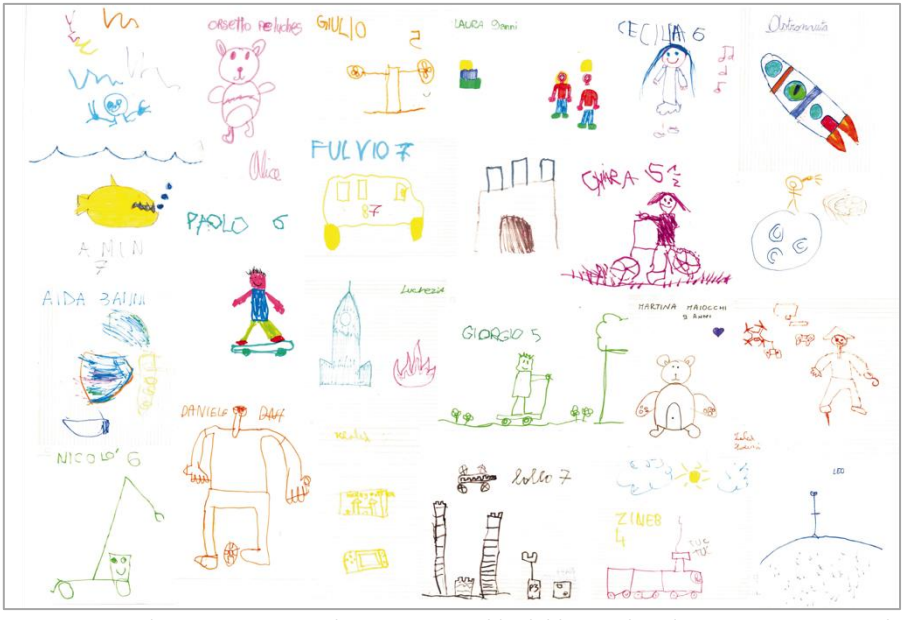

Figure 3. Co-design session with 3-9 years old children. The drawings represent the equipment of their ideal playground.

4. Design roadmap toward innovative Pocket Parks for Kids

Within the highlighted holistic framework, the research points to define a viable methodology to combine multidimensional competencies for improved urban resilience and child-oriented urban design. The innovative contribution concerns the transdisciplinary and trans-sectoral approach, linking different fields of research, local authorities and fundraising companies towards the shared goal of designing and exploiting Pocket Parks for Kids in urban contexts (Fig. 4).

The study identified the following step by step roadmap.

Preparatory multidisciplinary analysis

- urban planning investigation and identification of key areas for implementation
- identification of the relatively minor spaces where hosting the Pocket Parks for Kids analysis of the microclimate in terms of air pollution, over-heating and over-noising context to face
- societal acceptance surveys investigating people needs and their awareness and potentials about the proposed PPKs design in specific neighbours
- preliminary dialogue with local authorities (public administrations, private associations, citizens' associations etc.) depending on the context and fundraising

Integrated and inter-operative Design

- co-design session with users (parents, caregivers, children)
- design of the mitigation actions to be implemented
- concept of the Pocket Parks for Kids microclimate modelling and monitoring of the areas before implementation
- integrated and iterative design dialogue between urbanists, urban planners, kids designers, building physicists toward the final design
- final design elaboration including: (i) large scale urban conception, (ii) small scale design for kids solutions, and (iii) microclimate assessment and mitigation solutions.

Implementation

- identification of executive materials and solutions to be tailored for the social, cultural, climate context
- implementation of the Pocket Parks for Kids monitoring of local Pocket Parks for Kids microclimate in terms of air quality, overheating and noise pollution conditions through wearable and human-centered solutions
- re-submission of societal acceptance surveys on local population and Pocket Parks for Kids users

Final assessment report

- Financial report and assessment
- design quality evaluation and appreciation analysis
- microclimate evaluation and environmental quality final report
- social and regulatory framework proposition for fostering implementation a large scale in a variety of urban districts and contexts.



Figure 4. Key steps and figurative actions included in the proposed guidelines for Pocket Parks for Kids implementation and field final assessment.

5. Conclusions

This paper explores the possibilities for design to improve kids' condition, which encompasses physical and mental well-being, environmental quality, and the overall quality of life regarding contemporary urban conditions. It documents the state of the science

linking design to the human condition and highlights methods for architects, planners and citizens to improve the living environment.

This paper for the first time implements an holistic framework by driving operations toward the new kind of Pocket Park, i.e. the Pocket Park for Kids. While respecting all the urban design strategies of such urban layout, the PPK is specifically tailored over children needs to foster creativity, learning permeability, social interaction, cultural exchange and growth. At the same time, it is conceived to mitigate urban over-heating, over-noising and air pollution, with specific attention to those related morbidities which increased children population vulnerability during the COVID-19 pandemic and potentially in other challenging times, e.g. during hurricanes and earthquake-related hazards. This serves to remind us that even the smallest actions in the city can be charged with ideology, social and environmental meaning.

The proposal solution for kids-oriented urban design wants to propose Pocket Parks for Kids as an effective urban design strategy for societal and local renovation rethinking in urban areas with great potential as microclimate mitigation technique, benefitting environmental conditions in terms of thermal, acoustic, and air quality domains.

The operative design and implementation platform, populated by the proposed roadmap, was started from direct and indirect observations and ethnographic research already carried out on some urban parks. Canvas models and specially designed tools have made it possible to outline the needs and habits of children and parents concerning the use of different types of urban areas and green spaces. Data collected will be enriched through best practices in order to better define the design procedures and tailor the strategies consistently to each urban design need, from a microclimate, societal, and economic perspective.

As future development of this study, the design and implementation of exhaustive guidelines will be elaborated. Subsequently, field analysis will be conducted and the first implementations will be promoted through the realization of the interoperable feasibility study, multidisciplinary design and evaluation analysis applying it to the city of Perugia, in its variety of urban context by means of co-design activities to contribute children's voices in local planning for city growth management.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

NANOMEDICINE and TOURISM in the post-pandemic era: smart "mobility & health" through wearable design for lab-on-chips

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Abstract | The tourism is the globalization's weakest link because travelling has become one of the most risky activity due to the COVID-19. Therefore we must prepare well in advance to make travel safer in the post-pandemic step. The paper addresses the definition of furnished space model for traveler-tourist, designed of within the user-centered design philosophy. This allows the individual to fully experience the journey, monitoring with respect for privacy his state of health, thanks to the lab-on-a-chip, the microfluidic device that is revolutionizing the field of clinical diagnostics. The LOC technology could have an extremely interesting field of application in tourism and contribute to improve many services provided to passengers, as in air travel as in Hyperloop. The LOC thanks to its intrinsic advantages in terms of portability, accessibility, and technology, will allow the realization of intelligent mobility systems that combine the future expected perspectives of personalized preventive medicine during "journey".

KEYWORDS | NANOMEDICINE, TOURISM, HEALTH, WEARABLE DESIGN, LAB-ON-A-CHIP

> Sir, there is not much I can tell you. I don't know how we got into this tunnel, I have no explanation for it. But I ask you to consider that we are moving on tracks. The tunnel therefore must lead somewhere. There is no evidence of there being anything wrong with the tunnel, except of course that it doesn't end.
>
> *Friedrich Dürrenmatt*

1. Introduction

The tourism was one of the world's most thriving industry until the COVID-19, but it is in a state of collapse now and its future is uncertain. Travelling has become one of the riskiest activities in the pandemic era and it is also much more expensive than the cheaper and more comfortamble smart working way. Therefore, we should prepare well in advance to make travelling safer during this period and, well in advance, also in the post-pandemic step, if we do not want to lock ourselves in our homes for ever and become a sedentary society.
When we enter in the theme of travel, our most remote memories come to light. Even the stresses and emotions that come from the Cinema emerge - the "Seventh Art", the most generous -, that black and white Cinema that has filled our eyes with greetings from the train's windows, with handkerchiefs that melancholically sway in the air on the docks of the stations, of the bodies that swing in the corridors of a carriage to find a handold to search a new center of gravity, or even crimes full of mysteries aboard the International Wagon Company's train. The legendary Orient Express. Melting nostalgia and lacerating separations are the emotional feelings that often accompany the experience of films that talks about travel, even when you go out into space, as in the film by Andrej Tarkovskij in 1972. Before facing an important mission on Solaris's Planet, the protagonist, Kris Kelvin, spends days in his father's dacha, immersed in memories in the company of the elderly parent; here the camera lingers on that landscape which he will soon have to leave. And it is precisely the time of these shots on earth to increase the sense of detachment. To the trip's theme we also associate the pregnant images that descend from the visual arts. Unforgettable, for example, Compartment C, Car 293, one Edward Hopper's work (1938), one of his hymns to solitude, where there is an empty place, perhaps left by someone, between the window of a train that overlooks a landscape immersed in twilight and a woman caught in the act of reading, without great participation, almost casually, a booklet. The suggestions also come from the theater and fiction. In a short story by Pirandello, *The wheelbarrow*, the journey is transformed for the protagonist on an occasion to rethink his lifethe act of looking out of the train's window is his true journey, the inner one, which leads him to get to know himself. The multiple psychological variations, which are captured in the artistic and literary works of all times, express the richness and complexity of travel's theme and experience, and of the very meaning of the word "travel" in its various senses. Think about one of the most famous

journeys, those of Ulysses, Christopher Columbus or Neil Armstrong and Buzz Aldrin, all, for various reasons, mythical, generated by a vision, and which include commitment and risks; travels that always underlie the experience of the encounter, even dramatic or violent, with the other by itself. And to the traveler of the past, who is no even longer the men of art and culture of the Grand Tour, liberalism has replaced the touristconsumer, by conceptual subtraction from the experience of travel by the marketing’s dimension of risk, of daring, gambling, physical effort[1]. Today the traveler of the past is the emigrant who has a very specific purpose, to run away from the living hell of his country with the desire to reach a wellness state for him and his family. Considering travel as an internal experience, as self-knowledge, which has value beyond the aim to reach, and therefore beyond the purpose of the trip, obviously it sounds like a luxury reserved for those who can afford it, that is, to us. In the era of Liquid Modernity and the "software era", the space endures a decisive devaluation, to put it as Bauman (2006), to the point that the only dangers of a "navigator" are web viruses. It is worth mentioning here an illuminating passage from the chapter Time / space of Bauman's essay

> “In the software’s universe of travel at the speed of light, space can be crossed literally "instantly": the difference between "far" and "near" is erased. Space no longer limits action and its consequences, and counts for little or nothing; it has lost its "strategic value", as military experts would say. [...] Once it is possible to cover the distances (and therefore the materially distant parts of space on which we act) with the speed of the electronic signals, any reference to time appears, as Jacques Derrida would say, "sous rature". The concept of "instantaneity" apparently refers to a very fast movement and a very short time, but really it denotes the absence of time as a factor of the event [...]. Time is no longer "the way to go to achieve certain things" and therefore no longer gives value to space. The almost instantaneousness of the software era inaugurates the devaluation of space. [...] since all section of the space can be reached in the same time frame (or rather "instantly"), no part of space is privileged, none has a "special value." (Bauman, 2006, pp.132-133).

The traveler, however "[...] is not someone who loves traveling by remaining attached to his land, the traveler is a man who resolves himself in continuous movement, in the uninterrupted effort to free himself from all internal and external bonds, finding his own stability in continuous transformation "(Galimberti, 1992). What before the pandemic could have turned out to be a free choice, or a tendency, to remain nailed to one's home smart digital workplaced, preferring cyberspace navigation to the multisensory experience of physical travel, for almost all individuals today travel

[1] With the exception for 'adventure holidays', often combined with survival courses, which are in any case among the products of the tourism industry, where the inconvenience or accident is the result of a calculated planning. In addition, the metaphorical 'journey' of the drug addict deserves to be consumed exclusively within his body.

undergoes to a drastic and forced contraction. We are consoled by the benefits produced, thanks to this situation of planetary paralysis, by the reduction of atmospheric pollution, anyway the nostalgia for the journey is unbearable! Packing your bags, buying tickets, going to the airport, getting around in a foreign city, meeting strangers, working, chatting and dining with foreign colleagues, staying overnight in ever-changing hotels, are activities that belong to our personal memory. And when we see such situation in the movies, these actions that for us, before the pandemic, were ordinary, if not routine, today they seem to us carried out by inhabitants of other planets.

2. Nanomedicine and lab-on-a-chip

The traveler-tourist equation, beyond an understandable criticism that can also be moved against a second equation, much more problematic than the first one, tourist-consumer, now obliges to consider travel as an experience to be lived in compliance with security rules (with the attempts of the last few years, flight passengers had to be subjected to a gradual increase of checks in airport, with an increase of the time's boarding procedures and even of the simple access to some airports) moreover a limitation of things to be able to carry in the luggage. Passenger health is also a factor now regulated by international standards. Therefore we want to highlight how the "health" issue of the tourist - and of the passenger in general - can increasingly become a relevant aspect to offer quality services in international transport, not only by making travel accessible and safer to those who belong to risk categories, but always raising quality standards of travel, in relation to wellness, for all passengers. In this sense, nanotechnologies, due to the wide possibilities of application, low cost included, can represent a significant support. Nanosciences and nanotechnologies concern researches in various multidisciplinary fields that benefit from the collaboration of physicists, chemists, biologists and engineers. The growing applications of nanotechnology in the medical field have led to the creation of what is called nanomedicine. There are numerous opportunities in medical-surgical treatments, such as nano-encapsulation for the release of improved and focuses medication and reconstructive (regenerative) nanotechnology. However, nanomedicine seems to be able to develop more widely in the diagnostic field whether for the earliness of early diagnosis or for permanent health's monitoring. The growing use of nano-scale sensors integrated into micro-scale devices is leading to the production of low-cost healthcare devices that can be used outside the laboratory or hospital, by medical personnel or directly by patients in home care and telemedicine.

> "Nanotechnology and its applications in biomedical sciences principally in molecular nanodiagnostics are known as nanomolecular diagnostics, which provides new options for clinical nanodiagnostic techniques. Molecular nanodiagnostics are a critical role in the development of personalized medicine, which features point-of care performance of diagnostic procedure. This can to check patients at point-ofcare

facilities or in remote or resource-poor locations, therefore reducing checking time from days to minutes. […].” (Gorjikhah, Davaran, Salehi, Bakhtiari, Hasanzadeh, Panahi, Emamverdy & Akbarzadeh, 2015).

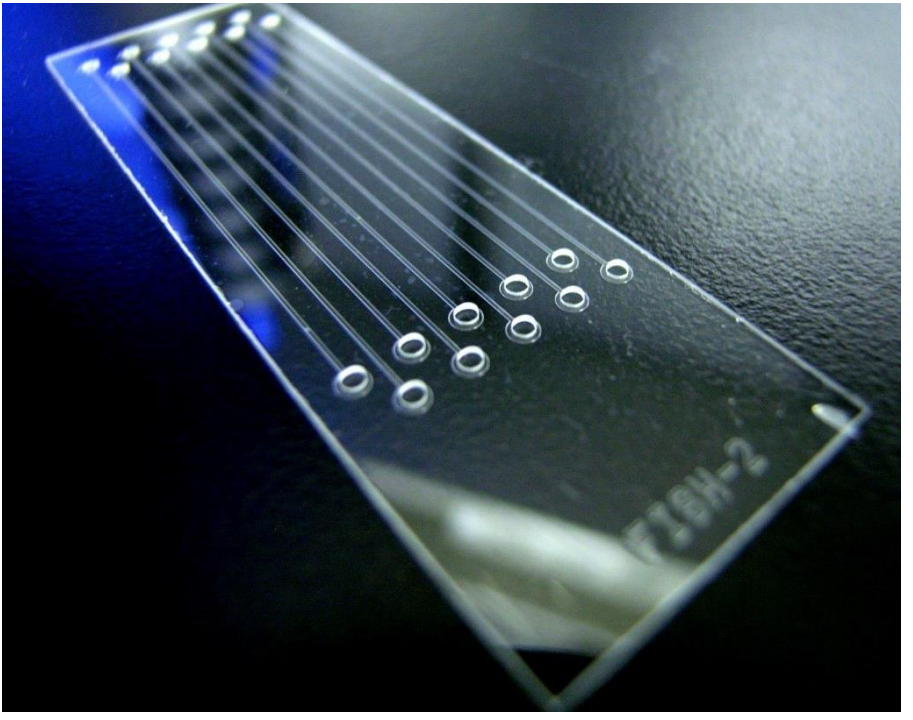

Figure 1. Schematic view of a Lab-on-a- Chip device for blood testing (see Red Blood Cells are flowing and analyzed)” by a compact microscope

The rapid evolution of scientific research is developing microfluidic small devices that integrate multiple functions on a single chip, the lab-on-a-chip (LOC), revolutionizing the field of clinical diagnostics. The chemical and biological analyzes, which today take place in specialized laboratories, can thus be carried out with striking advantages due to extremely reduced times and costs. Moreover, thanks to these miniature laboratories, usually only millimeters or centimeters in size, it will be possible to implement the so-called point-of-care analysis (POCT), or the possibility that the patient will avoid going to the laboratory. The prospects offered by this type of LOC technology, applied not only in the biomedical field, but also in the agro-food and environmental field, will enable rapid diagnosis and in any situation thanks to its portability and personalization. With the biosensors contained in the lab-on-chips it will be possible to recognize, for example, a specific molecule of clinical and diagnostic interest related to a pathological state or a functional alteration of the organism. “[…] By manipulating reagents on the microscale effects such as rapid heating and mixing can be exploited. It also allows waste and exposure to dangerous chemicals to be minimized”.

3. The project

According to the Constitution of the World Health Organization - OMS, the United Nations specialized agency for health issues established in 1948, the aim of the Organization is "the achievement, by all populations, of the highest possible level of health ", defined as" a state of total physical, mental and social wellness"and not simply" absence of disease or infirmity. The international system in charge and the railway, shipping and air companies must therefore commit to raise their quality standards. Therefore, it does not appear as an exaggeration to think of introducing the possibility of monitoring their health among the services provided to customers, before boarding, during and after the journey, to also guarantee an effective protection of the other passengers's health and of all those who will subsequently come into contact with them, in case of the spread of highly contagious diseases, as is happening with the coronavirus. What is illustrated here is the concept of a research project developed to participate in national and international calls, with the establishment of a transdisciplinary group of researchers and aimed to an obtaining funding for the experimentation and subsequent prototyping phase. In particular, we think about the preparation of special environments equipped with a lab-on-a-chip system integrated in a smart on-board furniture. Hyperloop, considered as the fifth alternative transport system to the four existing for long journeys, car, train, plane and ship. The sustainability of the system is added to the innovation of the system. Each capsule can leave 28 passengers every 2 minutes, for a total of 840 per hour. You could go from Milan to Bologna in 9 minutes, and in 30 minutes from Rome to Milan . The first commercial section to be operational will be the one now under construction in Abu Dhabi, but it is working also in Brazil, the United States, France, China, India, Korea, Indonesia, Slovakia, the Czech Republic, Ukraine and Germany.



Figure 2. The material used for the Oversee bracelets is the TPU, a thermoplastic polyurethane.

The application of lab-on-chips in the tourism’s industry, for travelling by plane, ship, train and future ones in Hyperloop capsules can be articulated into three different stages: 1) before boarding; 2) during the trip; 3) on arrival. The rapid monitoring of the passenger's state of health concerns not only the individual person, but also those he will meet in the cabin of an airplane or, for example, in the Hyperloop capsule. It is known to all that small-sized environments in which you have to stay for a long time, sometimes even beyond 12 hours, can be places that are strongly responsible for the spread of bacterial and / or viral diseases. The recent epidemic of the new coronavirus, which the real seriousness is not yet fully assessable, is showing that checks before departure and arrivals would seem to be the only weapon, at the moment, to control the spread of contagion. Rapid and targeted clinical analyzes can certainly be a more correct and advanced tool than the simply observation of passengers’s temperature, with a thermoscanner or with gun thermometers. The rise in body temperature is not necessarily a symptom of an ongoing infection; actually, the infection, as it now known, can be spread by people who have no symptoms and no fever. The rapid and low-cost clinical analyzes in steps 1) and 3), therefore, before and after the trip, they fulfill a social character, when they are made necessary for extremely serious events such as the spread of epidemics, or instead responsible self-diagnosis’s operations are the ones passengers voluntarily submit in all the other cases.



Figure 3. Oversee Bracelet technological system.

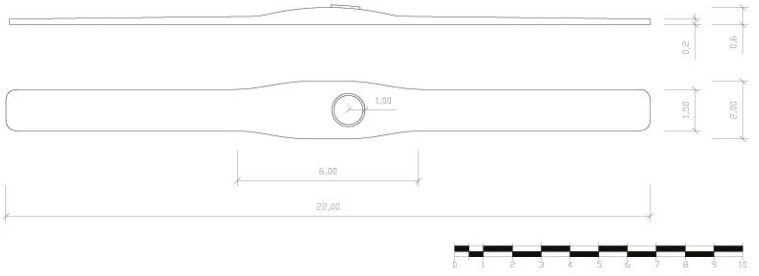

Figure 4. Technical drawings of Oversee Bracelet.

The project therefore consists in a realization of a chip lab-on contained in a bracelet - conceived as any fashion unisex accessory, but equipped with a second function aimed to a quick and effective test that identifies subjects positive for Coronavirus before boarding domestic flights. Without causing further slowdowns, the passenger who undergoes security checks before entering the gate or, even before passing through passport control, must activate the operation of the lab-on a chip. When passing through the metal detector or body scanner gate, with bluetooth technology through the radio waves of the ISM bands - Industrial, Scientific and Medical (electromagnetic radio frequency of 2.4 GHz), it signals the quick test result to a light and sound light. The negative subject passes smoothly, while the positive one is invited to enter a secure room. Any malfunctions of the device involve the repetition of the test.



Figure 5. Packaging of 0versee bracelet.

Diagnosis operations are those that passengers voluntarily submit in all other cases. During the journey, in step 2), they have a more "private" value. The idea is therefore aimed at ensuring maximum safety, in particular for the elderly or those suffering from certain pathologies, who do not intend to give up the travel experience without being separated and isolated in outpatient environments. In fact, in the future, the spatio-temporal dimension of the "journey" could be an opportunity to contextualize the journey with the possibility of undergoing diagnostic checks. The development of rapid and personalized diagnostics could have an extremely interesting field of application in the tourism sector, in particular where the conditions of travel are not guaranteed first aid, such as in air transport or in future trips in Hyperloop.

4. Conclusions

Therefore, Lab on chip, thanks to its intrinsic advantages in terms of portability, accessibility and technology, consensus will be the creation of intelligent mobility systems that combine the expected future prospects of personalized preventive medicine during the "journey".
It will also be possible to foresee, in the future, a subsequent phase of guided autotherapy, thanks to the Lab-on-a-chip, by sending the results of the analyzes to your doctor remotely and by administering specific drugs and in the indicated doses. The purpose of this work is to try to imagine a future world in which "the journey" will become an opportunity to carry out health checks. In fact, non-invasive or very invasive and portable devices could be imagined as integrated systems incorporated for example in passenger seats. By taking advantage of travel time, intelligent seat systems, equipped with electronic and lab-on-chip devices, will be able to provide a complete medical diagnosis.



Figure 6. Hyperloop is a futuristic magnetic levitation transport system that allows you to travel at 1126km / h.

As described above, these sensors will be able to monitor many physiological parameters and biomarkers during the journey. LOCs will require liquid samples from body fluids. In essence, we can consider that LOCs are made from different blocks or modules, regardless of the specific biomarkers and related deriseas. A) sampling systems for miniature system (i.e. microneedles); B) a microfluidic unit capable of manipulating the analyte; C) detection unit in which the measurement is performed; D) a signal processing system to provide data for a diagnosis; E) a storage and communication unit for communicating data to doctors in order to validate the diagnosis; F) the person's smartphone should also be connected to the system to allow communication with the sensors integrated in the smart seats. A seat design is required for hosting such devices and performing this analysis. The only modules that should be in contact with the body is the first module on the liquid sample. The rest of the modules can be incorporated and therefore not accessible to people. Lab on a chip device can be used for detecting and/or measuring different biomarkers in body fluids. Many diagnostic tools are nowadays based on Lab on Chip technology and have been proofed for detection of various types of biomarkers. Actually, significant R&D activity is pursued worldwide in many research groups both in industry and academia. For sure the technology of Lab on a chip will be the elective diagnostic paradigm in the near future. In this context we, at best of our knowledge, are the first to investigate and discuss a scenario in which such diagnostic tools can where the rapid and /or continuous diagnosis of human health can be integrated and embedded in the ordinary life of the "journey".We intentionally did not address the specific biomarkers or pathology that can be detected and evaluated by Lab on a chip as we are more interested in understand and explore in our research to build up a completely scenario that never has been addresses before based on user-centered design philosophy and fully integrated in a normal day-life and outside of the classical "clinic" and "hospital" situation.

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Acknowledgements: Thanks to **Livia Gervasio** for the translation.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Post-pandemic medicines: towards a new normality

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Abstract | The Covid-19 Pandemic has caused two types of phenomena: on one hand, it has profoundly changed people's lives, calling into question even the most normal behaviours, such as being able to walk out of the house; on the other, it has accelerated the consolidation of new habits, not necessarily appropriate. This is the case of behaviours linked to the dimension of care, of self-diagnosis and the consequent self-care are approaches amplified by the ongoing pandemic, bringing to light the lack of an overall vision of the Italian care system and in particular of the medicine management.
This paper explores this issue, firstly offering an overview of the problems and the changes taking place, and then offering some potential openings on project ideas. These openings would rethink the future processes of homecare and the entire drug supply chain, from production to distribution, up to post-sale tracking and consumption, to the disposal.

KEYWORDS | POST-PANDEMIC MEDICINES, MEDICINES AND TRACEABILITY, MEDICINES AND SMART TECHNOLOGIES, 3D PRINTING DRUGS, PERVASIVE AND PERSONALISED CARE

1. Pandemic distances: new behaviours in care

Indeed, the ongoing Covid-19 pandemic is radically changing many of the behaviours that take place in our daily lives. Old practices that have always characterized our ordinary life, are giving way to new experiences that are likely to normalize early, even if offspring of discomfort and behavioural restrictions (Van Bavel et al., 2020).

Distance, fear of relationships, isolation are the main drivers of new behaviours, affecting the relationship between doctor and patient, patient and hospital facilities, patient and disease, patient and care (European Union, 2020).

In an attempt to reduce the risk of contagion, many health services have drastically reduced outpatient visits and hospital admissions, revealing the weakness of the health system that, in recent years, especially in Italy, has followed models of strong centralization at the expense of a territorial medicine (Armocida, 2020; Dell'Acqua, 2020).

Like all disruptive events, the pandemic is proving to be a powerful catalyst for system innovations. An accelerator of innovations already in place, such as e-health and all forms of digitization of therapy that could, shortly, make available new modes of remote prevention, treatment, and care (Fagherazzi, 2020; Cobelli, 2020). The new ergonomics and proxemics of distance (Bolzan et al., 2020) generate new behaviours and processes and, at the healthcare level, affect the care system at different scales, from the places designated for this purpose to the individual drug packages. It is on this last aspect that this contribution dwells, probing the different aspects of pharmacological care put on the test bench by the current pandemic.

2. “Living” and “Orphan” medicines

The Covid-19 Pandemic shed light on the lack of a strategic vision of healthcare as a system. We can view the pandemic state as an amplifier of many issues related to the healthcare system as a whole and traditional care practices (Armocida, 2020). Epidemiologists and immunologists are predicting upcoming pandemics as a normal condition of our future. Viruses and bacteria will occupy a decisive place in spurring the opening of new diagnostic and therapeutic avenues. It is projected that by 2050, 50 million people will die from bacterial multi-resistance (Turin, 2018). The most traditional antibiotics and antivirals have drastically reduced their effectiveness in treatment (Li, 2014), partly due to their overuse in therapies (Alhomoud et al., 2017) and indiscriminate release into the environment, through crops and farms.

New therapies are appearing on the pharmacological research front. In Europe, the first clinical trials are starting to evaluate new forms of treatment against infections. These are trials already in use in the countries of the former Soviet Union (Altamirano & Barr, 2019) based on substances of a biological nature. They are called “phage cures” because they are

based on selective viruses whose peculiarity is to feed on bacteria: those that traditional antibiotics are no longer able to attack due to the resistance acquired by these microorganisms. These phage substances are “alive” and precisely for this status, their use poses new questions to science (on the risks implicit in therapeutic uses), to jurisprudence (on the rules of use of biological material very different from drugs whose peculiarity is to have a stable active ingredient) (Verbeken et al., 2017; Huys et al., 2013). But also design, as a translator of matter into objects, into production systems, into sales systems, into packaging, storage, and transport processes may play an important role in "shaping" this new system of care, through solutions designed starting from the needs gathered from the observation of user behaviour (Stegemann et al., 2016).

The transition from the experimental and laboratory level to the large-scale production of such peculiar products challenges the project in all the relations - widely explored - that link the term design to the industrial one, as well as challenging it in relations not yet fully addressed, such as those that connect the project to the transformations of the biological world and living matter (Weiner et al., 2000). It also activates systemic reflections on the role that the design approach could have in the field of pharmaceutical products in general. The pharmaceutical sector is a context which, despite huge investments in R&D that have historically led to innovation among the most advanced, has not paid systematic attention to the evolution of pharmaceutical shapes in order to improve the assumption and facilitate the processes of interaction with the patient. Furthermore, in the pharmaceutical sector, industrialization processes are based on rigorous criteria in terms of quality control, safety, efficacy, and economics. These plans are often in contradiction with each other and push, as in the case of some types of medicines for limited use, such as the "orphan drugs" - so named because they are intended for rare diseases, often "orphan" of the drug - to go to small production lots, almost artisanal in nature or, to quote Maldonado, super-industrial (Maldonado, 1976). Orphans, even more so, in the pandemic era when all industrial efforts have been diverted - sometimes with reconversion processes - towards the production of medicines and sanitizers of wider use.

“Living" and "orphan" drugs are two examples of the compelling relationships between the form of medicine, the form of the industrial process, the logic, and economies of production. To these tight logics are added the standards that define formats and sales packages according to standards aimed at responding to product safety and quality criteria (Van Baelen et al., 2017). These standards (which impose, for example, the minimum number of doses per package) are binding in Italy as well as in many European countries and, if on the one hand, they are effective in guaranteeing the safety and integrity of the product, on the other hand, they do not allow to meet the needs of personalized therapies for patients (Minghetti et al., 2014). There is also a lack of a design approach aimed at simplifying the experience of using the medicine, starting from the way in which the information for use is presented to the form of the packaging; the design process is very often unbalanced in favor of the reasons of production.

There are some virtuous examples, both currently on the market, such as some blister packs of contraceptive pills, and in the development phase, as in the case of the FebriSol project (www.febrisol.com); in both examples, elements and affordances have been designed that encourage the processes of interaction and consumption of the drug. Actually, in both these cases, information is presented on the primary and secondary packaging, guiding the user to the consumption of the drug and - thanks to physical interaction, such as crushing the blister or scratching the label surface - communicating and reminding the daily intake of the pill.

In the United States, drugs are sold according to the duration of therapy, and contained in prescription bottles; these containers are indistinguishable from each other and might cause poor adherence to therapy or errors in the use and consumption of drugs. If on the one hand, the process of care and therapy is personalized, on the other hand, the experience of care and management of the drug presents significant critical issues and risks, due to an object not properly designed for interaction with the user. An example of how design can address this challenge is Deborah Adler's project for CVS Pharmacy, to redesign the package and label (Adler, 2017). Concerning the package, different ones have been designed according to the type of drug to be contained; then colored rings have been realized, to be added to the packaging as customization and to make it visually more recognizable. Regarding the label, the hierarchy of the information has been reorganized, making more visible the name of the patient, the type of drug, and the useful indications for taking the medicine.

Personalization of the drug and its wrappers, containers and blisters, and attention to the design of the interaction and user experience with the drug represent perhaps one of the most important challenges that pharma should be looking towards. Especially at a time when pandemic behaviours are proving to be powerful accelerators toward autonomous and increasingly domestic management of care.

3. 3D Printed drugs: towards personalised care and distributed production

The applications of additive manufacturing related to Health and Care are growing and, according to data from the International Data Corporation (IDC), in the Western European 3D printing market, what is driving the growth are precisely the applications in the medical field, which in 2019 accounted for about 33% of the total spending of 7.2 billion in the additive sector (Naghshineh et al., 2020). In this regard, the path paved by experiments with 3D printing of the "custom" drug (Chavda, 2015), can prove revolutionary by introducing new logics of product, production and distribution process, prescription and dispensing of the drug.

In the health sector, there is an area of convergence between the official healthcare system, the making culture - as a new way of manufacturing - and patients as bearers of innovation

through the experimentation of devices for healthcare, according to a "Do It Yourself" logic (Maffei et al. 2019); these emerging socio-technical transformations seem to go together with those medical-pharmaceutical research trends that go towards *ad personam* treatments and that now constitute a consolidated research direction. However, these scenarios cannot be transferred tout court within the context of pharmaceuticals.

Indeed, the pandemic has fostered behaviours that distort the concept of personalisation, which was already widespread, and which are now encouraged by the imposed doctor-patient distance. This distance has led many patients to self-prescribe therapies, to borrow therapies from the network or from the experience of other patients (Bessell et al., 2003; Malik et al., 2020). On the other hand, what can be transferred by the new technological practices is the centrality of the patient, who is no longer just a "human factor" but a "human actor" in innovation processes (Maffei et al. 2019). As a patient personally involved in the dynamics of pathology and its treatment, he becomes a superuser, enabled by communities of designers and systems of digital experimentation (such as Fab Labs and makerspaces) to the role of the lead user (Von Hippel, 1989). A role that makes the patient an activator and an active participant in innovation processes. In fostering the emergence of the patient-innovator, these evolved forms of user participation simultaneously activate new forms of user-oriented health care (Oliveira et al. 2015; Sienkiewicz et al. 2017).

Technology, in other words, has triggered changes in mentality and cultural attitudes that go well beyond merely its technical-productive potential. Not that they should be put in the background. Far from it. The lines of experimentation for the creation of 3D printed pills, balanced on the personal needs of each patient, follow the logic of the small-batch, useful as we have seen in the case of “living” or “orphan” drugs that struggle to find space in traditional production lines. They also go in the direction of the unitary drug that replaces, in a personalized way, the multi-drug therapy, thus obviating the frequent errors of incorrect dosages or improper dosages (Norman et al., 2017).

Such examples are: the Galeno trial, initiated by BIOlogic, in which the digitization of capsule production allowed the subdivision of the capsule into modules, making it effective for the integration of active ingredients with scheduled release schedules; a 2014-dated study, in collaboration between the University of Milan and Massachusetts Institute of Technology, on the feasibility of Fused Deposition Modeling (FDM) 3D printing in the production of capsular devices for oral pulsatile release, based on a polymeric (hydroxypropylcellulose, HPC) swelling/erodibulum (Melocchi et al., 2015); the start-up Multiply Labs (multiplylabs.com) focused on creating multidrug therapies for cardiovascular disease, diabetes, HIV, and mental illness through capsules that contain each patient's daily prescription in a single capsule, with the goal of correctly dosing the patient's medication and improving adherence to treatment; the production of FabRx (fabrx.co.uk), a British company founded at University College London, which is focused on creating personalized treatment medicines - in terms of dosage, shape, size and dose combinations - specifically designed for on-site production at pharmacies or clinical trial units.

Although these cases are still a niche and are not destined to become the "new normal" with immediacy, we would like to underline here how, personalized production, modifies the industrial logics, also in terms of their territorial distribution, favoring new proximity to the hospital, to the doctor, to the pharmacist and ultimately to the patient and his needs.

Through the development of strategies such as those mentioned, moreover, it will be more guaranteed the safe and controlled accessibility to the drug and easier to manage the tracking of the entire supply chain of the pharmaceutical product.

In this field, a customization culture has not yet reached a sufficient maturity level, similar to the one that design has brought to other goods, interpreting it in a strategic way to make it become a competitive advantage factor. In the pharmaceutical sector, the systemic customization can offer different design chances, such as: the design of shapes conceived to meet the users' challenges (e.g., prehension, swallowing, recognizability, etc.); the customization of dosages; the research of potential ways of "joining" the active ingredient with the excipients, in order to enhance its bioavailability according to defined timing; finally, the hybridization of active ingredients in a single pharmaceutical shape.

Design can and should also intervene in the communication sphere in order to prevent the spread of a misconception of the concept of personalisation, which misinterprets the potential of available technologies and which could be exacerbated by pandemic isolation.

4. The Pandemic and the counterfeit medicines

During the pandemic, the strong limitation or even abolition of traditional diagnostic practices due to the high risk of infection has encouraged forms of DIY diagnosis and treatment. The Web reveals itself as a channel not without dangers, both in the diffusion of knowledge coming often from individual experiences that assume the strength of a generalizable knowledge, and above all in the concrete dispatch of care.

It has long been shown that the online sales channel is dangerous in the purchase of drugs dispensed by circumventing the necessary prescriptive path that makes the therapy unique and individual. Phenomenon amplified by the pandemic situation with a surge in the sale of drugs for the treatment of symptoms from Covid-19 and counterfeit vaccines (Ministero della Salute, 2021; Interpol, 2021; CNBC, 2021). These have been defined, not surprisingly, the new "liquid gold" (Fregatti, 2020). The phenomenon of counterfeiting and the increase in illegal trafficking of drugs (in particular antidepressants, disinfectants, antibiotics, antivirals, as well as medical devices such as gloves, masks, gowns, diagnostic tests, etc.) has had a high point from March-April 2020 (AIFA, 2020; Gruppo di lavoro ISS Farmaci COVID-19, 2020).

In April 2020, the Istituto Superiore di Sanità published a Report on the risks of online drug purchasing, warning about DIY coronavirus treatments. (ISS, 2020; Cazzaniga & Di Giorgio, 2020). Besides, on December the 3rd, 2020, the Italian Medicines Agency (AIFA) issued a Recommendation already christened as "Enhanced Traceability Drug" to increase the power

of the European traceability standard 2011/62/EU (European Union, 2011). With this recommendation, AIFA envisages the use of a digital platform, on which pharmaceutical companies are required to upload the serial numbers of the individual packages of each pharmaceutical product, before their shipment. AIFA, in this way can follow the path of the drug both towards the hospital channel and towards pharmacies.

5. From the pandemic, the design of new opportunities

The reinforcement of serialization, aimed at combating the illicit purchase of drugs, already widely in use but widespread during the COVID pandemic, lends itself to be an opportunity to stimulate new project scenarios, precisely because it allows to follow the path of the drug up to the end user. Their introduction has produced cascading effects, some of which are necessary to optimize investments in the readjustment of production facilities, others related to a more careful observation of the drug throughout its life cycle, from production, distribution, prescription, dispensing, purchase, use and consumption, until disposal. Even after the pandemic, this observation leads to a systemic increase in design activities related to good practices in the use of pharmaceutical products aimed at sustainability, which could become the standard in medicines life cycle management.

Serialization and antitampering have been, for example, an opportunity to redesign the secondary packaging of the drug, to ensure greater clarity and ease of access to information; understanding and simplicity in use; enlargement of the user base even to the weakest groups (Baule & Bucchetti, 2015). For example, the antitampering has for the first time forced the sale of the sealed drug. In this instance, the rule, born for safety purposes, has yielded the side effect of producing an increase in unused drug waste. The seal placed on the pack does not allow the package to be inspected to verify the shape and size of the prescribed drug. It is well known that, particularly in elderly patients, the difficulty in swallowing - especially tablets - is amplified by the size, thickness and roughness of the drug's surface. During the Metadesign Course within the Product Design Bachelor’s Degree at Politecnico di Milano, several exercises carried out on drug packaging, to improve its communicative potential, have brought out the need for pharmaceutical companies to represent in 1:1 scale the shape and size of the drug contained, to support patients with swallowing problems in the right choice of purchase. Confirming the need for this information integration, on December the 10th, 2020, Teva Pharmaceutical Industries (www.tevapharm.com) announced the new company policy that includes the obligation to report on each package the representation of the content in real size at the Smart Packaging Conference. Another virtuous example of how the anti-tampering regulations are guiding companies to more comprehensive interventions on packaging, to increase the level of security, is provided by the folding boxes, tamper evident, designed and produced by IGB Bressan whose R&D Centre has worked to respond to the regulations by integrating child resistant packs.

This is the context in which new design strategies can be included to extend the medicines' tracking to cover their entire life cycle, in order to move towards a fully smart medicine.

6. The attributes of post-pandemic medicines: smart and traceable

The serialization operations, aimed at making traceability possible, are useful tools to provide patients, health services and public administrations with greater forms of protection and guarantee on the originality of products (Piutti, 2020). They are made possible by the new opportunities that digitization makes available and are a first step in a series of broader interventions aimed at the “tecnologization” of the drug and the objects that surround it, to improve its use in the different phases of its life cycle.

We tend to christen all consumer products, including pharmaceuticals, as “smart” whenever a single technological application intervenes to modify or expand the possibilities of interaction between user and product; in the case of pharmaceuticals, this is often to mitigate the many problems in the proper management of therapy. Sensors to capture data useful for patient monitoring; ultra-broadband connectivity to allow data to travel and devices and people to communicate; internet of things, biotechnology and nanotechnology for targeted treatments; use of smartphones, apps, wearable devices to monitor vital parameters; ingestible digital pills that cure only diseased cells; QR codes that expand the package insert with how to take the drug and make the information available in different languages; smart carts that can detect the correct distribution of drugs in the departments; smart bracelets that allow the health worker to automatically select the patient and his correct therapy, etc (Pozzi, 2019).

But, once again, the breadth of the aspects of drug therapy touched by the pandemic, and their process relationships, have precisely demonstrated the need for a system approach to the issue of medication and treatment.

At this stage, each pharma is moving in an autonomous mode. This modality produces a puzzle of non-organic interventions, lacking a framework within which the various innovations can unfold their potential. Just as an example, we note that serialization for traceability purposes allows for the monitoring of particular aspects of the product's life (e.g., where the drug is located along the sales channel), but leaves uncovered and at the same time suggests that the forms of drug monitoring could be extended to the disposal phase (Chaves & Decker, 2010).

Moreover, it suggests that the many forms of quality control of products, used for example in food (Chen, 2020), could be introduced with positive implications on the fairness of use (adherence) of the medicine both in home therapy and in the hospital environment. We refer for example to "smart labels". We refer for example to the "smart labels": so far, there are two types of smart labels, mainly used in mass retailers and - marginally - in the

pharmaceutical industry, namely thermo-chromic labels and the ones with integrated RFID sensors.

The first can undergo a change of color (temporary or permanent) as a result of a thermal shock or temperature change. The latter, thanks to the presence of RFID sensors and the information they contain, can be used to ensure the integrity and traceability of products, from the production cycle to the sale, providing useful information to the consumer during use and consumption (Pozzi, 2019).

In pharmaceuticals, the massive diffusion of these types of labels could certainly benefit both the production, management and quality control processes and the user's experience of care. The design and integration of smart labels and products capable of reading and displaying the information contained therein, represents a challenge for new home care and telemedicine systems and processes.

And it is also the task of design to translate and even make plausible solutions that risk remaining only chimeras in the world of medicine. Consider, for example, the possibility of remotely communicating that the drug has been taken, an issue that is anything but trivial without a complex feedback system. The actual assumption, to be detected remotely, requires sophisticated technologies, very useful even and especially in a hospital environment, especially in high-intensity infectious wards, such as departments Covid-19, where there is the impossibility of staying inside the room during the assumption of therapy by the patient.

Some technologies under development, such as sensors and electronic circuits integrated into ingestible drugs, may be more appropriate for this purpose. Thanks to their small size, they can be ingested by the patient, to have accurate images in real time of some tracts of the digestive system, or to monitor the health status of people, or to control the correct adherence in drug treatment (e.g., PillCam, Proteus Digital Health, Abilify Mycite).

And extended or enhanced traceability could complete the life cycle of the drug also in the hospital environment where all steps, from the prescription, to the supply at the hospital pharmacy, to the storage of drugs in the ward cupboard, to the preparation of the therapy trolley, up to the patient's bed, are steps of a complex process with a high possibility of error because highly dependent on the operator. The introduction of drug and patient identification codes, already widely used in several European countries, has proved very useful to reduce errors in administration (European Directorate for the Quality of Medicines and Healthcare, 2018).

Finally, the management of the drug when it becomes waste, for different reasons such as its expiration, discontinuation or change of therapy, is not yet so structured and controlled, in the same way as the disposal of other types of waste (Žiauberytė, 2011). Indeed, to date, many drugs are thrown in the common waste, becoming a risk to public health and the environment (Li, 2014; Vatovec et al., 2017). Thus, the drug could be tracked not only in the production, transportation, purchase and intake phases, but also in the disposal phase, both

in terms of product design (e.g., baskets) and service design (e.g., the role of the pharmacy in collection procedures). While from a cultural point of view it would be necessary to further sensitize and educate citizens on the proper disposal of medicines, on the other hand, thanks to the possibilities offered by technology that is becoming increasingly widespread, the medicine could be tracked even at the moment it is thrown away. Based on existing experiences of smart baskets, which give information about their filling and optimize the collection processes, or that allow the collection of certain types of waste (for example, diapers and sanitary napkins, which if differentiated, can be recycled), during the Metadesign Course within the Product Design Bachelor's Degree at Politecnico di Milano, the students have developed a basket for the collection of drugs. With this example, we propose a design reflection on the traceability of the drug in its entire life cycle, acting both on the awareness and education of the user and on the management of the drug as waste.

7. Design culture within future care processes

There is one positive effect we can attribute to the pandemic state: that of having highlighted how little normality there is in the processes of care. Perhaps this is because the disease itself does not belong to the sphere of 'normality': all the complex practices that inhabit it and the behaviours it triggers are out of the ordinary, changing or distorting a person's everyday life. The accessibility of medicine, which is currently the main treatment practice, is a human right. To be considered as such, it is necessary to design new ways and new shapes of quality, safety, trust, friendliness for the patient, to make him/her feel in control and at ease when dealing with the healthcare system as a whole, compared to when he/she tries to manage his/her health status autonomously. Characteristics capable of promoting a new normality of care that is truly post-pandemic. In this sense, we have seen that the prerequisites are already in place in technology and policies to be able to intervene on certain customs and habits relating to the management of one's health, which were consolidated but which the pandemic crisis has eradicated.

The Design Culture can bring together the different knowledge and disciplines that affect the pharmaceutical sector and the processes of care. Indeed, as illustrated in the previous paragraphs, the design contribution can affect the different dimensions of care. It may involve the production, material and formal aspects of the medicine itself: thanks to the use of tools such as 3D printing, it is possible to create a truly personalized cure and design a custom treatment. It may concern the formal, graphic and material aspects of the packaging, and thus guide patients towards a better and more conscious interaction and experience of medicine use. It may address the management of home treatment and the relationships among the various actors of the process, investigating the communication potential through digital channels.

As a consequence of the pandemic situation, the often digital and virtual interactions among the patient, the medical staff and the pharmacist have become much more difficult; thus, all

the figures involved have had to adapt to communication tools and relationships not specifically designed for the management of care processes. The entire experience of care, from the purchase to the assumption of the medicine, has lost the degree of familiarity, control and security given by the direct and real interaction among the actors of the care process, amplifying the possibility of errors and related risks.

The potential offered by technology for the pharmaceutical sector, and the critical aspects that have emerged in the home care processes represent an opportunity: the Design Culture can indeed be an interpretative and project filter through which we can respond to the challenges of home care processes and interaction with drugs, keeping the human component at the centre.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Reaching Audiences in 2020

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Abstract | This paper explores novel approaches to teaching, learning, making and exhibition of student work amidst lockdown restrictions in autumn/winter 2020 during the Coronavirus pandemic. At a small, specialist arts university, in the North of England, Level 5 undergraduate students on BA (Hons.) Visual Communication embarked on a blended approach to teaching and learning, following strict social distancing measures for sessions in studio/workshops and with many sessions online. The module asked students to improve technical skills and principles, form small peer groups and choose exhibition theme, create final outcomes in response to themes and to present their work to an audience. Typically, all teaching happens face-to-face, and exhibitions are held in local public venues. This year, however, we had to embrace digital technology and social media, adapting to the 'New Normal' to reach both learners and audiences. This paper is a case study and reflection on efficacy and what we can learn and embrace in the future.

KEYWORDS: BLENDED-LEARNING, EXHIBITIONS, AUDIENCES, LOCKDOWN, DIGITAL MEDIA

1. Introduction

Visual Literacy is a module running for Level 5 (second year) undergraduate students on BA (Hons.) Visual Communication (Viscom) at a small, specialist arts university in Leeds, North of England. The Viscom course is very broad and multimedia in scope, encompassing a variety of skillsets: Graphic Design, Photography, Moving Image, 3D & Illustration. The course has a small cohort of students, with 45 students at Level 5. In the Visual Literacy module which takes place in autumn/winter Semester 1, our Level 5 students are asked to select a skillset in which to improve technical skills and principles, to form small peer groups, to decide on an exhibition theme, to create final outcomes in response to this and to present their work to an audience. Typically, all teaching and learning sessions happen in studio, and exhibitions happen in local public venues selected and secured by the students, such as a gallery or bar. Students are normally responsible for theming, booking, marketing, curating and installing their events with careful tuition and guidance throughout this process. They are also asked to respond to their group theme creatively in a way which demonstrates progression in their chosen skillset, and to produce final outcomes for their group exhibition or event. We have previously had student groups present work, for example, in an upstairs room in a popular bar in city centre, or in the city art gallery over a long weekend. The focus of these events is not just to showcase student work, but to also involve and engage the audience as much as possible. Often groups hold workshops or participatory activities associated with their outcomes, such as public colouring of illustrations reels, or interactive walk-through installations. The visceral experience or producing tangible work, installing it into a physical space, often prepping walls, using ladders, hammers, spirit level etc. and seeing an audience attend and view their efforts is both inspirational and rewarding for students. It shows them what they can achieve collaboratively and validates their practice.

However, against the backdrop of a worldwide coronavirus pandemic in 2020 the module had to be reconfigured for this year with social distancing measures in mind. During the majority of the time, our city was under UK government Tier 3 restrictions which prohibits all social or cultural experiences at which an audience might gather (UK Gov. 2020). It also meant a significant amount of teaching and learning had to take place online, but with a preference to enable all face-to face teaching wherever possible. Initially we considered whether this module could run at all in any meaningful way. However, after carefully reviewing some of the responses to the pandemic from around the world, we decided we could still facilitate a valuable learning experience as well as high-quality outcomes and public events. In order to do so, we had to embrace digital technology and social media, using all the tools commonly available to the general public to their full capabilities.

Not only did this change our means of engagement, but it also affected some of central critical concerns. Embedded into sessions this year were some of the following questions:

1. Social distancing and proximity: working together in groups

2. Creating conversations online: How can we engage audience across different digital platforms?
3. Measuring Impact: How can engagement translate into action/change in the real world?

Whilst not all of the work made was about coronavirus directly, it all dealt with contemporary cultural and social issues, often made more pertinent by prohibited social interaction.

Aims

The module is founded on the underlying ethos of the Viscom course, to foster a multimedia practice underpinned by design methods, which allows students room for nuances and differences to determined their practice. Primarily, students need to improve skills and knowledge in a chosen skillset. It also emphasizes the need to communicate to audiences, be they predetermined and specific, or more general as in the public at large.
The module also values real-world application of design and social skills. This year, against the background of the pandemic, these were not just driven by a need to communicate a particular theme or message in the best way possible and with the greatest aesthetic concern, but by a need to *connect*. This need to connect was much stronger than in previous years. Driven by periods of enforced isolation and more remote learning, students needed to connect with staff and with each other. We had to establish a network of mutual support and encouragement using digital technology, and then turn this outwards to connect with audiences. Therefore, this year the module retained the same drivers to improve particular technical skills, but with an overriding emphasis on the potential of digital communication and online technologies to connect meaningfully with real people.

Methodologies

Instigated by the university's decision to adopt a blended learning approach, we employed digital and analogue methods of delivery. Whilst a majority of the Viscom tutors have significant teaching, making, exhibition and participatory experience, we had little experience of doing this remotely prior to the first UK lockdown in March 2020. Therefore, the strategies for the module were:

1. To create communities of practice; with other practitioners, within the student body in small event/exhibition groups, and within tutor-led skillset groups.

2. To explore online and digital technologies; as tools for learning, as tools to create and communicate art practice, as tools to engage in conversation (with each other and audiences).

Before the pandemic, the Viscom team had no experience of employing online platforms as learning tools nor as the means by which to present work. However, with early training and by connecting to other practitioners globally through online meeting platforms, we created a network of support. This was achieved through listening, observing, testing and interacting, and was influenced by Wenger's ideas of communities of practice being groups of people who share a concern and participate in a practice together (Wenger-Traynor, 2015). We carefully curated our course Visiting Professional (VP) programme to include a variety or practitioners responding to the new scenarios created by the pandemic, particularly in the field of audience engagement. For example, we had Tandazani Dhlakama, a curator at MOCAA, Cape Town, South Africa, talk to us about curating and reaching a new demographic of audiences (Dhlakama 2020). Artist Lena Dobrowoska talked to us too, sharing her use of immersive digital technologies to communicate real world climate issues powerfully and globally (Dobrowoska 2020).

Our Visiting Professionals (VPs) also helped re-enforce critical and contextual sessions delivered by the Viscom team. We covered topics such as ethics, sustainability, representation and diversity, interactive arts etc., and our VPs Talks demonstrated these ideas in practice. This was one better than just showing students examples on google. Instead, they benefitted from being able to ask VPS questions, albeit through the medium of a screen, and to interrogate ideas at a more applied level. The immediacy of dialogue allowed students to become part of a specific community with our VPs. Not only did students ask module relevant questions, but also wider questions relating to their own practice and contextual interests. This generally resulted in open invitations to students to continue conversations beyond our allotted VP sessions.

In previous years, students were guided through a structured series of specialist workshops, skillsets and individual tutorials, upon which they were expected incrementally acquire technical skills and knowledge. However, access to new means of learning in the form of online resources (such as Adobe tutorials, Linked-in Learning or bespoke workshop videos recorded by the institution and uploaded to estudio pages, the university's virtual learning spaces), meant students could piece together their learning at a non-linear and self-determined pace. For example, a student did not need to do a screen-printing workshop before trying etching in a structure pre-arranged by module and workshop leaders. Instead, they could watch the etching induction videos first and then physically access the workshop through an online booking system. This new approach meant learning was more open, taking a constructivist approach to skills and knowledge acquisition rather than adhering to Piaget's developmental model (Piaget,

1936). That is, the student could engage with resources as and when they wish, rather than when a tutor believes they are ready in a linear model of development.

Within the module, each students' engagement was located around two peer groups: A skillset group with a specialist tutor (which came together as a result of students' choice to work in a particular media), and an event group (which came together as a result of students choosing particular themes of interest). These groups overlapped a little, but not much. Through them, students formed their own communities of practice. They also aspired to transform their audiences into a communities of practice through the activities and call outs on social media and digital platforms. To maximise inclusion and engagement, this had to be done online and using consumer-ready platforms. Students' creative outcomes also had to be digital for them to be seen. During the module, we looked at Claire Bishop's argument about digital arts. In *Digital Divide*, she asks:

> *"While many artists use digital technology, how many really confront the question of what it means to think, see, and filter approach the contemporary through the digital? How many thematize this, or reflect deeply on how we experience, and are altered by, the digitization of our existence?" (Bishop, 2012, p. 436)*

We attempted to really consider the potential of digital technologies at the ideas stage of development, rather than to convert outcomes merely for display. Rather than to disavow the digital means of production, we attempted to embrace this head on, even within analogue processes, with the prior knowledge of the imperative of digital encounters with between the work and audiences. Bishop quotes Lev Manovich, who asks if communication itself can be a subject of an aesthetic (Manovich, 2001), and due to our necessity to do this via screen-based engagement, it was a main point of consideration throughout.

Process

Whilst the first UK lockdown in Semester 2020 forced teaching online, much content had already been delivered. Therefore, most teaching at that point was feedback to individuals or small groups, meaning staff and students had a limited experience of digital teaching tools at the beginning of this academic year. These had not been applied, to the new context in which tutors and students were engaging. We were both unfamiliar with each other, due to new cohorts, and had not yet established relationships. Additionally, some skillset areas could be better facilitated than others. For example, 3D workshops in metal, wood, ceramics etc., as well areas such as screen printing, letterpress etc. could happen pretty much as normal with some scaling down of group sizes because they had prepared resource spaces to enable social distancing and hygiene in advance. Yet some areas, particularly Moving Image and Photography, were still struggling to recover equipment (most of which had been loaned out by last year's

outgoing Level 6 students prior to Easter holidays and lockdown). Therefore, not only were technical inductions difficult due to group sizes, social distancing and equipment handling issues, but the resource areas did not even have the equipment they normally have available.

The Module leader and Level 5 team centrally co-ordinated all generic module teaching, critical and contextual sessions, and overarching schedule (including the VP schedule). However, we decided to devolve all content of skillset learning to the relevant specialist tutors to research and deliver according to potential provision within the restrictions. We used teaching hours to build in tutor-led workshops in small skillset groups, enabling lecturers to develop and deliver specific skills and underlying principles, which differed significantly between skillsets, but which all covered a consistent high standard.

Table 1: Skillset tutorials and Tutor-Led Workshops

Graphics	The Brief & the Brand Logo & typeface design Layout & composition Resourcefulness Sustainability Resourcefulness; Sustainability (3Es) ADOBE CC History of Graphic Design Rights Print/Digital Self Confidence
Illustration	Working With What You've Got: Experimentation using everyday objects, testing techniques, tools and materials Icon: Self portraits for use as promotion, profile and branding Headlines: Information and story through illustration
Moving Image	Themes: Openings, Journey, Horror, Using Archive

	Sequence Self-Shooting Constructing a sequence Camera Angles Camera Movement Use of light and colour
3D	Make Do: Paperclip workshop, Potential, Taking things further, Materials, 3D Online, Visual Identity, Brand Building Material Culture: Object Anthropology, Your Work Culture, Ethics & Sustainability, Impact & Legacy, Community & Inclusivity Christmas Market: Selling Platforms, Customer/Audience, Trash into Cash, Zero Waste, Commerce
Photography	Exposure Compensation Composition Silhouettes Controlling Lighting Image post-production

Flexibility and freedom were key. For example, in Moving Image, we explored technology and extended our community of practice beyond the university. We looked at a mobile phone app, *Filmic Pro*, which enables a smart phone to shoot high quality footage, stored on the cloud, without codec issues when imported for editing. We also explored gimbals for mobile phone cameras and accessed some of the free archives available, in particular through the UK based *Archive for Education* programme. The tutor set tasks which were achievable regardless of equipment or isolation, do-able on any camera, in one's own room or out of doors. Yet these still explored key principles such as camera movement and shot angles, whilst focusing on creative ideas and creating high quality films. Being within a learning group with shared aims, students formed a community of practice, a peer support network which enabled Vygotsky's **'**Zone of Proximal Development' (Vygotsky, 1978), thus furthering each other's attainment and standards. Google Drive was also used to share work and upload it for tutor and peer review. Finally, these small skillset groups enabled us to hold some

classes in the studio (given the university had stipulated no large group or individual teaching could happen in person). This ability to be present (if it was appropriate to the session) meant staff and students could bond better. "*Genuineness, trust* and *understanding*" are identified as key attributes in any learning relationship by Carl Rogers (Rogers, 1967 304-311 in Smith, 2004). Evidence of this bond became apparent in student take-up of optional online tutorials when they became available later on in the module.

We engaged with the online learning resources to which the university had subscribed, such as Adobe and Linked-in Learning. Our workshop technicians and academics set recommended pathways for students, but the latter could also explore these resources for themselves. Our university workshops provided their own instructional videos too across a range of media, from After Effects to screen printing, and other online learning platforms such as Adobe Max conference and FilmBuddy gave students access to professional speakers, masterclasses and 'how to' guides. Overall, students were offered a much wider range of materials and methods of engagement. This supplemented focussed skillset learning with tutors and each other, and gave students the freedom to explore and engage as appropriate to their practice, learning style and speed. With the further feedback from tutors through online tutorials and in-person small group critiques, students were really able to develop an independent constructivist knowledge base.

By the time our Visual Literacy module started in September of this academic year, the world had experienced lockdowns in many countries and yet the creative industries had responded innovatively in order to share work with audiences. It was important that we, staff and students, were aware of what was already out there that might be useful. Therefore, the Level 5 team spent a significant amount of time preparing, researching and attending different online openings, events, seminars etc, and gathering them into a Padlet resource. One of the significant advantages of digital exhibitions or performances, for example, is the ability to access culture from your own home for free. For example, Tracy Emin's show, *I Thrive on Solitude,* at Whitecube Gallery, London, or The V & A's *Kimono: Kyoto to Catwalk*, were real treats. Similarly, participating in *Slung-Low* (a Leeds-based online choir) and attending *Stay-at-Home-Rave* by North England's original Indy Club, *The Hacienda* offered expanded cultural involvement, but all from within the home. Likewise film festivals, such as the independent festival, *Scalarama*, or *Leeds International Film Festival*, could be attended through a smart phone with good wifi, thus maximising opportunity to view films, but limited to the confines of an individual's domestic private space . However, the ability to go global and explore international phenomena such as *Global Hack*, was unique and unprecedented. Within this, we were conscious that the Viscom team's cultural choices might not resonate with students, and so we invited students to contribute to the Padlet and construct their own collective resource.

Students' thinking around events, exhibitions and their responsibility as creatives exhibiting work in public was supported by the critical and contextual studies programme embedded into the module.

Table 2: Visual Literacy Critical and Contextual Studies

Ideas and Process	Developing ideas Research skills Choosing which skills to develop and how (e.g. skillset tutorials, TLWs and LinkedIn Learning, Adobe Max) Initiating and actioning your own learning *Making work* - **Chuck Close** *Constructivism* *Working Knowledge,* **Tom Davenport** and **Laurence Prusak** *Tacit knowledge* *Skills Knowledge* - **Sister Corita Kent** *Reflection* – **Tom Waits**
Communities of Practice	**Lave & Wenger** What are these to you? (skillset group/event group etc.) How have you supported each other?
What is Visual Communication?	Viscom Lexicon – Develop your Viscom Lexicon Great Viscom during Lockdown **Paul Rand, John Berger**
Online/Virtual Events and Exhibitions	How have others thrived on the digital? **Mary Beard:** On Culture **Marshal McLuhan:** *The Medium is the Message* **Claire Bishop**: *The Digital Divide* **Craftivist Collective** – *social and political engagement through craft* **Tracey Emin:** *Solitude at White Cube*
Representation and Diversity	We are responsible for our representations, esp. of class, race, gender & sexuality **Clio Barnard:** *The Selfish Giant* **Chimamanda Ngozi Adichie:** *We Should All Be Feminists, The Danger of a Single Story* **Ayishat Akanbi:** *The Problem with Wokeness*
Ethics and Sustainability	Ethics*:* **Socrates, Aristotle** Case study: *Black Lives Matter* **Equalities Act 2010** *First Things First Manifesto* - **Garland** *Design for the Real World* - **Papanek**

	3 pillars of sustainability: Economic, Social and Environmental
Marketing and Strategy	Understanding your project and your audience Knowledge: content. audience. context. Aim: make people act Devices: format. tone. time. place
Online Publications	Exploring digital and social media to present and document projects
Interactive Projects	Audience Engagement and Interactivity *What is interactive art*? - **Bourriaud** *Non-Linear Visualisation* – **Alisa Lebrow** *Embodied Interactivity* – **C.Paul** *Pleasure Framework* ***– B. Costello*** *Exploitative Interactivity/Participation* - **Dovey** Online safety and behaviour
Interactive Documentary and Impact (delivered by VP Kate Nash)	*Social Functions of Documentary* – **Grierson, Channan** *Interactive Documentary* **– Wintonick** *Convening Publics* – **Zimmerman and Michiel** Dialogue is key What IMPACT is your project having? How do you measure and evidence impact?

These took place via large group Google Meets. At first it was a very different experience for all. As lecturers we would be communicating with students who mostly had their mics and cameras turned off. When presenting we could not even see the chat function (which was used by a just few of the braver students at first). To mitigate, we team-taught wherever possible when facilitating large groups in order to maximise student interaction Besides chat functions, examples of this are using Break-out rooms in Meet, as well as the whiteboard function (called a 'Jam') to enable students to respond to questions visually and in smaller groups where they felt more comfortable. Lecturers could support the groups virtually whilst using Google Hangouts to quickly exchange information between themselves. All of this was backed-up by Meet recordings and slides uploaded to our estudio pages. Despite our worries that this might affect attendance, we found this not to be the case.

We used Google Meets tools to facilitate students forming event groups according to their choice of shared themes. This year students formed six groups, with approximately eight students per group. In order to communicate with each other and plan beyond group tutorials with tutors, students generally used social media such as What's App chat groups, Facebook or Google Meets amongst themselves. This allowed them to plan, discuss, delegate and share elements, such as further refinement of group theme and aims, publicity design, marketing & distribution, colour schemes, website design etc.

Table 3: Student Event Groups, Themes and Platforms 2020

Group Name	Theme	Platform
LIV	Narrative, life cycle	Website and Instagram https://viscomliv.wixsite.com/home
Imbalance	Wellbeing	Website and Instagram https://imogenjoycedesigns.wixsite.com/imbalancedhouse
You	Popular British Culture	Zine collections hosted on a Website, and Instagram https://foryouaboutyouzine.wixsite.com/launch
Art Exchange	Lockdown boredom and isolation	Instagram https://www.instagram.com/artxchange_ig/
Renew	Environmental Issues	Instagram and Website with Youtube Live Stream event https://renewlau.wixsite.com/renew
Identity	Identity Formation	Artsteps, Google Meet (opening), Instagram https://www.artsteps.com/view/5fb677168e680c30237e3e6d

Most students used Instagram personally, so were already familiar with it to promote and build audiences for their online group events and exhibitions, and even to host the happenings in some cases. We looked at creative uses of Instagram, such as puzzles, give-aways and drip-feed releases. All final creative outcomes had to be launched and released online with no physical public interaction during the final week of teaching in December 2020. By connecting all six event groups to the Viscom course Instagram, other students and alumni could follow and join the different groups' events. After these successful online launches, the module submission was also digital. This was the second time since March 2020 that students had done so. We prepared students by asking them in advance to consider how best to submit their work digitally. We were able to show strong examples, from the previous year, of blogs or Indesign documents as digital PDFs in the place of physical sketchbooks(for submission). The advanced awareness of the online context necessitated by the enduring pandemic this time round, meant staff and students were better technically equipped and familiar with digital submission.

Evaluation

Student participation and engagement was facilitated by a blended approach of some in-person skillset workshops and a majority of learning online. Anonymous student responses to end-of-module evaluation report:

- Students liked recorded talks and resource inductions.
- Students liked group work and events for the social contact.
- Students felt they had lots of opportunity to seek feedback from tutors and that they were very supportive.
- Students enjoyed lecture content and industry talks.
- Students really enjoyed practical workshops (both online and in-person).

(various anon. 2021)

These responses were fairly positive but only a few students bothered to complete the evaluation survey. Potentially this is due to having nothing bad to say about the module, but it could also be due to online/screen fatigue coinciding with the start of another national lockdown in UK.

Staff and module leader observations following review and assessment of student work broadly align with student evaluation comments, with some additional thoughts:

- Familiarity with technology and better institutional sign-up to packages over time improved online learning experiences for staff and students as module progressed.
- Small groups/Break-out rooms facilitated more nuanced learning.
- Team-teaching allowed invaluable ability to assist students when experiencing difficulties.
- Students would not turn on cameras, and they rarely used mic. However, the chat function was frequently employed.
- Uploading presentations and lecture recordings enabled expanded learning, not limited by space and time, and allowed students to review sessions at their leisure.
- Budget did not need to cover travel costs and therefore was able to pay for more VPs from around the globe.
- Final outcomes were of a high quality consistent with other years.

(Hooper, S. 2021)

Of course, in a major UK city (Leeds), with most learners either in student accommodation or living at familial homes, access to internet and devices was not a problem in the main. Occasionally however, technological access was an obstacle and we attempted to provide laptops, hard drives, access to campus etc., where needed and

where possible. Most visual work was of a high quality and often technology-specific outcomes. Some students demonstrated strong engagement with online learning resources, developing independence that accelerated skills learning. However, some work was repetitive in its topic and approach, if not in outcome, probably due to reduced diversity of experiences and concerns during the pandemic. Of particular note, students have anecdotally repeated that they really valued the group work and the social interaction that this afforded (albeit online). Students believed it helped their mental health by providing a shared sense of purpose and connectedness that helped stave off some of the negative effects of social distancing and isolation (various anon., 2021 b).

Conclusion

New technologies have always brought new engagements and potential social change. Benjamin reminded us of this in his reflections on mechanical reproduction and the simultaneous capacity for both revolution and fascist appropriation (Benjamin 1935). The printing press and cinema allowed more egalitarian access to culture, in his opinion. In the current climate, we have seen further expansion of this as digital streaming has replaced cinema, often making it more affordable and accessible. Similarly, there are online teaching methods resulting from the pandemic that have proved positive, largely because of their capacity to enable expanded access and opportunities for review.

In proposing the emancipated spectator, one who can accumulate a knowledge bank based on their own subjective and collective experiences beyond a simple dichotomy of right and wrong, of passive and active, Ranciére has faith in the thought capacity of learners/spectators/participants to extract and build their own understanding (2007). Whilst online participation and learning could be dismissed as passive, it does present a gap, or space for active agency as well as for the imaginary and difference. Whilst there is a danger every student will unquestioningly draw information from the same internet sources and trending material, this can be differentiated by skillset groups and tutor influence to suggest more nuanced sources. Another advantage is a wider scope for Schon's Reflective practice, both during and after the practice (1991). The module results show students who used online technology and time alone well developed more reflexive praxis.

Many galleries and museums responded creatively to the possibilities of extended audiences as offered by remote access due to the forced move online. Tandazani Dhlakama of Zeitz MOCAA, South Africa discussed not only new ways of engaging with audiences, but the need to reconsider who the new audience is first and foremost (Dhlakama, 2020). Geographic location and time and budget constraints around travel and entry tickets are not such a barrier online, therefore potentially engaging a wider

demographic beyond the typical cultural elite and familiar middle classes. Whilst audiences to student online events were not wildly distinct from themselves, students did embrace the possibility, if not always carrying it through successfully. Such willingness is, in itself, hopeful for a more egalitarian future. Next year, we hope to embrace technology further and exchange with students in another country and culture.

If, as Wenger believes, learning is a process of actively becoming, both as an active learner and as a member of a community of practice, familiarity and comfort within this new digital space is a prerequisite. Initially, students weren't necessarily as familiar as anticipated with creating an online presence. For, despite being digital natives and used to constructing identities on and offline, the sense of permanence around the *academic* and *professional* output (in this context anything intended to be seen by a wider public), was less familiar to students, akin to Bourdieu's distinct social spaces (1998). However, due to the current, all-pervasive necessity to embrace the digital, and working within small groups for mutual support, students became more comfortable with this new normal over time.

There are many skills and benefits afforded by online events and exhibitions. Social media and digital technology provide us with a wealth of user-ready tools to communicate adequately with audiences. They increase our reach and make work more accessible. However, they do not offer all the benefits that in-person teaching and exhibition afford. The digital experience was positive overall, but could better co-exist with in-person participation. Like many institutions, we are intending to move forward with a blended approach, taking the best from what each has to offer, circumstances permitting.

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Acknowledgments: I would like to thank my colleagues on BA (Hons.) Visual Communication, especially Iona Jackson. I would also like to thank the Level 5 students for their engagement and ingenuity.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

(Re)envisioning the contribution of design to the sustainable transition of healthcare systems

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Abstract | The health emergency has challenged our health systems, stressing the weakest points but also revealing the strengths to be harnessed. Among these, the concern for the environmental, social and economic aspects of health systems – gathered under the heading of sustainable healthcare – has suffered a temporary setback but will certainly experience strong growth in the post-pandemic era. During 2018 and 2019, a collaborative foresight process on the future of sustainable healthcare was conducted with over 150 healthcare stakeholders. This paper starts from the strategies that emerged from the collaborative foresight to re-read them in light of the impacts of COVID-19 on health systems. A systematic literature review mapped the effects of the pandemic on the sustainable development of health systems and, therefore, on the defined strategies. Hence, the paper defines the connections with design disciplines and the possible contribution of designers in the development of sustainable healthcare in the post-pandemic era.

KEYWORDS | SYSTEMIC DESIGN, SUSTAINABLE DESIGN, HEALTHCARE, SYSTEM TRANSITION, SUSTAINABLE DEVELOPMENT

1. Introduction

1.1 Origins and effects of the sustainability debate in healthcare

In 1996, the U.S. Environmental Protection Agency identified the incineration of medical waste as the main source of dioxin, one of the most powerful carcinogenic gases. For the first time, healthcare organisations realised that environmental protection had a direct link to patient care, and international associations and campaign groups gathered under the banner of the Hippocratic principle *primum non nocere* (first, do not harm). Main organisation, such as Healthcare Without Harm, addressed the substitution of impactful chemicals and pharmaceuticals, endorsed energy efficiency initiatives in health care facilities and, above all, promoted awareness raising programmes on the environmental impact of hospital routines. The results have undoubtedly been positive, but the main limit of 'do not harm' is that of a fragmentary vision of the health systems.

During the 2000s, the economic crisis exacerbated the problem of the environmental, social and economic sustainability of the health sector, which has always been a heavy burden on the public budgets of Western societies. New health associations and hospital organisations started addressing the issue, and medical research engaged in the debate on sustainability. Important medical journals published the reflections of health professionals questioning the socio-environmental impact of their medical specialties, as evidenced by the contribution of Sherman and Ryan (2010), among the first to tackling the challenge:

> "Only through understanding the connectivity and contribution of modern health care practice to ecological issues can physicians work toward aligning commitment to individual care with public and planetary health" (Sherman & Ryan, 2010, p. 139)

As also recognised by the European Commission (2016), making health systems sustainable means to find new approaches to make them more effective, accessible and resilient. The Hippocratic principle deserves credit for having pushed medical research to question its role towards society and the planet, broadening the concept of health towards a holistic vision of well-being. However, it lacks of systematic methods to investigate sustainable healthcare, and the complexity of the issue requires a step forward to find points of convergence between different disciplines.

1.2 Design and medicine towards a co-disciplinary vision

The relationship between Design and Medicine consolidates in the same years of the sustainability debate in healthcare, but it focuses on topics other than the environmental ones.

The literature highlights multiple points of contact between the two disciplines: the attention to a new design of healthcare spaces was one of the first contributions of the design disciplines in the medical field (Golembiewski, 2016). A more recent field is the design

of biomedical devices (Vincent & Blandford, 2017), which involves design in the creation of home and hospital items for rehabilitating patients in their daily routines, or in the design of safer and more usable medical-surgical instruments to support professionals. The ability to understand people and manage complex systems has also found wide application in the emerging eHealth sector (Ekelanda, Bowes, & Flottorp, 2010), which adopts ICTs in the healthcare field to improve the treatment dynamics and foster the prevention and management of diseases at home, especially the chronic ones.

The combination of Medicine and Design has therefore produced interesting results, but the recent addition of the sustainability dimension significantly changes the state of the art. The economic, social and environmental sustainability of health systems goes beyond the product and service dimension and requires a strategic and all-encompassing vision. Design can offer a multi-level perspective to the complex problems of health care and, in particular, Jones (2013) identifies Systemic Design as a design discipline able to focus on the needs of multiple users, while addressing the indeterminate complexity of the system in which they are embedded.

Despite the peculiarity and challenges of the healthcare sector, it is inappropriate to think of "Design for healthcare" as a sub-discipline of Design, this is even more true for "Design for sustainable healthcare", where the inclusion of environmental sustainability leads to a further level of complexity. A single branch of design cannot address the issue of sustainable healthcare. Especially when it comes to environmental sustainability, the risk is to relegate competence and responsibility to a single discipline, as it has happened in the past for eco-design (Toso, Barbero & Tamborrini, 2012). Design has a clear disciplinary identity and well-established methodologies to dialogue on equal terms with Medicine. Sustainability comes into play as a transversal topic to both disciplines, and it must be tackled jointly, combining the skills and tools peculiar to Design and Medicine. Only an open and equal collaboration can enable to tackling the challenge of sustainable healthcare, avoiding the risk of making simple improvements to the status quo rather than pursuing real sustainable innovation.

1.3 Post-pandemic visions on sustainable healthcare

Today, the COVID-19 pandemic has further highlighted the need for adopting more sustainable approaches to health systems. Indeed, although environmental concerns on healthcare may seem secondary to the health emergency, the protection of our planet plays a crucial role both upstream and downstream in the value chain. First of all, mitigating climate change and reducing the consumption of resources will contribute to improve the economic sustainability of health systems – hence the financial resources for acute illnesses – and to prevent diseases of environmental nature or due to the destruction of natural ecosystems (Marco et al., 2020). Secondly, the linear system on which current supply chains are based has shown its fragility during the pandemic, leading to failures that more dynamic, resilient and local systems could prevent (Jafarnejad et al., 2019).

However, it is undeniable how the pandemic has changed and will change the approach to sustainability in healthcare, questioning the contribution of all disciplines involved. In the two years prior to the COVID-19 outbreak, the author collaborated in a foresight process, coordinated by the Nordic Center for Sustainable Healthcare, which involved several stakeholders in the health sector, particularly in the Nordic region. The process resulted in the definition of macro-strategies aimed at fostering sustainable healthcare. Although the strategies remain valid as an expression of the complexity of a consolidated system, it is clear that the pandemic emergency impacts on them, demanding a review in the light of the COVID-19 experience. It is also important to stress that the strategies were devised from a foresight process mainly involving the Nordic countries, whereas the pandemic phenomenon, as well as the research investigating its sustainability impacts, has a global reach. While, in some respects, this may be a limitation of the analysis of post-COVID strategies, in others the health emergency has exposed common flaws in health systems worldwide and their supply chains, thus highlighting the need to actualise the strategies at a global level. Moreover, the strategies involve different sectors and disciplines, and also strongly involve design. This paper starts from an analysis of design's contribution to sustainable healthcare strategies to envision the new evolution of the strategies themselves, as well as the role of design disciplines in the light of the pandemic experience, proposing possible approaches for a new normal.

2. Methodology

2.1 Research background

The growing interest in Sustainable healthcare highlights the common perception of the need for change in the sector. To date, different approaches and visions to the topic have not yet agreed on a shared definition but, as Fischer (2015) points out, "*all approaches seem to have in common that a comprehensive approach with a long-term focus and a need to balance economic, social, and ecological interests needs to be used in the discussion of sustainable healthcare systems.*" (p. 298).

This need for a systemic transition towards environmental, social and economic sustainability was the starting point for a foresight process on sustainable healthcare, which engaged – through 5 workshops – 165 selected stakeholders representing the health system: regional and national authorities, universities and research centres, NGOs and healthcare networks, clusters, health industries, health providers, professional consortia. This foresight process has jointly adopted anticipation and systemic design methodologies (Pereno & Eriksson, 2020). The results of the workshops have been elaborated with a double purpose: first, to identify possible future scenarios for sustainable healthcare, building a triple vision of the system in the medium-long term. Second, to define the strategies to concretely foster

a transition towards a desirable future, identifying three main areas of intervention (Table 1).

Table 1. Strategies for sustainable healthcare (SH). Adapted from Pereno & Eriksson, 2020.

Strategy	Strategic actions	Time horizon	Scale of action
COLLABORATION: Increasing national collaboration on SH	Establishing a national collective impact initiative for SH	Short	National
	Creating a Green Deal for SH	Medium	National
	Strengthening the cooperation around a shared vision of SH	Short	Local
INNOVATION: Increasing sustainable innovation in healthcare	Developing sustainability assessment models for industries	Medium	National Global
	Providing industry specific guidance	Short-medium	National
	Creating virtual accelerator for SH companies	Medium-long	National Global
	Creating 'publics' as interdisciplinary arenas on SH	Short	Global
	Increasing support for test beds in SH	Medium	Global
INFORMATION: Increasing collective knowledge about SH	Introducing SH into university curricula	Medium	National
	Promoting information campaigns targeted at decision-makers	Short	National Global
	Developing an international communication package on SH	Short	Global

The paper starts from the results of previous research to deepen the specific contribution of design in the strategies developed, to explore the implications that the pandemic has on sustainable healthcare strategies and, especially, on design disciplines in this area.

2.2 Research methodology

As pointed out in par. 2.1, the adopted methodology aims to answer the following research question: How does design support the implementation of sustainable healthcare strategies, given the changes triggered by the COVID-19 pandemic?

For this purpose, the research starts from the strategies that emerged within the foresight process completed before the pandemic (Pereno & Eriksson, 2020), and implements a methodology based on three analytical steps.

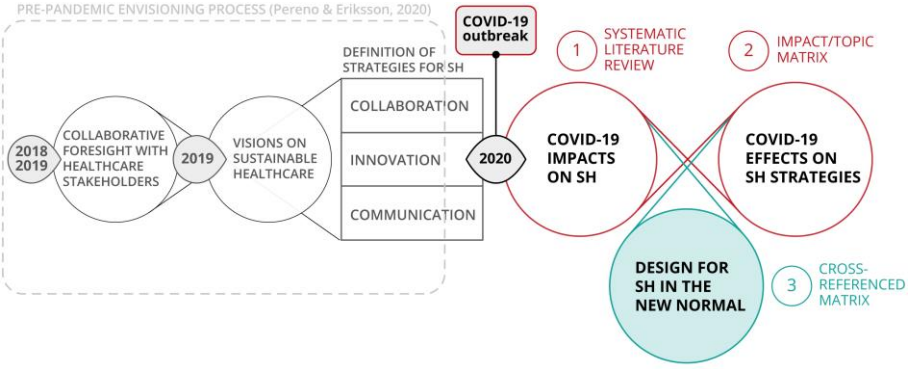

Figure 1. Graphical representation of the methodological process.

Figure 1 visualises the previous research phase in connection to the three research steps followed in the past year:

1. *Systematic literature review of the pandemic impacts on sustainable healthcare*. The first step has carried out a review on the main databases (Scopus, Web of Science, and PubMed) which allowed an overall analysis of the main articles through a categorisation of the authors' keywords and an in-depth analysis of the most relevant publications. This systematically highlighted the main impacts of the pandemic on sustainability in the healthcare sector.
2. *The effects of the pandemic on the strategies for sustainable healthcare*. The strategies presented in par. 2.1 (collaboration, innovation, and communication) have roots in the pre-pandemic era. While in principle they are still valid, it is beyond doubt that the global health emergency calls for re-reading them in the light of the new emerging landscape. Therefore, it has been used a matrix to cross-reference the topics and impacts of the pandemic on the sustainable development of health systems, in order to put them in connection with the sustainable healthcare strategies.
3. *The contribution of design to post-pandemic strategies for sustainable healthcare.* The last step combines the results of the two previous ones to define how strategies have changed due to the pandemic and how the contribution of design disciplines to sustainable healthcare should evolve into the new normal. The previous work (see par. 2.1) adopted a design approach for the analysis of foresight process results; however, the specific contribution of the design disciplines in the implementation of the strategies that emerged was not further investigated. Thus, the final step focuses on highlighting the synergies that design brings into play to contribute to these strategies.

The three-step methodology has enabled the pandemic phenomenon to be analysed by means of qualitative-quantitative databases in order to investigate, from a qualitative perspective, the design synergies in the emerging area of sustainable healthcare, in the post-pandemic era.

3. The contribution of design to new healthcare scenarios

3.1 The impact of COVID-19 pandemic on the sustainable development of health systems

A systematic literature review was carried out through the main databases (Scopus, Web of Science, PubMed) to define the impact of the pandemic on the healthcare sector as regards sustainability. Table 2 shows the results obtained through a query that was purposely wide-ranging to include all the topics and disciplines that have dealt, to some extent, with the effects of the pandemic on the sustainable development of health systems. The records obtained from the different databases have been cross-referenced to eliminate any duplicates.

Table 2. The main impacts of COVID-19 pandemic on sustainable healthcare.

Query	Database	Records	Final records
("covid-19" OR coronavirus) AND (health OR healthcare OR "health care") AND (sustainability OR "sustainable development") AND (LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020)	Scopus	370	429
	Web of Science	190	
	PubMed	169	

The next step was the analysis of the results collected and their categorisation according to the topics addressed. This has been done in two phases: first, a schematisation of the keywords of the total records that allowed a general analysis of all contributions. Figure 2 visualises authors' keywords in hierarchical order: some macro-topics emerge, both of a general nature (public health, system resilience, policy and strategic management, etc.) and of a more specialised interest (mental health, Personal Protective Equipment, ecosystems protection, etc.). Hence, the keywords analysis enabled to identify nine main topics resulting from the relationship between the pandemic and the sustainable development of the health sector: Health systems, Policy and governance, Environmental aspects, Social aspects, Economical aspects, Technological aspects, Industry, Food production and consumption, Education.



Figure 2. Hierarchical visualisation of authors' keywords related to the impact of the COVID-19 pandemic on sustainability in the health sector.

Starting from the general topic analysis, an in-depth reading of the most relevant publications (based on relevance and number of citations) has been conducted for each of the categories analysed. Table 3 shows the direct and indirect impacts that the COVID-19 pandemic has on sustainable healthcare, as revealed by the papers analysed.

Table 3. The main impacts of COVID-19 pandemic on sustainable healthcare.

Topic	Impacts	Main publications
Health systems	Origin of the pandemic; resilience of health systems; global health security; well-being during pandemic; impacts on specific people categories (elderly, young, people with disabilities); impacts on different categories of health workers; impacts on specific diseases (mental health; non-communicable diseases).	Coccia, 2020; Djalante, Fraher et al., 2020; Osingada and Porta, 2020; Shaw and DeWit, 2020.
Policy and governance	Public health policies; strategies for public governance; cross-sectoral government strategies; policies to enhance collaborative innovation actions; public-private partnership (PPP) and the role of private stakeholders.	Baxter and Casady, 2020; DeWit, Shaw and Djalante, 2020; La et al., 2020; Sarkodie and Owusu, 2020;
Environmental aspects	Health effects of environmental protection; Sustainable Development Goals targets; sustainable models of health system; waste management in healthcare facilities; medical single-use products and plastics; wastewater; sustainability of specific activities related to healthcare (tourism, production, energy).	Cheval et al., 2020; Marco et al., 2020; Naidoo and Fisher, 2020; Patricio Silva et al., 2020; Seshaiyer and McNeely, 2020; The Lancet Public Health, 2020.

Social aspects	Equity of access to healthcare; pandemic effects in developing countries; models of international collaboration for health emergencies; causes of inequality within the pandemic (migration, low-income, informal economy); causes of social exclusion within the pandemic; information suppression.	Bahn, Cohen, and van der Meulen Rodger, 2020; Wang and Tang, 2020; Armitage and Nellums, 2020; Shadmi et al., 2020.
Economical aspects	Economic risk management strategies; financial sustainability during the pandemic; labour market impacts of the pandemic; innovative welfare strategies; corruption problems.	Kruse and Jeurissen, 2020; van Barneveld et al., 2020; Visconti and Morea, 2020.
Technological aspects	Telehealth/telemedicine; social media and pandemic communication; Healthcare 4.0 and digital innovation in health systems; machine learning; Internet of Medical Things (IoMT) and medical devices.	Fryer et al, 2020; Helou et al., 2020; Smith et al., 2020; Thomas et al., 2020.
Industry	Supply chain management and supply chain disruptions; Personal Protective Equipment (PPE); sustainable manufacturing in the healthcare industry; sustainable transportation.	Ibn-Mohammed et al., 2021; Leite, Lindsay, and Kumar, 2020; Rowan and Laffey, 2020; Tirachini and Cats, 2020.
Food production and consumption	Food security; food safety; production and management of food waste; sustainable and healthy nutrition; sustainable agriculture models.	Galanakis, 2020; Attwood and Haja, 2020; Savary et al. 2020.
Education	Role of higher education in the pandemic; health education; technology and ICTs in education; Learning Management Systems (LMS).	Code, Ralph, and Forde, 2020; Hays, Ramani, and Hassell, 2020; Wahab, Shuib, and Shaik, 2020.

3.2 The implications of COVID-19 pandemic on sustainable healthcare strategies

While the sustainable healthcare strategies highlighted by the foresight process (see par. 2.1) show the potentials for action towards new pre-pandemic sustainable scenarios, the categories analysed in the literature (see par. 3.1) revealed the issues most affected by COVID-19, and which will undergo a significant change in the post-pandemic era.

In order to identify the role of design in this transformative scenario, a cross-analysis of these outcomes was carried out. Figure 3 presents the different sub-topics that have been analysed through a matrix that combines the topic specialisation level with its impact scale on individual and collective activities. The three categories of sustainable healthcare strategies are then included in the matrix to identify the scope for future interventions and impacts:

1. *Post-pandemic collaboration*. Collaborative strategies will mainly address general issues that may have specific impacts on individual activities as well as on collective life. Among the issues demanding greater attention in the future are the sector's governance strategies aimed at creating more resilient systems that can collectively address health emergencies and complex challenges, such as those posed by the UN Sustainable Development Goals. The economic and financial crisis has also highlighted socio-economic weaknesses, as in the welfare, that have a far-reaching impact on people's lives and require urgent collaborative strategies.
2. *Post-pandemic innovation*. Innovation strategies will mainly deal with specialised topics impacting on individual but also collective tasks. During the pandemic, manufacturing and agri-food industries have shown the need for greater flexibility, safety and sustainability, particularly some supply chains such as PPEs. Health technologies also need to innovate from a social perspective, addressing a global audience with different needs, especially in developing countries. The efficacy and sustainability of digital health is another social and technological issue that the pandemic has dramatically accelerated, while also highlighting shortcomings in usability and acceptability.
3. *Post-pandemic information*. The prevention and awareness-raising role of the media was already evident before the pandemic, but COVID-19 stressed the need for attention to environmental issues that may cause or accelerate disasters of environmental origin. Waste and supply chain management in emergency situations also require more careful and coherent information strategies. The role of education in such a context is even more striking, as there is a need to train students, professionals and citizens on sustainable healthcare issues that are cross-cutting to care, environment and wellbeing. The results of the literature review (see Table 1) showed that the topic of misinformation or suppressed information is marginal with respect to COVID-19. Although the link between sustainable development of the health sector and information transparency is not one of the core topics of current research, it is undeniable that seeking out reliable channels and modes to communicate with citizens is crucial, especially in relation to sustainable healthcare.

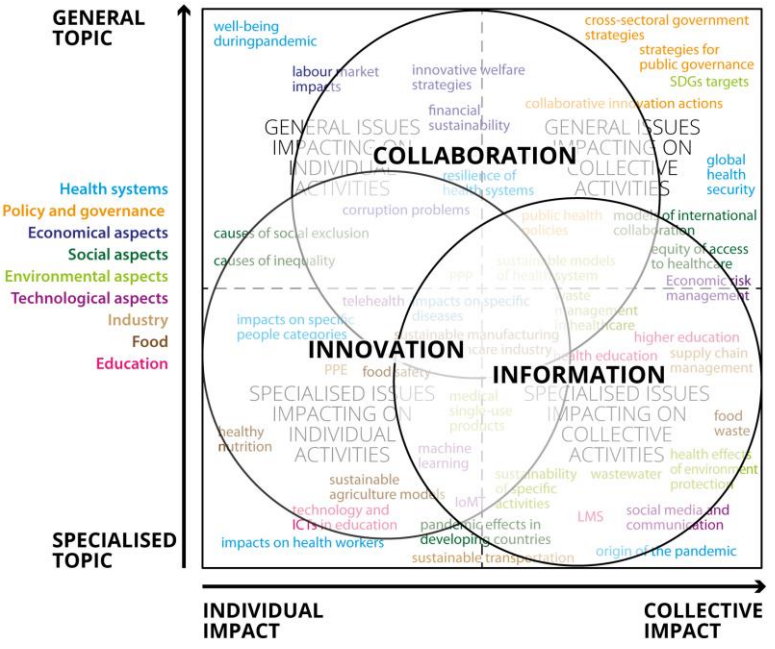

Figure 3. Relationship between the topics and impacts of the pandemic on the sustainable development of health systems, in connection with sustainable healthcare strategies.

3.3 The contribution of design to sustainable healthcare strategies in the post-pandemic era

Starting from the matrix shown in Figure 3, the research finally focused on the contribution of design disciplines to sustainable healthcare strategies, considering the new challenges that have emerged.

Figure 4 depicts the design disciplines within the matrix and in connection with sustainable healthcare strategies. The choice of design sub-disciplines is based on the categorisations proposed by Ceschin and Gaziulusoy (2019) and Irwin et al. (2015), as both address the issue of design for sustainability through different levels of action, from product to socio-technical systems. In some cases, the proposed disciplines have points of overlap or inclusion in each other (e.g. Design for sustainability transition includes policy design methods and tools), but the focus was placed on the disciplines themselves rather than on their interdependencies.

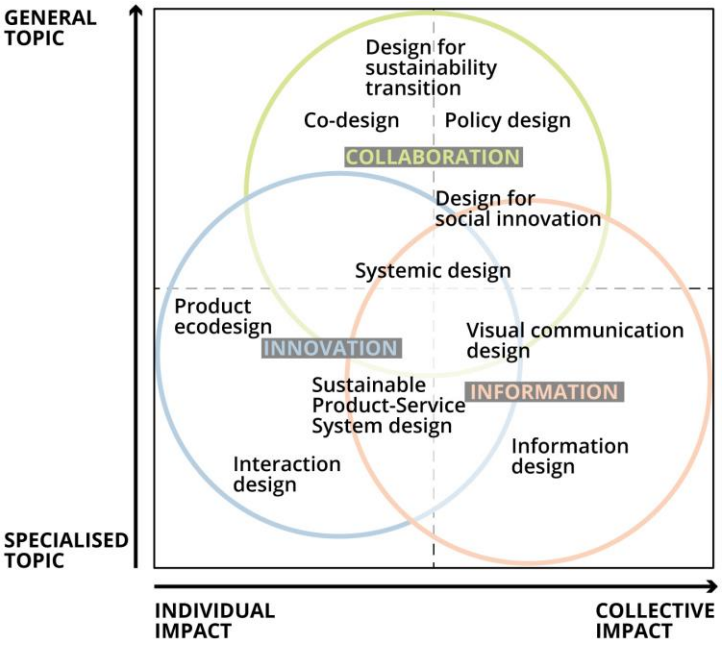

Figure 4. Relationship between main design disciplines and sustainable healthcare strategies.

Overall, the matrix provides support in defining the contribution of design to the three action areas identified as strategic for the development of sustainable healthcare:

1. *Design for collaboration in sustainable healthcare*. As previously highlighted, the governance strategies of the healthcare sector should aim at boosting the resilience of health systems, addressing the socio-economic issues and the need for collaborative actions. The pre-pandemic foresight identified collective impact initiatives and green deals as desirable instruments to enhance collaboration. The COVID-19 has been strengthening this urgency and design disciplines can support the process acceleration. To that end, co-design strategies are crucial: Manzini (2015) defines co-design as a problem-based and solution-oriented design process resulting from the interaction of a variety of disciplines and stakeholders. In this process, design experts have acquired the skills to foster collaboration and guide the process towards achieving solutions that meet actual needs. This ability is applied to the policy field, working on the design of policies for socio-economic systems, as well as to the definition of transition strategies for social and socio-technical systems in the medium and long term. Overall, design for collaboration towards sustainability acts at the level of complex systems, fostering trans-disciplinary and cross-sectoral processes. They support both the engagement of

key stakeholders and the pursuit of clear objectives over multiple time horizons, based on a clear understanding of the underlying system.

2. *Design for innovation in sustainable healthcare*. Whether collaborative actions can foster social innovation, industries from different value chain are called upon to address the demand for sustainable innovation, especially in services and products. The pandemic stressed the need of manufacturing and agri-food industries for greater flexibility, safety and sustainability from a cross-country perspective. Service design methods, and Sustainable Product-Service System design in particular, allow a lateral approach to product design, focusing on a strongly social dimension that enables complex innovations to be pursued. The tools for user engagement in the design and validation phases can also be valuable in the healthcare field, where sustainable healthcare strategies aim to accelerate the testing and introduction of new solutions. As healthcare, compared to other sectors, has a lower environmental concern regarding products, ecodesign skills can act to support recycling and reuse strategies, providing specific guidance to industries. Lastly, digitalisation and information technologies have been accelerated by the pandemic and the shift towards digital services will be confirmed and consolidated in the future. From that perspective, interaction design methods and tools have already been active in the area of eHealth, but they can still play an important role in driving new sustainable behaviours, from resource saving to distributed home care management.

3. *Design for information on sustainable healthcare*. The pandemic has highlighted the urgency of informing and training people and professionals on environmental issues. The environmental origin of COVID-19 strengthens communication strategies, providing new topics to be addressed. At the same time, some aspects of resource and waste management require effective communication even in stressful and emergency situations. In this context, two important design disciplines come into play: information design supports effective and efficient understanding of complex situations and information provided to users. In stressful conditions, this is even more important to enforce environmental guidelines without overburdening healthcare staff. Visual communication design, on the other hand, deals with communication to the general public, helping to define the channels, methods and messages to be conveyed towards creating a fertile ground for sustainable healthcare.

4. Discussion and conclusions

The paper addressed the impacts of the COVID-19 pandemic on sustainable healthcare, a trend that was rapidly developing in the pre-pandemic era. This contributed to understand how the phenomenon may be stalled or, conversely, strengthened in the post-pandemic era.

The literature shows very little research in the field of design for sustainable healthcare, and a greater gap exists in investigating how design will contribute to the sustainability of health systems in the future. The paper lays the groundwork to address this research gap, basing its contribution on solid research conducted within co-disciplinary and cross-sectoral arenas.

However, the research presents limitations that should be better addressed in the future. Firstly, the contribution of design is theorised through a deductive path which, although following a consistent methodology, remains in the realm of anticipation. Therefore, further validations are needed in the short- and medium-term to validate the actual contribution of design in a real environment.

The second limit, is related to the problem of assessing the design contribution through real case studies, which are not common in sustainable healthcare. As discussed in the introduction, collaboration between Design and Medicine has historically focused on other research fields – from medical devices to eHealth – other than the environmental issue. The radical change in the post-COVID era will further evolve existing disciplinary relationships and research topics, making it even more challenging to identify or create practical inter-disciplinary projects.

The third limitation relates to the high stress condition in which healthcare professionals are working. Although the pandemic seems to be coming to an end thanks to the new vaccines available, doctors, nurses and health workers will still face stressful working conditions in the coming months. In 2020, this forced the postponement of many projects outside the health emergency, and in the short term, the restarting of cross-sectoral and inter-disciplinary collaborations will take time before finding new spaces in a calmer and normalised situation.

Although not easy to address, these research limits pose important challenges for design disciplines, raising the bar towards broader sustainability goals – such as the link between the well-being of the planet and our societies – and towards new collaborations able to work on a system level rather than on specific products or services.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Reinforcing Networks of Place-Based Care and Resilience

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Abstract | Since early 2020, communities across the globe have been challenged by the ongoing COVID-19 pandemic. This project formed in parallel with the trajectory of the pandemic and in response to compounding ecological and social justice crises. Fragmentation of resilient care and kinship networks as an emerging consequence of COVID-19 prompted us to ask: how do we, as designers, researchers and educators, build up these networks in the absence of face-to-face contact? The project has resulted in an open digital publication and participatory workshop framework centring themes of collaboration, care, and resilience. As the pandemic rages on, the emergent methodology of this project has in itself become a typology of care, a creative refuge for collaborators which bolsters us in our collective efforts to observe, document, and prop-up small acts of care and resilience in the hope of living within the carrying capacity of our planet.

KEYWORDS | CARE, RESILIENCE, EMERGENCE, PLACE-BASED DESIGN, COVID-19

1. Introduction

it is the end of a day, a season, a way, an era
the change is tumult, terrifying and beautiful
we will never be convinced to be expendable.
alchemize every death system, liberate
our divine lives.
- Excerpt from adrienne maree brown's poem *for George Floyd: fire*

This project began in pursuit of optimism and agency as survival tactics in the face of massive, systemic crises. Uncovering moments of care and resilience in our daily lives and domestic spaces, now put front-and-centre as we sheltered in place, felt necessary as 2020 unfolded. We hoped that stitched together, these small things could become a wide and joyous network; a salve of tangible, positive and regenerative ways to approach living within the earth's carrying capacity together during a global pandemic. 2020 and 2021 have been years of ongoing and stacking global crises, which amount to challenging times in which to live, let alone work. Yet, as design researchers, we are positioned to work through, respond, and adapt to challenges alongside our communities. This project emerged within the context of three ongoing and interconnected global crises: (1) the novel coronavirus pandemic; (2) the diminishing capacity of our planet to support our current ways of life; and (3) ongoing racialized violence and systemic oppression.

In early 2020, we experienced the onslaught of a global pandemic: the rapid spread of the novel coronavirus disease (COVID-19) and its devastating effects on communities worldwide (Pitlik, 2020). News of overseas lockdowns quickly became news of local lockdowns in March, with health orders urging people to immediately decrease their social exposure and avoid all non-essential travel (Holliday, 2020). Businesses closed their doors, public transit halted, and universities closed, shifting classes and research activities online ("B.C. universities", 2020).

In April of 2020, with the pandemic in full-force across the globe, we (virtually) assembled as a small group of design researchers in response to a joint open call from the Canadian Association of Graduate Studies (CAGS) and the Social Sciences and Humanities Research Council (SSHRC). The call was an invitation to respond to a Policy Horizons Canada report titled *The Next Generation of Emerging Global Challenges: Living within the Earth's Carrying Capacity* (2018). The report reminds us of the many critical ecological tipping points we are hurtling towards, approaching the inability of the planet to fully support life and with that massive social upheaval, war, and widespread death. It is apparent that the pandemic is inseparable from these ecological crises. The efficiency at which the virus has swept through the bodies of animals, our human bodies, and our communities is a reminder of the fallacy of human exceptionalism; we are not and cannot be separated from the living systems around us (Kolinjivadi, 2020).

On May 25, 2020, George Floyd was murdered through an incident of police brutality in Minneapolis, USA (Hill et al., 2020). This event, as well as other Black deaths by police violence, sparked massive global protests under the banner of Black Lives Matter and other anti-racism movements. These movements demand justice for Floyd, defunding of the police, an end to mass incarceration, and other changes necessary for Black liberation (ACLU, 2020). Questions swirl in the already-ignited socio-political landscape: how can a just and sustainable recovery from COVID-19 ever be achieved without Black safety? Speaking up to the other systemic forces we are dealing with (COVID-19, ecological crises) is inextricable from speaking up to systemic racialized oppression.

As design researchers, we feel compelled to respond to crises with collaborative and creative work, to ensure cross-disciplinary dialogues are happening with communities at the centre. This paper describes an emergent process for responding to massive and systemic challenges from within community, while co-existing in pluralistic lived realities. First, it explores the core theoretical frameworks through which we approached this work. Second, it recounts our methodology as it unfolded from a decentralized and collaborative process, in an attempt to speak up to the great challenges we are living within; from our own perspectives, with observations of care and resilience that are small yet unmistakable. Third, we describe the designed outcomes of this methodology: an open digital publication and participatory workshop framework, which encourage readers and participants to notice, observe, share and document small acts of care and resilience within their own lives. Finally, this paper will reflect on the implications and significance of this emergent methodology and resulting outcomes.

2. Theoretical Framework

2.1 Networks of Place-Based Care

Within this project, we have envisioned our *networks* to include the people and other beings we live and work with, beginning in the immediate vicinity of our bodies — our gut microbes, pets, families, neighbours and houseplants. Here, *more-than-human* includes "things, objects, other animals, living beings, organisms, physical forces, spiritual entities, and humans" (Puig de la Bellacasa, 2017, p. 1). They also include our colleagues and students, with whom we collaborate and learn from, and whose creativity and pluralistic experiences richly inform the work. Each of us are nodes, or knots, in these complex meshed networks; the threads that connect us twist, overlap, and reinforce each other. However, the onset of COVID-19 produced isolating conditions under which these threads seemed at risk of loosening, going slack, or dissolving altogether.

Sheltering in place, we asked the question: how can we shore up networks of care and resilience, and remain accountable to the more-than-human systems we live within, while experiencing isolation and precarity? Our response is guided by a definition that care “includes everything that we do to maintain, continue and repair our world so that we can live in it as

well as possible" (Tronto, 1993, p. 103). This world includes "our bodies, our selves, and our environment, all of which we seek to interweave in a complex, life-sustaining web" (Tronto, 1993, p. 103). Care can be *place-based* when it derives meaning via relationships built through localized, contextualized, and shared experiences, informed by a rooted understanding of local cultural and natural systems (Irwin et al., 2015). This highlights care's always-situated implications; to care means to enter into a relationship of mutual obligation and reciprocity (Puig de la Bellacasa , 2017). This extends to our work as designers; to care- and design-with implicates us in relationship with our communities, for which we care and from which we receive care. Additionally, the temporality of care often disrupts the tight, linear schedule of our capitalist and productionist society (Puig de la Bellacasa , 2017). In taking the time to care, we are given permission to slow down, witness, and attune to our immediate environments.

2.2 Resilience and Emergence

The Resilient Design Institute (n.d.) defines resilience as "the capacity to adapt to changing conditions and to maintain or regain functionality and vitality in the face of stress or disturbance". Committing to a methodology that would allow us and our communities to recover and transform while developing work became a priority (brown, 2017). In *Emergent Strategy: Shaping Change, Changing Worlds*, adrienne maree brown outlines a concept of emergent strategy which includes "plans of action, personal practices and collective organizing tools that account for constant change and rely on the strength of relationship for adaptation" (2017, p. 23). It is rooted in a definition of emergence as the way in which multitudinous simple interactions and activities may give form to complex patterns and systems (Oblensky, 2014). As described by brown, the lineage of emergent strategy can be found in nature, as well as through the development of her own personal and familial relationships and histories, racial and economic justice movements, Indigenous knowledge and resilience, and the relational leadership models exhibited in the work of Black science fiction writer Octavia Butler (brown, 2017; Butler, 1993). In this project, it inspired a methodology which puts relationships at the centre, and allows processes, outcomes, and insights to emerge from those.

3. Methodology

This project developed first within a group of four design researchers (Jean Chisholm, Avi Farber, Laura Kozak, Julie Van Oyen); then expanded by four additional collaborators (Jacquie Shaw, Monique S. Carr, Oluwasola Olowo-Ake, and Jess Sung) and a workshop of ten.

3.1 Beads on String: A Collection of Small Things

A design response to *Living Within the Earth's Carrying Capacity* felt impossible without also addressing the immediate and interconnected conditions of the pandemic. We felt their weight each day through the isolation of lockdown and concern for the health of our loved ones and planet, and were at a loss for how to respond: how could we, from the makeshift workspaces of our kitchens and bedrooms, generate something in response? How could we recreate the generative nature of a shared studio without being in the same place? We checked our expectations as to what we would produce, and instead centred the wellbeing of our group and its members. Over several weeks, we met via short video calls to discuss everything from the massive reports and crises we were dealing with, to how small our individual lives had gotten. We shared stories of epic journeys across borders and mundane trips to the grocery store; struggled our way through lost opportunities and lack of childcare; and showed up for each other to reflect on the world as we saw it from each of our own windows and doorsteps.

The nature of these shifting scales of impact intrigued us: we became more attentive to place-based consequences of systemic challenges. The notion of fractals became a way we could understand how to respond to overwhelming systemic forces and injustices, given that "how we are at the small scale is how we are at the large" (brown, 2017, p.45). What was happening in our bodies, our homes, our neighbourhoods? From this vantage point, what small acts of care were we implicating ourselves in, and how might these small-scale actions impact the whole system (brown, 2017)?

We began with simple photo documentation of small acts of care and resilience in our own lives. Leaning into a slow and attentive approach, we gathered images in a shared Instagram feed (Figure 1), which gradually affirmed what we had sensed: when held together, these small things add up to something that feels significant even in the face of global crises. Our discussions and image archive evolved into descriptive personal texts, shared with each other via online multi-collaborator writing platforms. Through this collection of writing, we widened our scope to investigate how our individual experiences were connecting to broader systems and ecologies.

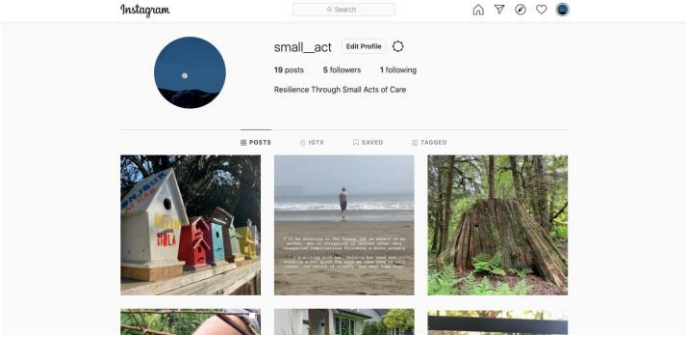

Figure 1. Shared Instagram feed holding our first observations of care from our own lives.

We also shared a reading list: it included Ursula Le Guin's *Carrier Bag Theory of Fiction* (1989), which offers an alternative way of being human in contrast to the story of prehistoric hunters and weapon-wielders. It is inspired by anthropologist Elizabeth Fisher's (1979) assertion that before the luxury of sharp tools and weapons, humans had been using containers for storing food, valuables, children and even themselves (via shelters) for a long time. This emphasis on humans as collectors, carriers, and sharers is important, as we seem to be reaching the tipping point of multiple crises caused by the weapon-wielders' dominating, extractive, and oppressive systems. Our group considered the ways containers might act as typologies of care: cupped hands holding water; beads on string connecting our stories; meshed networks emerging from connected nodes; bags and bundles, to help hold and carry weight. Our working group, image archive, and shared text documents all became containers of sorts to hold ideas, observations, questions, feelings, and reflections.

3.2 Mesh: A Weaving of Voices

During the summer of 2020, we each invited one person from within our own circles to contribute a text and take part in a discussion. The group now included a total of eight collaborators, creatives from both academia and community working together, connected virtually yet spanning North America. It was essential to expand and decentralize our group to encompass a greater plurality of responses to the contexts we found ourselves within. This gentle opening-up of our working group felt nourishing during continued pandemic-induced physical isolation. Once the additional contributions were written, we held a virtual event (Figure 2) involving a reading of each contribution and a discussion. Each collaborator was invited to reflect on how we engage and attune ourselves to small acts of care and resilience within our respective communities. Again, shifting frames of reference from macro to micro scales, and localized and virtual spaces, helped our respective but overlapping observations feel more connected and place-based.



Figure 2. Screenshots from collaborators' virtual gathering.

3.3 Bundle: An Offering

The workshop *Micro-Care: A Workshop on Small Acts of Resilience* held at Emily Carr University's *In Touch: Graduate Research Symposium 2020* allowed us to iterate on our first gathering, and to share our methods and extend the meshed network of care and creative kinship initiated in this project. The workshop was 90 minutes long, and began with some short contextual readings from the publication. Next participants were invited to observe their current physical surroundings or to reflect on the things they know and witness in their lives, and put some interpretation of care on a piece of paper – a drawing, a map, a written text, something else. This was done together in order to support any initial questions or confusion participants may have regarding the prompt. We then disbursed into breakout rooms to share and discuss, and returned together after half an hour. The session encouraged participants to be attentive to place-based consequences of systemic changes, as well as acts of optimism, care and resilience happening in place, and to establish trust dynamics and create conditions for collaborative work.

4. Outcomes

4.1 Publication

Micro-Care: Small Acts of Resilience for Living Within the Earth's Carrying Capacity (Figures 3-6) is an open digital publication which documents a process of attuning our attention to care and expands our understanding of what resilience might mean (Chisholm et al., 2020). It contains first-person texts recounting lived realities of the pandemic, ecological crises, and social justice landscape of 2020. It includes personal stories of neighbourhood networks of

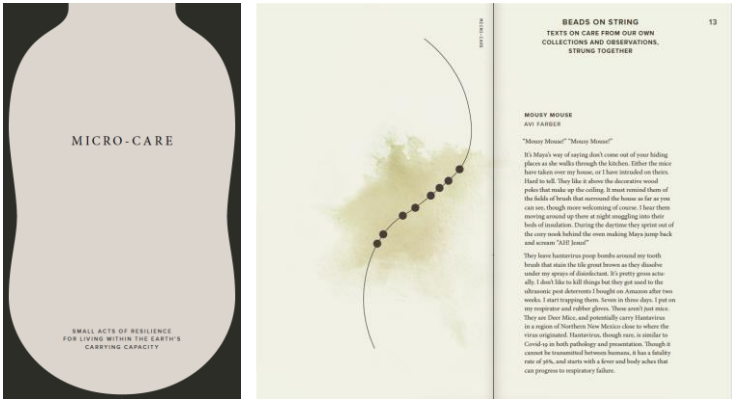

Figure 3. Cover and sample spread of the Micro-Care open digital publication.

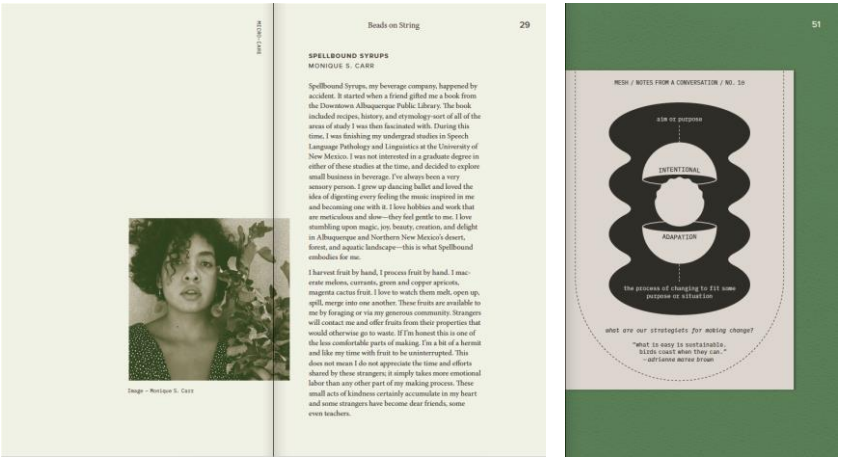

Figure 4. Sample spreads of the Micro-Care open digital publication.

resilience emerging with the onslaught of the pandemic, sharing and distributing essential goods such as food and children's toys; concerns about pathogens carried into the home by deer mice; methods of foraging and harvesting food which support biodiversity; as well as an original poem speaking to the importance of artistic expression and supportive personal relationships in the face of systemic racism.

The publication also includes a smaller booklet containing fragments of the virtual conversation transcribed as annotated visual formulas (Figures 5 and 6), titled *MESH: A Network of Emergent Fragments, Moments of Respite, and Points of Navigation to New Places*, nested within the collection of written texts. A multimedia approach followed the spirit of gathering, collecting, sketching, and placing ideas in relation to one another. The visual design process mirrored the writing process: humble ideas in small bits of work, stitched together: just making and seeing what emerged.

The work creates dialogue between the social and the scientific, in looking at the direct ways that policy reports and politicized social dynamics were playing out in our bodies, our friendships and our work. Held together in the container of the publication, the texts and images provide a snapshot of our small group's efforts to pursue optimism and agency in the chaotic face of larger systemic forces.



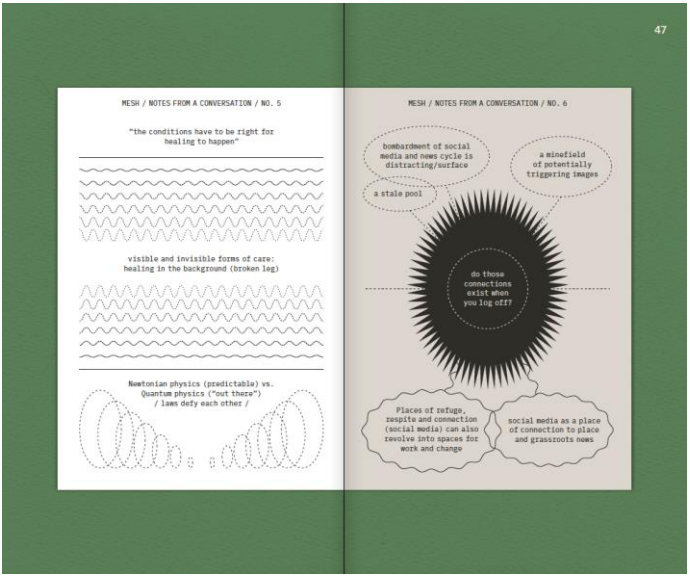

Figure 5. Spread from the Micro-Care document, depicting the MESH cover page next to an illustrative watercolour depicting a mesh texture.

Figure 6. Transcribed and diagrammed fragments of the virtual discussion.

4.1 Participatory Research Framework

Participants in multiple sessions have contributed texts and diagrams (Figure 7) describing acts of optimism, care and resilience happening in their lives. These offer an expanded model of how these small actions are taking place everywhere, even in the midst of great challenges. The outcomes of these and successive workshops stand as artefacts of their time, and are to be archived as the continued work of this project.

In keeping with the methodology of our publication, the workshop framework attempts to remain open-ended, thereby dismantling tokenistic methods of consultation in the field of participatory design, whereby 'design experts' consult with community stakeholders in ways that are instrumentalizing or over-simplified (Bratteteig and Wagner, 2014; Iversen and Dindler, 2014).

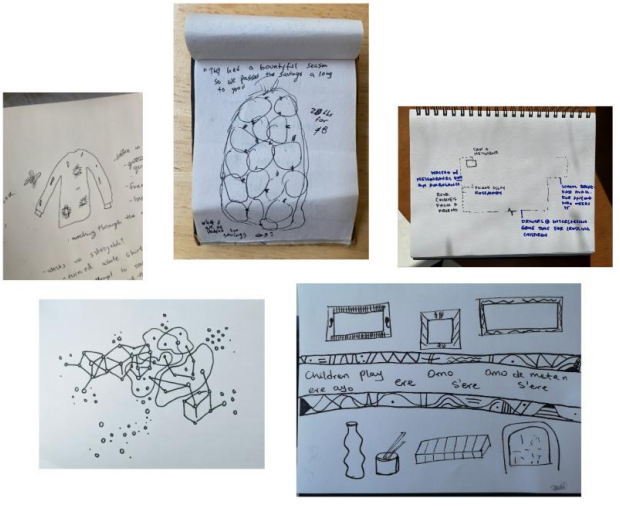

Figure 7. Sampling of workshop participant contributions: drawings and diagrams depicting observations of care and resilience in their own lives.

5. Reflection

By attuning ourselves to and sharing small moments of hope and optimism in our individual and communal lives, collaborators on this project cultivated a network of care and kinship with each other in the face of pandemic isolation. This work supports resilience in its multi-

scale approach: actions at the individual and community scales in turn respond to systemic challenges at ecosystem and global scales (Resilient Design Institute, n.d.). However, limitations exist with this framework as human to human linkages become more decontextualized. Simple and nuanced gestures such as asking participants to observe and identify what is happening around them can come across as privileged or oversimplified when offered to someone in an acutely challenging situation. As stated by Puig de la Bellacasa (2017), care has an ambivalent quality and is not to be engaged with innocently.

Another iteration of our workshop, at a second virtual academic symposium, revealed that without the ties created through sustained relationships and shared understanding of context, the approach held less meaning and had diminished potential to extend care amongst participants. Nuances surrounding what kinds of tenuous threads connect us to create safe spaces to participate in this work are emerging, and it would seem that greater attention to relationship building and protocol may be necessary in contexts that are farther-reaching and only digital. As a deeply relational practice, the methodology is not easily scaled or accelerated: at its core, it resists capitalist prioritization of these modalities. Despite this, we hope the emergent and adaptive methodology may be useful to others working and learning virtually during these times of evolving precarity.

5.1 Fractals: A Conversation in Spring 2021

As this paper is being prepared for circulation, further reflection has come to light from our collaborators. Specifically, it has become clear that the paper has failed to represent how truly intersectional the perspectives have been, and how much richness continues to come from BIPOC and queer collaborators in the emergent work. The following has been adapted from a conversation between authors during spring 2021.

Julie Van Oyen (JVO): Jacquie, how did it feel to work on the Micro-Care document together last summer?

Jacquie Shaw (JS): It felt like a casual, easy ask…and it felt great to be asked and have something to do during COVID. I was coming out of my own academic burnout, and it felt nice to feel like my thoughts and contributions were valued and safe in this space we built.

Jean Chisholm (JC): The way we'd started working, as described in this paper, felt like a great antidote to the way we're usually being asked to work. Jacquie, I remember I had just read your writing on water and care (cite Micro-Care) and it seemed like it touched on many of the ideas we were trying to explore. But there were also so many other reasons I was excited to invite you into this project, emerging out of our 10 year friendship.

JVO: Fast forward to now: how did it feel to review this paper we'd written about the project?

JS: When I skimmed it as both a contributor and a designer/futurist/researcher critically exploring design/er's roles in equitable and decolonized futures — looking at the citations,

who is actually involved, where is it coming from — I just didn't see the presence of the BIPOC and queer people involved. I, myself, am a queer person of colour, and that's really important to me. It's part of what community means to me, and what it means to serve a community. I know that other people of colour were involved and that wasn't placed anywhere. It was written in the context of the global reckoning of white supremacy that happened last summer, and mentions George Floyd, but not Breonna Taylor or Regis Korchinski-Paquet. I am used to feeling these ways about academia. I'm used to feeling overlooked, and used to feeling prickly about the use and inclusion of marginalized folk as props or as extractive knowledge areas. It really feels like "inclusion", but for the benefit of continually centring and moving forward whiteness in the academy. So when I reviewed the paper I had this strong critique, especially knowing that it had been written by a smaller, all-white part of the full collective. But if it weren't for my relationship and trust with Jean, and my involvement in early stages of the project, I may have just let it go.

JVO: Instead of back-editing the paper to include these things that are missing, we've decided to present the critique as an additional sub-section. To open it up and show what happened, the harms that were done. Why does it matter to present it this way?

JS: I'm interested in breaking the format of, "this a finished project, and this is what we did." I'm interested in how we can build and share skills around intersectional analysis and intentional intersectional approaches. How do we make those more explicit? Instead of just talking about designing-with, and designing for transformation, we can practice that today. The decolonizing of design keeps coming up; how can we actually practice that while responding to these kind of calls within institutional settings, which may be at the same time upholding systemic barriers rather than dismantling them? I care about design as a discipline, a culture. I care about the future of design. That internal institutional critique comes from a place of deep love, care and investment. It's the stubbornness of me: I'm like, "no, it can do better". Sometimes that critique happens and you go on to have great conversations, and build great work and cool spaces. And sometimes that critique doesn't take, and then you pack your bags and move on to the next space. There's no real scarcity of places to share your ideas. When you've invested a decade of your life in design, you want to stick it out.

6. Conclusion

Applying our theoretical framework of care and resilience, this project responds to three ongoing and interconnected global crises. We applied an emergent, evolving methodology to produce an open digital publication and participatory workshop framework which cultivate and strengthen community. Our expanding network of collaborators has built up a rich archive of caring and resilient acts and relationships, which when held together may stand up to even the most daunting systemic forces. Though we cannot know for certain how truly sustainable and just our ways of caring are, we attempt to stay with the trouble by remaining situated in relationships with those we work with, rather than considering ourselves as

design researchers remote or removed (Haraway, 2016). As can be seen in the collected and cobbled-together artefacts and conversations, this work is ongoing.

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Jean Chisholm (she/her) explores place-based design practices and community collaborations that work towards relational, ecological and equitable ways of living. She teaches design at Emily Carr University of Art + Design in Vancouver, Canada.

Land & Community Acknowledgements: The project described in this paper took place on the unceded territories of the xwməθkwəy̓əm (Musqueam), Skwxwú7mesh (Squamish) and Səlílwətaʔ/Selilwitulh (Tsleil-Waututh) Nations and the territory of the Jicarilla (hickoria) Apache, Pueblos, and Núu-agha-tʉvʉ-pʏ (Ute). As uninvited guests, the authors gratefully acknowledge not only where we are, but the ways in which responsibility to place have informed this work. We attempt to practice these land acknowledgements not only as acts of recognition, but to let them serve as a constant reminder to attune ourselves to the real, lived, and material impacts of colonial ideologies and their related systemic forces, and to consider the ways in which our actions can contribute to just and sustainable ways of living.

Practices of care, kinship and mutual aid – central to resilience and ways of living among BIPOC communities – have been long held and passed along through formal and informal networks. This includes the enormous importance and influence of the work of Black and Indigenous scholars, storytellers and theorists cited here, and also the original writing contributions of Monique S. Carr, Oluwasola Olowo-Ake, Jacquie Shaw, and Jess Sung.

Acknowledgements: A very special thank you goes to Avi Farber, design researcher and fourth member of our first Micro-Care working group. Avi's thoughtful and creative working style and contributions have been a core part of this project from the beginning. Thank you Oluwasola Olowo-Ake, Jessica Sung, and Monique Carr, for trusting us and adding your perspectives, wonderful writing, and thoughtful discussion to the project. Many thanks also extended to Steven Lam, for getting us started, and Hélène Day Fraser for joining and thinking with us during our MESH discussion. Finally, we have so much gratitude for all of our ECU symposium workshop participant-collaborators, for their insights and generosity surrounding the session — from the bottom of our hearts, thank you.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Research on rapid mass production of emergency products based on FDM 3D printing

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Abstract |This article uses a designed non-contact switch remote control product during the Covid-19 epidemic to solve public health safety issues, to explore the rapid development methods of emergency products, to study the design ideas of products based on 3D printing manufacturing technology, which can enhance the 3D printing speed, success rate of the product structure design.

KEYWORDS | 3D PRINTING, COVID-19 OUTBREAK, EMERGENCY PRODUCT DEVELOPMENT, RAPID PRODUCTION

1. Introduction

Since the outbreak of the Covid-19 epidemic, medical supplies have been consumed rapidly, and the production of medical supplies has also been restricted, resulting in a shortage of some medical products. In this emergency period, all parties have responded to the production of necessary protective products.Among them, the 3D printing industry has made great contributions to this, and 3D printing centers across the country(even the world) have joined together to produce mask breathing valves, goggles, and thermometer gun shells with various 3D printing equipment to solve the urgent need for medical products in short supply(As shown in Figure 1). With the maturity of 3D printing technology, the price of related equipment has been reduced, home 3D printing equipment has been popularized, and the e-model files of various medical products can be shared through the Internet. Therefore, distributed production of scarce medical products, even household production, is realized, long-distance transportation of materials is avoided, and the timeliness of material supply is greatly shortened.

Time is very precious during the epidemic. If the emergency product design for the epidemic follows the conventional production process, it is easy to miss key opportunities. 3D printing is an emerging production technology. It does not need to make molds, production lines, etc., Only with e-model files, through network resource sharing, mass production can be carried out immediately, thereby realizing rapid production of corresponding products during emergency periods.

Through an experimental case of product design for public health safety during the epidemic period, this article summarizes the design ideas, structural design, and circuit module design points of emergency products suitable for 3D printing technology.



Figure 1. 3D printed medical products

2. Reasons for choosing FDM3d printing

There are many kinds of 3D printing technology. Commonly used 3D printing processes are FDM3d printing and SLA3d printing(As shown in Figure 2). Hereinafter referred to as FDM, SLA. FDM is a thermoplastic polymer melted and extruded into filaments, layer by layer stacked on a hot bed molding, SLA uses a material that is photosensitive resin, through the laser irradiation at the top of the machine to make the resin layer by layer curing molding. Although SLA has better surface molding quality than FDM, FDM is more suitable than SLA for emergency production during an epidemic. The main reasons are as follows, first, the price of FDM printer is very low, the price of ordinary type machine is less than one percent of SLA printer, therefore, the use of FDM production costs are lower.At the same time, FDM printers are also the most widely used. Not only are 3D printing factories equipped, but general homes and studios will also be equipped with small FDM printers. According to the "2018-2023 Global 3D Industry Market Outlook and Investment Strategic Planning Analysis Report" of the Prospective Industry Research Institute, the development of 3D printing is heavily dependent on technological progress and breakthroughs. At present, the most popular technology for global 3D printing applications is FDM Technology, accounting for

63.9% of total platform revenue(Zhi Xin Wang,2019).Second, the materials that FDM can use are generally PLA, ABS, and nylon. The strength and toughness of these materials are much stronger than SLA resin materials. Third, in terms of post-processing of parts, SLA printed parts need to be soaked in alcohol to wash the surface resin, remove support, UV curing, sanding, painting and other steps, while FDM printed parts only need to remove the support to apply assembly, through the use of different color consumables can produce parts of corresponding colors without painting.



Figure 2. FDM and SLA 3D printing equipment

In a comprehensive comparison, FDM has huge advantages in cost, material, and model post-processing. It is an ideal way for emergency product design and rapid production during the epidemic.

3.Design test case introduction

This is a product design test for public health safety during the epidemic (As shown in Figure 3). The purpose of the test is twofold. First, through such a design, non-contact remote control of switches in public spaces is realized. Second, explore the optimal design direction for the characteristics of FDM. The name of the test product is called the wireless remote control switch. It is pasted on the side of the light control switch panel through nano rubber pads. The product simulates the effect of pressing the switch by the motor to drive the lever to move forward and backward to realize the remote control of the switch without changing the line. Convenient upgrade to traditional light-controlled switch panels, suitable for various indoor and outdoor environments,such as homes, companies, and schools.The product has a wide range of applications and can be installed on various key switch devices such as switch panels and elevator buttons. The product can be used not only in public places during the epidemic period, but also in daily life, providing convenient and safe remote control operation for the elderly who have inconvenient legs and do not want to move to press the switch, and children with short height who can not touch the switch.

According to the production characteristics of FDM, the product has been optimized for many times in the product structure to increase the printing speed and reduce the printing error rate. The configuration of internal electronic components has also been adjusted many times to shorten the development cycle of product circuits, thereby achieving the purpose of rapid development of emergency products and rapid mass production.

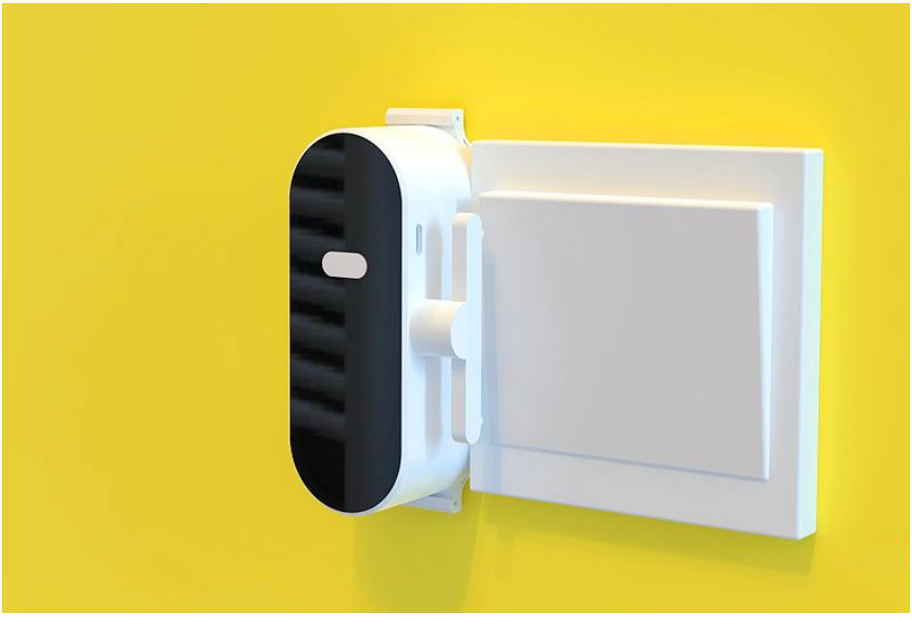

Figure 3. Test case-Remote control switch

4.Design ideas

The core idea of emergency product development and design based on FDM3d printing technology is to design according to the characteristics of FDM printing technology. 3D printing technology has always been used for personalized custom production, or for proofing before mold production. The products are produced in small quantities. If mass production is carried out, the structure of the design plan that affects the printing speed and success rate must be considered factor.

It is necessary to make full use of existing resources to design functional products that can respond to urgent needs. Product design is based on the basic principle of "making the best use of everything", making full use of existing resources and rationally deploying them according to the attributes of each item to maximize its value. "Make best use of everything" includes not only the use of various materials and standard parts, but also various processing technologies that can be quickly mass-produced. In product design, a brand-new part often

has to go through many tests from conceptual design to mature function, there will be a long development process, and accompanied by many unknown factors, the test cases in this article make full use of standard parts and try to avoid design of custom parts.

5. Structural Design

5.1 Removal of the mold pulling angle

The mold pulling angle is the angle between the tangential direction of the side where the workpiece and the parting surface of the mold intersect and the normal direction of the parting surface of the mold that is artificially set in order to make the workpiece more convenient to leave the mold. The draft angle will increase the thickness of the bottom of the part and thus increase the printing time. Since the FDM parts are formed layer by layer, the surface with inclination will produce more obvious layer lines. Therefore, when designing a 3D printed product structure, there is no need to consider the design of the mold pulling angle separately.

5.2 Structural design from the inside out

This kind of structural design process must first determine all standard parts used on the product, determine the spatial position of these parts on the product according to functional requirements, and then design the product shape according to the internal part structure. This can make the product more "tighter" and reduce the product volume (as shown in Figure 4).

In the test case of this article, we will first determine the parts to be used, create models in the software according to their actual dimensions, arrange them compactly, and finally design the product shape according to the internal part structure, which not only reduces the product volume, but also The important thing is to reduce the height of the product, reducing the height can significantly save printing time, usually the print layer height of FDM is 0.2mm per layer, if you reduce the height of 5mm, you can save 25 layers of printing time.

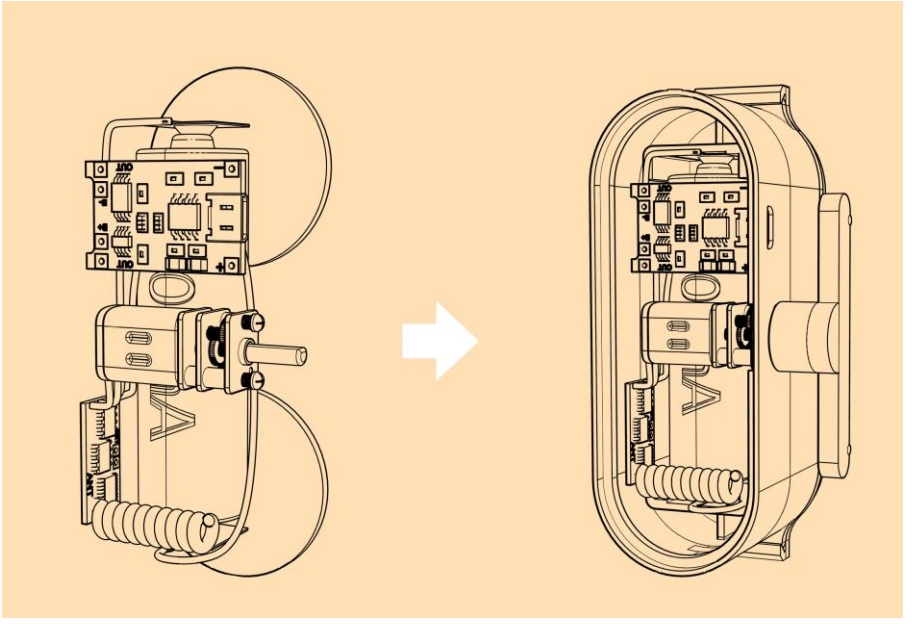

Figure 4. Emission of internal components first before designing the external shape

5.3 Optimize the support structure

There will inevitably be suspended parts in the product structure, which has no effect on mold production, but it will increase the difficulty of 3D printing. 3D printing is stacked layer by layer. The suspended structure cannot be printed directly, so In order to prevent the material of the suspended structure from falling, it is necessary to add a supporting structure in the suspended position (Mendonsa C,2015), but the supporting structure will increase the printing time and failure rate. Therefore, the suspended protruding part of the product needs to be optimized during the design. The usual practice is to design a slope below the suspended part.5

In the experimental case of this article, the convex eave structure in the initial plan of the product will generate a large amount of support during printing. In the print preview, you can see that a large number of blue supports are generated under the convex eave. After adding the inclined plane, the wire extruded by the printer nozzle will advance along the inclined plane layer by layer to avoid supporting (As shown in Figure 5).

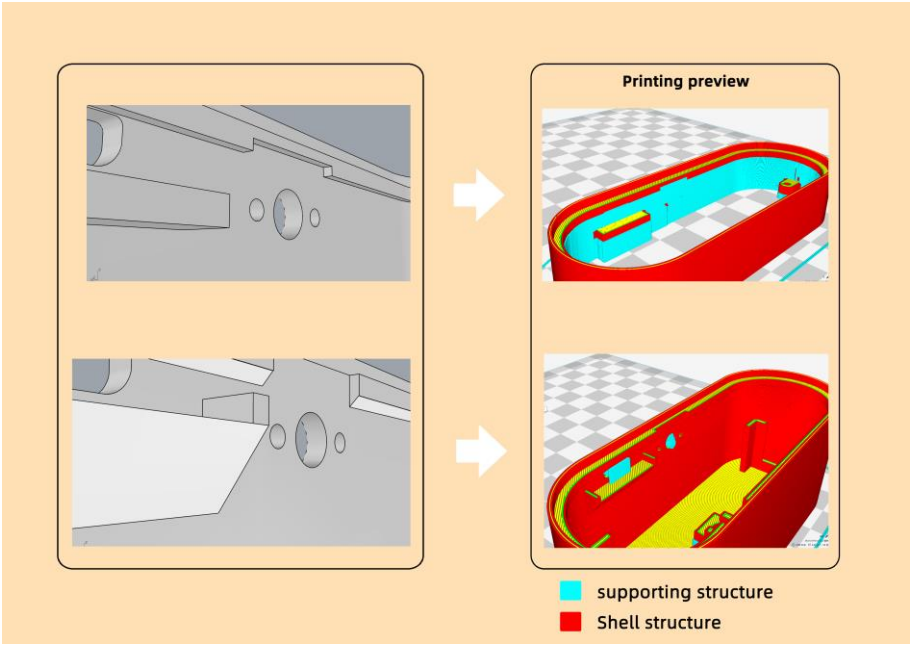

Figure 5. Optimising the effect of structure on print results

5.4 One-piece shell

In mold production, in order to facilitate the manufacture of the inverted structure, the product shell is usually divided into two. For 3D printing, this will increase unnecessary processing procedures. The XYZ movement of the 3D printer nozzle can produce various complexities. Therefore, the product shell can be designed as an integrated design (as shown in the figure 6).

In the test case, the segmented housing of the remote control switch was combined into one, the screw hole for screw connection was eliminated, the model structure was simplified, and the printing time was reduced.

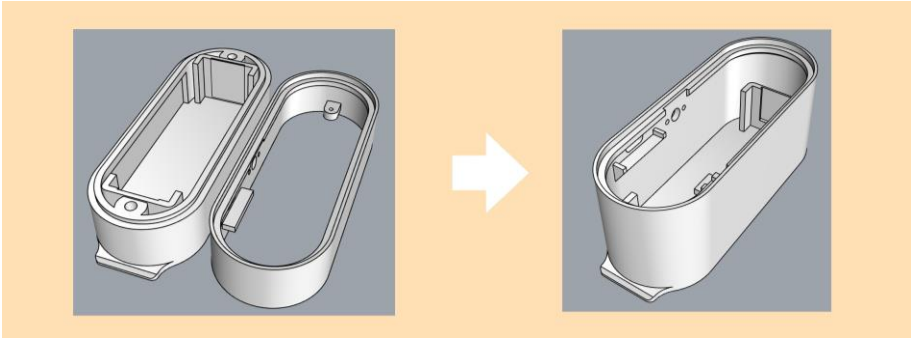

Figure6. *One-piece housing*

5.5 Assembly methods

There are four general product assembly methods: *Snap-fit*, mechanical fastening, hot melting, and welding. One of the most convenient is the snap and mechanical fastening. The *Snap-fit* structure (as shown in the picture7) is assembled and fixed by elastic deformation, so the material needs to have good toughness. The flexural modulus of PLA is greater than that of photosensitive resin (as shown in the figure8), indicating that PLA is not easy to deform. Due to the poor elasticity of PLA material, the buckle structure is not suitable for parts produced by FDM. For FDM, mechanical fastening is the best choice. Mechanical fastening includes self-tapping screws, rivets, nut screws. In order to improve the compatibility of the printing model, design thread structure should be avoided, because the accuracy of FDM3d printers of different types and brands is different. The thread structure requires very high precision, and a little error may lead to the failure of part assembly.

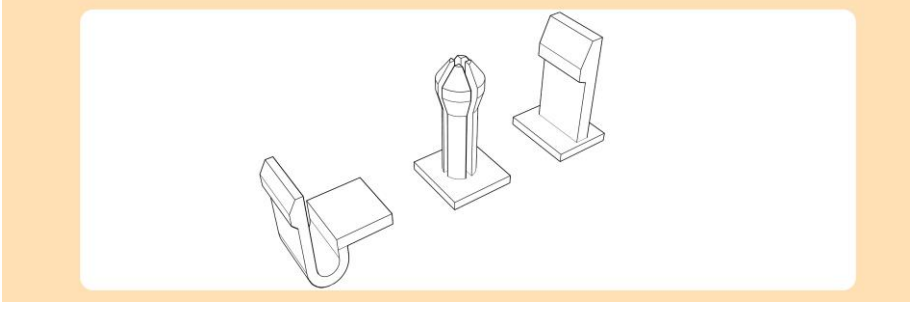

Figure7. Snap-fit

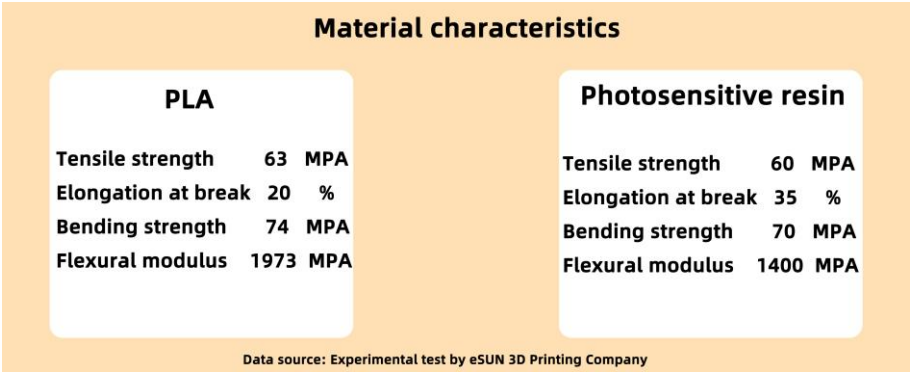

Figure8. Material characteristics of FDM and SLA

Self-tapping screws, including thread cutting self-tapping screws and thread forming self-tapping screws(As shown in Figure 9). The latter has greater circumferential stress than the former, so it is suitable for larger-sized stud structures, and for smaller diameter studs, it is more suitable for thread cutting self-tapping screws(Yuan Zhong,2016). Self-tapping screws are often used in brittle or harder plastics, so they are suitable for FDM hard PLA materials. In addition, the pressure riveting nut is also suitable for FDM parts. The nut is pressed into it, and the elasticity of the nut hole is used to realize the fastening of the nut. The advantage of this method is that it does not require equipment costs. The disadvantage is that internal stress will be generated. Thin wall thickness and smaller diameter pillars will affect the performance of the nut.



Figure9. Mechanical fastening

5.6 Assembly clearance

The precision of mold production is very high, and the assembly gap between parts is very small, usually between 0.1-0.15mm. This value cannot be widely used in various FDM machines. Parts manufactured using the above parameters will have over-assembly and running jams, death or even assembly failure. The assembly clearance of FDM should be designed between 0.2-0.3mm.

In this test case, the gap between the remote control switch and the base card slot is 0.20mm(As shown in Figure 10). In the later test, the parts manufactured and tested using a variety of different brands of 3D printers can slide smoothly.

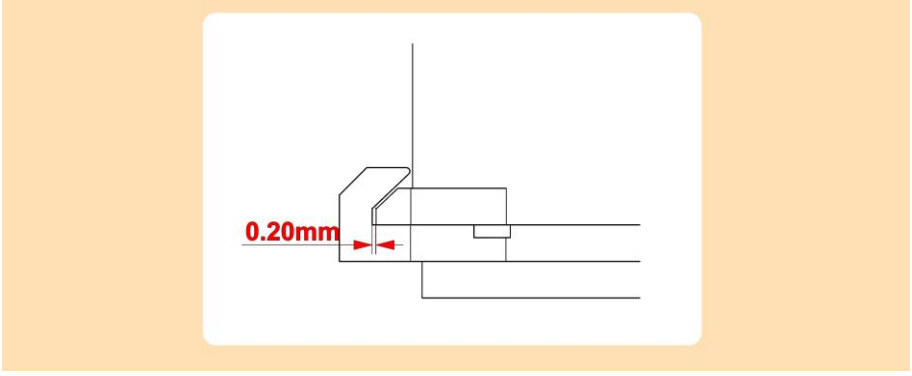

Figure 10. Assembly clearance

5.7 Hollow structure

Hollow design is very important to FDM, which can significantly reduce printing time. Only the parts on the part parallel to the horizontal plane can be hollowed out. The hollowed out treatment on the vertical plane will result in a suspended structure, which in turn will generate printing support and increase the printing error rate.

In the test case of this article, the base of the remote control switch is hollowed out and optimized. The function of the base is mainly to be glued and fixed. Therefore, the position outside the glue paste range is hollowed out (as shown in the figure 11).

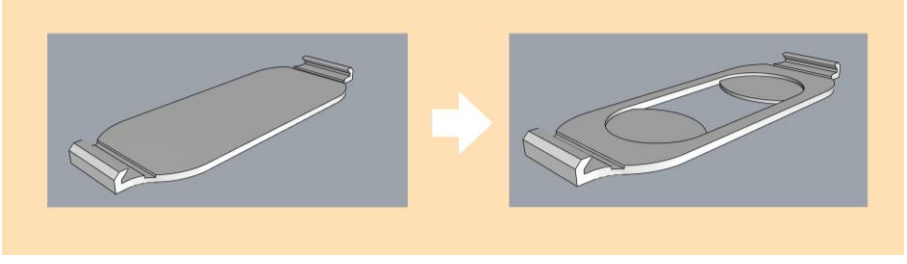

Figure 11. Hollow base plate

6. Modular circuit design

The purpose of modular circuit design is to shorten the development cycle and design process, and to split complex circuits into reusable modules. (ChunXia Yang,ZhengYan Feng,2012)

In the test case of this article, the initial circuit plan uses a highly integrated circuit board, which is a circuit board developed based on specific functions. The number of this circuit board is small in the market, and it takes a long time to develop an integrated circuit board. Therefore, special integrated circuits cannot meet the requirements of rapid development and rapid production.

Through modular design, the integrated circuit is split into "standardized" circuit modules. "Standardized" circuit modules refer to electronic modules widely used in the market, similar to standard parts in mechanical parts. These electronic modules are sold in many places across the country and have a large inventory. In the test process, the integrated motor remote control circuit board is split and designed, and a circuit board with the same function as a special integrated circuit can be combined. (As shown in Figure 12).

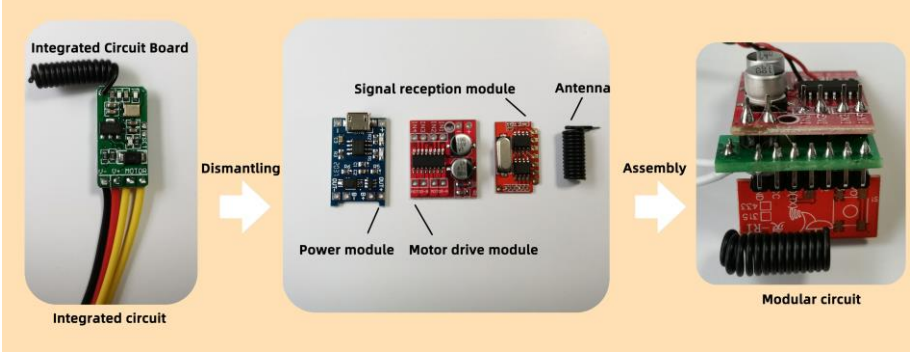

Figure 12. Modular circuits

7. Combination of other processes

The advantage of 3d printing is that it can manufacture complex spatial structures, and can be manufactured immediately on the machine with design drawings. Optimizing the parts through the above design principles can increase the printing speed. However, the overall manufacturing time is still relatively long, so it needs to be combined with other production processes, which need to have the characteristics of high precision and rapid production.

In the test case of this article, the black cover of the remote-control switch is processed by laser cutting technology, and the processing material is acrylic. The manufactured product cover is not only beautiful but also can be mass produced in a short time. This design method cuts product manufacturing time in half.

8. Network sharing platform

In order to realize distributed production across the country in a short period of time, product design digital files need to be shared through a network platform. The 3D printing community website is the most ideal platform. Most platform viewers have 3D printing equipment or are proficient in 3D printing technology. After downloading technical documents, they can quickly produce and produce efficiently. In addition, the platform should also add other production technology sections. In an emergency, all parties can unite and cooperate to quickly realize the production of products in various regions.

9. The expected effect of the project

Relying on the huge number of FDM3d printers in the country, the rapid distributed production of emergency products can be realized, and long-distance transportation of materials can be avoided. The extremely short development time ensures that the products can be applied in a critical period. In addition, the above-mentioned design methods also continuously lower the processing threshold of products, and get rid of the constraints of production lines on product manufacturing. For example, in the test case tested in this article, individuals can also complete the production and assembly of the product with detailed design information.

Due to the lowering of the production and processing threshold, small and medium-sized enterprises, studios, and student teams can also achieve independent product development and production, so that product design solutions can be implemented at very low investment costs, without the need to purchase expensive production equipment. In addition, this design method can quickly produce a batch of products to market, test whether the product features can meet the market demand, and quickly complete the improvement of the product according to user feedback.

10.Epilogue

Emergency product development and design based on FDM3d printing technology can solve the problem of rapid production of emergency products, provide new options for mass production, and make it possible for individuals to develop products, so it has a good application prospect. This article only summarizes the key points in the test case. There are more subject knowledge worth exploring behind each area. Industrial design itself is a comprehensive subject.I hope that experts and scholars in different fields can provide valuable opinions.

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Semi-immersive Virtual Habitat to Enhance Relaxation in People with Dementia during COVID-19 Emergency

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Abstract | The effects of lockdown-induced isolation, with changes in daily routines and reduction of emotional, social and physical stimuli, have been a detonator for the rapid increase of neuropsychiatric disorders among fragile elderly, such as people with dementia (PWD). The temporary closure of day care centres for dementia represented a serious shortcoming in the day-to-day care, with a related increase in stress levels for both PWD and their carers and a reduced quality of life. Within this framework, new non-pharmacological care methods are needed to help reduce agitation-related behaviours in PWD, in order not to increase the pharmacological load and its related healthrisks. This paper presents a pilot study focused on the development of a prototype of a semi-immersive virtual environment, called Semi-immersive Virtual Habitat, aimed at decreasing agitation and enhancing relaxation in PWD, especially after experiencing stressful experiences such as lockdown measures during COVID-19 pandemic.

KEYWORDS | DEMENTIA, SEMI-IMMERSIVE VIRTUAL ENVIRONMENTS, NON-PHARMACOLOGICAL THERAPIES, HABITAT

1. Introduction

1.1 Dementia and COVID-19 Emergency

At the end of February 2019, COVID-19 emergency has raised in Italy. Soon, the whole nation was put into a strict lockdown, and all the population, from young to elderly, had to stop and adapt to the novel measures restricting daily life and social contacts. The effects of lockdown-induced isolation, with changes in daily routines and reduction of emotional, social and physical stimuli, have been a detonator for the rapid increase of neuropsychiatric disorders among those most at risk, such as the cognitively impaired elderly. Among them, people with dementia (PWD), represent one of the most fragile group of people, due to the impairments caused by the disease, and its related symptoms: confusion, agitation, stress-related behaviours, depression and apathy. Dementia is not a specific disease, but a general term describing a wide range of symptoms associated with a decline in memory or other thinking skills severe enough to reduce a person's ability to carry out daily activities. Alzheimer's disease (AD) accounts for 60-80% of dementia cases. Therefore, at the peak of the pandemic, the lockdown triggered another emergency: the increase in neuropsychiatric symptoms, such as agitation-related and stress-related behaviours, in PWD and their families. Agitation-related behaviors include verbal, vocal, or repetitive motor activity (Cohen-Mansfield,2008). Stress-related behaviors include purposeless wander, screaming, repetitive calling out and accelerated breathing (Reynolds et al., 2018). During the lockdown, more than 60% of PWD showed an increase in behavioural disturbances, while more than 65% of family members were found to be more vulnerable and affected by overt symptoms of stress (Cagnin et al., 2020).

1.2 Day-care during COVID-19 Emergency

Strict lockdown measures led to the suspension of all the activities of all semi-residential, socio-assistential, socio-educational, multifunctional, socio-occupational, health and socio-sanitary centres for people with disabilities (comprising physical and mental disabilities, but also people with cognitive impairments such as PWD) given the difficulty of enforcing social distancing rules. The temporary closure of day care centres for dementia represented a serious shortcoming in the day-to-day care of people with dementia, with a related increase in stress levels for both patients and their carers. In general, the most frequently reported symptoms were irritability (40%), agitation (31%), apathy (35%), anxiety (29%) and depression (25%) (Cagnin et al., 2020). Gradually, daily care centers were reopened, once the initial emergency seemed under control. Hence, healthcare professionals had to face the increase of these symptoms affecting the quality of life of PWD, delineating mostly new non-pharmacological methods and therapies, in order not to increase the pharmacological load and its related healthrisks.

1.3 Virtual Reality (VR) Environments as tools in dementia care

Virtual reality (VR) is scientifically understood as a complex environment, determined by a differently immersive, interactive and three-dimensional graphic interface that allows simulation operations and specific forms of communication and learning, offering the user the possibility of perceiving himself as physically present in a virtual world, so that he can interact with it, through sensations, emotions, evaluations and behaviours typical of everyday reality. Among the different types of VR available, this study focuses on the Semi-immersive category, i.e. those VR devices that come in the form of an environmental device, with the size of a small room, equipped with projection or rear projection devices and screens (3 to 6 surfaces) that reproduce the stereoscopic images of the computer and project them on the walls, with different shapes and degrees of convexity, adequate depth indices of the image, giving a three-dimensional effect. To date, there is evidence of the effectiveness of using this tool in various neurorehabilitation fields (Garcia et al., 2012). Moreover, the use of virtual reality environments for PWD is an emerging field, which has shown encouraging positive results in previous research (Flynn et al., 2012; Van Schayk, 2008; Garcia et al, 2012; Reynolds et al., 2018; Kim et al., 2019). In this framework, semi-immersive virtual environments for PWD aim to improve the person's quality of life, decrease the incidence of certain symptoms such as stress, agitation and anxiety and monitor the person's residual capacities. After XXX was put in lockdown due to COVID-19 pandemic, health professionals encountered an increase in those symptoms in PWD. Forced isolation and lack of social interaction had a negative impact on those fragile individuals. Cognitive impairments made difficult for them to understand the occurring situation, increasing their anxiety and behavioural symptoms caused by the lack of assistance due to the closure of socio-assistential services during the lockdown. Thus, semi-immersive VR environment represent a promising tool for dementia care, effective in the decreasing of such symptoms, without increasing the pharmacological load (Kim et al., 2019).

This paper illustrates a pilot study conducted on the effects of using virtual environments on PWD. In particular, the study conducted explores stress-release virtual settings to enhance relaxation in PWD. The research developed the prototype of a Semi-Immersive Virtual Habitat, in the form of an environmental device of 16 sqm (4 meters edge length), aimed at decreasing agitation and stress-related behaviours in PWD.

This study presents an attempt to apply VR technologies in the field of dementia care, especially in the framework of non-pharmacological therapies, aimed at increasing the quality of life of people with dementia. Moreover, COVID-19 pandemic, and the related lockdown measures undertaken in Italy, offer a relevant occasion to experiment this prototype and its therapeutic outcomes, as forced isolation and lack of socio-assistential services led to a heightened need to develop tools and care methods able to lessen stress levels and agitation, and increase wellbeing and quality of life for PWD.

2. VR Environments

According to Ellis (1994), a virtual environment consists of three essential components which, in a transverse manner, integrate with each other:

1) Content: this concerns the quality of reproduction of the virtual objects, which must be as similar as possible to the real ones, having characteristics of staticity and movement, regardless of the user's will or not. In this way, the user has the possibility of integrating with the content, as an agent subject but also as a simple explorer.
2) Geometry: refers to the physical extension that the computer programmer intends to give to the environment, for example closed (a building) or open (a park).
3) Dynamics: this concerns the rules of interaction between all the contents that a designer must bear in mind when creating a simulation. For a virtual environment to be credible, in fact, all the objects contained within it must conform their behaviour to the normal laws of physics of the real world.

Currently, there is evidence of the effectiveness of the use of VR in neurorehabilitation with cognitive impaired people: i.e., in the rehabilitative treatment of memory disorders, both prospective (related to remembering to carry out intentions and actions that cannot be carried out at the very moment they are formulated, but must be postponed to a later time and in a different retrieval context); and recovery, by using the restoring function (repetitive exercises to improve performance in a memory task), for reorganising functions (using the intact function to make up for the damaged one) and to calm states of anxiety or agitation due to neurodegenerative pathologies that impact the person's cognitive abilities.

People with cognitive impairments report decreased stress when using VR for both stimulation and relaxation (Garcia-Betances, 2015). Moreover, individuals with cognitive impairments may positively benefit from the implementation of VR technology care tools which encompass quasi-naturalistic and/or realistic stimuli (Manera et al., 2016).

Thanks to its ability to allow the creation and control of dynamic three-dimensional environments, in which behavioural response can be recorded, measured and improved, virtual environments offer options that are not available with traditional methods (e.g. assessment of cognitive abilities over time, training, sensory stimulation, etc.).

Nowadays, we can discern 2 main categories of VR simulations employed in VR environments: semi-immersive, and fully-immersive ones.

As Persky & McBride (2009) state “Fully-immersive virtual environments allow researchers to create very realistic environments while maintaining a high level of experimental control”. This specific VR technology has been successfully implemented in VR environments aimed at curing phobias, anxiety, stress and memory problems (Garcia, 2012).

Semi-immersive virtual environments are computer-generated environment mainly composed of interactive computer graphics, designed to physically and/or psychologically

immerse one or more users in an alternative reality. This kind of VR Environments can be applied in CAVE-like systems, which generates a room-sized semi-immersive virtual environments with the number of rear-projected bounding surfaces ranging from 3 to 6 (eventually including floor and ceiling).

2.1 Semi-Immersive VR Environments in Dementia Care

Thus, the use of virtual reality environments for people with dementia represents an emerging field, particularly in residential facilities for the elderly, where opportunities to engage residents in a meaningful way may be limited (Siriaraya & Ang, 2014).

VR environments are an emerging technology with a variety of potential benefits for many aspects of rehabilitation assessment, treatment and research in the field of dementia. An interactive and generically immersive virtual environment encourages the creation of virtual but realistic environments for people with dementia, designed with the aim of improving the quality of life of the person living with dementia and monitoring the person's residual capacities (Kim et al., 2019).

Prior studies have explored design requirements when developing VR Environments experiences for PWD in both semi-immersive and fully immersive modalities (Siriaraya & Ang, 2014; Hodge et al., 2018). These studies demonstrated the key role played by VR Environments tailored on PWD preferences and personal interests, as it could enhance a more meaningful engagement (Tabbaa et al., 2019).

In particular, the pilot study presented in this paper, focuses on the development of a prototype of a semi-immersive VR Environment, called Semi-immersive Virtual Habitat, aimed at decreasing agitation and enhancing relaxation in PWD, especially after experiencing stressful experiences such as lockdown measures during COVID-19 pandemic. The semi-immersive Virtual Habitat replicates most of the features of a real-sized CAVE™-like system, allowing health professional to introduce non-pharmacological care methods using virtual reality environments. Moreover, extensive research has examined the important role quality of life plays in the wellbeing of PWD. The environment plays an important role, as it can sustain PWD stimulating correctly their residual capabilities, supporting their loss, and enhancing their independence (Gramegna, 2017). Thus, therapeutic tools aimed at relieving stress and agitation-related behaviours could positively contribute to the enhancement of quality of life for PWD.

3. Semi-immersive Virtual Habitat for dementia care

3.1 Definition of the Habitat

The pilot study presented in this paper is part of a wider research on therapeutic environments for PWD carried out within GRACE_Lab, an experimental laboratory of research involving designers and researchers from Politecnico di Milano and therapists and medical professionals from Genera Onlus, an organization active in the care of PWD in Milan.

The Semi-immersive Virtual Habitat represents the first digital prototype of a virtual therapeutic habitat for PWD developed within GRACE_Lab research.

The Semi-immersive Virtual Habitat physical structure is mainly based on CAVE™ system features and technologies. The first CAVE™ system was designed and built in 1992 by Carolina Cruz-Neira, Daniel J. Sandin, and Thomas A. DeFanti at the University of Illinois, Chicago Electronic Visualization Laboratory (Cruz-Neira et al., 1992). CAVE™ system is a room-sized semi-immersive virtual environment equipped with three to six projected surfaces (eventually including floor and ceiling).

The Semi-immersive Virtual Habitat is a front projected semi-immersive virtual environment which embodies three surfaces for projection and interaction.

The Semi-immersive Virtual Habitat is an interconnected system aimed at stimulating/facilitating cognitive activities involving mainly PWD with Mild and Moderate dementia, and only few with Severe Dementia. Through the use of semi-immersive virtual reality, the Semi-immersive Virtual Habitat creates an interactive environment where PWD can perform cognitive and/or physical activities. In addition, the Semi-immersive Virtual Habitat could represent in the future a dynamic monitoring system of cognitive abilities and a virtual space for rehabilitation activities. At the moment, these possible functions have not yet been tested. Further test and experimentations will be conducted in order to inquiry those aspects and develop a defined protocol of use and evaluation.

The virtual environment is intended to offer different digital configurations in order to create multiple scenarios according to the specific activities (i.e. relaxation, contemplation, cognitive stimulation, etc.) and needs of PWD using the environmental device.

3.2 Habitat Features, Purpose and Interactions

The Semi-immersive Virtual Habitat consists of a physical room enriched with interactive digital projections and tools where PWD, accompanied by therapists can perform therapeutic, contemplative or playful-educational stimulating activities. Inside this virtual environment, researchers adopted a habilitative approach designed to support PWD remaining skills instead of stimulating lost or impaired ones, promoting meaningful and engaging (Brawley,2007; Zeisel,2013; Zeisel & Raia,2000; Zeisel et al.,2003; Reynolds et al., 2018).

These activities are based on the orchestration, in time and space, of appropriate visual, sound, tactile and olfactory stimuli through multimedia projections, lights, sounds, aromas, physical objects (i.e. fabrics). In particular, in the pilot study presented in this paper, designers and researchers developed a collection of digital contents focused on the interactive projection of natural environments, natural elements, animals and outdoor natural environments (i.e. reproduction of woods with hidden interactive animals, woodlands and seascapes), as promising, but still hardly explored, therapeutic elements to foster relaxation in PWD. According to Reynolds et al. (2018) "Research has found that viewing nature reduces stress and improves mood, but few studies have focused on the potential of viewing nature to reduce negative emotions associated with dementia". Previous studies underline how direct contact with nature has a positive outcome on PWD mood and wellbeing (Zeisel,2013; Zeisel & Raia,2000; Zeisel et al.,2003). Nature and in particular, gardens and woodlands represent an effective and evidence-based approach to reduce agitation-related and stress-related behaviours in PWD (Zeisel, 2013; Reynolds et al. 2018). Several studies described the benefits of viewing natural scenes and natural landscapes on PWD. This supports the hypothesis that also experience a virtual natural landscape may reduce stress-related and agitation-related behaviours among PWD. The specific purpose of this study was to understand whether a virtual natural experience could reduce stress and agitation, enhancing relaxation, in PWD attending a daily care center, after a stressful experience such as the lockdown occurred in Italy in 2020 due to COVID-19 pandemic.

3.3 Habitat Experience

Specifically, the pilot study conducted, involved a group of 30 PWD attending a day care center in Milan. Participants ranged in age from 70 to 83 years, involving both women and men. Moreover, participants were experiencing stress-related and/or agitation-related behaviours. Two alternate 30-minutes sessions were conducted with each group. Previously, all the persons involved undertook a mini-mental state exam (MMSE). The MMSE was used to provide an overall picture of cognitive status and dementia severity and produced a range from 9 to 25 where lower scores correspond to greater dementia severity (Folstein et al., 1975). Participants were divided into two groups, both of them covering Mild, Moderate and Severe dementia. Each group experienced alternatively the virtual environment during a 30-minutes session, in which therapists alternated contemplative views and short interactive activities. Initially, an introductory phase was conducted by the therapists: they asked to the participants to describe the view they were seeing, which kind of elements they could discern, if they liked it or if they were scared. Afterwards, therapists conducted short question-based activities, supported by interactive projections taking place in the Semi-immersive Virtual Habitat. Some of them encompass the contemplation of natural sceneries, associated with sounds and odours. In the end, therapists proposed to the participants to directly and freely interact with the projections.



Fig.1: Pilot study participants spontaneous interaction with Semi-Immersive Virtual Habitat

4. Outcomes

Design researchers participated in the sessions as observers. Comments and gestures (in the form of body positions, non-verbal gestures and communications, movements) made by participants were analyzed to understand the overall reactions. In particular, the sessions were audio recorded, in order to be further analysed by the research team, giving special emphasis to the comments made by the participants during the different interactions. Comments made during the sessions were associated with discomfort, agitation, pleasure, relaxation, with supplementary observations regarding reminiscing factors and past life events. Comments made by the participants associated with discomfort and agitation were “I don’t like this place”, “What’s wrong here”, “I don’t like it”, in a single case accompanied by gestures such as searching for an exit wandering purposelessly around the room. Comments associated with pleasure encompassed “how beautiful is here”, “wonderful”, “I like these trees”, “I feel good”. Often these comments were associated with facial expressions indicating enjoyment and astonishment, hand gestures and non-verbal expressions indicating positive amazement. Relaxation was detected from body positions and gestures: some participants assumed a more relaxed position while seated on the chairs, one participant fell asleep during a natural scenery contemplation activity. During the sessions, some participants reminisced about past experiences sharing comments like “I

have been there", "when I was young I went there with my family", "With my wife we liked walking in the mountains". To resume the comments made by participants during the sessions, there were 6 comments related to discomfort, 3 comments related to agitation, 22 to pleasure, 4 related to reminiscence. Regarding the participants, during the sessions, one person expressed agitation-related behaviours, wandering around purposelessly. Another person expressed discomfort. None of the participants expressed apathic behaviours. 28 participants out of 30 expressed interest and/or positive mood. Among them 24 undertook body positions expressing relaxation and comfort. 1 participant fell asleep during the session. We could discern 2 kinds of behaviours among the participants: on one hand, active participation accompanied by curiosity for the interactions taking place, on the other hand, contemplation and amusement for the virtual sceneries. The last part of each session was dedicated to free interactions with the digital environment: 28 participants out of 30 spontaneously interacted with the digital environment through gestures associated with verbal comments. Those comments include "That's wonderful, you can draw without getting dirty", "look at the flowers I'm drawing", "I like it".

After the sessions, therapists asked to participants to describe their mood. 28 participants made positive comments like "I feel good", "I enjoyed it", "I'm fine and I liked it". Therapists noticed that the majority of the participants were calm, without expressing agitation-related behaviours. Moreover, 11 participants fell asleep after the sessions.

5. Discussion and Limitations

The pilot study was conducted with a small sample of participants due to the limited number of PWD attending the day care center involved in this research. Recruiting more participants for the study was not possible, given the maximum attendance of 35 patients in the day care center. Taking into account this limitation, the results are promising, and a sample size of 30 represents a statistical significance in this pilot study. Accordingly, future studies with larger sample sizes have the potential to show results even more significant.

Previous research supports the benefits of direct contact with nature on hospitalization (Ulrich et al., 1991; Rodiek, 2006), and moreover on PWD (Brawley, 2007; Calkins, 2011). Virtual environments have been extensively used in the treatment of agitation in people with cognitive impairments (Garcia-Betances, 2015), while little research has been conducted on the positive effects of virtual environments on PWD (Siriaraya & Ang, 2014), making this specific topic a promising field of research. This pilot study, gives support to the hypothesis that a virtual experience of natural scenes may enhance relaxation and positive mood, reducing agitation-related behaviours in PWD exposed to a stress period.

From the pilot study conducted it is possible to deduce that a VR semi-immersive experience, focused on the projection of natural environments, significantly improved relaxation and pleasure in PWD involved. Pleasure comments and the lack of agitation-

related and stress-related behaviours underline the positive outcomes of such virtual experience on PWD.

Key findings of this pilot study are that semi-immersive virtual environments positively affect the majority of the participants, with only 2 of them expressing increased agitation or discomfort. Pleasure and positive mood were clearly identified among the majority of the participants. The analysis undertaken during and after the sessions represented an initial attempt to evaluate qualitatively the mood and the state of relaxation among participants. All the participants involved were showing agitation-related and stress-related behaviours before being involved in the semi-immersive virtual sessions. Their spontaneous interactions with the virtual environment may represent that semi-immersive virtual environments could be considered effective tools in the care of PWD. Moreover, the participants who fell asleep after the sessions, may represent a significant sign of the effectiveness of such experiences in enhancing the relaxation of stressed PWD without using pharmacological interventions.

Recommendations for future research regard the involvement of a larger sample of participants, in order to strengthen the efficacy of the study. The collection of data in the form of comments through the use of a video camera may reduce the influence of the presence of a researcher in the room, which could have influenced the emotions and behaviours of some of the participants, and so could have represented a limitation to the study. Further analysis may be conducted on the potential correlations between the severity of dementia (Mild, Moderate or Severe dementia), the type of comments and interactions performed with the virtual environment.

Actually, the ongoing sanitary emergency prevented the researchers to perform further studies, as social distancing measures were recently reintroduced in Italy. The introduction of heart rate monitoring before and after joining the session in the Semi-Immersive Virtual Habitat would represent a significant measure to effectively quantify stress in the participants, associated with agitation-related behaviours. Another future significant implementation could be the use of eyes tracking technologies in the Semi-immersive Virtual Habitat architecture, in order to detect clear signs of agitation among the participants.

6. Conclusions

The pilot study presented in this paper has a dual purpose: on one hand, to examine the effectiveness of a semi-immersive virtual experience on PWD experiencing agitation-related behaviours. On the other hand, this pilot study inquiries the effectiveness of a natural virtual experience on PWD, and its capability to reduce stress-related behaviours. Literature underlines that direct contact with nature should be preferred, but some studies started to explore the effectiveness of virtual natural experiences. The Semi-immersive Virtual Habitat presented in this pilot study could be considered a promising tool for enhancing relaxation in PWD experiencing agitation, stress and anxiety. The semi-immersive virtual experience provided showed positive results in reducing agitation. A virtual space could offer a cost-

effective solution in the hands of therapists to reduce stress in PWD, without recurring to pharmacologic treatments. As Alzheimer's Association (2015) reports, new treatment strategies are needed to help reduce pharmacologic interventions and their associated healthrisks.

New therapeutic tools such as the Semi-Immersive Virtual Habitat presented in this pilot study, represent promising tools for the enhancement of the quality of life of PWD, especially after experiencing stressful life events such as lockdown and social distancing mesures, as happened in 2020. Effective non-pharmacological tools and therapies may promote positive mood and relations among PWD, staff and family members involved, and may improve PWD involvement in meaningful and pleasurable activities (Livingston et al., 2014).

The Semi-Immersive Virtual Habitat presented in this pilot study is not meant to be a stand-alone intervention, but rather needs to be integrated into a complete care management program, tailored on the individual's needs.

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Acknowledgements: EDME- Laboratory for Environmental Design and Multisensory Experiences contributed to the physical and technological development and experimentation of the Semi-Immersive Virtual Habitat.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Shifting paradigms in Sustainable Fashion Design education: Studying implications & effectiveness of pedagogical methods adopted in a pandemic setting

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Abstract | The onset of COVID-19 pandemic in early 2020 led to an abrupt shift of design studios online worldwide. Overnight, design environments fully transitioned from a traditional face-to-face setting to a virtual studio. Fashion design educators began deliberating on how to teach various projects online as part of the design curricula. In order to deliver certain components of the Fashion Design curriculum, faculty and staff resorted to live recorded videos in studio or at home to demonstrate pattern making and garment construction to the students. On the contrary, it was found that sustainable design module, when delivered as part of the curriculum, there are advantages of delivering the project online (or in a blended mode once the crisis is over), instead of a complete traditional studio environment. Following a practice-based approach, the paper explores the effectiveness and advantages of teaching the module in context online by discussing pedagogical techniques through a classroom project undertaken during the pandemic. Conducting project and faculty feedback through surveys, personal interviews as well as studying students' work as evidence, a design framework has been proposed detailing the flow of learning activities and methods to approach sustainability in design curriculum in a holistic manner using an online or blended mode of delivery.

KEYWORDS | EDUCATION FOR SUSTAINABLE DEVELOPMENT (ESD), SUSTAINABLE FASHION DESIGN, DESIGN FRAMEWORK, ONLINE LEARNING, BLENDED LEARNING.

1. Introduction

The disruption caused by the pandemic-induced nationwide shutdown of schools and colleges in early 2020 had alarming ramifications on the education sector worldwide. Novel terms like Emergency Remote Teaching (ERT) (Hodges et al., 2020) and Crisis Distance Education (CDE) (Al Lily et al., 2020) came into frequent use by researchers to explain the forced education scenario the teachers and students collectively found themselves in. Aa was found, this type of learning is fundamentally different from online education, e-learning, or distance education, in the sense that ERT is an ad-hoc alternative rather than a preferred choice (Al Lily et al., 2020; Hodges et al., 2020). In response to the crisis, the digital transformation of education (Iivari et al., 2020; Korkmaz & Toraman, 2020) brought about meaningful learnings in virtual teaching specifically pertaining to fashion design education, wherein a significant part of the curriculum is built around the human body, fabrics, garment construction, and most importantly fit and quality of the outcomes—tangible aspects that are difficult to replicate in a virtual environment. Teaching sustainable design module as part of fashion design curriculum, which is the area of focus in this study, in addition to the above aspects also entails problem-based design thinking, working on collaborative assignments, field research, and strong industry interface. To summarise, the student is not just producing a design outcome such as a garment but developing long-term values and ethics as well.

To make graduate students become more responsible designers, Education for Sustainable Development (ESD) or Education for Sustainability (EfS) has gained increased relevance in the last few years, constituting an important part of curricula across design disciplines (Thomas, 2009). While ESD focuses on the learning process essential to support sustainable development, EfS emphasizes building the capacity to live more sustainably (Lang, 2004). The fashion industry generates large quantities of waste at every stage of the supply chain, causing harm to the environment (Gam & Banning, 2011), thereby increasing the relevance of ESD/EfS in the context of fashion design education. Owing to its long-term nature, sustainability as part of the curriculum is a value-driven module (De Kraker & Lansu, 2007; Grose, 2013; Huckle, 2006; Wolff, 2020), a way of thinking (Leal Filho, 2010); it is not just about equipping students with required knowledge, skills & tools, values & ethics but building empathy and resilience as well. The ideas and ethos integrated as part of the learning process are internalized for lifelong learning (Yasin & Rahman, 2011), attuned to the student's philosophy and aesthetics, with the knowledge developed guiding them in complex decision-making situations they may encounter in real-life. Students often take time to imbibe these values over the academic years, and so the way the class delivery is approached becomes crucial and plays an important role in long-term learning.

A practice-based research, this study acknowledges that online delivery is not merely a digital translation of what is being taught in a face-to-face learning environment but about rethinking and realignment of pedagogical practices and classroom delivery. This study explores the effectiveness and advantages of teaching sustainable fashion design module online by discussing pedagogical techniques through a six-week online classroom project

titled 'Design for Sustainability' taught to undergraduate second-year fashion design students in India, during the pandemic. The project has previously been delivered in a traditional face-to-face setting, in a pre-pandemic scenario, with 15 contact hours and 15 self-study hours allocated per week. For this study, qualitative methods like surveys, semi-structured personal interviews, and written student feedback were employed. Furthermore, students' work—design outcomes, reflections, digital blogs—provided useful insights into their thinking and learning processes while they were working on the project.

The study discusses the delivery formats incorporated during the project, largely focusing on Masterclass & Panel Discussion with Global Experts, Thinking Thursday, Independent Study (of the Local), and Collaborative Working for Knowledge Sharing; approaches that were previously not explored in a traditional learning environment. These techniques can be perceived as symptomatic of the present reality but supported with a review and synthesis of the literature on sustainable design education in a pandemic setting as well as discussing blended models in design education, it can be ascertained that the approaches will stay relevant once the crisis is over and face-to-face teaching can resume. For sake of clarity, the term 'blended' in this paper refers to a mix of physical space (face-to-face) and virtual space (online) to facilitate teaching and learning activities. The findings implied that there are advantages of teaching sustainability module in a blended mode as compared to a complete face-to-face learning environment. As a result of the study, a learning design framework has been proposed, detailing out how the module can be delivered in a blended mode. Acting as a roadmap for researchers and design faculty teaching on sustainable design module as well as to enhance the existing curricula across design disciplines, the framework can be altered to suit contextual needs depending on the objectives, timelines, etc. of the project to arrive at holistic learning for the student.

2. Discussing approaches incorporated for online classroom delivery

A six-week-long project taught to a cohort of 32 students, 'Design for Sustainability' introduced students to sustainable design in the fashion domain underpinned by its core notions and ethos. As a concept, sustainability is often interpreted as too broad and abstract (Landgren & Pasricha, 2011; Leal Filho, 2010; Thomas, 2009) and at times delivering this project in a short duration incorporating the important aspects of sustainability within the module can be a challenging task (Yasin & Rahman, 2011). In order to simplify and break down the wider concept of sustainability while retaining its significance, a strong emphasis was laid on how the project was planned and delivered as well as designed in a way for the students to understand the concept from a wider perspective—primarily defined by their local context, slowly examining it from the lens of fashion, and eventually moving towards a global context.

The primary learning outcomes of the project dealt with the student's demonstration of strategic use of research methodologies and analytical tools, formulation of an individual point of view as well as the ability to critically comment on the interface of context & design. To fulfil these outcomes, different delivery formats were planned incorporating the 6 types of teaching and learning activities as formulated by Laurillard (2013) in the Conversational Framework – Acquisition, Collaboration, Discussion, Investigation, Practice, and Production. While planning the learning activities, special focus was given on how to drive student engagement and participation since in a virtual learning environment, as is often found, students do not turn on their cameras because of various reasons and find it difficult to build a sense of community. Integration of theory and practice (Moore, 2005), as well as a combination of synchronous and asynchronous activities including lecture presentations, interactive sessions with industry experts, watching documentaries, and holding discussions, collaborative learning & assessment, and knowledge checking strategies like quizzes, were incorporated. Bloom et al.'s (1984) six levels of cognitive learning – Knowledge, Comprehension, Application, Analysis, Synthesis and Evaluation, were referred to in deciding the progression of these activities over the course of six weeks.

Table 1 summarises this alignment along with appropriate technology used in the virtual environment for maximizing student engagement. Alongside, the table also suggests the possible application of the delivery format in a post-pandemic learning environment. It should be noted that each session in any of the formats was held for a maximum of 150-180 minutes every day, including 10 minutes comfort break. Canvas (Instructure, n.d.) was used as a Learning Management System (LMS) to host project content, organize assignments, tasks, and activities, share learning outcomes & rubrics, and manage assessments. As first-time users of Canvas, both the students and the faculty took time to familiarise themselves with the platform but eventually found it extremely useful. Additionally, Microsoft Teams (Microsoft, n.d.) was used as a video-conferencing platform to conduct online sessions as well as for quick sharing of important resources and links or notifying students about any changes in the class schedule. Also, various online tools and technologies were used to assist student learning, as will be discussed in the next few sections. Working in close collaboration with the institute's librarian, Learning & Resource Centre's services were extensively used with E-books and scanned copies of rare books organized on Google Drive for easy access.

Feedback during the project was delivered through a combination of mediums – annotated corrections on the submission document (using SpeedGrader on Canvas), detailed critique in comments, analytic rubrics, peer feedback, and verbal feedback provided by the faculty synchronously in groups during online sessions. Since both students and faculty were working in a forced online learning environment and there was a lack of resources and equipment at home, it was fair to provide more oral or written constructive feedback and assessing the student on fewer outcomes—graduating from quantitative to qualitative assessment methods (Farrington, 2020). Expectations were explicitly set through the rubric with the intended learning outcomes mentioned to assist students in self-paced learning—an important aspect with the students working in isolation, and for them to align the pace of

the classroom, with their health and well-being as the country approached an upward increase in the pandemic curve. Being considerate of the situation, all online synchronous sessions on Microsoft Teams, barring one-on-one mentoring sessions and sessions conducted in breakout rooms, were recorded for students' reference and hosted on Microsoft Steam (Source). During the project, the students maintained a design journal as a daily log of reflection on activities as well as made a conscious effort to regularly post their reflections on the blogs. Wix, a free website builder (Wix, n.d.) was used as a simple, easy-to-use technology platform that simultaneously aided in the creation of a digital repository of the student's design journey during the project and concurrently building 'communities of practice' (Dewitt et al., 2015).

Table 1: Alignment of teaching & learning activities in accordance with Laurillard's (2013) Conversational Framework

S.No.	Delivery format	Technology / Mode	Learning activity type	Frequency across activities	Synchronicity	Post-pandemic learning environment
1	Lecture Presentation	Microsoft Teams virtual meeting	Acquisition	6	Synchronous	Virtual classroom
2	Masterclass + Panel Discussion with Global Experts	Microsoft Teams virtual meeting	Acquisition + Discussion	7+2	Synchronous	Virtual classroom
3	Thinking Thursday	Breakout rooms in Microsoft Teams	Investigation	4	Synchronous	Virtual classroom
4	Independent study (of the Local)	Home/ Local area	Investigation + Production	2	Asynchronous	Home and On-field
5	Problem-based Learning Task	Teams meeting + Self	Practice + Production	2	Synchronous & Asynchronous	Face-to-face classroom

6	Collaborative Working for Knowledge Sharing	Padlet, Mural, and Mentimeter	Collaboration	2	Synchronous	Virtual classroom
7	Discussion Board	Canvas	Discussion	5	Asynchronous	Virtual classroom

2.1 Lecture Presentation

A frequently-used delivery approach, the lecture presentations were largely PowerPoint presentations used to introduce concepts around sustainability and fashion, supported by the use of collaborative platforms like Padlet (n.d.) or Mentimeter (n.d.) for knowledge sharing amongst the students. Aimed at instigating the learner's curiosity and foster student engagement (Latchman et al., 1999), the presentations were not descriptive—had more images and less content, with every slide following up with probing questions in order to scaffold student's learning, during the project as well as learning from previous terms. This is consistent with Dovros & Makrakis' (2012) view that scaffolding questions help trigger students' critical skills and allow them to stay focused. For example, while introducing sustainable fibres and fabrics, the conversation was initiated from their previous knowledge of natural fabrics in the first year. The use of Padlet as a tool with anonymous responses was helpful in co-creating this knowledge, the outcome of which was used to discuss the topic further (See Figure 1).

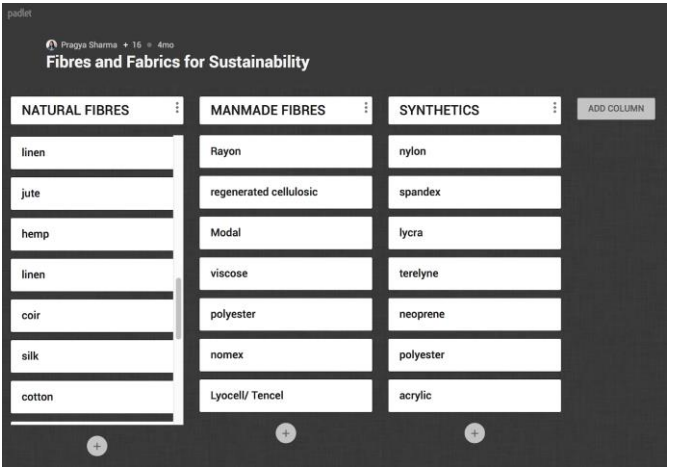

Figure 1: Interface of Padlet showcasing students co-creating knowledge during 'Fibres and Fabrics for Sustainability' discussion.

A face-to-face learning environment provides fewer opportunities for this form of knowledge sharing amongst the learners. Unlike a physical classroom session where some students do not get the chance to contribute to the co-creation of knowledge, in the case of the above-mentioned activity, every student was able to share and do so anonymously without inhibitions or fear of judgment. In other small in-class activities, for example, while discussing longevity, the students were asked to pull out their favourite piece of clothing from their wardrobe and study labels in order to understand fabric composition, wash care as well as the origins of the garment. This resulted in real-life learning about the significance of wash care labels and understand the meaning of various symbols. To supplement the learning from lecture presentations, e-books and scanned library resources were shared on Canvas LMS.

2.2 Masterclass & Panel Discussion with Global Experts

A 90-120 minutes long intense interaction, discussion, or lightning talk lead by an industry expert, the online Masterclass format provided students the opportunity to reduce distances and interact with global experts from different domains of sustainability irrespective of location or traveling constraints. To provide a multifaceted learning experience to the students, the project incorporated 7 masterclasses, with experts ranging from representatives from waste segregation organizations, sustainable fashion designers, journalists, and textile artists to writers, speculative designers, and young graduates. The instant project commenced with one such Masterclass titled 'Trash Talk' that provided a good entry point to the larger domain of sustainability, exposing students to the most basic aspects of sustainable living.

Partly owing to the circumstances where one vied for connecting more with people (albeit virtually) and build meaningful connections, the experts were quite enthusiastic to share their knowledge & experiences and interact gratis with the students. This format essentially reinforced learning from lectures, giving learners an insight into the speaker's ideas & practice in addition to fostering cross-cultural exchanges. In one such masterclass with Texas-based textile artist Maday Lange, the students were provided a virtual tour of her working studio. The session concluded with the students sharing the quilted textiles they had worked on in their summer break and getting a quick review by Maday (See Figure 2). In a regular face-to-face format, such an activity would have taken up a lot of time with individual students.



Figure 2: Screen capture of masterclass with Texas-based artist Maday Lange

The Panel Discussion format brought together four global experts from various sustainable domains to discuss topical issues in the fashion context like supply chain, circular design, co-existence of luxury and sustainability, the impact of COVID-19 pandemic on fashion systems, to name a few. This format was incorporated twice during the project, giving students a practical insight into the workings of the industry. Such formats helped them engage in discussions with the panellists as well as with their peers, thereby strengthening their individual skills like speaking and impersonal communication that did not receive an outlet during longer isolation periods (Al Lily et al., 2020).

2.3 Thinking Thursday

To lighten up the classroom sessions, with the motive of stimulating students' curiosity, a discussion-only day was planned every Thursday that brought on board artists and curators across varied disciplines to collaboratively indulge in a range of activities—from studying and critiquing a piece of artwork, discussing and deliberating ways of working and building aesthetics, to analysing a research paper. The format acted as a medium for the students to contest dilemmatic topics that piqued their interest such as planned obsolescence and conspicuous consumption, to name a few. In alignment with the multifaceted nature of ESD, the objective of this format was to probe students to activate their analytical and critical thinking skills, and encourage open-ended discussions while engaging them in a learner-centred dialogue. Research by McCarthy & Boyd (2005), indicated that students become more critical in their thinking when they try to defend their ideas in a discussion. This form of classroom talk, as articulated by Barnes (2010) has the power to shape knowledge through learner engagement with processes ranging from hypothesizing, exploration, debate, and analysing. Additionally, during the sessions, non-recorded breakout rooms

(Poston et al., 2020) with limited faculty intervention allowed students to share their thoughts and opinions freely with their peers.

2.4 Independent Study (of the Local)

As part of the project, two inquiry-based assignments centred around independent learning, assisting students in taking ownership and deciding the pace of their learning. Post the 'Trash Talk' Masterclass at the beginning of the project, they were assigned a home-based research task wherein they had to look into different sections in their house – kitchen, washroom, dining area, living area, etc. and closely observe the unsustainable products & practices and suggest healthy alternatives. The core aim of this peer-reviewed assignment was to identify and rationalize the concept of sustainable practices, within the context closest to them, their home in this case, and develop an appreciation and critical eye towards the impact their lifestyles create on the environment. With analytic rubrics providing an objective way for peers to offer feedback, such formative assessment activities have a significant impact on improving student learning and are appropriately facilitated through online technologies (Carter, 2009; Yam & Rossini, 2011), for example, Canvas LMS in the current case.

With the local aspect forming an important role in understanding sustainability (Fletcher, 2008), a follow-up of the above assignment required students to study in-depth any one of the local industries in their respective region. Titled 'Finding my Local', the assignment aimed at making students more conversant with their surroundings, articulate their findings, and offer critical commentary in the form of a 500-word reflective essay, reinforcing their critical and reflective thinking skills, one of the key skills for ESD (Dovros & Makrakis, 2012; Howlett et al., 2016; Pavlova, 2013). Furthermore, this kind of student engagement with local communities reflects the principles of sustainability (Leal Filho et al., 2018) as well as helps them understand different points of view (Too & Bajracharya, 2015). In both the activities, the student's context became important and so this particular assignment was designed in a way to reinforce the relevance and importance of local especially during a time when there were mobility restrictions. The goal was to make the student more self-aware about their surroundings and explore local creative industries via primary research, thereby leading to the creation of a customized real-world learning experience for each student.

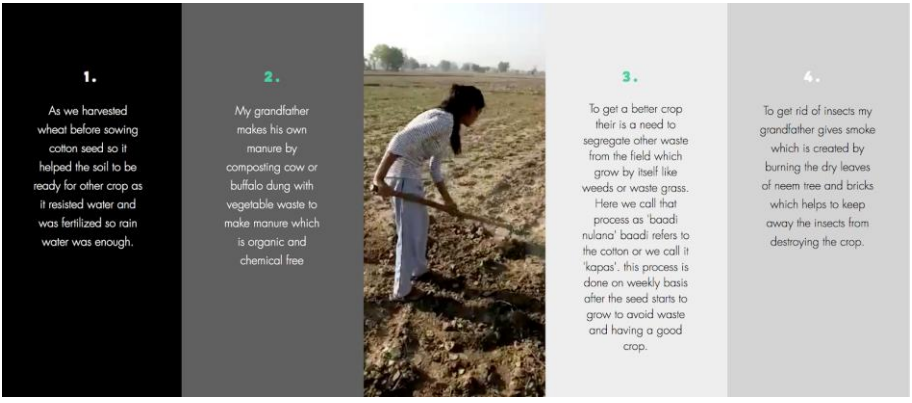

Figure 3: A student's blog entry on 'Finding my Local' assignment.

2.5 Problem-based Learning Task

Incorporating the 'Learning by doing' philosophy as advocated by De Kraker & Lansu (2007), this format involved activities that provided a hands-on learning experience. One particular assignment aimed at understanding and finding a solution to the immense amount of cut-and-sew waste generated in the garment construction process—an important discussion in the sustainable fashion context. The students were supposed to select an unused or discarded garment from their wardrobe, deconstruct and rip it apart, separating all its components, and subsequently place them on a piece of fabric to calculate wastage generated in the making of the garment. Further, they investigated how the original garment could be re-designed with minimum waste as well as explored different ways of incorporating the waste pieces in the new garment, ensuring maximum fabric use. Due to material and equipment constraints at home—a dress form and a sewing machine—the students were advised ways to put the panels together, other than machine sewing, using hand stitches, pleats, tucks, insertions, folding techniques, etc. to assemble and construct the garment. Figure 4 shows one such visually documented design process.

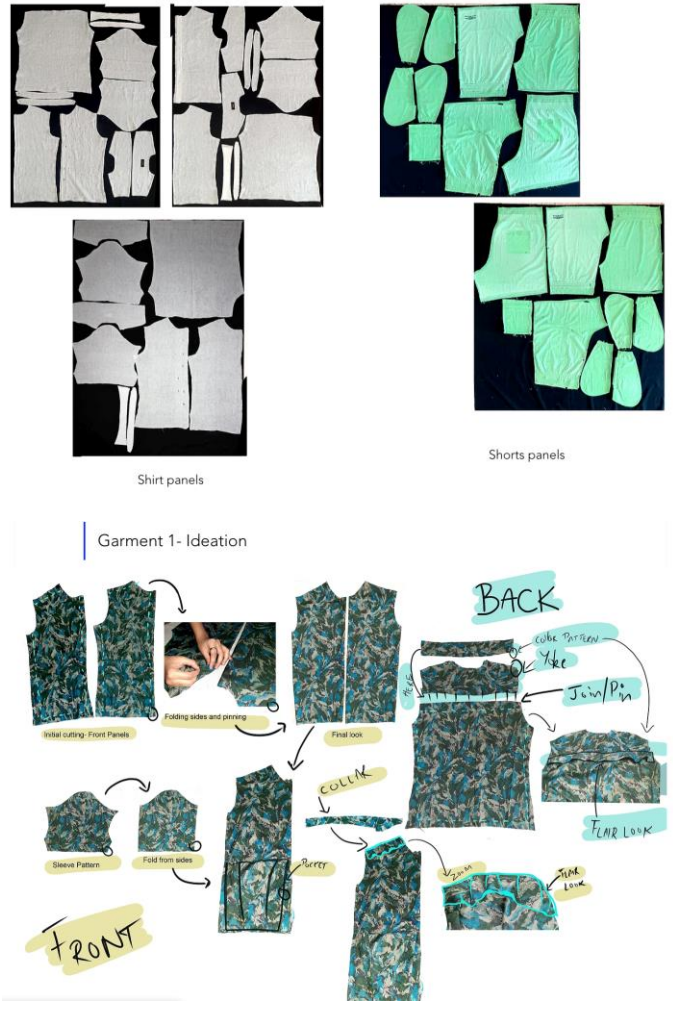

Figure 4: A student's work showcasing de-construction and garment waste calculation for her garment, and subsequent re-arrangement of the panels to create new design.

Addressing and understanding the dilemmas and challenges of sustainable development requires skills in critical thinking and problem-solving (Huckle, 2006; Thomas, 2009). Such assignments prepare students for the industry and aid them in any complex decision-making process they may encounter in their day-to-day lives. In another assignment aimed at hands-on learning, the students approached sustainable garment making through the zero waste design method, a popular sustainable design strategy. Initially instructor-led with step-by-

step demonstration, the assignment involved creating zero-waste patterns through folding techniques. In the synchronous online session, all the students had their laptop cameras tilted towards their working tables in order to imitate the studio environment, enabling students to see each other's explorations as well as for the faculty to appropriately guide them. The small miniature folds—after initial explorations on a 12" small mannequin for determining openings, were translated into self-size muslin pieces, asynchronously. In this kind of practice-based problem-solving learning environment, the teacher's role moved from an instructor, a primary source of knowledge—to a facilitator (Hoic-Bozic et al., 2008). One-on-one mentoring sessions, discussion with peers, and self-reflection enabled feedback in this format.

2.6 Collaborative Working for Knowledge Sharing

To aid participatory decision-making with the peers as well as drive student engagement, small activities were planned within the online sessions. In one such classroom activity, Mural (n.d.) was used as a collaborative platform. The activity was aimed at understanding the origins of the Fashion Revolution movement #whomademyclothes (Fashion Revolution, n.d.) and involved critically listening to the narratives of garments' workers that explained their working conditions and treatment by employers in a sweatshop in Bangladesh. While studying sustainability in the fashion industry, developing an understanding and building empathy becomes vital. Following a Flipped Classroom approach (Bergmann & Sams, 2012), the students were assigned the pre-work to listen to a 25-minute podcast episode by Fashion Revolution (Fashion Revolution Podcast, 2017) prior to the online session. During the class, an important dialogue emerged among other discussions points, about Turkish factory workers, who made clothes for fast-fashion brand Zara and had placed tags in garments that read, "I made this item you are going to buy, but I didn't get paid for it" (Park, 2017). After listening to the podcast, as a roleplay, they were asked to imagine themselves as the garment worker and write a 50-word note to be attached to the garment, answering the cue '*What would you want to say to the customer, if you get a voice?*'. They wrote and pinned their letters as sticky notes on Mural, a snippet of which is shown in Figure 5. The Flipped Classroom approach helped foster a deeper understanding of the concept since saving the classroom time to listen to the podcast episode, provided the learners enough time to engage in critical discussions in the session.



Figure 5: Notes to garment workers on sticky notes on Mural as an outcome of #whomademyclothes activity

2.7 Discussion Board

The Discussion tool on Canvas LMS was actively used to hold asynchronous discussions on micro or out-of-the-classroom activities like documentary & movie reviews, sharing of reading resources, opinions on articles, etc. It also acted as a Q&A forum for the students to pose question or clarify any doubts on the project. Usually, a thought-provoking statement was often posed on the board by the faculty or the student to collectively reflect on. Since sustainability as a topic is subjective and is largely defined by one's socio-cultural context, a lot of its aspects require crucial discussions. Hence, topics were chosen in a way that brought forward one's individualised context, thereby fostering intercultural learning. Storytelling was used as a powerful way to evoke responses, for example, while discussing upcycling in class, the students were asked to share a repurposed story of a garment from their family on the discussion board. A comment by one of the students read,

> "When I entered first grade, we had strict restrictions on wearing school uniforms with accessories of the proper colour, either grey or the colour of your uniform and no other colour was acceptable. My mother knitted a woollen grey scarf for me and I never liked it. I always thought it looked so ugly on me. I used to wear it till I got on my school bus and then removed it. My mother knew it and she knew I played this mischief so she unravelled it and made a cap out of it, mixing a little of black yarn as well. I loved it but when it stopped fitting my head, my mother unravelled it again and used it to make a crochet cover for the offering plate she took with her to the temple."

Belonging to different parts of the country, sharing of similar stories & perspectives from students' contexts resulted in building of ideas and experiences amongst the student

community. Features like threaded discussions, like, reply to a peer's comment were enabled, thereby helping in building meaningful conversations amongst the student community.

3. Survey Results

To measure the implications of the delivery approaches, a survey was conducted on Google Forms in the first week of conclusion of the project. Questions were answered on a 4-point Likert scale form Strongly Agree to Strongly Disagree. Additionally, four face-to-face semi-structured interviews were conducted, 8 weeks later, with the students from the cohort. Table 2 highlights the feedback criteria along with the results.

Table 2: Student Feedback Survey Results

S.No.	Questions	Strongly Agree	Agree	Disagree	Strongly Disagree	Total
1.	Introduction to the project enabled me to understand what is expected of me	15	12	1	0	28
2.	The concepts covered in the project were explained well (made it easy for me to understand and apply)	14	14	0	0	28
3.	The delivery of the project was interactive and engaging	13	15	0	0	28
4.	I was challenged and motivated to stretch and push my abilities	15	13	0	0	28
5.	The criteria for feedback has been made clear to me	14	13	1	0	28
6.	Detailed feedback has been given on my work in a timely manner	15	12	1	0	28
7.	Feedback given has helped in improving the quality of work	14	14	0	0	28
8.	Overall I am satisfied with the quality of teaching	12	15	1	0	28

Summarising the results, 96% of the class, 27 out of 28 students were overall satisfied with the delivery of the project. Table 3 further elaborates on some of the students' comments sharing aspects of the teaching that they believe had a positive impact on their learning.

Table 3: Student feedback sharing comments

S.No.	Respondent	Comment
1.	R4	The constant positivity during the class
2.	R8	Masterclasses and one to one discussions.
3.	R10	Everything was taught in a simple, practical manner, making it easier to learn
4.	R12	The masterclasses were very enriching and faculty supportive and encouraging throughout the project
5.	R14	I think all the aspects helped- masterclasses/ discussions, assignments. Challenging yet interesting.

4. Analysis of Approaches

Based on evaluation of responses generated student feedback through survey and interviews, classroom observations, as well as literature review, Table 4 gives a detailed analysis of the approached.

Table 4: Inferences and detailed analysis of delivery approaches

S.No.	Delivery Format	Analysis
1.	Lecture Presentation	As observed from the active participation of the majority of the students, good attention curve combined with the critical questions posed by many of them, it was found that the classroom discussion facilitated students' high-order thinking skills, an important aspect of ESD. This format stimulated student participation; oral contributions from the students were elaborate, and the responses were quick, illustrating that the students found the sessions to be engaging. Anonymous responses on Padlet fostered student engagement as researchers have found that anonymity in activities makes learners more participative since they do not need to reveal their identity (Brady et al., 2013).
2.	Masterclass & Panel Discussion with Global Experts	As per the survey results, the masterclass format was the 'most-liked' aspect of the project and students found them to be 'enriching'. As one of the interviewees spoke, the sessions gave them a "global viewpoint on how artists, designers & organizations are incorporating sustainability in their practices." This format allowed students to get an

		insight into different aspects and avenues they can explore within the larger context of sustainability. Listening to varied perspectives as well as building their own, the environment that was consequently built through this format, helped students experience they were a part of the larger design community.
3.	Thinking Thursday	As was observed in online sessions, this format provided the students with a day in the week where they were not concerned about absorbing knowledge or producing an output. Through their active participation, it can be deduced that the students enjoyed these design thinking sessions wherein they were actively observing, analysing ,and synthesizing the visual elements they were being exposed to.
4.	Independent Study (of The Local)	As gathered from personal interviews, practical learning was seamlessly integrated into the student's day-to-day personal and professional contexts. This format activated the students' self-initiative skills, making them more reflective and self-aware, with most of them looking at their home-based industries or the ones in their closest proximity. In an interview, a student mentioned that working independently provided her ample time to apply her learnings, and critically reflect on them. While working on the home-based research assignment, students discussed how the assignment led them to initiate conversations with their parents and grandparents around sustainability, getting insights on how it was being practiced traditionally and applying their findings towards the deliverable.
5.	Problem-based Learning task	The assignments were designed to be self-paced and exploratory in nature. Although a challenging yet important aspect of the project, 'designing around limitations' further reinforced by the constraints the pandemic brought about, strengthened the student's problem-solving skills, compelling them to make conscious decisions at every stage, and finding the best possible way to tackle a problematic situation. One of the students commented in the survey, "Understanding deconstruction has led to ample wastage of fabric in the form of ripped garments." This implies that the student was actively conscious of fabric waste while working on the assignment, thereby signifying that the student's higher-order thinking skills were activated.
6.	Collaborative Working for Knowledge Sharing	Collaborative activities were good forms of engagement amongst peers. As became apparent from the notes written on Mural, the #whomademyclothes activity invited an empathetic response from the learners, followed by a discussion where the students commented on and appreciated one another's notes.
7.	Discussion Board	Even though students were not evaluated on their participation, they were found to be engaged and reflective in the discussion forum with their comments supported by sound knowledge. Important arguments were being raised in threaded comments that prompted others to join

the conversation, fostering peer-based learning. Echoing Dovros & Makrakis' (2012) view and as was observed, introverted students were better at expressing their opinions asynchronously as compared to a traditional face-to-face classroom, thereby building a supportive and inclusive learning environment.

Additionally, annotations on SpeedGrader on Canvas (n.d.) helped in sharing individualized feedback which is a powerful learning engine as espoused by Rapanta et al. (2020) in their research. For every assignment, rubrics were shared on Canvas to set expectations. One of the students interviewed shared that the rubrics helped her direct her learning on the project, a sentiment echoed by Mirriahi et al. (2015) as well. An emergent asynchronous communications approach, blogging acted as a strong learning tool (Rhode, 2009) with the student documenting their daily or weekly reflections (based on the learner's pace) on classroom discussions. Arena (2008, p.3) identifies that blogging also promotes higher-order thinking skills since, in order to establish a conversation and to construct knowledge collectively, learners and instructors will have to "… go beyond superficialities, posting entries that increase reflection, analysis, discussion, and synthesis."

As has been discussed by many researchers, the main challenges faced by the students in a remote teaching environment primarily included – impact on emotional well-being, absence of dedicated working space, lack of family support, socio-cultural barriers, technical glitches, internet connectivity issues, etc. (Iivari et al., 2020; Kini-Singh, 2020; Paudel, 2020; Rapanta et al., 2020). In addition to these challenges, the author observed the following shortcomings as well:

- In the absence of necessary equipment, primarily a dress form and a sewing machine at home, the fit, and quality of garments impacted design outcomes. While some students had provision of these at their homes, some did not and so it was fair to not assess them on the construction aspect of the assignment, but on the conceptual strength of the design as well as their risk-taking abilities; the alignment of Learning Outcomes (LOs) in the rubric was done accordingly. It was also ensured that the students were well-appreciated when they mitigated problems while working from their home environment.
- As one of the interviewees pointed out, the students were not getting enough chances to see each other's work unlike in a face-to-face setting. The student spoke about how seeing each other's work motivates and encourages them to perform better. To resolve this dilemma in future projects, free cloud storage platforms like Shared Drives on Google (Google Drives for Developers, n.d.) or OneDrive on Microsoft (n.d.) can be incorporated.
- In the shutdown scenario, students were unable to undertake a campus-based learning project, unlike last year when the project was delivered in a face-to-face setting. As emphasized by many researchers, the campus—as a learning location and students' first contact to practical experience—forms an important element in understanding sustainability concepts through problem-solving (Gudz, 2004;

Moore, 2005; Too & Bajracharya, 2015). Due to remote teaching, the students missed out on this learning aspect.

- Collaborative learning through teamwork can be explored as one of the delivery formats. As emphasised by Remington et al. (2017), teamwork encourages every team member to be actively involved and accountable for their learning goal. Additionally, working as part of the team, learners develop skills like leadership, communication, considering different perspectives and opinions as well as conflict resolution. Since this was the first instance a project was delivered completely online and due to lack of experience in planning and designing activities incorporating teamwork, the format could not be explored but now with much experience, this can be further worked upon.

4. Opportunities in a post-pandemic scenario

There is no doubt that a virtual environment that educators were inadvertently forced into, played a huge role in the planning and restructuring of the design of various projects. The efforts put into remodelling projects from a face-to-face to an online mode leads to the pertinent question of whether or not these practices will be relevant in a post-pandemic scenario. Design institutes worldwide are already considering a blended approach that involves a combination of traditional and online delivery methods, keeping in mind the advantages and opportunities that online learning environments offer – flexibility, accessibility, allowance of self-paced learning, affordability, to name a few (Bleed, 2001; Carman, 2005; Iivari et al., 2020; Kini-Singh, 2020; Paudel, 2020; Rapanta et al., 2020; Singh & Phirriyalatha, 2020).

As per the student survey results, 5 out of 6 students feel that they would have performed better in a part studio, part virtual environment, as opposed to a complete face-to-face or a complete virtual learning environment. This brings into light a blended mode of delivery, and hence, the following approaches can be suggested for if and when the project is delivered in a blended mode:

- In order to space out the level of learning in the context of sustainable fashion design, it is advisable that this component should start early in the first year of fashion design itself, to create a significant experience at each level. This results in a scaffolded learning experience for the students, sharing Bruner's (2009) view in his Spiral Curriculum theory.
- The number of masterclasses can be minimized to accommodate other virtual events aimed at participatory learning amongst peers such as Virtual Hackathons. Hackathons are collaborative and intense activities with the focus on producing a definite outcome by the end of the event (Aguado et al., 2014).
- More interdisciplinary approaches can be explored such as working on collaborative assignments with students from other disciplines—communication

design or product design. Not only does it form an important element of ESD (Yasin & Rahman, 2011), it has been routinely highlighted by many researchers that the transformation in higher education towards sustainability should encourage inter and transdisciplinary approaches (Ferrer-Balas et al., 2009; Moore, 2005; Remington-Doucette et al., 2013; Sterling, 2013).

5. Learning Design Framework for blended delivery

As Kini-Singh (2020), Pektas & Gurel (2014), and other researchers have reiterated, blended learning in design education is not a new phenomenon, with appropriate use of technology becoming important for facilitating and enhancing the learning experience (Rapanta et al., 2020). Informed by qualitative data collected from respondents as well as supported with literature, a blended learning framework has been designed based on a layered thinking approach that can be used to deliver the module holistically (See Fig 6). Following the essential ingredients for blended learning, as formulated by Carman (2005), the cells with white background suggest that the format works best in a virtual learning environment while the cells with grey background require physical studio space. As has been routinely observed, incorporating varied platforms for learning is less monotonous for the students, and makes them more inquisitive learners. Thought-provoking activities as part of the framework will help intensify the learning process. Design Council's (n.d.) double diamond model was referenced to plan how students' learning during the project can be reinforced through different delivery formats (as highlighted in different coloured boxes).

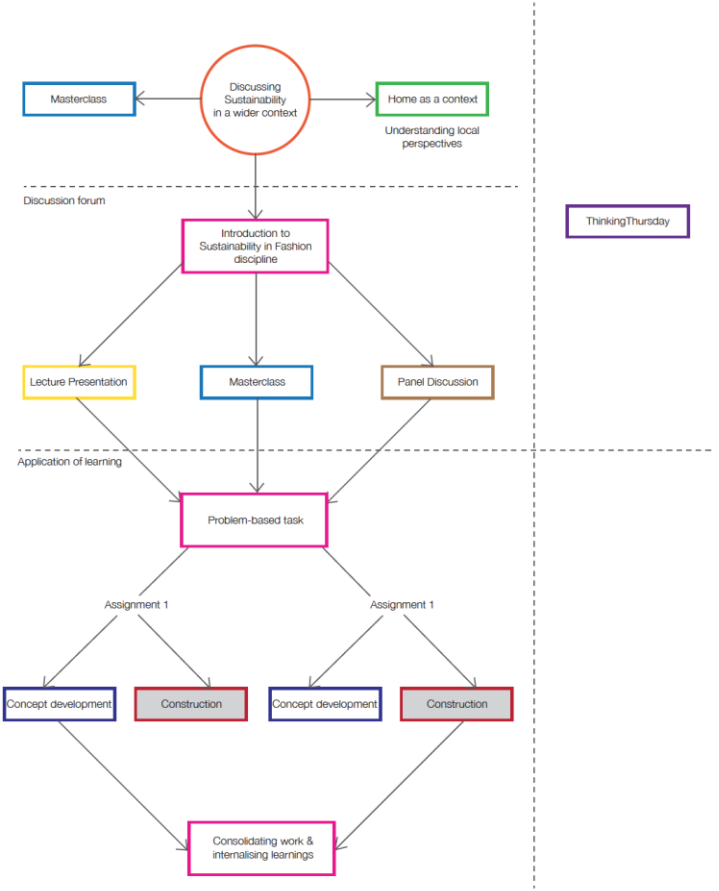

Figure 6: Proposed design framework for a blended mode of delivery of sustainability module taught to third year undergraduate Fashion Design students

5.1 Discussion & Limitations

As was observed and has been pointed out by Dovros & Makrakis (2012) in their research, at times, design faculty find it challenging to orient their curriculum owing to the multidimensional complexity of the sustainability module. The proposed framework aims to assist educators in ad-hoc circumstances like the ones encountered in the past year. As advocated by Carman (2005), “People perform better when they have a mix of modalities and methods of learning.” The framework, in this case, helps cater to different students’

learning styles and pace (Rapanta et al., 2020). Some of the challenges that one can encounter while using the framework are:

- Considering student diversity while working in a virtual environment and as aptly articulated by Pedró (2012) in their research, one should be mindful of the fact that various kinds of polarizations exist between those who have access to and ability to develop digital literacy skills and those who do not.
- Although multiple online technologies and tools were discussed in the instant research, one cannot assume that all platforms are safe to work on. As Rapanta et al. (2020) warned, available 'free' tools may share user data with third parties and this may not align well with an institute's privacy & protection policies. In addition to this, not all online tools are free or there are certain limitations on the number of users or the number of files that can be created. The use of such platforms, as mentioned in the paper, was done as an experimentation phase, before deciding on whether or not the institute should invest in them.

Another limitation of the framework is that it does not accommodate faculty's digital literacy skills and other competencies while adapting to new technology or platform and ease of working. In this context, the framework can start a larger conversation worthy of a separate paper. Also, as Leal Filho et al. (2018) pointed out "…the capabilities of academic staff to support learning transformation processes are too often assumed, and more attention should be devoted to faculty professional training." Hence, the development of appropriate pedagogical content knowledge (Shulman, 1987) will be required for designing and delivering the project in a blended mode.

6. Conclusions

The research conducted in this paper gives an overview of the approaches incorporated in the delivery of a Sustainable Design module virtually during the pandemic, as well as suggests ways of rethinking teaching Sustainable Fashion Design in a blended mode. Design educators worldwide have always believed that studios are best functional in a physical setting unless there is not a provision for one, but the findings of this paper imply that it is advantageous to take some or most of the aspects of a sustainable design module in the fashion domain online for better student learning and engagement with the project. Incorporating activities and tasks as part of different formats, as discussed in the paper, and aligning these with varied learning activity types leads to holistic learning for the student that has a lasting impact. As was identified, an online learning environment leads to more independent and self-driven learning for the student.

Blended approaches in delivering modules in fashion design curriculum may become the norm in the future irrespective of any calamitous situation that may occur. The pedagogical approaches and methods discussed in the study will continue to remain relevant in a post-pandemic learning environment. More in-depth comparisons could have been drawn when the project was taught last year in a complete traditional face-to-face learning environment

versus an online delivery, however, that study would have been out of the limits of this paper. In order to further enhance the design of the framework, another aspect that can be studied further is exploring the approaches and implications as well as the proposed learning design framework from a faculty's perspective and accommodate their challenges. As an important participant in the student's learning process, the faculty needs to be conversant as well as comfortable with the technologies incorporated in the classroom delivery.

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Acknowledgements: I would like to thank my students for contributing to the research as well as my course leader, colleagues and acquaintances at IIAD and outside for proofreading my work and giving valuable suggestions.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Strengthening city resilience through the re-orientation of a social innovation incubation programme in Covid-19 time. The case of 'The School of the Neighbourhoods'

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Abstract | This paper describes the impacts of Covid-19 on the social innovation incubation programme, 'The School of the Neighbourhoods', promoted by the Municipality of Milan, as a policy that aims to enable and empower prospective social innovators to transform ideas into prototypes and actions. The nature of the programme, intrinsically disruptive because focussed on up skilling people, on learning from the most interesting experiences, on providing solutions and generating social impact, has been regarded as an already potentially excellent answer to the pandemic in a 'new normal' perspective. The programme has now been adjusted to increase its capacity to activate a strategic conversation with and within local communities and to train the sense-making ability of the prospective innovators to design a 'new normal'. It may be regarded as a living experiment to enhance the resilience of a city, part of a wider policy for the *cultural and technical empowerment* of communities before and beyond the pandemic circumstances.

KEYWORDS | SOCIAL INNOVATION, INCUBATION, CO-DESIGN, SERVICE DESIGN, STRATEGIC DESIGN, PROTOTYPE

1. Background knowledge

1.1 Design for social innovation incubation.

The dramatic effects of the CoVid19 pandemic had an impact on people's lives in every country in the world. The state of emergency has affected all levels of society, highlighting how much a choral and cohesive action among different sectors is necessary in facing issues arisen from this situation and in devising a change on a systemic level.
At the local level, communities have shown an unprecedented capacity of action, often collected in repositories or platforms (to mentions but a few: in the city of Milano, the initiative by the municipality 'Milano Aiuta'[1]; in the city of New York the initiative 'Mutual Aid NYC'[2]; in the USA the 'Mutual Aid Hub'[3], and many more), by fast prototyping innovative solutions as creative reactions to the emergency state. Considering the main traits of such extemporaneous initiatives (e.g.: the origination in the local community, the creation of collaborative relationships often based on mutuality, the innovative use of resources to create commons, the care for social inclusion and public value, beside the massive and creative adoption of digital solutions), these can be considered as practices of social innovation (Murray et al, 2010; Howaldt, J. et al 2018). As such, they might benefit from specific support policies to scale and to increase both their efficiency and impact, so to create the basis for a more proactive and participatory post-emergency society. This paper discusses the contribution of design to shape a strategy that an existing social innovation local policy may explore to capture the momentum associated to the pandemic and to envision a 'new normal'. More in particular it describes some of the initiatives undertaken within 'The School of the Neighbourhoods', a programme promoted by the Polimi DESIS Lab - Design Department of Politecnico di Milano with the aim to enable and empower prospective social innovators in areas of the city in need for an economic and social boost.
As discussed in several arenas (Meroni, 2019; Lou, 2018; AAVV, 2015) social innovation is a key element to create more resilient societies, that is able to achieve and sustain health and well-being through recovery (how well people bounce back and fully recover from challenge) and sustainability (how well people sustain health and psychological well-being in a dynamic and changing environment). In fact, from a design perspective in particular, social innovation is a process that, at the same time, implies and results from empowering people to overcome difficulties by using creative thinking and problem solving, looking at problems as opportunities and becoming open to change. As such, designing for social innovation is a way to strengthen the resilience of a community.

The scholarly debate around how social innovation can be empowered and enabled is wide and articulated (Dees et al, 2004; Westley & Antadze, 2010; de Bruin & Stangl, 2013; Gabriel,

[1] 'Milano Aiuta', https://milanoaiuta-servizi.comune.milano.it
[2] 'Mutual Aid NYC' https://mutualaid.nyc
[3] 'Mutual Aid Hub', https://www.mutualaidhub.org

2014): it is particularly focused on the trajectories of scaling and on the programmes to accelerate and sustain such progresses. A common agreement emerged on the necessity of moving beyond the idea of scaling as an organizational growth (Bradach, 2010; Addarii & Lipparini, 2017) narrowed on the capacity of the single innovator to acquire technical skills to improve the performances. Instead, the dichotomy between 'scaling out' – disseminating social innovation to benefit more communities – and 'scaling up' – connecting the social innovation to opportunities in the broader economic, political, legal or cultural context (Westley & Antadze, 2013) – is useful to frame the subject of this paper. In fact, it helps to understand that effective processes enabling social innovation need to nurture an innovation culture in society at large (Moulaert & Van den Broeck, 2018; Meroni, 2019) besides to train specific skills and provide technical measures. Indeed, incubation experiences (Davies & Simon, 2013b; Miller and Stacey, 2014) have demonstrated that supporting social innovations requires to consider, as part of the process, disseminative, open and inspirational initiatives with a twofold aim: on the one side, to empower communities, by generating awareness, critical and creative thinking, entrepreneurial skills to develop ideas that can generate public value (Murray et al, 2010; Pauwels et al, 2016; Selloni, 2017) and, on the other side, to stimulate in people openness, interest and then behavioural change toward different ways of living (Manzini & Jégou, 2008).

In this line, we can see that in the last few years the public sector, specifically at the local government level, has been acquiring awareness and knowledge on the importance of setting the stage for design conversations about the future of the cities as ordinary practices of participation. These initiatives are 'infrastructuring' processes according to the definition of the Scandinavian scholars of participatory design (Karasti and Syrjänen, 2004; Hillgren et al, 2011): policies aiming to connect the players of the civil society, by building relations and organising purposeful encounters to stimulate social innovation from citizen-based initiatives. These policies are not straightforward directed to produce solutions for societal challenges, but are rather strategies to stimulate conversations, collaborations, mutual trust and awareness among the players as preconditions to accelerate social innovation and important as the more operative measures.
By acknowledging the diffused creativity of local communities and "empowering people to conceive, develop and produce solutions together" (European Commission, 2013; Davies & Simon, 2013a), such policies configure themselves as a "designerly way" (Cross, 1982) of incubating social innovation, for two distinct reasons:

1. On the one side, they aim to form the capabilities of understanding and tackling ill-defined problems, of synthesising, inventing, making and doing. They do so by stimulating awareness on the on-going challenges, by making people, familiar with the surrounding ecosystem and not afraid to experiment and by facilitating participation. In other words, these policies are thought to create a culture of innovation, so to stimulate sense-making, behavioural change and the readiness

to adopt new ways of living. We can call them 'actions of *cultural-empowerment'*.

2. On the other side, they operatively support people in framing intuitions, modelling interactions, using ingenuity, empathy and developing a concern for 'appropriateness' (Cross, 1982), adopting a 'design thinking' approach and largely using service design methods and tools. Through these actions, incubation programmes aim at developing in the innovators the more technical skills of design and entrepreneurship, so to accelerate the conception and prototyping of solutions. We can call them 'actions of *technical-empowerment'*.

According to Manzini (2015), a designer may act within these social innovation policies as 'expert', able to trigger, facilitate and participate in different 'design conversations'.

Thus, in this paper, when speaking about design for social innovation incubation, we refer to both these different kinds of actions of *cultural* and *technical empowerment*, implemented within policies that can be described as participatory processes involving social innovators and stakeholders, where designers contribute by bringing and transmitting different competences mainly from the service design domain, among which, co-design has a relevant role as a way to achieve citizen empowerment (Selloni, 2017). In fact, being social innovations relational, collaborative and multi-stakeholder forms of service, service design acquires relevance to social innovators for 1) outlining complex form of interactions, while keeping a focus on maximizing their social impact, 2) addressing a defined target audience of beneficiaries and their needs, 3) designing the experience of the users and of all people engaged, 4) considering the adoption and adaptation of technologies, 5) conceiving innovative form of purpose-driven partnerships with a wider potential network of stakeholders, and 6) establishing meaningful relationships with the community and co-designing the solution with it.

1.2 Design for public-interest services and place development.

Public-interest services are solutions able to create a value that can be shared among the community: they do not benefit only few individuals, yet respond to individual interests and needs. They serve the well-being of a social collective, while transforming the culture of a community by means of participation, deliberation and social learning (Selloni, 2017). They are the outcome of a "configuration of citizens construed as a 'public' around a crucial issue in a local context" (Selloni, 2017, page 41) and they are placed within a hybrid area between the state and the market.

The convergence of the notions of public-interest services and social innovation is evident and recognised, being the latter focussed on changing social practices in order to overcome societal challenges, meeting social demands and exploring different ways of doing things, while creating social relations and public value (Howaldt, J. et al, 2018). It unfolds from the natural and conscious desire of citizens to be pro-active and from their need of having things done in a more satisfactory way.

As a result, it is increasingly becoming an integral part of public policies the strategy of enabling social innovation to flourish in places, cities or neighbourhoods where the social fabric is weak, the commons are inexistent or disappearing, and the public value is few recognised. This is precisely where social innovators can bring substantial benefits for people, de-facto partnering with the public administration for the purpose of regenerating places and communities.

1.3 An experiment of resilience

When it comes to the circumstances of Covid-19 pandemic, both the described design approaches might be called up as instrumental to envision and experiment with a tremendous transformation. A transformation intended to be necessary not only to manage the transition to the so-called 'new normal', but also to shape this new normal in itself. In fact, we are now in the unique position, as a society, of orienting the needs, values and priorities that will inform the future. The design community must have a voice in this by bringing its expertise to the several policies across the world aimed at the cultural and technical empowerment of citizens for the generation of public-interest initiatives.

The programme 'The School of the Neighbourhoods' started at the end of 2018, time before the pandemic: yet, in its premises the foundations of this approach are well established, since it has the ambition to make emerge and empower the innovators, to facilitate collaborations at the neighbourhood level, to align the visions towards a shared and collective value of social innovation, to improve the quality of life at the local scale. As a whole, it intrinsically puts into action the above-mentioned strategies for resilience, namely empowering people make a new sense of their life, using creative thinking and problem solving, looking at problems as opportunities and becoming open to change.
With the outbreak of Coronavirus, the fundamentals of this programme did not change, but the way in which it is being implemented and the relationship with the innovators and the context actually did, not only as a reaction to the temporary circumstances. The whole programme, thus, is undergoing a resilience test in itself against the uncertainty provoked by the pandemic.

2. The case study of 'The School of the Neighbourhoods'

2.1 Context: Milan, 'a social innovation city' reacting to Covid-19

Over the last years the city of Milan, according to different observers, has witnessed a period of 'renaissance' (Guerrini, 2017; Magni, 2018), energised by Expo 2015 and supported by a changed city government (Tajani, 2016), as well as a series of public/private projects contributing to shape its identity of vibrant, restless, city and to expand its capacity for innovation (Clark et al, 2018). From February 2020, the pandemic of Covid-19 dramatically

hit Milan (and the whole Lombardy region) as the very first area in Europe: it was, since the beginning to date, the most impacted area in Italy and a great shock for the whole city. One of the first actions of the municipality was to publish a document open to the city's contribution, entitled 'Milano 2020 - city adaptation strategies' (Comune di Milano, 2020a). It is a strategic document to explore some possible scenarios for the restarting of Milan, together with actions for the management of a 'new normal', focusing on the dimension of the neighbourhood as the unit through which to reconceive the services and sociality of a city and explicitly connected to the '15-minute city' model developed by Carlos Moreno and welcomed by many other cities in the world (C40 Mayor's Agenda for a Green and Just Recovery, 2020). The purpose of 'Milano 2020' was precisely to collect suggestions focusing on reconceiving services and sociality of a city (Comune di Milano, 2020a): the success of the initiative (335 extended proposals among 2967 received ideas) testifies the willingness of the Milanese to promptly respond to the pandemic. Looking at the silver lining, this momentum has materialised, for instance, into a fast and fearless digital experimentation, a test of flexible working solutions, a series of solidarity initiatives, an emotional and collaborative use of the public space, a rethought of life priorities. It has also generated new dramatic needs, often basic and primary, connected to the social and economic crisis.

2.2. 'The School of the Neighbourhoods': structure and phases

'The School of the Neighbourhoods' (La Scuola dei Quartieri, 2018-22) is a programme initiated by the municipality of Milan to stimulate and enable social innovation in some disadvantaged areas of the city. The research group of the authors is core part of the consortium of partners implementing the project.
The programme is organised into 3 main cycles of scouting and incubation, impacting different areas of the city in the outskirts. Each cycle lasts about one year and is composed of 3 phases. While the first phase of scouting takes more a form of *cultural-empowerment*, the third phase of prototyping and accelerating solutions is more a form of *technical-empowerment*. The second phase, which consists in the School's 'Advanced training' is something in between: on the one side, it is about supporting people to tackle challenges and invent innovative responses, on the other it deals with modelling solutions and developing entrepreneurial skills.
Here below we provide a brief description of the process.

1. Scouting and participation to the municipal call: citizens are called to participation through a series of initiatives 'on site'. The first step of 'The School of the Neighbourhoods' is indeed a free and open programme of encounters that aims to let needs and opportunities expressed by the neighbourhoods to meet prospective social innovators and to guide them in submitting their ideas to the call. Conceived as an incremental path of support, it consists of 5 different formats that move from an initial 1:1 interview with the participant to a series of meetings investigating the impact of the project and its relevance for the communities, and finally a more technical workshop that supports participants in the preliminary design of

the solution and the drafting of the application. Besides this, the first phase encompasses open lectures from the neighbourhoods, a series of 'The Good Stories' (Figure 1) from the communities and established events such as 'The Ideas' Festival", during which we developed a series of design tools such as 'The Fortune-Teller of Ideas' (Figure 2), a set of cards to stimulate ideas, and 'The Compass of the Ideas', a tool to navigate the design of an idea (Figure 3).



Figure 1. 'The Good Stories' exhibition aims at inspiring new ideas by presenting innovative service models based on existing social innovation practices.



Figure 2. 'The Fortune-Teller of Ideas' designed to stimulate new ideas.



Figure 3. The desk of 'The Compass of the Ideas' to support the initial design phase of a project.

2. Advanced training: selected participants attend an intensive training programme lasting 10 weeks in which they learn how to transform their idea from an initial concept into an actual solution. The ideas are deepened in all dimensions from the value proposition to the user journey, identifying possible business models and legal forms, until a phase of prototyping and of defining an action plan for the first year of development. As stated, our contribution is focused on diverse areas of the design discipline: mainly service design, as the majority of the ideas are service solutions that need to be framed by using service design tools, but also co-designing and prototyping are key-expertise, because engaging multi-stakeholder communities is part of the process as well as the ability to transform a solution into a prototype easily actionable and adjustable.

3. Prototyping and personalised support: selected participants receive personalized support and a project grant up to a maximum of 25000 euros to co-finance the first year of activity. Aim of this stage is to prototype the solution designed during 'The School of the Neighbourhoods', adapting it to the changing conditions and involving the neighbourhood in a process of experimentation and often co-production of the activities

2.3 'The School of the Neighbourhoods' for the 'new normal'

Within the pandemic situation, 'The School of the Neighbourhoods' has being regarded as an ideal initiative to support projects that could match the needs related with the post-emergency conditions of the city, such as new models of aggregation, food-related services, alternative forms of care and much more. The reflection made within the whole consortium and with the municipality brought to decision of strengthening the capacity of 'The School of

the Neighbourhoods' to attract or make emerge ideas consistent with the strategy of the Municipality for future and desirable for their potential of creating public value. The wide principle at the basis of the redesign of the programme, besides the contingency of organising scouting and training activities in an effective way, is to plan and act for the future. For the 'new normal' indeed, moving from the stimulus of what we would like to see realized in the long term that this emergency could somehow promote, so to capture the momentum generated by Covid-19. This reflection regards the whole programme, yet, for the purpose of this article we focus the discussion on the redesign of the second cycle of scouting and incubation (started in January 2020), which has been heavily impacted by the isolation measures that locked down Italy.

Being the second cycle interrupted in its scouting phase, the first action promoted by the municipality, in a constant dialogue with the consortium, was to reformulate a new communication and scouting plan to better tackle the new condition of the city and specifically of the targeted neighbourhoods. Conceived as a set of initiatives of *cultural-empowerment*, it resulted, for example, in a new online format of open lessons named 'Live from the Neighbourhoods' to give voice to adaptation strategies and initiatives (Figure 4). Their goal was to showcase different living experiences in order to feed the civic imagination, spread awareness and inspire new projects to face the uncertainty of the time. Such initiative was reinforced and integrated to the third cycle (currently on-going), together with new online tools to support participant in getting into contact with local communities during the pandemic restrictions (e.g. 'Explore the Neighbourhood', designed as an online pocket guide and a series of 'Virtual Walks' of the neighbourhood).

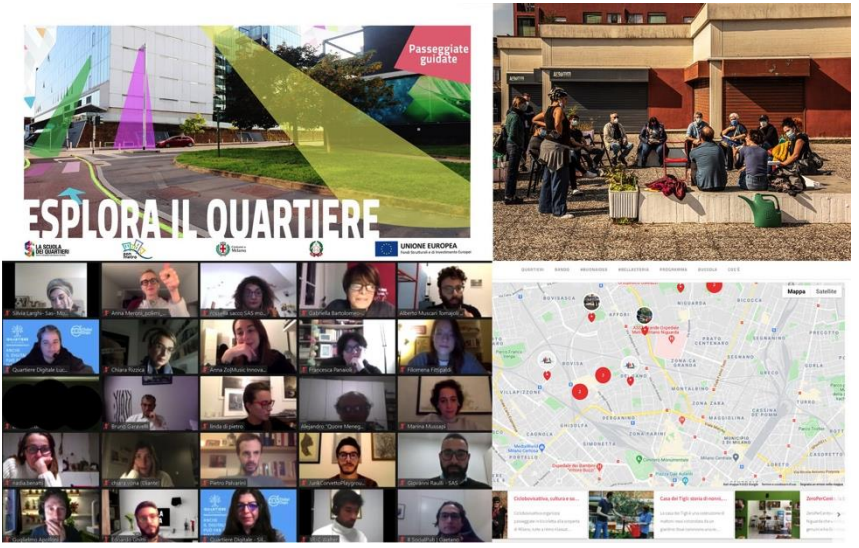

Figure 4. The scouting activities of the School experimented with online, offline and blended ways of connecting participants and the neighbourhoods.

Furthermore, the call for ideas and the scouting phase of the second cycle were re-oriented for attracting social innovators with a more robust background in terms of networks, and resources. The assumption at the base of this orientation was that citizens more prepared, motivated to adjust their ideas and with a more established network of relationships in the neighbourhoods were likely to be more capable to face the present situation and, to drive other subjects toward action, eventually uplifting the overall quality of life. To make this in practice, we designed a way of conducting the interviews with the prospective innovators explicitly aimed at bringing about a form of *technical-empowerment*. A tool for the logical review of the idea was created, so to be used during short on-line interviews. Designed as a progressive journey, it allowed both the team of the School and the innovators to become aware of the concreteness and potential of the idea and its promoters.

As a result of these initiatives, in June 2020, 57 applications were submitted by 157 citizens and among these, 25 ideas have been selected to participate to the advanced training. Looking at the numbers, 19 out of these 25 proposals participated to the scouting phase, thus being involved in the dissemination and light training activities. As a matter of fact, the call received more applications than in the first cycle (+20% of applications) of an increased quality attested by a higher average evaluation score. This seems to reach the objective of having more concrete and promising ideas. Some proposals, such as a platform to display and connect local shops, a neighbourhood hub, a service to support collaborative actions in condominiums, can be defined as actual ‘neighbourhood services’ and can be viewed as an

evolution of the small daily tasks exchange that some communities of neighbours carried out during the lockdown. Moreover, the submissions revealed a renewed attention to a more participative use of the public space and to the topics of ecology and sustainability, seen as collective and collaborative actions (thus installing smart machineries in condominiums, reinterpreting the urban gardens in terms of a new proximity and activating agroforestry processes in periurban areas).
In our view, this orientation of the proposals towards the creation of a more connected and dense social fabric is linked to the several mentioned local initiatives in which the principle of proximity is crucial: people give back meaning to district, to neighbourhood practices, to the creation of a network of relationships with a high level of connectivity, even more important in Covid-19 time.
In addition, we have seen some changes in the profiles of the people submitting ideas to the call. Indeed, compared to the first cycle, the participants are on average younger, most of them are inhabitants of the target neighbourhoods, and with a stronger motivation of contributing to the improvement of their own district. They also demonstrate a wider capacity of relying on existing networks, testified by the increased number of letters of support.

The advanced training that started in September 2020 was completely redesigned into dynamic and modular digital formats, which includes video-pills, online lectures, 1:1 coaching support and an open platform, but also a 'blended' modality that combines digital and physical encounters with local communities (when allowed). As regard to the contents of the lectures, the redesign focused on paying more attention to critical aspects and good practices emerged during the Covid-19 outbreak, but also on supporting participants in the design of more adaptive solutions. Moreover, managing ambiguity has become one of the most important subjects of the training so to deal with aspects (such as flexible offering, integration of different digital touch points, integration of new assets and stakeholders), that emerged as crucial during the pandemic, while keeping the focus on maximizing the social impact of the solutions.

3. Incubating social innovation as a policy for resilient cities

As in many other cities, we can assume that in Milan the pandemic has exacerbated context related critical issues, being these connected to inequalities, fragilities, unemployment, access to resources, quality of the urban commons, insulation, bad narratives and perceptions, personal safety and security (Sokol and Pataccini, 2020). While doing this, it has also brought out unprecedented forms of solidarity and mutuality, concretised by creative communities into original solutions to new 'old' needs, often primary, such as making a living, receiving care and socialising. This can be synthesised in the observation that the creativity spread in society is a powerful bottom-up resource for the resilience of cities. Yet, this creativity and what it is able to produce needs to be supported and empowered, so to

scale up (influencing institutions and rules) and scale out (getting more robust, diffused and therefore impactful). The occasion offered by the on-going programme 'The School of the Neighbourhoods' to make this happen and shape a post-coronavirus society could not be neglected. In fact, the readdress of its actions as a response to the situation was both a need and an opportunity for strengthening a programme already very much in tune with the strategies toward the 'new normal'.

Adopting a design for social innovation perspective, we can comment and cluster the actions according to their ambition to produce a cultural or technical empowerment.
With regard to the the first kind, the *cultural-empowerment*, the scouting, communication and dissemination initiatives conducted in the neighbourhoods, such as the online format 'Live from the Neighbourhoods', the open lectures, the 'Good Stories' and the digital open workshops to explore the neighbourhood, together with the new strategies and actions designed for the third cycle are thought to spread awareness of the creativity of some communities in giving response to everyday needs, to generate a snowball effect of positive emulation and self-confidence in other people, and to progressively instil the sense that different ways of living are possible. The impact of the pandemic highlighted the importance of the proximity and collaborative dimension not only between neighbours, but also the organizations already operating in the places and between these and impromptu initiatives. This emerged from the number of partnerships and letters of support included in the submissions to the second cycle of 'The School of the Neighbourhoods', and on a more general perspective from the on-going initiatives in the Milanese area. Connecting such initiatives and reinforcing a new storytelling of the neighbourhoods can be considered as part of the impact of the *cultural-empowerment* activities of the School, going beyond the single social innovator and embracing the city scale as beneficiary.
Last but not least, the activities of the School during the Covid-19 outbreak and in the following months had the ambition to generate 'comfort with ambiguity': a mind-set ready to change and aware that ideas continuously evolve and therefore are in permanent prototyping.

With regard to the *technical-empowerment* actions, the tools and methods adopted in the interviews with the prospective innovators to prepare them to the candidacy were thought to guide the conversation toward understanding the needs of the target beneficiaries, the value of their experience and the capacity of the idea to answer them, not forgetting how technologies might have helped. Therefore, they were built around service design principles. Whilst developing these features, the innovators were stimulated to consider their personal capabilities, the connection with other stakeholders and the actual capacity of the solution to produce value for the neighbourhood. The links with the context emerged to be crucial not only in future scaling the ideas but also in networking the social innovators with the neighbourhood and in grounding the solutions to the actual needs and assets of its community, i.e. to provide a sense of reality to the intuitions. Such approach has been further implemented both in the scouting phase and in the advanced training, by increasing

the focus on co-design and prototyping expertise. Altogether, this highlighted the distinctiveness of social innovation of being responsive to social needs, of generating public value and fostering sustainable behaviours and outcomes.
The noticeable emphasis on local identity and local scope of the proposals submitted to the second cycle's call for ideas can be seen as a mere reaction to the Covid-19, but also, and together, as a renewed sensitivity and awareness for the quality of the places we live. Indeed, 9 out of the 25 selected ideas are connected to the Covid-19 in different ways:
_the pandemic worked as a background in which their intuition took shape, such as the urban garden born during the lock-down in the shared spaces of a condominium, the activities dedicated to support foreign people blocked in Italy due to the Covid-19 restrictions that evolve into a community hub and the services to connect and give support to the local shops in order to design shared facilities;
_the pandemic worked as a stimulus to rethinking their initial solution, for example, reshaping a cultural centre into an itinerant truck that, to quote the participants, "preserves cultural survival" in situations of emergency and fragility; the renewal of abandoned green areas as platforms for new educational paths dedicated to young generations and professionals supports the creation of intergenerational relationships of mutual help.
Beyond the specific themes, these examples show the purpose to (re)activate the social fabric through collaborative actions, that work as a way to create a more resilient society in normal time, able to face emergency situations and more in general a conflicting and fragile environment. Using the words of a prospective social innovator, there is a need of creating "moments of collective productivity" as seeds of sociality. Only by making things happening together, he writes, it is possible to start creating those social ties that emerged to be truly qualifying, vital and distinctive resources during the most difficult phase of the pandemic.

Finally, we can discuss the re-orientation of 'The School of the Neighbourhoods' as a way for top-down social innovation policies to intercept and empower a bottom-up creativity sensitised and boosted by the outbreak of an unprecedented situation. In this framework the design discipline acted as a cultural agent capable of stimulating a strategic conversation with the whole consortium of partners, in order to reorient a complex and interlaced system of initiatives, actions and training formats towards a rapidly changing environment and to align the scope of 'The School of the Neighbourhoods' to the new needs and sensitivity of society. Even if not directly involved in each action of the programme, the design discipline made use of its sense-making capacity to interpret the emergency situation and bridge it with the possible horizon of a post-pandemic society. It contributed to give the start to a wider and more participative strategic conversation with and within local communities, through the scouting and disseminative actions redesigned in the lockdown which are likely to become integral part of the 'new normal' of 'The School of the Neighbourhoods'. As such, in the mid-long run, it can prove to be a strategy to strengthen the resilience of a city, by implementing incubation actions that empower both the cultural and technical capabilities of individuals and communities.

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Acknowledgements: we thank Chiara Galeazzi, Martina Rossi and Andrea Taverna, that took part in the School of the Neighbourhood project, without participating in the preparation of this specific contribution. La Scuola dei Quartieri is an initiative promoted by the Municipality of Milan, Councillor for Labour Policies and Economic Development. The project is co-financed by the European Union - National Operational Programme Metropolitan Cities 2014-2020 (PON METRO). The programme is implemented by a consortium made by Avanzi, a|cube, Comunità del Giambellino, Dynamoscopio, Fondazione Politecnico di Milano, Gruppo Cooperativo Cgm, Kilowatt, PerMicro, Politecnico di Milano – Polimi DESIS Lab, Spazio Aperto Servizi.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Telemedicine, today more than ever. The ABBRACCI design concept for COVID-19 patient monitoring

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Abstract | In times of COVID-19, where keeping distances is essential to safeguard people's health and life, remotely monitoring infected patients both in hospitals and homes becomes vital. Telemedicine is the key to ensure healthcare assistance by minimizing human-to-human exposure and the spread of the virus. Evidence suggests that during the first pandemic wave in 2020, COVID-19 spreading took place to a great extent in hospitals, nurse houses, senior living communities, and more generally among healthcare workers and patients. Today more than ever, technological solutions that provide remote healthcare are needed to mitigate the infections among health system personnel and patients. In this paper, we propose a multidisciplinary design solution: ABBRACCI, an AI-based smart wearable device for COVID-19 patient monitoring and care, that is meant to be a tool to monitor the health and wellbeing of people diagnosed with COVID-19 – both critical hospitalized patients and non-severe ones that have been confined at home – but also people at high risk of infection who suffer from chronic diseases and multimorbidity.

KEYWORDS | TELEMEDICINE, COVID-19 MONITORING, WEARABLE DEVICE, MEDICAL DESIGN, ARTIFICIAL INTELLIGENCE

1. Introduction

The Coronavirus epidemic has created an unprecedented situation due to the great number of people infected, the virulence and morbidity of the virus and its geographical extension. It has also brought new attention to healthcare workers (doctors, nurses, paramedics, family doctors, pharmacists, and even cleaning attendants) who must manage a complex and critical relationship with patients. Data reported by the Italian National Institute of Health (ISS, 2021) shows that COVID-19 virus has spread to a great extent in the health system: from the crisis' start until March 24, in Italy about 127.581 healthcare operators had been infected, in a total of 3.402.290 cases of COVID-19. Medical action cannot be separated from direct contact with patients, therefore the interaction between medical staff and patients represents a risk of infection for both of them. First of all, in hospitals or nurse houses where patients and health personnel interact on a daily basis. Second, in patients' homes where infected people are quarantined and visited regularly by family doctors or healthcare workers. And third, in older people's homes or senior living communities where patients are not infected but are at high risk of contracting the virus due to their compromised health status (chronic diseases and multimorbidity). Thus, it appears evident that the pandemic represents an enormous risk to both sides (patients and healthcare workers), and technological solutions to give response to this current issue are essential.

The question then arose: how could *design* contribute to enabling healthcare workers to operate minimizing contacts with COVID-19 patients while ensuring safety and effective assistance? And, on the other side, allowing both hospitalised and non-hospitalised patients to feel monitored and assisted? To answer this present question, European institutions and research centers (Unimore; RE:Lab; Università Iuav di Venezia; Fondazione Democenter - SIPE; Pannon Business Network Nonprofit KFT; August Pi i Sunyer Biomedical Research Institute IDIBAPS; Humatects GmbH) have pooled their ideas and know-how to come up with a design concept: *ABBRACCI, AI-based smart wearable device for COVID-19 patient monitoring and care*. That, in a future perspective, it could respond to new potential dangers and emergency situations.

2. The ABBRACCI concept: a possible multidisciplinary response

2.1 Design and use cases

The vision of ABBRACCI begins with the acknowledgment of two primary needs of healthcare during a pandemic: the first is the need to keep healthcare workers safe to avoid the disruption of the healthcare systems, and the second is the need of a continued, effective, and prolonged monitoring of the patients in a safe environment.

ABBRACCI concept combines a wearable device, which integrates a set of measurement sensors of physiological data, to an AI-based platform specifically developed for patients' parameters analysis and for predicting potential disease deterioration. It consists of a smart wristband (a silicon band and a removable integrated sensor as shown in Figure 1) that detects heartbeat, arterial oxygen saturation, body temperature and dehydration − as suggested by the evidence, these parameters are relevant to detect COVID-19 physiological changes (Seshadri et al., 2020; Islam et al., 2020; Ates et al., 2021) − and a multiple-device monitoring application (both smartphone and desktop) for real-time viewing and storage of data collected, in order to maintain prompt caring attention continuously.
Since healthcare has spread across different areas, ABBRACCI would adapt to three use cases (hospitals, assisted living facilities, and home) related to two user groups (healthcare workers and patients) – Table 1:

Table 1. The ABBRACCI use cases.

Place	**Healthcare workers**	**Patients**
Hospitals	Doctors, nurses, hospital staff	Hospitalised patients
Home	Family doctors, healthcare workers	Non-hospitalised patients
Home, senior living communities	Family doctors, healthcare workers, caregivers	People at high-risk of infection (elderly, chronic disease sufferers)

As shown in Table 1, ABBRACCI concept is intended to those hospitalised patients with severe COVID-19 complaints; to non-hospitalised patients who are recovering at home from mild symptoms; and also, to high-risk of infection people such as elderly, chronic disease suffers who need to be monitored in their domestic environment or in senior living communities.

Hospital healthcare providers are the most at risk, having to deal with extremely symptomatic patients and highly contaminated places of work. Due to the difficulty in replacing personal protection equipment (PPE) and the general shortage of them, even a simple operation such as consulting the health condition of each patient can be difficult and potentially dangerous for nurses and doctors. ABBRACCI would allow healthcare operators to look at the parameters of their patients both at a safety distance and constantly. Possibly they would be able to consult vital signals even more than in the usual situation, where they are usually collected two or three times a day. Moreover, this operation can be conducted by fewer people than before, leaving the others available to work on emergency cases.
In this way, patients can stay in the infection department and in the meantime, doctors and medical staff would receive and visualize the updating of the parameters from distance.

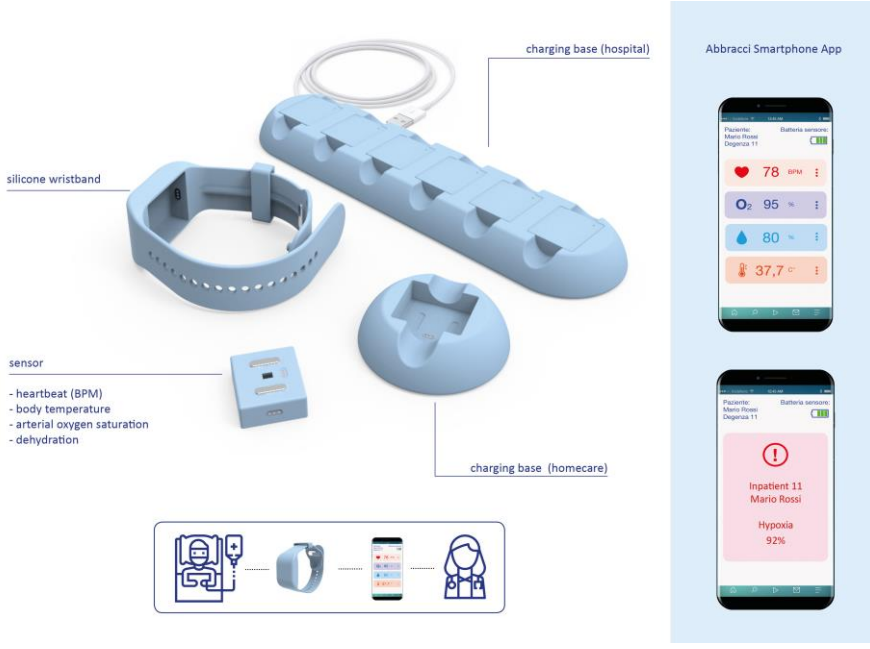

Figure 1. The ABBRACCI kit and the doctor version smartphone App

The role of family doctors has gained a renovated attention as well. Since their duties have much increased, they had to deal with new forms of stress caused also from the lack of protection. Although some academics point out that

> "physical distancing in family practice is operationalised by a variety of measures, such as triage, phone or teleconsultation, removing chairs from waiting rooms and putting up Plexiglas screens at the reception, making it possible to keep the practice open and to welcome the patients who need seeing us" (de Sutter et al, 2020, p.59),

in the case of a home visit, distance is almost impossible to maintain, and family doctors are exposed to great risks. Even so, they play a crucial role in COVID-19 research thanks to their careful registration of all their patients, especially those with typical COVID-like symptoms who were not hospitalised but recovering at home. Therefore, ABBRACCI can allow them to consult the health parameters of their isolated patients without physically going near them and without exposing themselves to unnecessary risks.

Quarantined patients receive from the hospital the ABBRACCI kit (which integrates two sensors to guarantee constant monitoring and the patient version smartphone application) and family doctors visualize the updating of the parameters on their App version – Figure 1. They can consult the parameters in every moment and, thanks to the AI-system, potentially prevent the rise of emergencies. Involving family doctors, the same procedure will be run

also with no-COVID patients during their cure at home, to have more data and compare different parameters, progresses and outcomes. This is also important for the category of 'fragile' patients, such as elderly, with chronic conditions and multimorbidity, which also include the ones in nurse houses and other kinds of healthcare facilities or senior living communities. Since the practices and gestures of care have changed so much to avoid the risk of infection, patients have also suffered from isolation and loneliness. ABBRACCI has the potential of reassuring patients thanks to wearing the remote-control system and making them feel close to their family doctor. The simple and intuitive app interface provides a practical utility as well as brings psychological benefits to all kinds of patients.

2.2 The Artificial Intelligence's role and technological integration

The integration of Artificial Intelligence and wearable biometric monitoring devices can ease the medical and care operations. Indeed, AI-based devices enable the monitoring and measuring patients' data in real time, supporting the diagnosis, and predicting patient's status while helping health operators to provide the appropriate treatment or prompt intervention. Decision-making algorithms incorporating telemedicine, designed through the utilization of Artificial Intelligence tools, could be used to assist with definitive disposition of the evaluated patients by remote analysis (Chauhan et al., 2020).

The AI and machine learning solution can enhance every stage of patient care, from research and discovery, to diagnosis, to selection of therapy.

> "As a result, clinical practice will become more efficient, more convenient, more personalized, and more effective. [...] Physicians have long needed to identify, quantify, and interpret relationships among variables to improve patient care. AI and machine learning comprise a variety of methods that allow computers to do just this, by algorithmically learning efficient representations of data" (Johnson et al., 2018, p. 2668-69).

The integration of AI applications with wearable sensors can help detect the disease and predict the potential evolution in the patient based on the analysis of the personal history and the comparative analysis with vast amounts of unstructured medical data.

On these premises, the project ABBRACCI supports the product innovation of a smart, AI-based wearable device for the monitoring, recording and analysis of significant physiological data for the screening, diagnosis, and prognosis of COVID patients, elderly and 'fragile' users, to be accessible by medical staff through a monitoring application (smartphone and department computers). The continuous recording of real-time data would allow health workers to compare information extracted from historical datasets − considering that Health Systems are digitising their patients medical histories and collecting them into Electronic Health Records (EHRs) (Caceres, 2013). Moreover, integration among all the tools characterizing the proposed solution would identify individual personalized treatment based on recorded parameters and the clinical history of the patient. The AI platform built on the Dynamic Bayesian Networks would help evaluate and optimise strategies for controlling the

spread of the epidemic and it would detect the presence of the pathogen related parameters especially in an early stage of infection, helping medical staff for diagnostics, prevention, treatment, or rehabilitation. It is important to note that, to obtain an AI component with high performance level, many data are required, which could only be collected by using the monitoring application over time. Therefore, in this project the initial model for the AI component would be trained from clinical data, which would be collected from hospital partners of the project (AOU Policlinico di Modena and August Pi i Sunyer Biomedical Research Institute). While testing and validating the monitoring system, the AI component would collect patients' symptoms data and, once enough data are collected, the level of services provided by the monitoring application will be increased.

Going into details, the technology instruments to be integrated are sensors for the detection of physiological parameters, the AI-based software, the monitoring application used by medical staff and, in some cases, by non-hospitalised patients, and the geographical network for sharing and transmission of notifications. Sensors and software have already designed, developed, and validated in laboratory during the project AGEDESIGN Interreg V-A Italia-Austria - Call 2016 in which it has been developed a kit of devices (wearable and portable) for the daily monitoring of physiological parameters (heartbeat, cardiac frequency, arterial oxygen saturation and body dehydration) of the older population. The validated results of AGEDESIGN feed into this ABBRACCI design concept that would embrace emerging technologies as Artificial Intelligence tools. Therefore, ABBRACCI integrates a set of sensors into a wristband to measure vital parameters of the patient, such as heartbeat (BPM), arterial oxygen saturation (SpO2), body temperature and dehydration. The choice of these parameters provides required information for the remote medical staff and can be used as an effective framework for detecting alarm situations in patients with related diseases, both at home and in residences for the elderly.

As shown in Figure 2, the sensors embedded in ABBRACCI concept would be:

- an optical sensor (photoplethysmography) for the detection of the heartbeat (BPM) and SpO2;
- a thermistor for the temperature;
- and a bioelectrical impedance sensor for body hydration.

As for the AI component, the processing unit would be realized as a probabilistic model, specifically as Dynamic Bayesian Networks (DBN). The DBNs capture temporal evolutions and statistical relationships between the model variables, including the sensor data, and the patients' symptoms and disease histories. The probabilistic model would be trained as a data-driven and expert-driven model, meaning that it would be used both data and expert knowledge to build the structure of the model. The probability distribution of parameters and the statistical relationship between variables would be learned from available data.

The training of the model is repeated when a new set of data samples is collected to increase the accuracy of the model prediction over time – Figure 3.

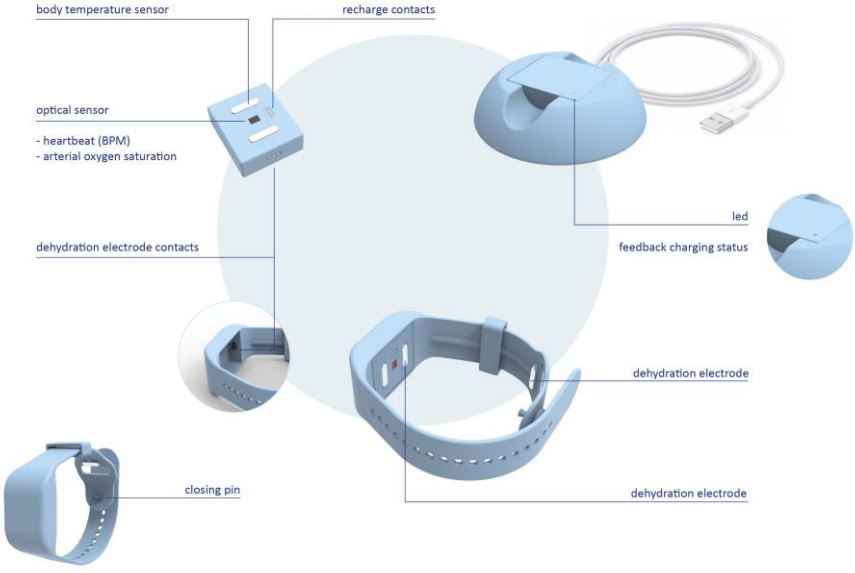

Figure 2. The ABBRACCI technological components

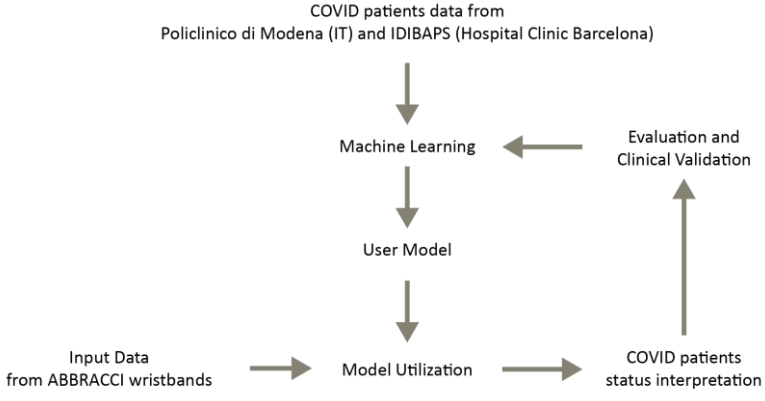

Figure 3. The ABBRACCI overall concept

2.3 Toward validation and medical certification

Since ABBRACCI is intended to be a wearable medical device, it is fundamental to go through a medical certification process.

User pilots represent the possibility to demonstrate the efficacy of the kit, the measured parameters, its usability (user experience, perceived usefulness and acceptability), the technological and innovation potential of the project, and the benefits for users. The device would be compared with similar solutions already in use and certified. In order to provide evidence of the sustainability and maturity of the solution, the pilot phase would be run in the project partner hospitals:

- AOU Policlinico di Modena (Hospital connected to UNIMORE), Italy;
- August Pi i Sunyer Biomedical Research Institute IDIBAPS (connected to Hospital Clinic Barcelona), Spain.

The validation of the device would be first carried out through the involvement of healthy users. This is also due to the uncertainty about the evolution of the COVID-19 disease in the next months and the difficulty to predict whether there will be COVID-19 patients to be involved in the test. In addition, to test the accuracy and the feasibility of the system the project does not necessarily need ill users (for example, it may involve patients with heart failure or COPD, where SpO2 monitoring is important). Another phase of the validation would involve COVID-19 patients, both inpatient and non-hospitalised ones. Starting from the COVID databases from Italian and Spanish Hospitals, the aim is to verify accuracy of ABBRACCI in detecting symptoms and related alarm signals by obtaining a specific algorithm. The table below shows the alarm levels considered for each parameter – Table 2:

Table 2. The ABBRACCI alarm levels

Parameters	**Mild**	**High**
Rest heart rate	> 95/min	> 110/min
SpO2	< 95% in ambient air	< 90%
SpO2 in COPD	< 90% in ambient air	< 87%
Hematocrit (HTC)		
Male	> 53%	
Female	> 50%	
Body temperature	> 37,5 °C	
High alert level		
Rhr	> 100/min	
SpO2	< 90%	
HTC	> 55%	
Temperature	> 38 °C	

The parameters shown in the table have been chosen for the following reasons:

- High heart rate at rest is an indicator of disease and indirectly also of febrile state and dehydration. It becomes a high alarm in resting tachycardia (>110 / min);
- Low SpO2 (partial oxygen saturation) is the most accurate sign of COVID pneumonia; the alarm level is inferior in COPD (Chronic Obstructive Pulmonary Disease) patients;
- Haematocrit (HCT) is an indirect sign of dehydration and therefore of fever and disease status (it is usually lower in females);
- Body temperature greater than 37.5°C is suggestive of possible infection.

It may be assumed that the combination of the four parameters with alarm level at maximum values configures a state of high probability of COVID infection. It is possible that the combination of two or three of them with high levels could also constitute a high suspicion of disease.
These parameters will be tested in hospitals as well as in nurse houses and patient homes. In hospital the validation would be done with the parameters derived from hospital instruments, the results would be compared to ABBRACCI's data to validate the level of accuracy and the ability of the algorithm and AI model to predict the evolution or deterioration of the disease.

Regarding the medical certification, the kit could be classified as Class I of medical devices with measuring function. It is intended to pursue a certification process based on the requirements of the MDR 2017/745, European regulation on medical devices. From the architectural point of view, the project foresees a connection between mobile phone and sensor-based wristband via Bluetooth protocol. There is no interaction between the wristband and the mobile phone that interacts on the hospital's monitoring systems and IT infrastructures. Obviously, the mobile phone can provide some form of interaction with the hospital network, but this would not concern any critical IT systems. In other words, complete independence of the networks would be ensured according to the directives of the MDR itself and with reference to IEC 80001. The MDR 2017/745 specifies that devices that are intended to be operated together with other devices or products should be designed and manufactured in such a way that the interoperability and compatibility are reliable and safe. Compatibility refers to the ability of a device, including software, when used together with one or more other devices, to perform without losing or compromising the ability to perform as intended. Interoperability refers to the fact that the two or more devices, including software, should exchange information and use the information that has been exchanged for the correct execution of a specified function. Other fundamental aspects for Class I of medical devices are compliance with the metrological requirements. This activity would be carried out by comparison with reference certified instrumentation adopted as "gold standard" for the different types of measurements performed by ABBRACCI kit.
In addition, the guidelines EN 60601-1 and EN ISO 14971:2020 should also be considered.

2.4 Market analysis

To understand the ABBACCI level of innovation and its positioning compared to competitors[1], a market analysis was carried out. Compared to the current devices available in the market and in use to detect vital parameters, the project grants the contactless real-time detection and remote transmission of patient physiological data to the doctor.
The analysis of the state-of-the-art places ABBRACCI to be the only wearable device that continuously detects heart rate (BPM), saturation of arterial oxygen (SpO2), body temperature and hydration status through a single and integrated device. Another distinctive element of the project ABBRACCI could be the accuracy of the data, that would be certified and allow the project ABBRACCI to be classified as a medical device. In fact, no wearable devices exist for the detection of certified data regarding the vital parameters considered. Moreover, the feature of the device is the way the data are read: they cannot be viewed on the display (i.e., directly on the wristband) but only on the smartphone monitoring application supplied to medical and nursing staff, to control their patients without direct contact, and non-hospitalised patients.

Based on the results of the market analysis, as shown in the positioning maps below (Figure 4), ABBRACCI could be the only device with continuous monitoring with certified data, which continuously stores it and makes it viewable on the monitoring application used by medical staff and patients at home. It could be the only one, in the category of wearable devices, able to combine heart rate detection (BPM), arterial oxygen saturation (SpO2), temperature and body dehydration.

[1] Referred competitors: TENSORTIP MTX (Cnoga Medical); iHEALTH AIR (iHealth Labs); FOX-300 (I-Tech Medical Division); HONOR BAND 5 (Huawei); CHECKME O2 (Viatom); CHECKME PRO (Viatom); GARMIN VENU (Garmin), O2RING (Wellue Health); HEALBE GOBE2 (Healbe); COSINUSS TWO (Cosinuss).



Figure 4. ABBRACCI vs Competitors

3. Conclusion

Dealing with the emergency caused by the pandemic required enormous efforts from all citizens. It certainly was not the first global threat, but, for the first time, we saw a global response. The technological tools have helped us be truly cohesive in understanding how we could defend ourselves, how and what to design and build to protect us, those who cared for us and generally all vulnerable people. Designers were called to prompt action to suggest a wide variety of solutions to the problems that covid-19 continually introduced; in this context, the ABBRACCI concept was born.

Given the essentiality of maintaining distance from one another in the COVID-19 era, the ABBRACCI project is meant to be a telemedical tool for safer monitoring by the health workers of the infected patients, both hospitalised and those confined at home. The design concept integrates Artificial Intelligence as a way to better prevent, diagnose, treat and predict the course of the disease. The global spread of COVID-19 provides a large amount of data regarding citizens health, supplying a way to the enhancement of the Artificial Intelligence system and employing it in healthcare. Artificial intelligence thrives on data, and in healthcare, there has never been a more fruitful opportunity to feed clinical research and fulfil the AI in the medical field itself. ABBRACCI might also contribute to the digital transformation of the health system and medical practice by providing tested and demonstrated tools, practices, skills, and services hoping to extend this approach also to the treatment of other diseases (the detected parameters might also point out other pathologies and, in the worst scenario, might be useful in the next pandemic).

Over the past year, the pandemic has accelerated the technological development of remote monitoring devices for Covid-19 patients or potentially at risk of infection (Best, 2021). However, current solutions (like ABBRACCI) are still under research and need further experimentation to reach the marketplace. Several companies in the biomedical industry and some clinicians have adapted existing solutions to the new requirements and challenges dictated by the coronavirus pandemic, but, to date, there is no specially designed solution.

The effect of this project in the market would consist in responding to a specific user's need in a more integrated, faster, and evidence-based way creating new perspectives for multidisciplinary collaboration. In fact, the conception of ABBRACCI has involved many professionals, such as doctors, engineers, designers; and it highlights the potential of the design discipline: it is not just the design of an intelligent wearable product; it is the design of it into an extended design service.

Nevertheless, given the urgency of designing new solutions and the promptness with which the idea was conceived, this project needs further insights and analysis of strengthens and weaknesses.

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Acknowledgements: ABBRACCI design concept is the result of collaboration between Unimore, RE:Lab, Università Iuav di Venezia, Fondazione Democenter – SIPE, Pannon Business Network Nonprofit KFT, August Pi i Sunyer Biomedical Research Institute IDIBAPS and Humatects GmbH.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Challenges and Benefits of online Education and the possible impacts of the entry of IT firms in the education ecosystem

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Abstract | Traditional university education is poised for radical change. As we move into the 4th industrial revolution, the experience of the consumer will become critical in every sector, including education. We will also soon see colleges compete with IT firms that have the capabilities to deliver this mode of digital learning. This is evidenced by Google's plan that is set to disrupt traditional four-year degree programs. Educational institutions will need to have robust systems in place that differentiate them from the IT companies offering e-learning courses. It would be up to the universities to ensure that higher education is more than vocational and skill-based training and to foster a culture of independent research and investigation.

KEYWORDS | ONLINE EDUCATION, E-LEARNING, DATA , TECHNOLOGY, IT COMPANIES

Traditional university education is poised for radical change. This was already underway via an increasing number of online courses and vocational training options, and in many parts of the world, the complaints and dissatisfaction expressed by students about rising fees and an education that doesn't justify the cost. With the coronavirus pandemic, this gap has exacerbated at a much faster rate than previously anticipated. There are both benefits and drawbacks to this impending change. In the short term, this is causing disruption in delivery methods, in the quality of interaction being offered, and access to education for those without digital resources. In the long term, this could be beneficial for education systems as a whole, though many challenges lie ahead.
Progress in this sphere has been limited due to a lack of incentive for commercial institutions and the possible threat to the job security of academicians (Klain, 2015). With the COVID 19 pandemic, this is changing but it needs to be steered in a direction where the quality of education is not compromised and more people have access to this new mode of learning.
Right now the world has 4.57 billion internet users. This figure is increasing by more than 8% every year (Datareportal, n.d.). This growth is especially noticeable in developing nations like India where there are nearly 700 million internet users and by 2025 this is projected to grow to over 974 million users (Keelery, 2020). Asia makes up for 55.1% of the world's population and has 52.2% of the world's internet users (Internetworldstats, n.d.). A study conducted by IBM showed that for every $1 spent on e-learning, a company can stand to gain $30 while the Research Institute of America found that retention rates can increase by 60% via online education (Thorton, n.d.).

This provides us with the unique opportunity to bring a standardised quality of education to every individual with access to the internet, irrespective of their socio-economic class, and to some extent, independent of the quality of instructors. We can exponentially increase and improve access to education. In India apps like Baiju's and Toppr are already greatly assisting school students. Online learning can also bring these benefits to tertiary education, especially in Asia where this number stands well below developed nations. Content creation has already been democratised by the internet and online learning presents us with the opportunity to invite multiple teachers and practitioners from different regions to collaborate on content and we can tailor the content for different levels of learning and for students from very diverse backgrounds.

We can in the near future expect Facebook/social media like interactive models of learning which will be extensively personalised, powered by Artificial Intelligence and Machine Learning that curate content for individual students. As we move into the 4th industrial revolution, the experience of the consumer will become critical in every sector, including education. We will have opportunities to optimise the use of audio, video, animation, simulation, and other online technologies to promote engagement with the students for deeper understanding and retention.
We will soon see colleges compete with IT firms that have the capabilities to deliver this mode of digital learning. This is evidenced by Google's plan that is set to disrupt traditional four-year degree programs. Google's Career Certificates will allow students to gain job spe-

cific skills for in demand profiles at a fraction of the time and cost required for traditional higher education (Nott, 2020, Google Digital Unlocked, n.d.). Educational institutions will need to have robust systems in place that differentiate them from the IT companies offering e-learning courses. It would be up to the universities to ensure that higher education is more than vocational and skill-based training and to foster a culture of independent research and investigation. This paper will summarise the benefits and challenges of online education before delving into the role of IT companies in facilitating this mode of learning.

Benefits of Online Learning

1. Standardised quality and mode of delivery.
    - Online education provides us with the opportunity, through standardised training and material, to bring quality education to every individual with internet access. Time is carefully utilised for material to be delivered and the preparation happens beforehand.
    - In India apps like Baiju's and Toppr are already greatly assisting school students. Although it should be noted that these companies are not ed-tech (at least not yet) but content companies marketing aggressively. Baiju's has over 40m downloads, 2.8m paid users, and average engagement of 71 min (Banerjee and Sharma, 2019 , "Is BYJU's Really EdTech", 2018).
2. Record keeping
    - Assignments, presentations, reference material and submissions are more readily available to students, administration and faculty via the mode of communication and through learning management systems.
3. Flexibility
    - Besides administrative benefits the flexibility and autonomy for students and instructors can greatly benefit both parties especially when they have other commitments. This works especially well for students with families or employment that can benefit from the flexibility and self directed nature of online education (Makernko and Andrews, 2017).
4. Skill Development
    - Online learning can greatly broaden professional and skill development for employed students. As mentioned earlier in this paper, online vocational training and credit courses can be of immense aid to expand skill sets and further career goals.
5. Reduced Cost
    - The Infrastructure cost of buildings, power, tools etc is absent. However, this has a flip side of technological infrastructural costs which will be discussed later in this paper.

6. Online Resources

   - An array of tools for assisting and facilitating better instruction such as bulletin boards, electronic texts, hyper-linked sources, and immersive multimedia.

7. Accessibility

   - For students from less privileged backgrounds and for those with families or employment (Makernko and Andrews, 2017). Online instruction also overcomes geographical boundaries and can be delivered at lesser costs to students of lower socio-economic class.
   - There's also greater accessibility when learners have a certain degree of anonymity. Factors such as age, appearance, and gender are largely untraceable and so the focus can remain on the content of the subject and the individual's response to the material at hand.

Despite all these benefits and the potential of equality offered by online education, there are sadly many practical, administrative and political challenges plaguing beneficial development of this domain.
This paper will discuss these challenges and then discuss in detail, the role of IT companies in this sphere and why this needs to be regulated and monitored very strictly.

Pitfalls

1. Stress of learning new tools and a new learning environment

   - For instructors and students, particularly with how suddenly faculty and students have had to adapt to the COVID 19 situation. Facilitators not properly trained in online delivery or familiar with online tools may not adequately be prepared to deliver in the Virtual Classroom, despite being very adept in on-ground instruction.
   - For many instructors, the new delivery method also means that they're at work 24/7 with students reaching out via texts, calls, not giving the faculty enough time to unplug and rest (Anderson& Rainie, 2018).
   - Many teachers have had to recreate entire syllabi and curriculums to adapt to this new method of delivery while often facing similar connectivity and emotional challenges as the students.

2. New technological infrastructure expenses

   - High speed internet, laptops/ computers, webcams and software have placed burdens of sudden expenditure of students, faculty and administration. Broadband access in third world countries exacerbates these issues, affecting certain students and faculty

more than others. Lower income households are also less likely to have multiple devices at their disposal for use by all family members (Perrin, 2019).

3. Less immersive than in campus instruction

- Video chats make it harder to process “non-verbal cues like facial expressions, the tone and pitch of the voice, and body language” (Jiang, 2020). Delays in the video communication also make it harder to have natural conversation while being on camera makes people self conscious and can quickly get exhausting. All these factors make it difficult to gauge students’ attention, understanding and retention while also undermining the teacher’s role as a facilitator for learning since it’s difficult to create the right environment
- Additionally, living off campus may have added responsibilities at home such as caring for their families or completing chores while being disconnected from their colleagues and fellow students.

4. Devaluation of university degrees

- This is a possibility due to downsizing of higher education by reducing the number of full-time faculty and using less involved part-time instructors and technical support. Standards of accreditation for "cybercourses" may need to be relaxed, thereby ultimately devaluing university degrees as online learning threatens to commercialise academic discourse (Gallick, 1998).
- With less immersive roles off campus, faculty may not time to research and as more part timers join, there is danger of tenure at risk, thus weakening faculty loyalty and declining academic careers (Gallick, 1998)

5. Copyright and Intellectual Property

- As campuses go online, faculty are increasingly required to share their course descriptors, catalogues and content. Gallick (1998) cites a number of cases of plagiarism of course content in similar situations with no protection for the intellectual property of the course instructors.

6. Politics

- Gallick, 1998 suggests a political agenda for edutech investments wherein governments are hoping to save funds in the future. He remarks that constrained education budgets are the one the major reasons to support online education. In India for example, in 2020, there has been a 3% increase in the amount allocated towards higher education from 2019-20. This is unlikely to meet the requirements of entrants for higher education (over 800,000 in 2018-19) and employability of graduates in India is a serious concern (Roy, 2020). This is likely to encourage the move to online learning but also rings alarm bells. In India, UGC frames rules and regulations and is responsible for

monitoring quality but has no authority to implement regulations or penalise defaulters so if standards of education quality are not met, there may not be any repercussions for it and higher education will suffer.

- Take as an example, a 10-year contract in 1998, between Microsoft, GTE, Fujitsu and Hughes Electronics with CSU administrators to create a for-profit, joint-venture company, called the California Educational Technology Initiative, or CETI (Klien, 1998). This move was criticised by faculty, students and citizens as "vague and a possible threat to competition and academic independence, and for passing on hidden costs to students" and CETI was eventually voted out. Then in 2003, CSU entered a $662 million Common Management System contract with software giant PeopleSoft, which was once again viewed with suspicion by faculty and staff who claimed to have been underrepresented in CMS and CETI negotiations (Banres, 2003)
- Both deals were criticised for "controversial corporate participation, legislative investigation, a lack of competitive bidding, union concerns about job security, and charges from faculty and student opposition of conflicts of interest and bad business sense" (Banres, 2003)
- CMS was defended by the university while staff was critical and unhappy (Angel, 2003). Initially planned to be voluntary, CSU forced all campuses to adopt CMS. CMS appeared to save neither effort nor time and it was hard to gauge if it was saving money.
- It should be noted that CSU's assistant vice chancellor of Information Technology Services, David Ernst was paid $11,000 a month by PeopleSoft to "facilitate meetings" for the company (Angel, 2003).

7. Mental and Emotional wellbeing

- Online teaching has been observed to increase rates of burnout (Hogan & McKnight, 2007), loneliness (Dolan, 2011), stress and isolation (Smith, 2015) in online instructors as compared to on campus teachers (Makernko and Andrews, 2017). Makarenko & Andrews (2017) suggest that instructors with longer careers who've taught substantial numbers of courses per year may acclimatize to demands of online teaching over time and therefore, do not report higher levels of stress.
  Dolan (2011) identified some broad categories of concern for adjunct online instructors, based on qualitative analysis of interview data -
  - Poor compensation
  - Lack of materials
  - Lack of communication and connection
  - Large class sizes
  - Lack of support from administration
  - Ill prepared students

- Dolan found lack of connection as the most relevant ie, feelings of isolation from students and other faculty members and disconnectedness from the larger univer-

sity. Makarenko & Andrews (2017) concluded from their study that findings suggest the flexibility of time and location offered by online instruction may have negative socio-emotional effects. While online instruction has risen in acceptance and popularity, research on and solutions for the well being and mental health of online instructors is limited (Makarenko & Andrews. 2017). If these issues continue without being addressed, we may have online courses but not instructors and a learning management system alone may not be able to address this (Makarenko & Andrews. 2017). While Online learning does have the advantage of using pre recorded material and resources from the web, Wilson, Ludwid-Hardman, Thornam, and Dunlap (2004) assert that instructors remain crucial in the learning process, even in higher education. Instructors provide and maintain infrastructure for learning (syllabus, calendar, communication tools, and instruction resources). They facilitate participation, collaboration and community building for learners while assessing learning and giving feedback. They resolve instructional, interpersonal, and technical problems while also creating interest in the subject matter. (Roddy et al., 2017)

8. Entry of Tech giants into education

"Corporations already control much of our lives. Do we want to hand over public education as well?' David Kien, 1998

- This is the primary concern of this paper. We will try to understand the threats to the future of education and individual development and society, if IT companies facilitate learning without rules, restrictions and proper frameworks for how much data they can gather and where it can be applied.
- Restrictions on physical contact, lack of opportunity to meet top academicians, and learn from fellow students threaten the rationale for university education during the pandemic. IT firms may offer a better deal for online learning in comparison and there are time, geographical, and monetary advantages to this. However, IT companies can not offer holistic development of an individual, only high quality vocational training. Most concerningly, however, is their habit of data collection and using this data for commercial purposes as well as influencing behaviour. If IT companies are now given the opportunity to observe and govern educational development, the possibilities of them harnessing this data on how students learn, grow, interact, is potentially dangerous. As many schools and universities turn to platforms like Google Classroom, the question to ask is, what does Google gain from this?

Take for example Google Book Search project. Initially presenting the project as altruistic, Google uses the vast library at its disposal to train AI to better optimise its search engine and thereby, make its profits. It was particularly useful to have var-

ied and rich language in fiction books, based on which the system is able to mimic almost fluent sentences. While the Author's guild has claimed copyright infringement, Google claims that this is fair use of data (Lea, 2016). Google has contended that its book search project will not harm the market for books due to the limited amount of text available for viewing and may benefit the market by identifying and summarising books for users, which may be particularly beneficial for books that may not be well publicised. Google will therefore encourage users to buy the book by providing links to where the book may be borrowed or purchased (Band, 2006). Legality of this aside, Google did not initially reveal its intentions and this was not how the authors intended for their work to be used (Lea, 2016). Google started this project, as startups today seem to, with a "better ask forgiveness than permission" attitude, Authors Guild's Gleick pointed out (Rosenberg, 2017).

- Let's look at another IT company handling large amounts of data - Facebook. Popular social networking sites where we share information, videos, music and images or create new connections like on Facebook, Instagram and whatsapp, are owned by Facebook. There are dedicated channels to cater to music, like Spotify, or videos, like Youtube or shopping, like Amazon. Today a handful of companies control how we see and share information. Surveillance has emerged as the new business model for internet companies. This information is used in a number of ways, many of which compromise privacy -

  i) Targeted Advertising
  Predictive Analysis of gathered data and behavioural research can be used to target users for relevant advertisement for shopping and to improve products and services (Chen, Pavlo, Canny, 2009)

  ii) Social Score
  Studying an individual's internet usage, social media activity, purchases, financial information, hobbies all allow the system to predict, with accuracy, the individual's age, income, beliefs, friends etc and some systems, and countries are using this information to assign people a "Social Score". China for example is putting a Social Credit system in place which is intended to assess citizens' and businesses' social and economic reputation ("China's facial recognition," 2017) , Xu and Xiao, 2017) This data will directly determine individual aspirations, job accessibility, prospects of finding a spouse and will thereby be used to nudge citizens into complying with desirable behaviour. (Creemers, 2016)
  These measures can potentially start being applied from an early age to model the growth and learning of children and young adults, not only by governments but also by IT companies that will seek to profit off this kind of data and apply it to improve the growth and algorithms of these companies.

  iii) Invasion of privacy

While an extensive, organised and public surveillance system like the one in China may not exist in the west, data is being used for surveillance almost universally. Surveillance in the form of "Facebook likes" can be used to predict "sexual orientation, ethnicity, religious and political views, personality traits, intelligence, happiness, use of addictive substances, parental separation, age, and gender." (Kosinski, Stillwell, Graepel, 2013). The effects of such surveillance will be more pronounced as algorithms seek to predict how individuals will grow and possibly steer their development in directions suited to commercial and political agendas.

iv) Social Cooling

People vary their behaviour when they know they are being observed. This behaviour modification becomes pronounced when we realise that our digital information and search history is available and can be used to assign a score. Data gathering can be used to infer and predict personal information (such as ethnicity, age, habits, political views etc). This affects our "digital reputation" and could affect opportunities or bring us under scrutiny. Social Cooling is a long term phenomenon that occurs in a reputation based economy which results in a culture of conformity characterised by self censorship, an aversion to risk taking, and rigid social structures (Schep, n.d).

Online meetings can already be fatiguing as discussed earlier in the paper due to the stress of being under observation and without the non-verbal behavioural cues like expressions and body language. This with the added stress of being observed and recorded can make it difficult to create an apt learning and teaching environment.

Conclusion

We can be sure that in the case of Google Classroom and other online learning platforms as well, all the assignments, submissions, course details, interactions etc being shared are being or will in the near future, be observed closely. This data can be used to measure progress and set learning goals for students based on their ability, comfort and requirement but in the hands of IT companies, it will be used to possibly compete with the very universities and schools that are using these platforms and to, more dangerously, maybe use this knowledge to influence user behaviour for corporate gain. Based on data gathering and lack of accountability from large IT companies in the past, we must come to the realisation that the data on the developmental psychology and learning of students will be used to monitor and shape not only them but may also be used to censor and steer education in ways beneficial to those monitoring it.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The design culture and the challenges of the new normal

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Abstract | The challenge of the *new normal* would be nothing particularly new for those designers that for years have advocated radical challenges to address major socio-technical crises in our society. Yet the urgency of the new normal would need society to take action very quickly, and this in turn, imply a well-structured design approach. The challenge for designers is therefore to operationalise principles that have been in the air for quite a long time, transforming them into practices, accelerating the exploration of mechanisms of transition and finding conceptual terms and operative strategies for working at different scales. This paper is exploring the implications of the idea of a *new normal*, in the view of taking a further step for the definition of a working site for the *new normal.*

KEYWORDS | NEW NORMAL, MISSION ORIENTED INNOVATION, EVOLUTIONARY INNOVATION PROCESSES, TRANSITIONS

1. Introduction: the new normal and the dynamic of innovation

The pandemic crisis and what is coming soon after it is monopolizing the debate in all the disciplines working on innovation, from the most technical ones to social and humanistic disciplines. Since the beginning of this crisis it has been clear that the challenge it poses is not limited to the medical science, which are frantically working to find vaccines and treatments, but it is a systemic crises that involves the way capitalist societies are organized (Latour, 2020; Mazzucato, 2020) and it is therefore extended to all the aspects of society, and it does not exclude any geographical region in the globe. No technical device or knowledge will solve this problem if its use will not be complemented by a radically different way to organize our everyday social interaction. Moreover, the challenge is not limited in time, we will not come to the *normal,* as the socio-technical configuration of the post-pandemic will never be the same as the old one.

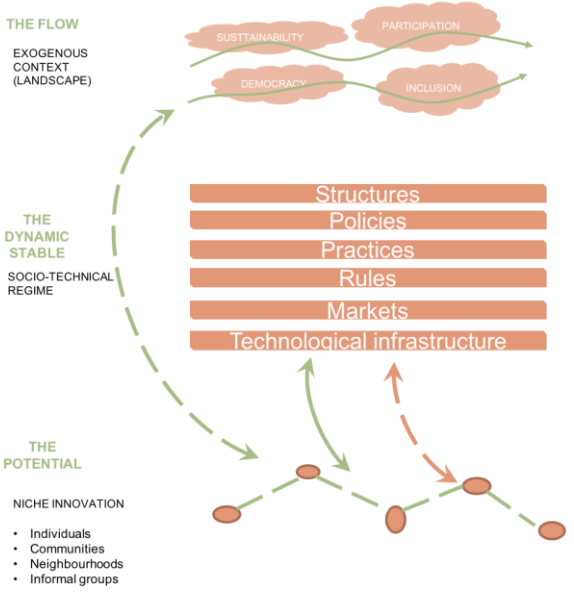
Talking about the *new normal* means imagining a way of living, interacting, working, learning, and taking care of people that is unfamiliar to the most, and the permanent condition of this change requires that such change be widely accepted, possibly co-designed by large part of society, and organized at multiple levels.

The concept of normality refers to routinely way of doing things, it is about everyday doing and it is based on a multitude of practices, each related to specific niches, activity, social-cultural contexts and technical knowledge. Routines generate the structure of social practices and social order (Reckwitz, 2002). A transition in social order implies the crises of the routines and of the knowledge such routines are based on. The crisis of the normal and the shift to a new normal has to be explored as a change in different logical structures, at different levels. It is not just a new way of living the everyday life, but it has to be understood as a change in the context, in the structures, in the institutional forms and in the general socio-cultural landscape that frames our society.

Changing such practices and the infrastructure that support them is usually very hard, because of the inertia they oppose to every major transformation. History of society and technology do recognize a progress in such social structures, but the nature and speed of change process seems inexorable. *We use to think that the "train of progress" was unstoppable or could not even been stopped, and yet, in few weeks this train has been stopped. It could not be slowed down or redirected* (Latour, 2020).

A restart on a new track implies a process of innovation at both the micro scale and the large scale. It requires the acceleration of processes that are normally slow and evolutionary and, for a design perspective, it requires the extension of the design approach to a scale of change that designers have never faced.

Several recent studies are emphasizing how the structure of innovation can be described as an evolutionary process that amplifies some cases of innovation in niches, to create changes in the way institutional structures are organized (see figure below). Clusters of niche innovation can converge into changes that have an impact in regimes. Those regimes in turn impact on new niches, but in some cases the change at the regime level can impact on the system of values, culture, believe and organizational frames on which institutions are funded. This new level has been described as a landscape, which change slowly and according to evolutionary processes, while they set the frame for changes in niches and regimes. (Geels, 2005; Geels & Schot, 2007).



The evolutionary innovation process, inspired to (Geels, 2005), elaborated by the author.

Design and transitions to the new normal

The dynamic of change described above and the relation between changes at different levels is also part of the discussion on the possibility and opportunity of those changes to be *designed* or in any way *directed* by designers, planners or policy makers. This discussion challenges the design community to a deeper understanding of the structure and the dynamic of change and an exploration of the strategies for this change to become real.
In fact this discussion is not new to the design community. The call for a radical view towards change has been advocated for many years, especially in respect to crucial questions, such as the question of sustainability. Soon after the Club of Rome urgent call for action

(Meadows & Club of, 1972) design research started to systematize the early experience of the pioneers of environmentally responsible design, such as Buckminster Fuller and Victor Papanek (Papanek, 1973), towards strategies to support radical changes in the way human beings organize their artificial environment (Manzini, 1997) and it was quite clear that such change would have started from the everyday life (Manzini & Jegou, 2005), but would have implied broad framework changes (Thackara, 2007). The question of sustainability was possibly the first working ground for designers to face challenges that overcome their traditional range of action, which until that point was focused on products (industrial design), interaction and participation (interaction design). Other challenges came, which implied a design-oriented vision towards broader changes, from the question of migration and integration to the call for social innovation and even to democracy (Margolin, 2012) While this approach was maturing on a theoretical level, the explorative activity was very prolific, but limited to local experiments and it was hardly scaled up to broader changes, as it was facing the resistance of social, technical and economic systems to any large transition. Design conferences offer many examples of local projects focusing on social innovation, personalized healthcare, environmental initiatives, but few contributions - such as Manzini and Rizzo (2011) - and few projects – such as *DoTT07* (Thackara, 2007) - are focusing on how those initiatives should be scaled up.

The pandemics has changed the context conditions, because it introduced an element of radical change that cannot be avoided any longer. Everybody understand that we cannot come back to the previous situation, everybody understands that the accumulation of points of crisis and the massive investment of funds to face the upcoming crisis will need to be addressed somehow, towards a *new normal*, i.e. new practices, new institutional frames, new cultures.

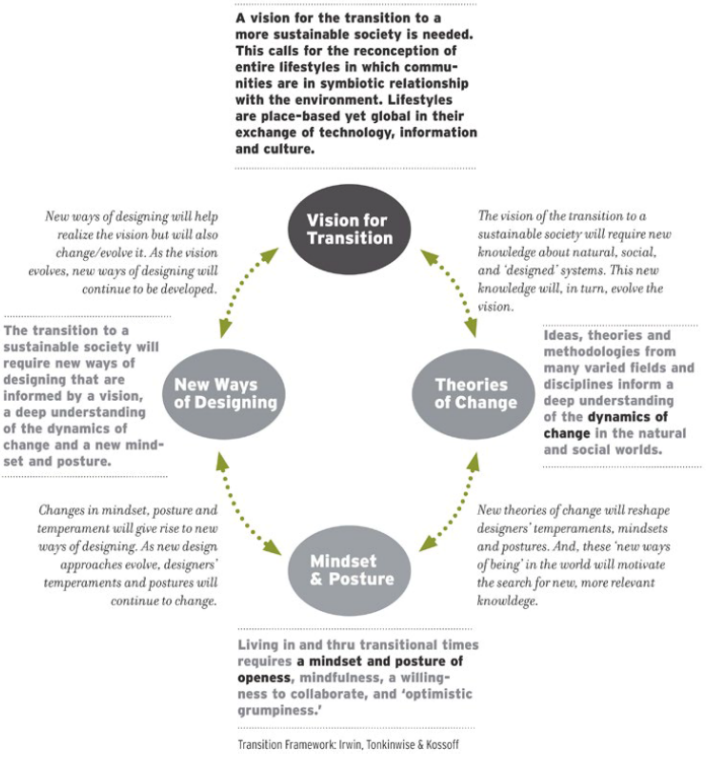
The problem can be seen from two perspectives: from one perspective the massive crisis is imposing large visions of change, which need to address major challenges highlighted by the present crisis. On the other hand it becomes very clear that the *new normal* society is looking for cannot be sufficiently described through large visions, or through a panoramic view, but they need to be projected on the everyday observation and in the way the life of everybody is changing. The problem that the crisis is proposing is not only to figure out the missions for the upcoming future, but also to make sure that the change in everyday life, or, to come back to Geels' transition patterns, the innovation in niches, is going in the right direction, that clusters are created and amplified, that converge towards the desired missions, and that every single initiative and every minimal change can be used - if consistent with the broader missions - to reach the results that society is looking for, especially in this moment. Such results are addressing certain objectives, concerning healthcare, environmental conditions, social equality, democracy or different configurations for capitalism, that are shared by large part of the public opinion. Some of those objectives are explicitly specified by the Sustainable Development Goals, which probably represent the most widely accepted set of missions for the future of the planet. Others, like democracy or the reformation of the capitalist system are less explicitly implied by the sustainable development goals, but are at the centre of the debate about economic development and

society. (Mazzucato, 2014; Piketty, 2014)
Looking at those changes from a design perspective means focusing on how those mechanisms of change can be analysed and possibly supported.
We can look at change in two complementary perspectives: the landscape-to-niche perspective and the niche-to-landscape perspective. The first may start from the large challenges and try to address the niche changes, the second should start from specific projects and look at how the direction of change suggested by those projects can be selected, empowered, when they are heading to the desired direction, or avoided, when directed in undesired directions.

The landscape-to-niche perspective: translating missions to action

In the last few years, the most frequently mentioned approach to large-scale change has been articulated around the definition of specific *missions (Georghiou, Tataj et al., 2018; Mazzucato, 2017; Mazzucato, Kattel et al., 2020)*. This term is used for defining well-defined goals, that address major societal challenges and help policy-makers setting directions for growth and making strategic investments. It is important to mention that missions do not refer to top-down policy intervention, but rather into the operationalization of visions based on a large consensus around problems that are considered as crucial in every specific moment and social context. This concept has been integrated in the forthcoming programs of the EU (Mazzucato, 2019) and develops the implications of the definition of *grand challenges* in the previous strategic programs (Georghiou et al., 2018). Missions are therefore a way to define direction of changes, or preferred trajectories of evolution of the whole socio-technical landscape in a geo-political context, such as Europe in this historical moment. The challenge is obviously to translate such missions into actions and strategies that also concerns the minimal changes in everyday life, or in specific local contexts. This translation from broad societal goals to people's life is in fact bridging the question of innovation from the political and strategic level close to the area of interest for design, at far as we consider design as an attitude to translate values and social aspirations into concrete actions or infrastructures.
This strategic level however, has hardly been considered by the design discipline, which has more often worked at the level of interaction, participation, personal and social engagement in specific cases. Only in the last few years the interest in increased, for design actions that could trigger a dialogue between different perspectives, from the perspective of policy makers to initiatives of co-design, that could operationalize the activity of policy making (Bason, 2014, 2017; Irwin, 2015; Kimbell, 2015). In parallel, the awareness of a possible role for design in broader societal transformation has been considered in EU-funded projects, such as *Design for Europe* (designforeurope.eu) or within broader innovation support projects, such as *Designscapes* (designscapes.eu) or *Urbact* (urbact.eu).
From a design perspective the question is to understand the role of design, or a design

approach, in processes of transition, but also the operational definition of a design approach and the impact that could result.
The most articulated theoretical frame to propose a design approach in the perspective of long term transition has been proposed by the studies on transition design (Irwin, 2015). Transition design analyses the role and contribution of design to large socio-technical changes, in the perspective of addressing major challenges, such as sustainable futures or social equality. This approach is based upon the understanding of the interconnectedness between social, economic, political and natural systems and explicitly refers to the connection between place-based solutions and lifestyle changes and broader social, economic and environmental changes. Transition design is the explicit attempt to challenge existing paradigms and envisioning new ones, using design as a methodological approach. Rather than proposing a methodology, transition design proposes a process that starts from a vision, elaborates and proposes a dynamic of change, proposes a new mindset and posture of openness and proposes a new way of designing. The process is circular and assumes a progressive and co-evolving development of visions for transitions.



The transition design co-evolution process (Irwin 2015)

The process suggests a design attitude, rather than a specific methodological toolkit, however one of the stages, the theory of change, is now a consolidated methodological tool for describing a dynamic of change and assessing its impact (Simeone, Drabble et al., 2019). The other stages of the process are instead looking at the design attitude towards change and are useful to frame individual design interventions, so that they are consistent with broader visions for transition. They are therefore useful to link landscape changes to individual instances of change, or to point out niche innovations that present promising opportunities to impact to larger scale. This highlights the interconnectedness of a landscape-to-niches and the niche-to-landscape perspectives.

The niche-to-landscape perspective: the contribution of design for service and design for social innovation

Working for niche change means generating concrete transformations of everyday life by interacting with it, provoking, triggering new behaviors and proposing new solutions. Service designers do not need particular exemplifications to understand the nature of this work, because this is their bread and butter. It implies the interaction with people, their engagement, understanding their needs and possibly organizing solutions according to existing social, cultural or economic conditions and according to technological knowledge available at the local level. In the last decades, the contribution of design for social innovation has redirected design attitudes towards participatory approaches (Saad-Sulonen, de Götzen et al., 2020), thus changing what Irwin defined as the mindset and posture of design in respect to innovation.
Working at the niche level, that means working in specific contexts and on specific design solutions, with the aim of generating larger scale change implies an attempt to scale-up, or institutionalise change, thus generating mechanisms of codification and scalability that trigger regime changes, i.e. changes in public institutions and in the regulatory framework. Change at this level creates the institutional basis for changing what is perceived as *the normal* in a *new normal*.
Working for such change also implies that certain assumptions in the existing practice of professional design are changed, such as:

- *Assumption 1. Change needs a designer, that means only expert designers have the knowledge and the methodological tools to generate change and innovation.* Although this assumption is based on the fact that designers are officially trained to manage innovation and are educated to methods and tools to support such capabilities, in fact the change resulting from a design action is the result of the negotiation of several actors, including citizens, experts from other disciplines, service providers or public administrators (Concilio, De Götzen et al., 2018; Manzini, 2015). A designer can only orchestrate or facilitate the action of such actors, the designer's action can trigger creative processes or support the

development of new solutions by infrastructuring the creative process (Hillgren, Seravalli et al., 2011; Morelli, De Götzen et al., 2020), but the result is not in the brain of a single person, it is rather the result of a community.

- *Assumption 2.Supporting a group of people and lead them towards the definition of new solutions is enough to imagine large change.* In fact small participatory processes are very interesting and very encouraging, but in se they do not imply that those innovation processes can be scaled up or replicated. Several cases can be found in literature, that propose very interesting and stimulating examples of co-design of new solutions, interaction among specific groups, brilliant cases that inspire the work of other designers. However the replication of such cases is not always possible, because it depends on the context, on the availability of the same human and knowledge resources and on the quality of interaction among communities (Morelli, 2015). A different strategy to support large scale changes based on the replication of small niche interventions would be to set up framework programs, thus defining relevant thematic areas and ecosystems, on the basis of which the niche interventions should be organized (Manzini & Rizzo, 2011)
- *Assumption 3. Replication and scale up can be seen with the same lens as the analogous industrial processes*. In fact we cannot imagine to replicate a niche project, what we can replicate is the structure of change, but not the result of such change. The replication should be based on a process of codification of knowledge and skills and on an analysis of the process of value creation within the niche, in order to understand which of those processes can be replicated, which actors (and therefore which knowledge and skills) would be needed for the replication and what kind of scalability is possible to achieve. While industrial processes may generate wild fire scaling out mechanisms, small interventions of social innovation may replicate by clusters or by nodes (Morelli, 2015).
- *Assumption 4. The rules of replication are similar in all places*. in reality a change in UK has mechanisms of interaction that may not work in Greece, change is context dependent and so is replication, as well. It is not a case that certain design practices, such as participatory design, were very productive in Scandinavian countries, where the co-operative movement had shaped relevant social and productive infrastructures, including food production, housing and wind-energy production. The attempt to export successful models, such as the Scandinavian model or the industrial districts developed in the northern part of Italy in the 60s-70s have often failed because of the different landscape conditions, i.e. different institutional structure, different cultures and different way to live together or to share knowledge, experience, resources and risks.

The challenges of designing for the new normal?

The challenge posed by this crisis calls for a change in practices and minimal details in everyday life, but this change is only possible if institutional structure can support the change and if the broad cultural, political and societal landscape is reconfigured. This paper outlined two approaches to those changes, which are not alternative, but rather complementary. The dynamic of socio-technical transition proposed by Geels and Schot (2007) highlights that this process is a continuous reshaping of niches, regimes and landscapes, with quick and small changes in niches shaping slower regime changes and evolutionary landscape changes. Understanding this dynamic and exploring the way it operationally works in real contexts is the challenge for everybody, but this challenge becomes even bigger when considering two further instances:

- A design approach to those dynamics implies a research on how their operationalization can be in fact *designed*. While designers are comfortably managing or facilitating change at the niche level, and they are more and more often called to contribute to regime change, i.e. policy design, government intervention, public advocacy and consultancies, they are quite unfamiliar with changes at the level of landscape, and in fact the evolutionary nature of transitions at this level poses the question of the *designability* of such transitions.
- While the changes described by Geels and Schot (2007) are slow and evolutionary, the present condition, and the same idea of *the new normal* implies that the speed of the transition being much faster. In few periods in history such transitions have been so fast, more recently the post-war reconstruction in Europe, or, earlier in the last century the Chinese revolution or the Turkish cultural revolution promoted by Ataturk. Most of those transitions were simply acceleration of the evolutionary process, given a radical change in the status and the condition of a social context. In none of those cases the idea of *designing* the change was suggested, yet, in all of them we could find people that actually worked as *designers*. The question is whether this time we can propose a design approach – and of course if this approach can preserve fundamental values such as democracy, social equity and freedom, that were not always present in the previous cases.

The challenge of designing the new normal is therefore in the novelty of the situation and in the lack of a design culture embracing such broad changes. Designers, or a diffuse design approach, will need to redefine their way of working, tools and methods, mindset and posture. This is what makes the design of the new normal an opportunity the design community cannot afford to miss.

Conclusions

The scale of the present challenge demands a design approach. National and international institutions seem to understand this, when they organize the economic support to the coming change not simply on the health crisis, but looking to broader and largely shared missions. However the involvement of professional designers in this process is not given for granted. Several contributions to the debate of the ethical values of design, from Papanek (Papanek, 1973) to Margolin (Margolin, 2002, 2012) suggest that design cannot just be seen as a *technological fix* to the demand for such a radical change, because its implication are implicitly or explicitly political, that means that design implies political decisions and critically develops their consequences at the societal level. This paper suggest that the role of design in this epochal change could be to link broad visions for societal transformation and changes in specific contexts. It is important however, to take into account and to debate the relevance of this role in orchestrating and coordinating the actions that would lead to changes in different levels. Because of its political nature, design is not a *neutral* tool in this change. Design is biased, because it implies a choice of what change directions design and designers will infrastructure. The risk is to *colonize* the change and to oversimplify the manifold structure of the context in which design works (the urban context, local communities), or to propose a "social ventriloquism" in which a self-entitled innovative organization develops its own finding and proposals as "the voice of a target audience"(Vassão, 2017)

This paper is not proposing solutions or recipes to address the action of designers, but rather a ground for discussion, which implicitly suggests a number of questions: is the design community equipped to contribute to qualify missions in operative terms? What methodology do we need to operationalize missions into concrete and specific actions? On the other hand, do we have the conceptual tools to raise the impact of design action in specific initiatives to a level that contributes to larger transitions? How can the process of scaling up and institutionalizing those initiatives be infrastructured without losing their manyfold structure?

These are possibly questions to discuss in the design community, in education institutions and in common forums, even though the urgency of the search for a new normal will push the same community to participate to this transformation before the definite answers are mature.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The effects of eye expression on emotion perception

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Abstract | In 2020, worldwide are affected by the covid-19 epidemic, and people need to wear masks to maintain their everyday lives. In this situation, people could only recognize the upper half of the facial expression to judge the emotions from others. Therefore, to improve the public's emotional judgment in a harsh environment, this research uses the method of Kansei engineering to classify and evaluate 200 male and female eye images collected on the Internet. After the expert focus group method, the visual type factors table of Eye gaze (including six characteristics and five levels) is established. Then, through regression analysis, four characteristics that can effectively judge emotions are found, such as pupil's position, squinted eyes, brow wrinkles, and lying silkworm. Finally, the experiment aims to find out three regression equations to predict the positive and negative feelings of different pictures to the participants.

KEYWORDS | EYE GAZE, SIGHT, EMOTION PERCEPTION, FACIAL EXPRESSION, KANSEI ENGINEERING

1. Introduction

In 2020, every place in the world was suffered from the covid-19 epidemic, and people must wear masks in their daily life. However, the mask covers one-half of the face area, leaving only the upper half of the facial expression features (eyebrows, eyes), allowing people to evaluate emotions from the limited facial features. However, the information provided by the eye area has been proved in the research of Smith, Cottrell, Gosselin, and Schyns (2005). They found that the information from the eyes and eyebrows is the key to assessing facial expressions' most accurate recognition. Under the influence of the epidemic, people had no choice to improve their ability to interpret facial expressions based on eye contact clues.

Facial expression

Facial expressions are combined with various contractions and relaxation of facial muscles and bring people 250,000 attractive faces (Altıntaş & Çamur, 2005). When it demonstrates human expressions, there is much implicit emotion that could convey the message with behavioral intentions, social communication, and other information(Tian, Kanade, & Cohn, 2011). Mehrabian (1968) found that in face-to-face interactions, 7% are transmitted through text, 38% are conveyed through intonation, and the most significant proportion is transmitted through body language – which is 55%. Although the human brain can predict other's facial expression recognition effortlessly in typical daily situations; however, the influence of epidemic makes the situation more difficult to recognize the facial clue while wearing masks. For instance, in some language exam, candidates are required to wear masks for speaking examinations, which affect the examiner's judgment results strongly. Therefore, if there is a visual reference for the upper half of the facial expression cues, it might help people recognize emotion under challenging situations.

Most facial expression recognition research extracts expression features from the entire face(Ekman, 1993; Friesen & Ekman, 1978), and there are not many studies based on the eye and eyebrows. In Wells, Gillespie, and Rotshtein (2016) study of facial expressions, such as fear, anger, and sadness, these emotions can be recognized from the eyes; eyebrows can further support and enhance these expressions. In Oztel, Yolcu, Öz, Kazan, and Bunyak (2018) research, a set of iFER expression recognition system is proposed. In their system, emotional judgment based on facial features only on the upper face can be as effective as 92%, but it still cannot reach 99.38% of full-face recognition (such as dlib facial recognition). Therefore, this research intends to find a table of visual features through experiments, which can help people effectively recognize others' emotions while wearing masks during the epidemic and show research results to developers who conduct research on facial expressions A.I. researchers.

Kansei Engineering

The word " Kansei " is derived from Japanese vocabulary, and its original meaning is the psychological feelings and images that users think about one object. In the field of cognition, it is expressed as the starting point of people and objects and exploring the relationship between people's perception of objects, sensory feelings, and their behavioral

intentions(Nagamachi & Lokman, 2016). Kansei imagery has a wide range of applications, including ergonomics, cognitive science, psychology, design, and information science. It can be used to help understand the feelings of using products and design psychology, so that it can be used to fulfill the user's expectation and enhance user experience. (Schütte, 2005)

Mostly Kansei Engineering is built to research people and products' relationships. The primary purpose is to help the designer create a new product based on user's feeling. It contains four main points: (1) How to understand user's attitude toward objects by estimating their psychological feelings (2) Through understanding the feelings, researchers can find out the design features of products, (3) Establishing Kansei engineering in with human-oriented design considered, (4) Adapting changes in society and user preferences to pivot the direction of design features (Matsubara & Nagamachi, 1997).

Although there is much previous research on product or object, there is rare research discussing facial expression with Kansei engineering methods. This method could help the researcher transfer qualitative data to quantitative formula. For instance, the researcher can collect people's feelings when they receive visual information through *focus groups and interviews.* According to these qualitative data collected, researchers can use questioner to validate the result and find out the equations that which features are able to affect user's feelings. Therefore, this research aims to gather the participants' perceptual information from this method and explore what kind of eye expression elements will affect people's positive and negative feelings after viewing the eye pictures. According to the above discussion, the three research purposes are below:

(1) Through experiments design, find the eyes features that could identify positive and negative emotions.

(2) Provide an "eye gaze of the visual feature" for people to recognize emotion when they do not have sufficient cues for emotional recognition.

(3) Explore whether there are differences in expression features and feelings in the eyes gaze of different gender

2. Method

The experiment in this research will be divided into three stages: (1) Collect the experiment images, (2) Classify the pictures in positive and negative directions, and (3) Establish a visual type factors table. After that, the experiments' results were used to find out those visual elements through questionnaires, which have an impact on the positive and negative perception of the picture.

2.1 Experiment

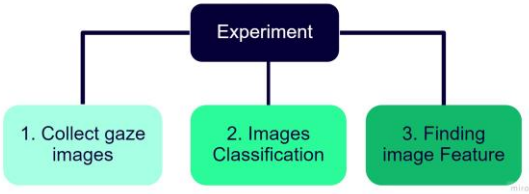

Figure 1. Experiment process

The first stage: Collect Gaze images

At this stage, we asked 6 participants, three males and three females, about 20~26 years old, who have received 4~6 years of visual education and training and selected the experiment's pictures according to the criteria provided by the researcher: (1) Age / about 12-50 years old (2) Race / regardless of skin colour. Previous research indicated no difference between Black and White skin people's eyes or between Asian and White eyes in the level of cooperation elicited. (Berki, 2014) (3) Gender / each participant must collect 20 images for each male and female (40 sheets in total) (4) Look straight ahead. (5) The images colour and resolution should be clear enough (more than 150dpi) (6) Images show eyebrows, eyes, forehead (7) People inside the images are not allowed to wear glasses, and without any movements or gestures (ex. hand posture) (8) People inside the pictures can have various expressions (happy, angry...).

The pictures in the existing facial expression databases are not used because the eyes we see every day are all-natural eye expressions. Furthermore, the pictures in the databases are manipulated by other researchers, which is different from what we see in a typical environment, so we choose the eyes photos collected on the Internet. Among them, 20 images of males and females (a total of 40 photos were collected by one person), and the researchers deleted duplicate and substandard pictures and cut them to a uniform size of 148*105mm. Finally, 100 male and 100 female photos were collected (200 photos in total) (Fig.2).

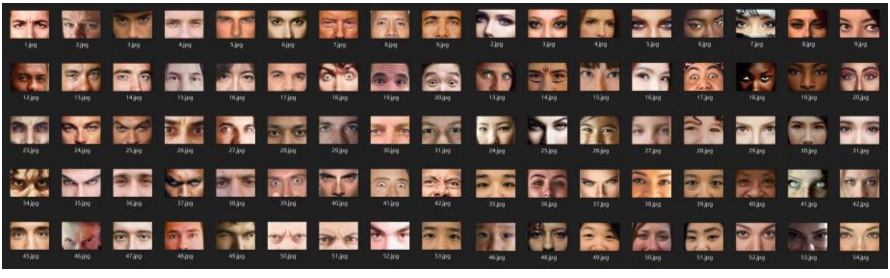

Figure 2. Images of eye gaze collecting (male and female)

The second stage: positive and negative image classification

There are 20 students from National Cheng Kung University, ten males and ten females. Their ages ranged from 20 to 25 years. They are asked to watch these 100 picture cards selected in the previous stage and evaluate the positive and negative emotions. According to the positive and negative perception, the pictures are divided into two categories, the weak and robust sightline, and finally divided into positive strong, positive weak, negative strong, negative weak. After that, each picture was counted into different points: positive strong 4, positive weak 3; negative weak 2, negative strong 1. Finally, the researcher got the average score of each picture and selected three pictures with the most substantial positive and negative directions; 3 pictures with the median positive and negative directions, as Figure 3 (below).

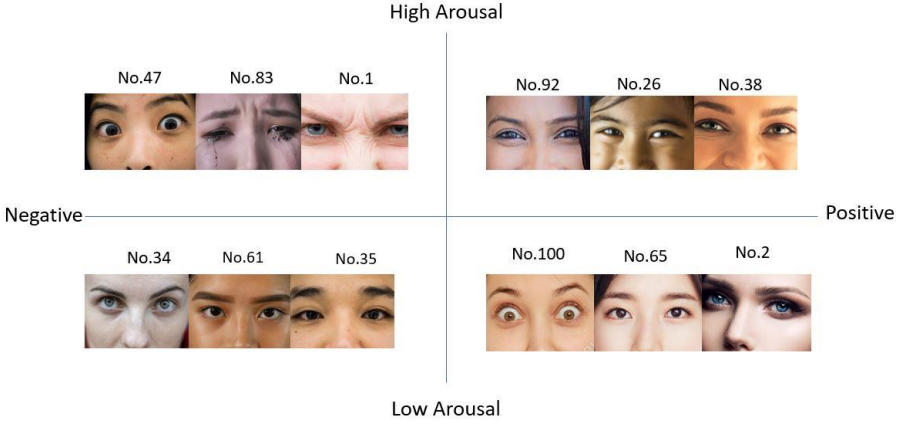

Figure 3. Final selected pictures (female)

The third stage: Analyse the feature of pictures

At this stage, three designers with more than four years of visual design work experience are selected as the Focus group members. After a complete discussion and analysis by the focus group, the visual elements and influencing factors that make up the eye gaze expression are summarised, and the visual factors table of eye gaze is established, as shown in Table 1 and Table2. These tables of the eyes can be aggregated into six items, namely *eyebrow angle, pupils' location, the distance between eyes and eyebrows, squint degree, frowning degree and lying silkworm*. Here are six categories and 5 degrees, which are subdivided into 30 items.

During the second stage of the experiment, the researcher has received 3-4 participants referring that" lying silkworm makes me feel more positive and charming". This result also rephrases in the third stage when designers were analysing these 100 pictures. According to doctors' definition in cosmetic surgery (medpartner, 2016), what constitutes a lying silkworm is a part of the eyelid obliterator muscle (orbicularis oculi muscle). This part is close to people's eyelashes, and there will be a line about 0.2 cm to 0.7 cm wide (could see in *Figure 4)*. Different from squinting eyes, the lying silkworm is no need to squeeze the muscle.

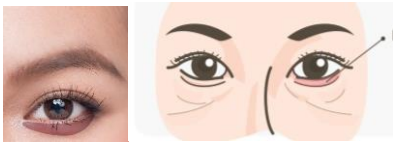

Figure 4. The position of silkworm

Table 1. The visual factors table of Eye gaze

Category		Level 1	Level 2	Level 3	Level 4	Level 5
Category	Eyebrow Angle					
	Pupils' Locations					
	Distence between Eyes & Eyebrows					
	Squint Degree					
	Frowning Degree					
	Lying Silkworm					

Category		Level 1	Level 2	Level 3	Level 4	Level 5
Category	Eyebrow Angle					
	Pupils' Locations					
	Distence between Eyes & Eyebrows					
	Squint Degree					
	Frowning Degree					
	Lying Silkworm					

2.2 Questionnaire

The 24 pictures (12 males and 12 females) selected in the second stage were used in a questionnaire to correspond to the visual type factors table in the third stage to collect the visual elements in each picture. Secondly, the researcher asks about the positive and negative emotional value of each picture. At this stage, 20 questionnaires were collected, ten males and ten females, aged about 20-25 years old. This research uses an internet questionnaire to collect data and ask the following questions with 24 pictures:

According to the question below, select the degree of the feature that you think fits the pictures:



- Eyebrow angle (1 drooping / 5 raising)
- Pupil position (1 lower / 5 upper)
- The distance between eyebrows and eyes (1 very close / 5 very far)
- Squinting degree (1 none / 5 intense)
- Eyebrow wrinkles (1 none / 5 strong)
- Whether there are lying silkworms (1 no / 5 strong).
- This picture gives you the positive and negative feelings (1 negative / 5 positive)

All data were recorded and analysed anonymously.

3. Result

In this research, the six features of the visual type of feature table (eyebrow angle, pupil's location) were used as independent variables, and positive and negative emotional feelings were used as dependent variables to perform *Multiple Regression Analysis* with SPSS. The questionnaires were performed with P-values, <0.05 are considered as statistically significant and p-values. = 0.05 but ,0.1 are reported as non-significant trends. The 24 selected pictures (12 for each male and female) are analysed first, then the male pictures (12 males) and final for the female pictures (12 females), so there were three regression equations found.

All pictures (male + female pictures)

For all 24 pictures, a multiple linear regression was calculated to predict participants positive and negative feelings based on 6 visual features. A significant regression equation was found ($F(6,473)=36.546$, $p<.01$), with an R^2 of 0.317. In all features, only pupil position($p<.01$),

squinted eyes(p<.01), brow wrinkles(p<.01) and lying silkworm(p<.01) were significant predictors of positive feelings of eye gaze pictures, and the relationship is as follows:

*Positive feelings of **All pictures** (Y) = 2.479 - 0.163*__pupil position__ + 0.278*__squinted eyes__ - 0.407*__brow wrinkles__ + 0.202*__lying silkworm__*

Male pictures

Second multiple linear regression was calculated to predict participants positive and negative feelings in all male eye gaze pictures. A significant regression equation was found (F(6,233)= 26.878, p<.01), with an R^2 of 0.409. Only pupil position(p<.01), the distance between eyebrows and eyes (p<.01), brow wrinkles(p<.01) and squinting (p<.01) significant predictors of positive feelings of eye gaze pictures, and the relationship is as follows:

*Positive feelings of **male pictures**(Y) = 2.4 - 0.238*__pupil position__ + 0.226*__distance between eyebrows and eyes__ + 0.255*__squinting__ - 0.272*__brow wrinkles__*

Female pictures

The last multiple linear regression was calculated to predict participants positive and negative feelings in all female eye gaze pictures. A significant regression equation was found (F(6,233)= 14.255, p<.01), with an R^2 of 0.269. Only squinting (p<.01), brow wrinkles(p<.01) and lying silkworm(p<.01) significant predictors of positive feelings of eye gaze pictures, and the relationship is as follows:

*Positive perception of **female eyes**(Y) = 2.462 + 0.291* __squinting__ - 0.482* __brow wrinkles__ + 0.229* __lying silkworm__*

4. Discussion

With Kansei engineering, this research had transferred participants' feeling into quantitative data. According to all pictures' equations, we can find that these four visual features, pupil position, degree of squinting, brow wrinkle, and silkworm, can effectively predict the positive feelings of the eye gaze. When the eye gaze picture with pupil position is lower (-0.163), the degree of squinting is intense (+0.278), the eyebrow wrinkles are almost no (-0.407), and with a bit of lying silkworm +0.202 are more likely to cause the participants to have positive feelings.

Interestingly, the eyebrow angle that the researchers thought could accurately predict the positive and negative emotions of the eye gaze, which Oztel et al. (2018) uses the eyebrow angle as one of the considerations for judging emotions in their iFER system. These results in our experiment are not significant. The possible reason might because when people showing a smiling face, the eyebrows are not always raised; some people appear to be dropping (see Fig.5). These two pictures get the highest positive pictures, but they show entirely different eyebrow angles. As a result, this feature cannot efficiently predict the positive and negative feelings alone.



Figure 5. Corresponding pictures with the visual features derived from the equation



Figure 6. Corresponding pictures with the visual features derived from the equation

In the male picture's equation, it can be found that the eye gaze will be predicted positive when the pupil position is lower (-0.238), the distance between the eyebrows is moderate (+0.226), the degree of squinting is substantial (+0.255), and there are almost no brow wrinkles (-0.272) (see Fig5.). When scoring the positive and negative images, the researchers recorded that among 20 participants, four of them mentioned that "male pictures have largely strong negative emotions, and even neutral eyes are easy to let me feel negative." Previous studies have shown that the gaze on the male face is significantly more threatening than the female face (Ohlsen, Van Zoest, & Van Vugt, 2013)

In the female picture's equation, there are only three features that can provide optimistic emotion predictions, followed by intense squinting (+0.291), flat eyebrows (-0.482), and a little lying silkworm (+0.229). Compared with pictures of male, women have fewer distinguishable features. During the experiment, some participants also mentioned that it is not easy to distinguish women eye gaze between a positive or an aggressive look in the neutral eyes. Women's nonverbal cues are more accurately judged (Hall, Carter, & Horgan, 2000) and women generally have richer facial expressions than men(Brody & Hall, 2008), but in this research, there are quite different. Although the participants thought that neutral eyes were less recognizable, there were still five participants who mentioned that women's eyes were cheerful, friendly and attractive (Korthase & Trenholme, 1982). In our statistics, the results are also in line with the feedback from the participants (see Table.2). The number of female pictures rated as negative feelings is less than that of male pictures.

Table 2. Table of subjects' evaluation of male and female pictures (1 negative / 4 positive)

Male Picture No.	*Mean*	Participants gender & scores of pic.				Female Picture No.	*Mean*	Participants gender & scores of pic.			
		male	*M*	Female	*M*			male	*M*	Female	*M*
37	1.05	37	1	1	1	1	1	1	1	1	1
46	1.05	46	1	35	1	70	1.05	83	1	70	1
50	1.10	73	1	23	1.1	83	1.05	18	1.1	83	1.1
51	1.15	50	1.1	37	1.1	47	1.2	70	1.1	47	1.2
73	1.15	61	1.1	43	1.1	18	1.25	47	1.2	68	1.2
93	1.15	22	1.2	46	1.1	53	1.25	53	1.2	33	1.3
23	1.20	51	1.2	50	1.1	68	1.25	22	1.3	41	1.3
1	1.25	93	1.2	51	1.1	41	1.3	41	1.3	53	1.3
61	1.25	23	1.3	93	1.1	64	1.3	43	1.3	64	1.3
22	1.30	89	1.3	18	1.2	43	1.4	64	1.3	18	1.4
33	1.30	33	1.4	26	1.2	94	1.4	68	1.3	96	1.4
35	1.30	1	1.5	33	1.2	33	1.45	94	1.3	12	1.5
89	1.30	26	1.5	34	1.3	22	1.5	13	1.5	43	1.5
26	1.35	90	1.5	42	1.3	96	1.5	33	1.6	56	1.5
18	1.40	100	1.5	73	1.3	37	1.6	37	1.6	94	1.5
43	1.40	18	1.6	76	1.3	56	1.6	96	1.6	37	1.6
34	1.45	34	1.6	89	1.3	12	1.65	56	1.7	22	1.7
100	1.45	35	1.6	22	1.4	13	1.65	12	1.8	13	1.8
42	1.50	98	1.6	25	1.4	32	1.85	72	1.8	32	1.8
76	1.55	42	1.7	44	1.4	72	1.85	8	1.9	35	1.8
98	1.55	43	1.7	61	1.4	8	1.9	9	1.9	46	1.8
25	1.60	25	1.8	100	1.4	9	1.9	24	1.9	57	1.8
44	1.60	38	1.8	54	1.5	48	1.95	30	1.9	8	1.9
91	1.70	44	1.8	98	1.5	57	1.95	32	1.9	9	1.9

5. Conclusion

The contributions of this research are as follows:
(1) This research uses a focus group to find the six features and five levels of eye gaze
(2) Make a visual factors table of eye gaze, and summarize the four major characteristics that affect people's positive feelings of gaze
(3) Collect positive and negative feeling evaluations of each picture during the experiment, found that the male's eye gaze pictures are more likely to make people feel threatened and negative feelings. In contrast, female eye gaze pictures are more attractive and accessible to give people a positive evaluation(Korthase & Trenholme, 1982).
(4) With Kansei engineering, the equations of eyes gaze pictures had been founded out. By using these, people can predict positive and negative feelings with different features.

These results could be applied to the judgment of emotional faces, adding criteria for identifying positive and negative emotions to improve its identification. Moreover, when designers are working on character design, they can use the results in this research to carry out character design and animate design. With the tables, it could help designers to enhance the detail features between the eyebrows and the eyes and make it more vividly. With the contribution of this research, the result can be used at strict environment which need to wear mask or helmet. Furth more, it can also help people effectively recognize others' emotions while wearing masks during the epidemic

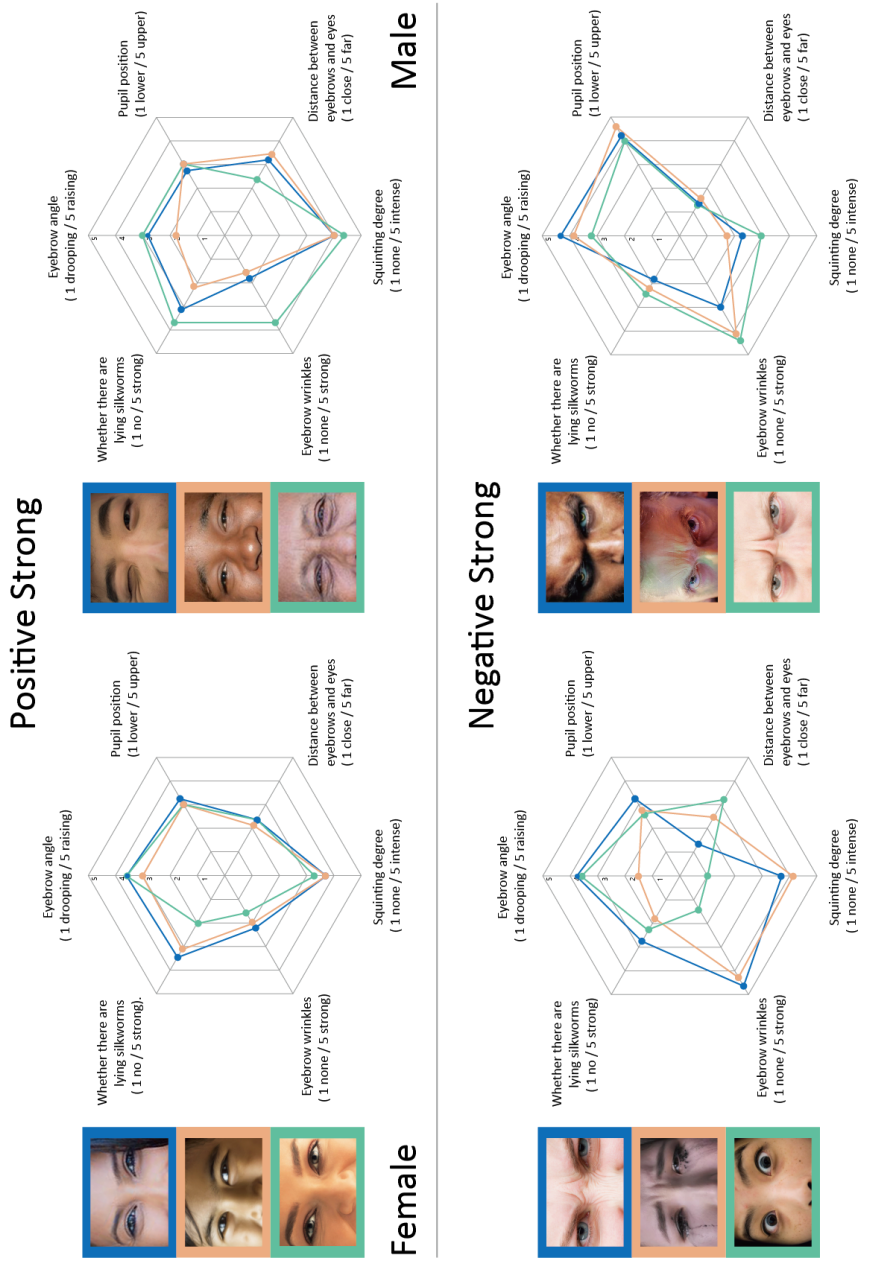

Figure 6. Radar chart of the strongest positive and negative emotions

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Acknowledgements: Thanks to the participants who helped this research produce experiment. Without their participation, such interesting experimental results could not be obtained. Many thanks to Hsi Jen Chen for your professional advice and guidance so that this research can proceed smoothly.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The value of design in the emergency-driven scenarios. Crafting Ecosystems with data

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Abstract | During the Covid-19 emergency of 2020, the Information system, governed by data-flows, generations, and representations, proved to be one of the most overwhelming and uncontrolled phenomena. In this scenario, the essay presents a critical analysis, highlighting urgencies and opportunities for the design discipline to define its substantial and meaningful role in the Information Age. The research encourages the design culture to go beyond the dichotomy between materiality and virtuality by depicting reference's paths and practices, trying "to craft" new hybrid ecosystems. To inspire new design challenges, the experimental project Crafting Ecosystems is a proposal of a new design-led scenario for the Information. The goal is to offer a different kind of public Information based on empathy and awareness, focused on the restoration of a balance between natural and artificial, translated into tangible actions, replies to emergency circumstances. The final designed project is an interactive invitation to observe reality in an integrated way and realize how data and emergencies inevitably depend on the interconnected balance between all living beings.

COVID-19, DATA VISUALIZATION, MATERIAL-FOCUSED DESIGN, ALGORITHMS, NATURAL ECOSYSTEMS

_DCs 1. The impacts of emergencies on the design culture:

rebuilding ecosystems.

The transversal of design is crucial for understanding the present and future scenarios, the interdependence between knowledge, and the discipline's evolution. Through the hybridization between heterogeneous sectors such for instance, electronic and materials engineering, natural, social, and economic sciences, philosophy, and human studies, the design culture can enlighten the deeper purpose of its project: the indissoluble interconnection between human beings, nature, technology.
Adopting both the operational protocols of scientific knowledge and the complex readings peculiar of the humanities, design can reinterpret reality, going beyond the traditional disciplinary categories, for the construction of an interconnected system between society and environment. The hybridization between different fields also derives from a complexity of instances, in line with the most urgent global issues that affect society today. Among these, a central role is assumed by environmental sustainability, the relationship with technologies, digital communication, and big data, the geopolitical debate. These are multi-faceted issues that can only be approached through a partnership between multiple players and know-how. This is evident when we consider what the Covid-19 pandemic has made clear: the unstoppable alteration of ecosystems due to the impact of human life. "In these days, there is a recurrent use of the expression "back to the normal world" as if what we lived before Covid-19 was normal: social disintegration, widespread poverty, animal exploitation, destruction of the environment, increasing damage to the planet and natural things [...]. (Caffo, 2020, p. 30).
The Covid-19 emergency has radically changed our lives' structure, destabilizing them through a forced acceleration of the digitization processes adopted in this Social Distance phase. Never as in this period, smart working, use, and abuse of social networks, overproduction of data, can be considered tangible and widespread phenomena of a new way of living culture and professional relationships. Planetary emergencies such as those we are still experiencing today - on which Covid-19 is only the iceberg peak - put in crisis the whole system of values previously based on the so-called "progress." The center of gravity of the issue shifts from humankind to the entire planet, a necessary approach for constructing a real, sustainable society in an anti-hierarchical perspective. In this ecosystemic vision, the approaches, strategies, and objectives must be reviewed. It is a question of rethinking the world as a fluid and interacting ensemble (Coccia, 2018) through a neo-humanist approach that no longer constitutes anthropocentric and promotes coexistence between heterogeneous organisms, races, and cultures. (Latouche, 2004, p. 95). Design sustainability is not only aimed at restoring a primordial nature but rather intervenes by raising consciousness in the desire to rethink the world of production and consumption in a completely different perspective, integrated with all other living beings. (Haraway, 2016). Thanks to its ability to illustrate complex problems through a rich narration, the project can be a strategic tool for a collective awareness of the most current and complex phenomena. In this scenario, communication design plays a crucial role and becomes a "common space to facilitate processes of understanding, approach, and management of our time's fragilities.

[...] The designer has an enormous responsibility because in his being a seismograph of the existing, he records and keeps track, reads and interprets, making an idea of the future emerge [...] and impacting on reality". (Piscitelli, 2019, p. 122).
By envisioning desired scenarios, design becomes a vector for dialogic processes where its narrative is as meaningful as the final result: the goal is to open questions and understand what role it can play, acting first of all in the perspective of change. Therefore, through its ability to raise a collective awareness, identifying both consolidated issues and embryonic emergencies, design takes on an educational value. Add to this; it is considered that the concept of emergency must be re-examined as permanent and implicit in contemporary society. "Nature compromised, broken, interrupted, is, in fact, not only that of the plant world but also that balance between all living species, that coexistence between vital worlds that our anthropocentric culture has progressively ignored. In this imbalance - provoked by arrogant anthropocentrism [...] - we find ourselves today in its totality, with our responsibilities as dominant species and our culture as colonizers of ourselves". (Boeri, 2018, p.9).
In light of these instances' complexity, the positivistic view that sees the designer as a problem solver, thanks to absolute and crystallized solutions, vanishes. His role is now closer to the one who - permanently in an investigative state - identifies the controversial points, creating virtuous and hybrid solutions that firstly trigger a change.
With the dematerialization of objects, even design is transformed, incorporating digital data and inputs from the web. Considering its transdisciplinary nature, the impact of design culture can become life-saving through an ethical integration of different aspects of reality. Design projects, understood as devices of divergent thinking, assume the ability, through their narrative existence, to act by raising awareness aimed at new behaviors and human being-world interactions. In this perspective, the future discipline directions are characterized by infographic installations, interactive systems, material and processual experiments, high technological devices. In this hybrid landscape, projects no longer belong to closed product categories.
In a context of a design culture that reinstates equal importance to the human being as well as to nature, the most stimulating works concerns themes such as the survival of man on earth, the preservation of living species, the care of territories and biodiversity, the integration between technology and nature. Between them, an extraordinary opportunity for investigation emerges from the digital flows of data, from the information that crosses the network and its possible translation in objects and processes. The idea is that even the product designer has to learn to manage these flows, shaping them most ethically until their incorporation into the project, to create new knowledge and an unimagined empathy. Whit these premises, in the followed chapters, the essay will investigate two crucial aspects of the current infodemia condition - the handling of data and the design with data - arriving until to a speculative design proposal that projects data towards a physical and sensitive impact.

_DCs 2. A new scenario for the design: handling data.

Is there any connection between the fact that "we are altering our infosphere fundamentally [...] adding a whole new stratum of communication to the social system" (Toffler, 1980, p. 172) and the culture of product design? It could probably be envisioned in the attempt to

try, within design methods, to reinterpret human beings as "informational organisms interconnected with bio-logical organisms and engineered artifacts" (Floridi, 2015, p. 161). We are living in a new era where communication technologies are shaping the environment into a new reality. However, how much does the design discipline have a real idea of the rules by which the data flow constantly shapes our routines? Answering such a question is becoming essential for the discipline's evolution due to the impact those entities have on our environment. Now, more than ever, knowledge, in the contemporary form of information flows and data, "is and will be produced in order to be sold, it is and will be consumed in order to be valorized in a new production." (Lyotard, 1984, p. 4). Covid-19 has stressed an extreme global fragility affected mainly by the information system. The design discipline should look at the potential of such an unprecedented mutation proposing future-proof scenarios made of products that coherently live in their contemporaneity. Because lacking comprehension about the qualities and the effect of the information system - of which data are a brand-new raw material - means not being able to shape our environment profitably. That is why it is urgent to fully understand this new material's characteristics and start deepening specific studies to play an active role as critical observers. During Covid-19, some topics emerged that asked for reflections, like those related to the Information reliability and the relevance of the sources and their contents, but primarily those connected to people's capability to critically filter the information.

The "imperative to abandon blind trust in technology and to deepen our critical spirit" (Perez Tornero, Varis, 2010, p. 24) is now at a crucial crossroad where the declared intent of the global network to make everyone equal is missing its promises in front of two main issues, non-equal accessibility to the network, and consequently to its contents, and the capability to interpret the information itself. Looking at numbers, we see that internet users increased globally from only 413 million in 2000 to over 3.4 billion in 2016 (Roser et al., 2015). Nevertheless, how many people are online? The map of this distribution overlaps that of world poverty and countries lacking in democracy. Such asymmetry of information's distribution generates inequalities. That is why the United Nations demanded global cooperation through a data revolution to eradicate poverty while underlining that even considering the massive changes carried through technologies from the year 2000, "inequality remains and opportunity is not open to all" (UN, 2013). On the other side, the fact that we have left most of the information processing to the machines has affected our computational thinking abilities over those years, making us lazy for deep understandings. That is why the UN has asked international experts to propose ways to improve sustainable development data. The report summary states that "Data are the lifeblood of decision-making and the raw material for accountability" (UN, 2014), underlining how the current state of data is stressing the gaps between what we know and when we know it, as well as the gap between who know and who do not.

The amount of data unconsciously produced daily is massively used to profit and model our compelling needs. The economic and political impact is enormous, impacting negatively on a social justice level. It is exactly that supposed global access to the privileges of knowledge that was in the “dreams of the digital insurrection” (Baricco, 2018), but that, along these

years, has shaped a habitat in which the disproportion between rich and poor is upgrading in the disproportion between included and excluded. This asymmetry embraces large groups from the developed countries, particularly those who cannot access, analyze, evaluate, create, and act in the digital ecosystem; in other words, those who lack Media Literacy and consequently suffer the negative impact of media manipulation and misinformation unconsciously. Being illiterate in such a topic transcends the boundaries of poverty and transversally impacts the capability to read contemporaneity and fully handle our new reality.
In the last 100 years, communication accelerated human evolution and all its related phenomena more than ever in history. Product Design has interpreted this acceleration and shape the human environment by wholly accompanying the upcoming needs and behaviors. Nevertheless, communication also created a brand-new era of the economy in which data is a whole new entity that we should shape and model with the same intent as before. That is why we think that data should be considered as a new contemporary physical material. Data's increasing variety of forms, velocity, and quality has allowed their success, wide-spreading, and profound diffuse impact. According to a white paper by the IDC, the global data sphere could grow from 33 to 175 zettabytes by 2025. Industries will mainly define such massive data growth as Financial Services, Manufacturing, Healthcare, Media, and Entertainment. The critical point of this process is that we are nearly entering the age of data readiness, and for this reason, we are still in need of understanding the issue that this will bring, which, as we described till now, is essentially affecting our lives and our environment at all levels. This condition is crucial considering that data technologies are becoming central for productivity expansion, data monetization, and value creation. Designers, as well as Architects, have, in this sense, a unique and crucial responsibility in shaping future synchronic societies in which "every object worthy of human or machine consideration generates a little history. These histories are not dusty archives locked away on ink and paper. They are informational resources, manipulable in real-time." (Sterling, 2005, p. 45).

_DCs 3. An overview of contemporary practices: designing with data.

In the Information Age, the design discipline has to face the dichotomy between virtuality and materiality to solve its hesitancy to define and affirm its clear role. In fact, "although scholars in information-centric disciplines are keenly aware of the connection of data to materials, their counterparts in fields relating to the built environment are less cognizant of this relationship" (Brownell, 2016, p. 1238).
The connections between Information and materiality have been studied rigorously within the fields of Informatics, Communication Theory, Organization studies, and Interaction Design. This latter, together with Data Visualization and Digital Fabrication, is the only design

field to have developed a confident approach to the dynamics of data flow, establishing their tools and methods. On the other hand, Material-focused Design, such as Product and Industrial Design, shows a lack of consistency when dealing with the translation between Information and materials. Should we consider these disciplines unaffected by Data flow and continue exploring and implementing only specific practices such as Data Visualization and Digital Fabrication? Should we continue handling data only as inputs for visual outputs or as a tool for technical solutions? In this case, the whole Design System would miss the opportunity to evolve its culture by enhancing its awareness of new resources.
Focusing on the union of information technology and materials, Duncan (1994, p. 203) stated that "the single most important material used by manufacturers in the future will be data." In this paper, data are interpreted as a new kind of raw materials that the designers can exploit and the responsibility to handle. We specifically address them as "raw" materials instead of any other type of entity to lay out a more confident and more precise design discipline attitude towards their analysis and exploitation. This analogy provides us with a comparative path to define meaningful and sustainable approaches and challenges of the discipline in this field. The endless research and technological process related to raw materials took centuries to achieve a relevant classification and systematization of resources. We claim that, in order to face and handle the complex scenario of data and Information, we should inquire about our solid experience with raw materials, and all the related issues, such as their shortage, to have a reference of theories and agencies. It is emblematic that we also use analogies in terms of both vocabulary and technology, such as mining and extraction.
Considering data as raw materials would help the design:

1. to define a meaningful translation and application of digital contents into physical products and actions,
2. to reach a deep knowledge about typologies of data for their classification and systematization,
3. to update the design culture with new resources, generating unusual sustainability concerns on the environmental, social, economic, and cultural levels.

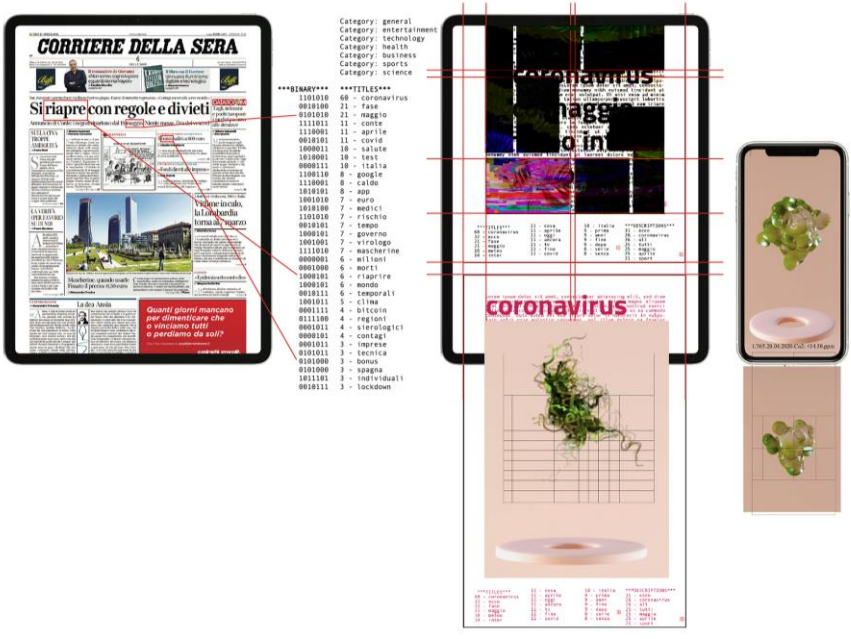
During this research, we have been studying contemporary approaches that use data as materials for design to highlight the strength and weaknesses points in this field. Observing mainly two directions, Data Visualization and Data Physicalization, we selected three case studies as relevant for our goal.
One of the most considerable design achievements is the approach of Data Humanism by Giorgia Lupi. It is built on a deep speculative attitude towards the evolution of Data Visualization. Data Humanism generated a substantial shift from Data Visualization to Data Drawing. The "first wave of data visualization [...] was successful in making others more familiar with new terms and visual languages" (Lupi, 2017, par.1). After this accomplishment, there has been a trivialization, and "visual design is often applied to data simply as a cosmetic retouch of important and complicated issues in an attempt to make them look simpler than they are" (Lupi, 2017, par.1). Lupi seeks to humanize data visualization to make it speak our language, questioning the impersonality of a merely technical approach and starting to design ways to connect numbers to knowledge, behaviors, people. Another consistent contribution is about techniques and skills. Her practice is based on "drawing" data rather than let the machine automatically process them. *Drawing* is a human capability that supports and drives thinking and comprehension of things. Drawing is also part of the

design process, so it is a way how designers can exploit their specific methods to generate innovation.
Another Design accomplishment is the manifestation of data as a physical embodiment, which is often collected under the term data physicalization or physical visualization. A remarkable contribution is the activity of The Mediated Matter Group of MIT. They created a multi-material voxel-printing method enabling the physical visualization of data sets commonly associated with scientific imaging. This technology consists of multi-material 3D printing with polymeric photo materials, which enable the simultaneous use of several different materials, and by utilizing cyan, magenta, yellow, black, white, and transparent resins, full-color models with variable transparency can be created. This process allows the physical visualization of unconnected points, cloud data, lines and curves, open surfaces, and volumetric data (Bader et al., 2018). Physical information displays offer tangible interaction, enabling a more comprehensive understanding of information intuitively, going beyond the possibilities offered by virtual and augmented reality. Moreover, voxel printing enables direct digital manufacturing of data sets without creating intermediate representations for 3D printing. It proves to be a more accurate and effective visualization, avoiding the loss or alteration of information. Consequently, data representation in a physical form through digital fabrication has emerged as a research area and practice.
The other example is Forensic Architecture's work, which provides us with one of the most interesting references in terms of new applications and opportunities for the Design discipline to have an active role in the Information Age. Forensic architecture is the name of an emergent academic field developed at Goldsmiths University. It refers to architectural evidence's production and presentation—relating to buildings, urban environments— within legal and political processes. This research group uses data as a source of investigations to help international courtrooms, parliamentary inquiries, United Nations (UN) assemblies, as well as in citizens' tribunals and truth commissions. They make use of digital and physical models, 3D animations, and cartographic platforms to recreate crimes' dynamics and scenes to support the justice system. This approach creates a fluid translation between digital and material, moved by a very clear and practical mission, and represents a model case going beyond the visualization and the technological improvement, to focus on applications, roles, and untapped forms of interdisciplinarity. It is also inspiring in terms of method; in fact, it treats data through traditional design competencies and tools, such as spatial, mechanical, physical, and behavioral studies. From this analysis, the research outlines, as strategical strength points for an evolution of the Design discipline, the concept of humanizing data, the materials-led practices of physicalization and crafting, and the experimentation of unexplored interdisciplinary collaborations. In terms of weakness, it comes upon the need to overcome visualization's main goal and the exclusive focus on very techno-scientific applications.

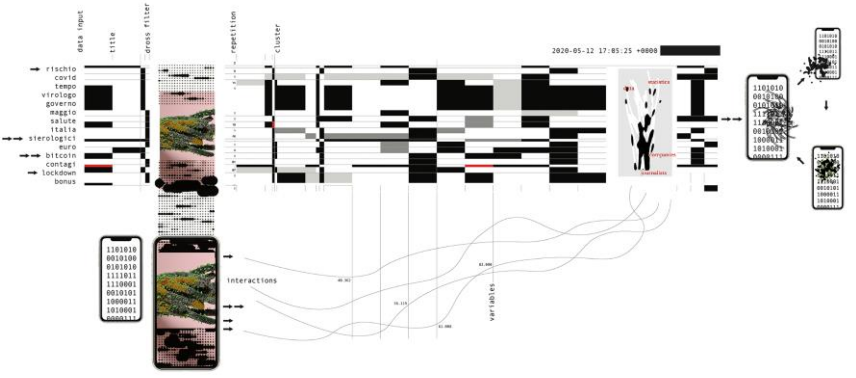
_DCs 4. *Crafting Ecosystems.*

The experimental project Crafting Ecosystems, activated by the emergency of the global pandemic, is an attempt to exploit the traditional approach of the designer toward data to produce a new awareness about extraordinary dynamics and bold design-led scenario. In

this proposal, raw data are seen as physical materials expressing information capable of modeling a tangible change process.
The project is based on a double-time perspective, made evident during the lockdown: the speed of the media information coming from the continuous digital flows; and the slowness of the natural ecosystems with its calm and inexorable evolutionary times. With the aim to relate man and nature through digital technologies, combining these two-time levels, it is an invitation to observe reality in an integrated way and realize how emergencies inevitably depend on the interconnected balance between all living beings, humans, animals, plants.
Firstly, to activate this design process, it has been selected a source, as the designer usually does when looking for specific raw materials. In this case, view the focus on the pandemic's related information, they have been chosen the Italian journalistic daily news from an API in open-access. In collaboration with a network engineer, we designed different algorithms to use as crafting tools for these "data flows." The first algorithm has been created to filter data and keep only the ones relevant to represent the current scenario of Covid-19. Secondly, we obtained a collection of words, such as the most used by National newspapers in pandemics, concerning health, science, technology, and politics sections. [Figure 1] We have considered their frequency and the exact words used to enable filters of comparison, statistics, priorities and determine their presence variability and relevance. In a very synthetic way, this data collection has depicted the dominant info-sphere during the climax of the virus spread in Italy.



After this phase, a second algorithm has been structured to extract a cluster of sub-data, such as recurring words associated with the main ones, to start portraying a more exhaustive scenario made of quantitative and qualitative information, whose intersection composes a narrative of both numbers and perceptions. [Figure 2]



The result has been a daily collection of selected data which we processed with a final 3D modeling algorithm. This passage envisions an organic and virtual plant generated by the selected data's interaction, critically filtered to respond to our goal to connect technology, design, and ecosystems perception. In this sense, we aimed to clarify the relation between emergencies, as the current pandemic, and human responsibilities translated into the ecosystem's alterations. For this purpose, we have imagined an interactive app that visualized the monthly growth of the plant. [Figure 3]

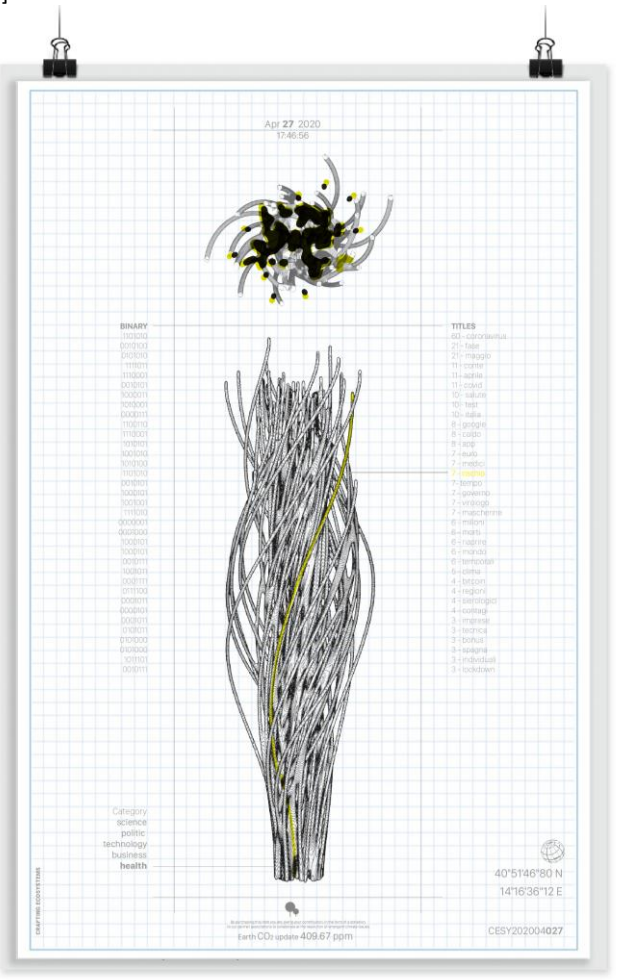


The plant grows organically, day by day, interconnecting at different levels the words selected by the two previous data algorithms, the geo-fencing coordinates of the user, and the local daily CO2 levels generated in real-time. By selecting a specific day, the user can purchase the corresponding physical graphic artwork in order to rebalance, by their planting, the number of trees needed to restore that ecosystem.
From a conceptual perspective, the visual combination of algorithmic design and the progressive inclusion of data from nature reveals a philosophical choice of a non-passive acceptance of our interconnected condition between natural ecosystem and infosphere. Through the app project, the data algorithm governs the virtual plant's growing logic, while the critical thinking project coincides with the decision phases that establish the operations at multiple levels of complexity (numerical, geographic, climatic data, xyz variants).
The plant's variations proceed according to rules that can only be partially controlled because they are linked to the world of media information flows and the atmosphere's ever-changing parameters. [Figure 4]





The experimentation - shown here through previous study diagrams, a series of interactive app screens, and a final material graphic artwork - produces a symbiotic digital ecosystem generated by the algorithmic 3D crafting of multiple intertwined branches. In summary, the branches grow from the update of the news flows of the world of journalistic information. Every day is different due to the ecological footprint - associated with a progressive serial number that corresponds to the global warming CO2 ppm present in the atmosphere (for instance, 20.04.2020 Co2: 414.50 ppm) - and the numerical indicators corresponding to the number of trees necessary to compensate for the system's imbalance. (Mancuso, 2017) [Figure 5]



The visualization produced through the use of the digital device's app that informs their daily readers wants to compare itself to a completely distort newspaper, in the form of an iconic natural plant. In this way, the user is stimulated immediately to develop empathy and active

participation towards the daily ecosystem, observing and interacting with the variable information. Moreover, punctual information is added through the input of the user's IP in the only form with open accessibility, not requiring a GDPR approach that is not including sensitive data. A numerical code obtained from his/her location, date, and time of stay enters the algorithm. In this way, the users are also part of the creative process, personally affecting the digital outputs' creation, later translated into a tangible graphic artwork.
In the final phase of the project, not yet realized, Crafting Ecosystems wants to use in real-time both a web platform and the app, creating a multi-layer interface of 365-days from its starting day. Thus, the designed algorithms are detectors of fluctuant ecosystems, whose variations are expressed by the aesthetic, linguistic and quantitative hybridization of different values, both natural and artificial.
This last interaction is still in the final design phase since we are planning to enable the user to interplay with the layouts and share their content, extrapolate meaning, concretely activate a series of actions aimed at the change, building a correlation between the digital and the real world.
The virtual plant visualized suggests so a new design-led scenario: to metaphorically cultivate natural ecosystems which, thanks to the app, can be grown, be shared, and changed through physical actions and behaviors.
As an envisioned result, we imagine an interactive app that allows the users - by purchasing the graphic daily material poster - to contribute to the restoration of the natural balance ecosystem during and after Covid-19. This economic contribution can be in donations to partner associations devoted to the plant of trees.
Crafting Ecosystems is aimed to hybridize virtuality and materiality, infosphere and natural ecosystems, algorithms and critical thinking, information, and empathy. It claims that data-focused design should actively participate in the definition of an advanced Information Age. It opposes digital information's intellectual laziness, employing awareness, nature, crafting, humanity, and transdisciplinarity.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Thinking with Card: Curriculum-Led Making Activities Integrated with Distance Learning

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Abstract | This paper describes the integration of creative making activities into existing curriculum components primarily for Chinese (Middle School) students (approx. age 7-14). The strategy is built on an understanding and experience that while such activities are crucial to the development of design and spatial ability, their presence is generally undervalued and marginalised in favour of higher status subjects. In developing learning tools that reinforce more traditional subject areas, (particularly STEM), the project aims for a greater acceptance of design-led and making activities. The provision of a free (bilingual) online repository of these activities has made them highly suited for use during the Covid-19 pandemic and corresponding increase in distance learning and home-schooling. Early user tests indicate good acceptance of the concept, and recent government policy announcements may improve acceptance further. The design of new models has been built into a standard course for undergraduate design students.

KEYWORDS | EDUCATION, ACTIVE LEARNING, MAKING, CREATIVITY

1. Introduction

This paper presents novel strategies for improving access and acceptance of art and design making activities in the curricula of Chinese middle schools. While recent years have seen some enthusiasm for reform in the area of 'aesthetic' education, this has rarely translated into increased access to making activities in art or design fields (Yang, 2019). The project described in the paper, "Thinking with Card" attempts to integrate these valuable making skills into more traditional subject areas, thereby gaining acceptance as a means of augmenting learning in the traditional setting. These students generally lack the opportunity to engage in hands-on lab activity in science subjects and have limited scope for exploring their learning outside of lectures, essay writing and problem solving (Tatlow, 2019). The project is aimed at Chinese (Middle School) students (approx age 7-14) but has been developed in a bilingual model so that it is also suitable for UK (Key Stage 2 and 3) students. These activities are designed to be available for download from a website and then printed and made at home using simple and widely available tools. The outcomes serve not only to illustrate complex ideas in subjects such as maths, physics, biology and geography, but also to develop students' skills and interest in making card models. This in turn is intended to boost students' spatial and construction ability which is seen as crucial in developing design and problem-solving capabilities (Hughes & Milton, 2006). We have sought throughout the project to gain feedback from both teachers, students and parents in order to enhance the material. Derived as a means to improve making and spatial skills at an early age, the project has also been integrated into a course for undergraduate students (to develop new card models). This is a way of ensuring the sustainable development of the project as successful outcomes from the students work can be incorporated back into the resource.

2. Educational Reform and Shortcomings of Creative Education

While represented in the core curriculum up to grade 10 in China, art education is generally limited to 'Art Appreciation' type courses in secondary schools (Wang, 2003). The responsibility to provide more familiar 'hands-on' learning in this area has therefore fallen to parents rather than schools in China. In the last decade this has created a boom in extra-curricular art and design education as the growing middle classes recognise the importance of this type of activity in terms of creative thinking and problem solving (Tatlow, 2019). Previously only part of a national strategy in the broadest terms, there are signs that the traditionally conservative Ministry of Education is working to improve access to art education for Chinese students. On July 8th 2019, the Communist Party Central Committee and State Council published new guidelines for education reform including a call to strengthen 'aesthetic training with more art curriculums and activities." (Communist Party of Central China Central Committee and State Council, 2019). This includes a desire that "More information technology should be integrated into school teaching with more free and high-quality educational resources in rural and remote areas." These guidelines have evolved into

more concrete proposals such as the announcement on October 20th, 2020 that further promotes 'aesthetic' education in schools. These proposals culminate in a pilot policy that for the first time, assessment in art subjects will be included in the general standards for high school enrolment over the whole country by 2022 (The Chinese Ministry of Education [MOE], 2020).

The issue remains, however that in practice there is much misinterpretation of the guidelines and huge differences between the quality and quantity of arts education, much of it continuing to focus on the accumulation of knowledge to pass exams rather than the merits accorded arts education in a broader developmental sense (Yang, 2019). In terms of fine art, this is likely to mean the ability to assess a movement, style or individual artist from a prescribed viewpoint, in turn taken from a sanctioned historiography of art history (Yue, 2009). Given the large class sizes and limited resources this content is generally delivered in a lecture or powerpoint format. There is little opportunity for the appreciation of real artefacts and even less for hands-on experience of materials and techniques. In some circumstances the guidelines ascribed for 'Aesthetic Education' are interpreted as more akin to citizenship - assessed in relation to being well-disciplined or doing good deeds in public (Li, Xue, 2020). It becomes clear that while there is recognition at a government level as to the importance of creative activity, there is often little enthusiasm for space within the curriculum given the existing pressure on examined subjects.

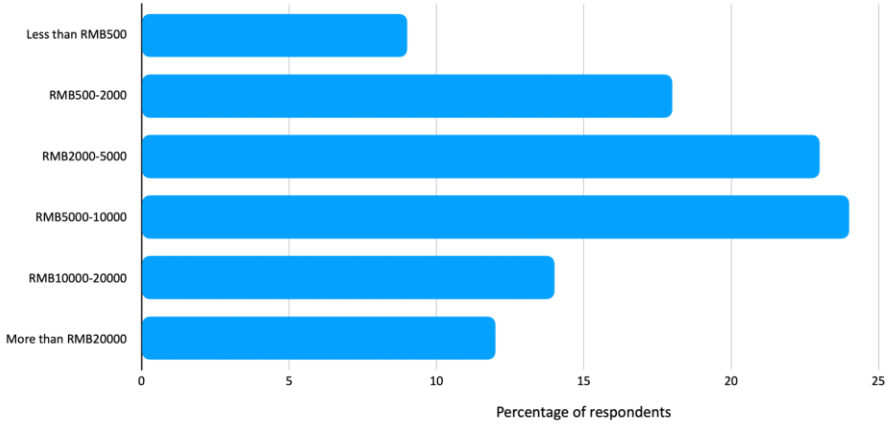

Figure 1. Projected annual expenditure per child on extra curricula art classes (sample taken from parents whose children already enrolled in extra curricula art classes. (Wang, 2020).

This shortfall in provision is therefore left to the parents to pick up - those sufficiently keen to promote creative practice in their children's development (and sufficiently affluent to provide it). Demand in this area has created a growing industry of specialist institutions who provide extra-curricula activities in a wide variety of subjects - painting, ceramics, textiles,

drawing, sculpture, art appreciation. One such provider is Big Ink Dandelion (大墨蒲公英素质美校) which boasts over 200 sites in 150 cities throughout China. The company claim to have taught over 10,000 students (ages 3-16) since their founding in 2001 (http://www.dmpgy-art.com). The branch in Weiyang District, Xi'an, Shaanxi Province has 11 teaching staff and between 500-600 registered customers. In order to better understand this market and some detail of parents' attitudes, spending patterns and interests, a survey was conducted in collaboration with Big Ink Dandelion in September 2020. 100 parents from the company's database which fit the profile of our target audience (age 7-14) were canvassed (Wang, 2020). It was found that while the vast majority of parents expressed their interest in art and design courses, 80% felt unprepared to provide access to these kinds of activities at home. 51% of all parents were planning to purchase art related activities in the next year, prepared to pay over RMB5,000 (U.S.$760) per year, rising to over RMB20,000 (U.S.$3050) for 12% of respondents) for the privilege (figure 1). In terms of the aims of this investment, it was clear that parents didn't expect the children to move into arts education, but that they considered the outcomes beneficial to their children's overall powers of imagination and creativity (51%) and appreciation of art (46%).

As a 'New First Tier City' (Yicai Global, 2019), Xi'an has a wealthy middle-class population where parents are evidently happy to spend money on their children's education outside school, but this research is by no means representative of the whole population. It is reasonable to extrapolate a broad picture, however, of a growing market for, and importance placed on, the provision of suitable art and design activities.

3. A New Strategy for the Integration of Making Activities

In developing a strategy for the promotion of making activities in schools, three issues were considered in relation to each other: Firstly the lack of provision of studio or art-room based teaching in Chinese middle schools; secondly, the acceptance of and demand for creative training amongst middle school parents and thirdly, the traditional focus on core examined subjects in the curriculum.

The strategy itself is based on an understanding of the importance of making in relation to creativity and design (Williams et al, 2010). The author's own experience with hundreds of design students in Chinese Universities reveals that only a small proportion have been able to acquire anything beyond the most rudimentary making skills and that the accepted practice is for model-making requirements within a design course to be farmed out to professional companies. The level to which this approach is normalised runs counter to evidence that links making practice to creativity and problem solving in the design process (Hallgrimsson, 2012).

This project aims to combine the benefits related to the making of physical models with the benefits related to the use of practical elements within the teaching of STEM subjects in

schools. In the UK, this has its origins in the Nuffield Science Projects of the 1960's which imagined the 'Pupil as Scientist' and encourages the natural curiosity of students with the effect of a deeper learning experience with better recall (Millar, 2004). While this has even extended to the teaching of science in a distance learning format in the UK (Fox, 1994), it is relatively uncommon in China where a teacher-orientated approach means that even laboratory work is taught through demonstration or even video rather than direct experimentation (Fulmer et al 2015).

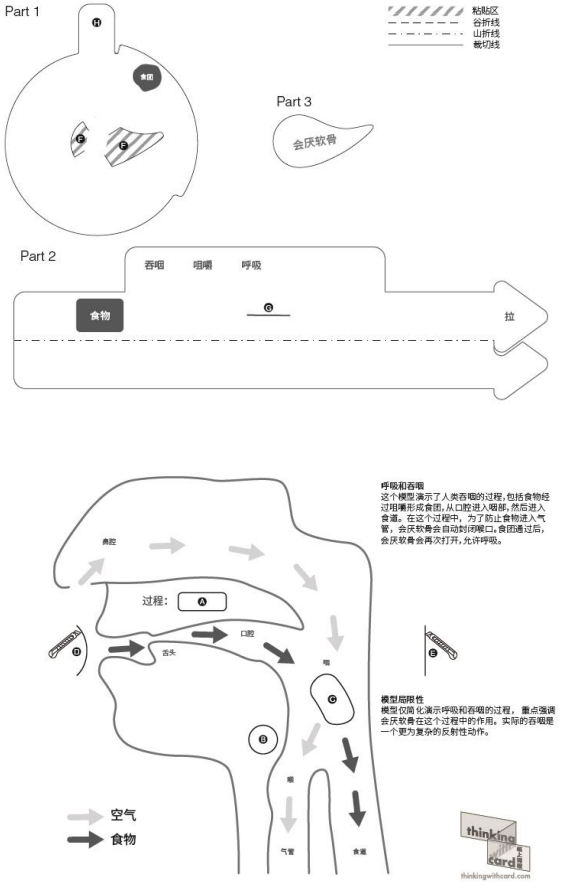

Figure 2. Thinking with Card Epiglottis Function Interactive Model Example (printed spec).

The Thinking with Card project provides targeted curriculum support material that is relevant to specific knowledge that the student needs to acquire. This is a step towards a

more experiential learning model (Dewey, 1938), which is not widely implemented in China. This novel teaching material is in the form of print specifications in PDF format which may be downloaded via a computer or mobile phone and printed out (figure 2). This material comes to life when it is constructed by the student using simple tools either at home or in school. The resulting interactive model, intended to show the concept in an engaging way, adding an extra dimension to existing teaching materials which should in turn lead to greater comprehension and recall. The models generally contain supplementary information to support the concept being demonstrated, but may also be amended and added to by the student. The making and interaction with the model is intended to bridge the gap between the theoretical model of the world (required in order to reproduce the information) and the physical world (that which is directly experienced by the student). This 'changing of register' to make the phenomena appear in a different medium (Figure 3) is thought to help students better construct meaning to their knowledge and be able to apply it in more abstract ways (Tiberghien, 2000).



Figure 3. Categorisation of Knowledge Based on Learning Experiences. Adapted from "Towards Research-Based Design of Teaching Situations in Physics at the Secondary School Level." (Tiberghien, A. 2000).

Whilst the 'hands-on' nature of the learning experience is itself only another representation of the phenomenon described, the fact that this model can be subject to physical interaction and repeated movement makes it a far more valuable resource than a diagram or even a series of diagrams. It becomes possible to represent opposing elements within a particular concept, for example the relationship between current, movement and magnetic field in the process of electromagnetic induction in a coil, (figure 3). This making activity and subsequent interaction provides the kind of opportunity for the reconstruction and retention of knowledge in the mind of the learner that is so valuable (Driver et al, 1994).

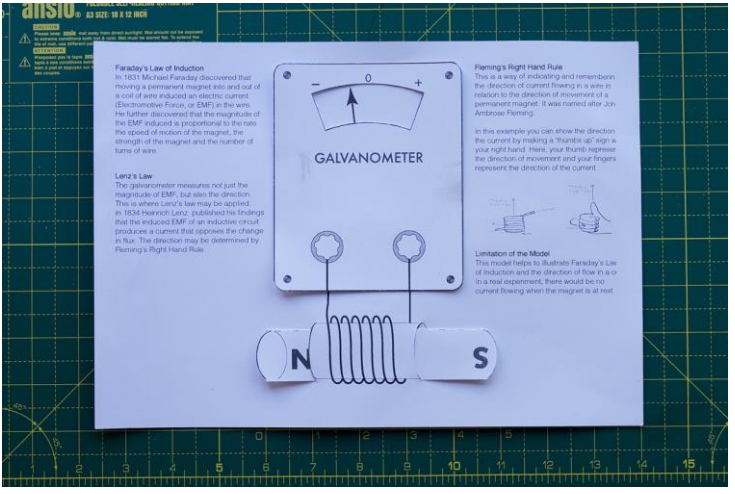

Figure 3. Thinking with Card interactive model demonstrating electromagnetic induction in a coil, Faraday's Law, Lenz's Law and Fleming's Right Hand Rule.

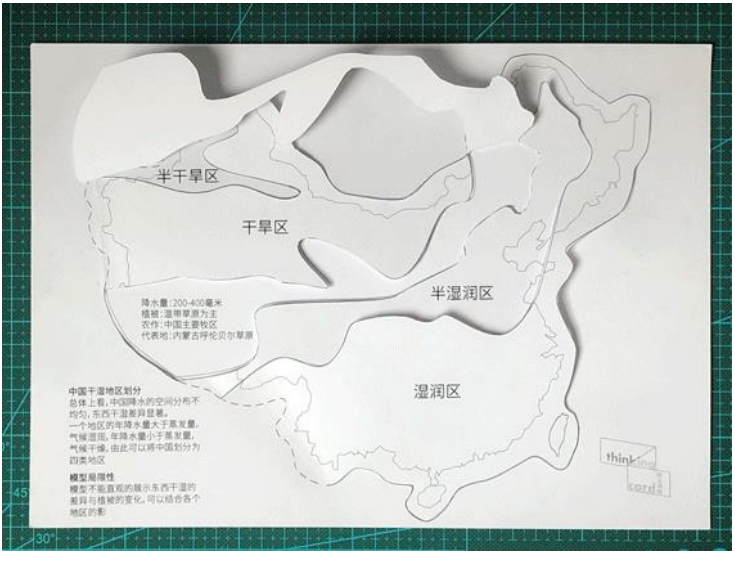

Figure 4. An interactive map demonstrating the zones of Chinese climate based on rainfall. One of a series of interactive models based on standard elements of the geography curriculum.

4. Integration of New Strategy into Learning Schedule

The route to integrating the model and making activity into a student's schedule may be instigated by either teacher or parent. Each activity is intended to fit with a subject in the STEM curriculum, although there have also been models added that relate to the History and Geography curricula (Figure 4). The parent or student can download the PDF model onto a computer or smartphone and print this out either at home or cheaply at a local print shop. Each .pdf document is available in English and Chinese and includes both the parts needed to make the model and the instructions to be followed (Figure 5). Certain models are intended to be made from paper, others in thin card (180-250gsm). Where the latter is required, the model may either be printed onto paper and mounted on card or printed directly onto the card. The basic tools required include a cutting mat, knife, glue stick and metal ruler, with instructions given on how to use these safely.



Figure 5. Example of the instructions required to make one of the models, in this case the structure and function of the middle ear (Chinese Version).

The strategy developed makes use of relatively simple materials and processes but aligns these with the high penetration of computer and smartphone use and the availability of printing resources either at home or in local print shops. The website was created with a simple interface through which teaching models can be downloaded and printed out. This meant that the models can be used both in established school curricula, those developed in

response of the Covid-19 pandemic (and greater need for distance learning tools), and those developed for home schooling.

The website started with a handful of models in order to demonstrate the concept. From this, we sought advice and feedback from teachers, parents and students in terms of identifying suitable models for development. This led to a set of 14 models which address the various areas identified. There are several more models in development, but the complexity of some leads to a lengthy development period. It is interesting to note that while this project was undertaken to address a particular set of concerns, it is not unique in its outlook. In the course of developing the project, we came across interesting historical examples of card models both for education in a conventional setting and also through promotional items. One significant example is a series of card models published in Manchester by John Heywood Ltd. This series of articulated cardboard models show detailed schematics of piston and valve timings in several engine types including diesel, petrol, Corliss steam and simple steam engines (figure 6). These models are similar in concept to models in the Thinking with Card project, albeit more sophisticated and detailed. It goes without saying that the user is not required to make the models, but their implementation, along with instruction in the included booklets, engineering students can create complex calculations related to efficiency and pressure (Jones, 1903)

In addition to historic examples of card models, the potential for combining home printing technology and card modelling techniques as an educational tool have been explored by researchers in the past.

> "As many teachers and parents are aware, building pop-up books and cards can be a compelling creative activity for children. Pop-up forms manage to combine, within a single artefact, artistic and creative invention, spatial and mechanical motions of paper, and (often humorous) writing." (Eisenberg et al, 2003 p.2)

While the activities described do not quite fit the model described in this paper, they share two key components: mechanical pop-up forms and making activities for children. In terms of the development of creative skills, there is broad consensus in the design education community regarding the importance of prototyping and model-making. While the role of visual models and prototypes are fairly familiar, it is also acknowledged that sketch models and experimental models are also crucial throughout the development process.

"Prototyping is a key problem-solving activity in product design. It starts right from the beginning of a project and continues right into production. Given the complexity of product development, it is critical to take as much of the guesswork out of the design process as possible, and prevent surprises from showing up later in a project." (Hallgrimsson, 2012 p.7)

While many design texts focus on the use of foam, clay and timber models, it is clear that card models are widely implemented and valued for their speed, accuracy, reproducibility and cost-effectiveness (Saul G. et al 2010)

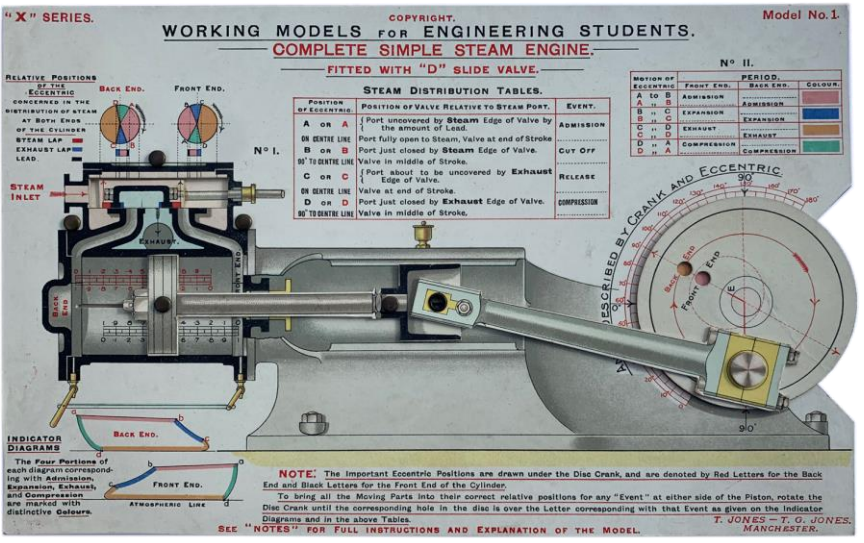

Figure 6. Example of an articulated card model used to teach engineering students the parameters of steam engine performance and design. (Jones, 1903)

5. User Testing and Feedback

From the beginning of the project, an attempt was made to develop an ecosystem for the project from which feedback may be sought from teachers in the area targeted. These teachers, once familiar with the aims and scope of the project, would be able to both select appropriate tasks for their students and suggest models that would be useful in the teaching of particular themes and concepts (Figure 7).

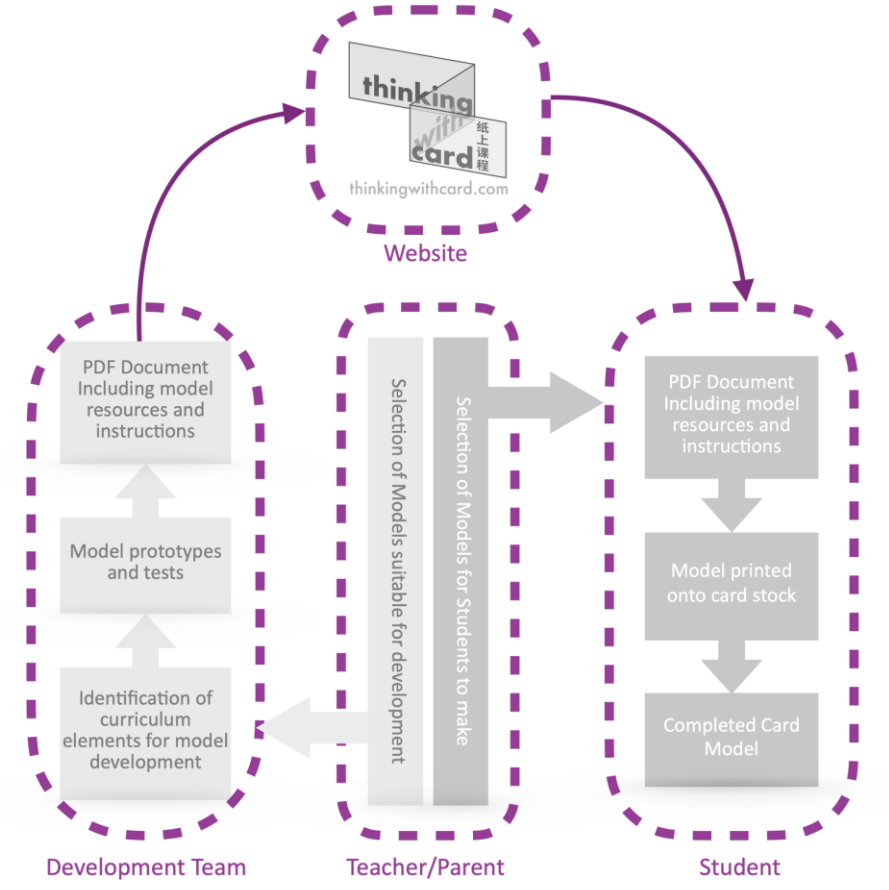

Figure 7. Representation of the different roles within the Thinking with Card ecosystem

Once a series of models had been developed, the website was promoted amongst teachers and parents who might be able to implement the tools in their own teaching. This included posting to relevant social media groups, targeting specific teachers and running workshops with students of an appropriate age where additional instruction could be given and observation could be undertaken (Figure 8).



Figure 8. Workshop conducted with students to build sample models.

The initial interest was good amongst students of the target 7-14 age bracket. They managed the tasks well and reported enjoying the experience. It is clear that this kind of making activity, despite being themed around academic subjects is considered more like 'play,' where the novelty and freedom to explore holds less status than perceived activity of accumulation of knowledge. We were therefore more interested (and apprehensive) regarding feedback from teachers and parents. In order to get as much coverage as possible, this was sought through the more formal means of a survey.

The survey was undertaken to identify areas of weakness in the strategy and as a tentative evaluation amongst the target audience. The sample was chosen through a database of families and teachers who had participated in workshops or been made familiar with the project through introduction by students and tutors in the previous 6 months. 70 respondents were canvassed through Wechat social media, accessed through smartphone. The questionnaire contains both closed-ended and open-ended questions in order that we can use the information in a numerical analysis and also accept more detailed insight where it is available. The closed-ended questions are concerned generally with opinions about the use of practical making activities for middle school students and the use of the Thinking with Card models. These questions have a Likert five-point scale choice to determine the strength of opinion (figure 9). The questionnaire was conducted in Chinese language only amongst Chinese teachers and parents. The results are published online (Hughes, 2021).

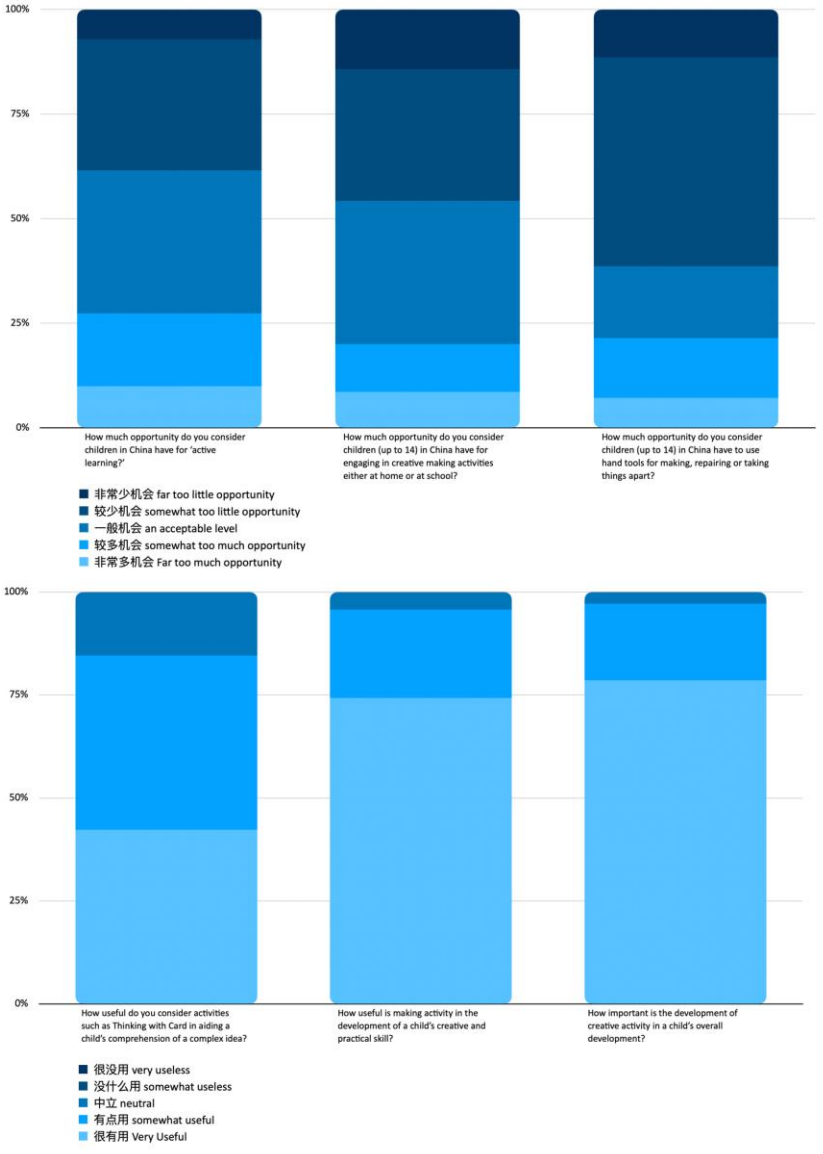

Figure 9. Selected outcomes of survey amongst parents, teachers and users of the Thinking with Card resource.

The findings demonstrated that 95% expressed a belief that 'making activity' was useful in the development of a child's creative and practical skill. The 5 most popular models in the

range were geographical terrain; historical Spring and Autumn Period; geographical climate distribution; earth orbit and seasons and biological plant photosynthesis. Of those with direct experience of using the models, only 5% found any of the models difficult to make, the reason given being that the description of the steps was not clear enough. 84% of these users considered this kind of activity useful in aiding a child's comprehension of a complex idea while 88% of all respondents consider the development of creative activity important to a child's overall development. All teachers canvassed indicated that they were willing to implement the tools in the classroom. They suggested that the content should be more extensive, so as to ensure that the knowledge is common and easy to understand, and that the instructions and operation be as straightforward as possible.

The open-ended questions garnered a good number of supportive comments as well as constructive suggestions, for example:

> "Quite necessary, Chinese children lack such hands-on opportunities. Such activities during adolescence will benefit children a lot in their growth and future life."
>
> "I strongly support the idea, but it should not be simple cut and collage – it needs a variety of materials research and application of divergent thinking."
>
> "Very good to do this kind of learning enhancement activity with children. Whether or not the material is useful, it is still a worthwhile experience."

6. Future Development

As previously described, the project relies in part on an ecosystem from which feedback may be sought from the teachers and parents of the target users. Teachers, in particular, once familiar with the aims and scope of the project, would be able to both select appropriate tasks for their students and also provide feedback to the development team regarding improvements (figure 7). Of particular relevance to design educators is the way that this development team is being configured to include undergraduate and postgraduate student projects. While initial project examples were developed by a professor with a small group of three postgraduate students, the aim in the future is to populate the project with models developed by larger numbers of students attending a course focused specifically in this area. The lack of making skills amongst design students means that tuition on basic card modelling skills are of great benefit and can yield excellent results. This starts with tuition regarding tools, safety, basic cutting and folding techniques and joining techniques. From this foundation, students can be introduced to modelling structures and mechanisms in card of increasing complexity (figure 10).

The Thinking with Card project is a good vehicle for this type of project because it provides a well-defined focus that requires students to put themselves in the position of both teacher and middle school student. Although the task appears relatively straightforward, the time and effort needed to refine a concept into a fully functional proposal is surprisingly great. On

a small scale, this gives students a good insight into the process of create and specify a design for production. Following some initial success with workshops and short courses in this area, the course is being piloted as an online MOOC course. This includes 8 sections: Basic card modelling materials and tools; Basic card modelling techniques; Sample structures in card; Sample mechanisms card; Introduction to Thinking with Card; Selection of Theme; Concept Development and Evaluation; Product communication and specification. A set of 'style guides' have been produced to ensure that models produced for the project adhere to the same basic layout and legibility.



Figure 10. Workshop with postgraduate design students to develop mechanical structures in card.

6. Conclusions

The distance-learning/home-schooling strategy described in this paper was created as a means to not only boost the understanding of complex ideas to an audience starved of rich learning experience, but also to introduce, almost by stealth, a component of making. Each of these elements, it turns out, had been implemented previously in some form or other but their conflation into a single entity became more realistic in 2020. The combining factors that facilitated this this include the penetration of internet and mobile phone usage in China, the proliferation of cheap options for printing; the desire for education reform and the Covid-19 pandemic which meant many students working from home for the first time. The first challenge was to prove that the strategy was feasible - that the DIY construction of physical learning tools was achievable and engaging to the core audience (7-12 Year old middle school students in China); the second was to gain acceptance amongst the gate-keepers of education in China - parents and teachers. The first challenge took time and seemingly endless permutations of model development in the early stages, but our

workshop activity demonstrated early enthusiasm for the concept. The second challenge is ongoing. The Chinese education system is founded on a broad acceptance of the teach-to-examine model which dates back centuries. The legally guaranteed 9 years of education has proved difficult to standardise in terms of quality given that China is such a vast country with huge disparities in income and lifestyle (Postiglione, 2006). It is not unreasonable that initiatives generated outside of the Ministry of Education would be treated with some suspicion. Follow-up projects and further engagement with teaching staff is seen as crucial to the future success of the project. Thinking with Card is a pilot initiative that provides access to a richer and more practical learning experiences (Dewey, 1938). The hope is that it can provide an example of how experiential learning can be integrated into a system that is less informed by exploration and active learning. An elective course for undergraduate and postgraduate students is being developed which will help produce further models for the project; improving and enlarging the content in the next stage.

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Acknowledgements: 杨建明教授，姜可教授，吕晓欣，杨惠茹，王成飞

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Understanding public health communication design globally during the Covid-19 pandemic: The Good, the Bad and the Ugly

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Abstract | The aim of the study reported in this paper is to develop an understanding of official public health communication design on Covid-19 globally. As a new disease, the rapid rise in the sheer volume of new scientific information about Covid-19 surpasses human processing capabilities, impacting the public and policy makers, creating an 'infodemic crisis'. Following a two-stage message/language framing and visual design analysis of crowdsourced official Covid-19 Public Health material we present findings from 46 countries, across five continents, and more in-depth analysis of 32 material from 17 countries. This is the first of its kind paper offering an analysis of the global situation on Covid-19 public health communication design; and six draft recommendations on how to effectively plan communication and frame messages that are compelling and actionable to the local audiences considering their social, cultural and economic circumstances.

KEYWORDS | COMMUNICATION DESIGN, PUBLIC HEALTH, COVID-19, VISUAL DESIGN, DESIGN FOR HEALTH

1. Introduction

The coronavirus disease 2019 (Covid-19) pandemic has ushered a new era of increased conspiracy theories, fake news and misinformation, regarding the aetiology, outcomes, prevention, and cure of the virus (Tasnim, et al, 2020; Van Bavel, et al, 2020).

This has made it very difficult for the public to distinguish scientific evidence and facts from less reliable sources of information, often leading to counterproductive practices that increase the spread of the virus.

Governmental agencies rely on public affairs messaging to address public health crisis (Barbour, et al, 2015). In this unprecedented situation, Governments across the globe and policy makers are looking at each other for solutions inspiration, trialled policies and interventions they can implement by their own national and regional authorities. But have failed to establish international cooperation and knowledge exchange to cope with this. In this context, local COVID-19 communication plays a key role in informing citizens.

In response to that, the Design Research Society Special Interest Group on Global Health, has developed an open access repository containing crowdsourced information on Covid-19 public health messages and information set by official national and international bodies. The aim is twofold. First, to develop an official of data on public messages and information on Covid-19 that researchers, public health authorities and policy makers can access and forward to communities globally. Second, to conduct a multinational and multicultural visual and language communication analysis of Covid-19 public health messages included in it. The latter is presented in this paper.

2. Background and Related Work

2.1 The Infodemic Challenge of Covid-19

Infodemic refers to an exponential increase in the volume of information associated with a global issue such as an epidemic (WHO, 2020). As COVID-19 has been a relatively unknown virus, in terms of the impact on humans, we are witnessing a rapid rate of new scientific information being published (Eysenbach, 2020).

Since the Ebola outbreak in West Africa, in 2014-2016, the health sector has learned that trust in health authorities, community engagement and accurate information can go a long way to help the public comply with public health measures (Gilmore et al, 2020). The need for official messaging during the COVID-19 pandemic is arguably far greater than in more commonly encountered hazard settings, and the demands on communicators to inform and motivate are higher (Sutton et al, 2020).

Governments and international health bodies are engaging the scientific community for evidence-based recommendations on how to minimise harms and better manage the

pandemic (Sutton et al, 2020). The widespread of misinformation related to the diagnosis and prevention of Covid-19 has confused both the general population and policy makers who are regularly issuing new and revised guidelines for disease prevention and treatments (Tasnim et al, 2020).

The main challenge here is not just the sheer volume of information, but critically its translation and communication into actionable recommendations that are contextually, socially and culturally relevant for different audiences across different parts of the world; especially among countries with low income, low life expectancy, and less education (Savoia et al, 2013; Gagliardone, 2016a; Brisset-Foucault, 2016).

The Covid-19 pandemic has resulted in an enhanced requirement for communication with the public on an ongoing basis, not only to pass on warnings and alerts, but also to inform, educate, and continuously motivate individuals in their roles as de facto responders in the ongoing disaster (Sutton et al, 2020). There is a need for more targeted public health information within communities and for partnerships between public health authorities and trusted organizations that are integral to these communities (Van Bavel et al, 2020; Srinivasan & Lopes, 2020).

2.2 Lessons from past epidemics/pandemics

As demonstrated by recent public health crises, such as the global Ebola outbreak, it is clear that threats to public health do not respect national boundaries (Barbour et al, 2015).

Communication of timely risk information is absolutely vital for behavioural change to protect public health and safety. However, prior work on messaging in response to emerging health threats such as Zika and Ebola has shown that effective messaging strategies can depend upon details of the threat itself (Sutton et al, 2020).

Past outbreaks' analysis, such as that of Ebola and the Zika virus, shows that effective communication about the outbreak to the public and how to prevent its transmission take time and offers lessons for the current Covid-19 pandemic public health communication messaging (WHO, 2015; WHO, 2016). Covid-19 presents a challenging context for communication about prevention, containment, and treatment as well. Rather than a single, one-time big event, we have seen that Covid-19 presents as a rising tide or prolonged risk incident with several waves of occurrence.

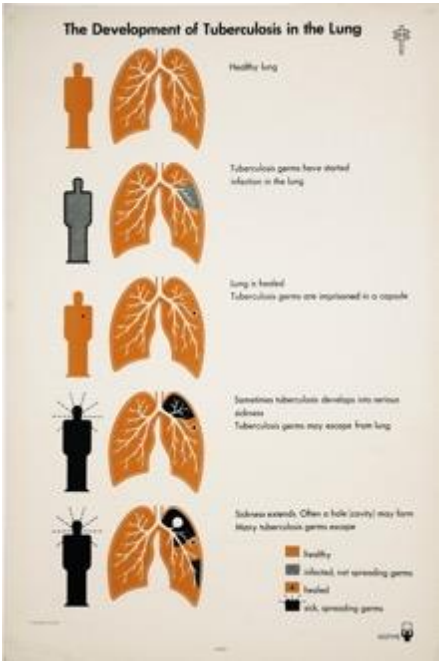

Figure 1. The development of tuberculosis in the lung', 1938. Charts from the 'Fighting tuberculosis'exhibition produced for the National Tuberculosis Association in the USA in 1938 (Black, 2017)

Public health officials and scholars agree that cultural values and traditions significantly influence responses to pandemic (Vaughan & Tinker, 2009; Lin et al., 2014). Work from the early 20th century on poster leaflet design to raise awareness on Tuberculosis (TB) in Nigeria, has demonstrated the importance of mapping visual characteristics, such as the use of colour, to match it with existing cultural associations and perceptions. For instance, lungs marked in yellow, to designate a healthy person; red, to represent tuberculosis due to associations with danger and misfortune – see Figure 1 (Kindel, 2013 in Black, 2017).

As in the cases of responses to influenza, covid-19 risk information, are influenced by existing psychological, social, cultural, health, and socioeconomic factors, which greatly affect how individuals interpret health risk communications, as well as their willingness and ability to act in a timely manner. Lessons learned from historical and recent public health crises suggest that inappropriate communications and insufficient planning can greatly compromise risk reduction (Maunder, 2004; Vanderford et al., 2007; Vaughan & Tinker, 2009).

2.3 The role of Design Communication in Public Health

Public health communication must successfully instruct, inform, and motivate appropriate self-protective behaviour, update risk information, build trust in officials and dispel rumours (Vaughan & Tinker, 2009). Communicating effectively with the public about specific threats is the key to successful emergency management and public health, helping to mitigate the risks. It supports the implementation of protective actions and contributes to minimizing negative mental health impacts of disasters (Savoia et al, 2013).

Traditionally, the field of health communication has been grounded in the natural and human sciences where gold standard research is still based on defining prior hypotheses and testing them (Neuhauser Kreps, 2014). Information design and data visualization has recently emerged as a new field on the communication of public health. Information design is cross-disciplinary, including typography and graphic design, applied linguistics, applied psychology, ergonomics, and systems engineering and has been found to be particularly valuable in health communication (Black et al, 2017; Walker, 2019, Noël et al, 2019; Walker et al, 2020). It is concerned with both language and with visual presentation so that messages are presented clearly and address the needs of the audiences (Neuhauser et al, 2009; Walker, 2019).

Health communication approaches are often intended to translate evidence-based research findings to the public. However, the traditional approach has emphasized the expert design and delivery of generic (one-size-fits-all) messages that are not always relevant to people's personal characteristics or social settings (Neuhauser & Kreps, 2014; Lin et al, 2014). This is because, much day-to-day health communication nowadays (as in the case of Covid-19) is produced by people who do not fully understand typographic principles, which can result is sub-optimal presentation of information (Noël et al, 2019; Walker, 2017). Information design methods involve collaboration and discussion between all those involved, such as scientists, clinicians, designers, writers, technicians and intended audiences (Walker, 2019) and could thus contribute significantly to the design of more effective public health communication material on Covid-19. It can help people retain information that is relevant to them or their situation and it can make the difference between taking action or not, contributing to behaviour change (Walker, 2017).

3. Methodology

3.1 Methods

Our methodology is formed around our research question. This is to explore *how might communication design analysis of official Covid-19 public health material help develop recommendations that are contextually, socially and culturally relevant for public audiences across different parts of the world*.

The study incudes two parts. The first part of this study comprises documentary research of crowdsourced information on Covid-19 Public Health messages and Information, set by official national and international bodies, such as Government, Ministries and International Health organisations. This has led to an open repository which at the time of writing includes data from 46 countries from across five continents. These were collected between April and November 2020.

The second part includes the Information design analysis through language and message framing, as well as visual design framework. The analysis of the language and message framing was done through 15 points divided in five themes: culture, language, social, structure and inclusivity. While the visual design framework analysed another 15 aspects divided in 4 themes: impact, structure, colour and inclusivity. A selection of established documents on public health communication design were collated and reviewed (the WHO Strategic communications framework for effective communications [WHO, 2017]; the Johns Hopkin's Bloomberg School of Public Health Field *Guide to designing a health communication strategy* [O'Sullivan et al, 2003] and the US Centre for Medicare & Medicaid Services The *Toolkit for Making Written Material Clear and Effective* [McGee, 2010]) in the development of the language and message framing and visual analysis framework the team used to analyse the public health Covid-19 communication documents. The process followed the thematic analysis methodology by Braun and Clarke (2008). Once the team was familiarised with the documents, we began the code generation. This was done by looking at each document guideline and coding data by writing notes through the use of notes within the electronic version of the document. After the data coding and collation, we started to look for overarching themes based on the initial research questions. This process produced a number of guidelines, which were reviewed amongst the team and then consolidated and updated to provide the framework guidelines, shown in Table 1. Although we recognise that designers employ picture, symbols, typography, colour patterns in an integrative manner to compose the final visual product, it was necessary for the purposes of our investigation to deconstruct the different visual elements to explore them both individually and as a whole message too.

Message and Language Framing	Culture	Does it use words that are familiar and culturally appropriate for the intended readers?
		Are suggestions or instructions, specific, realistic, and culturally appropriate for the intended readers?
	Language	Is the material/message framed in a friendly/positive way/tone?
		Is the material written in a conversational style, using the active voice?
		Is it keeping sentences simple and relatively short?
		Is it being direct, specific, and concrete?
		Is it written as simply as possible, taking into account the reading skills of the intended audience?
		Does it use devices that engage and involve readers, such as stories and quotations, questions and answers, etc?
	Social	Do readers trust the information sources (is it based on information sources the intended audience will trust)?
		Does it emphasise the health impact here and now?
		Does it encourage action now?
	Structure	Is it giving the context first, and incorporating definitions into the text?
		Does the material say how to get help or more information?
	Inclusivity	Is it gender neutral or inclusive?
		Can readers relate to the health statistics given (do they match as closely as possible to the characteristics of the intended readers and their communities)?
Visual Design	Structure	Is the size, shape, and general look of the material designed with its purpose and users in mind (I,e. more important elements in larger size, etc)?
		Is there a clear and obvious path for the eye to follow through each page?
		Does it have a clear and consistent style and structure?
		Are the visuals that are clear, uncluttered, and consistent in style?
	Colour	Are the colours appealing to the intended readers and free from unwanted connotations or problematic cultural significance?
		Is colour used in a consistent and deliberate way that reinforces the meaning of your messages and enhances their impact?
		Is colour used sparingly (3-5 colour palette)?
		Is text and colour legible?
	Inclusivity	Does the in a colour take into account that some readers are likely to have diminished or limited colour perception (i.e. colour blind, older people vivid colour limited perception)?
		Are visuals gender neutral or gender inclusive?
	Impact	Does the material look appealing at first glance?
		Do the visuals relate directly to the information in the material and reinforce the key messages?
		Are the visuals culturally appropriate for the intended readers?
		Are charts/figures simple and easy to understand?
		Can the visuals evoke affect appropriate for the intended audience?

Table 1: Framework guidelines employed for data analysis

3.2 Data Analysis

Data analysis was carried out in two stages. The first stage was an analysis of the documents to evaluate the guidelines set above and how they were implemented. The data analysis included samples from each country that included a combination of text-based only (i.e. website information on Covid-19, FAQs, prevention instructions/guidelines); visual and text

(i.e. websites, posters on handwashing, mask wearing, prevention, self-isolating, etc). Only documents targeting the general public were examined, as those aimed at expert and professional groups (such as healthcare professionals, etc.) were out of the scope of the study.

The data analysis composed of language and message framing (Akl et al, 2011) and visual analysis (Welhausen, 2015) following the guidelines set in our message framing and visual analysis framework. During this stage, from a pool of eight (with different sociocultural backgrounds, that understood the first language of the communication analysed and with some of them being from those countries), two researchers scored independently (scale 1-5) the documents sampled from a country and added notes. These were reviewed by a third researcher who scored them also ion cases where there was a large score discrepancy (more than 2 points). The stage one analysis took place between July to September 2020.

The second stage comprised of a more in-depth content analysis of the sub-sample of the documents that were explored in stage one. This focused on further analysing good and bad practices of public health communication messages and visual elements applied in the context of Covid-19. The aim was to look at a representative samples of good, mixed, bad and ugly official covid-19 public health message documents, in order to develop recommendations and a toolkit that will guide experts and practitioners to communicate with impact, so that the public understands and supports action on COVID-19. A total of 32 documents from 17 countries were further analysed by researchers individually from October to November 2020. An inductive detection of the primary themes that emerged in the documents was conducted to determine the themes and major issues explicitly stated to examine deeper themes in covid-19 public health communication. A series of groups discussion among all researchers followed, in order to establish common language and message framing and visual analysis practices and patterns, which in turn led to the development of recommendations.

4. Initial Findings

A total of 122 materials from 31 countries across five continents (Africa: 7, America: 8, Asia: 9, Europe: 6, Oceania: 1) were examined. Our findings show that when it comes to the design of Covid-19 public health communication material there are a range of practices (both positive and negative) found across the material reviewed, irrespective of the country or region they come from. Some are found across most material and countries, some across several and a few in more specific materials and countries. We present these below in relation to the message and language framing, and the visual design.

4.1 Language and Message Framing

The analysis revealed that cultural aspects, such as culturally appropriate words or instructions, of the message was considered as an important aspect while transmitting the message. Whereas the structure aspects, giving the context and details about how to get more help, within the visual communications would require more attention.

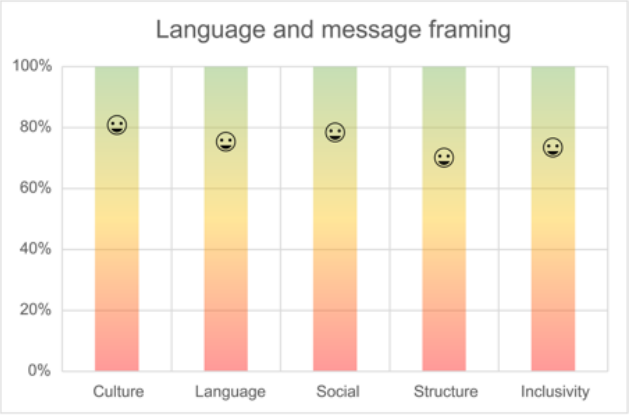

Figure 2. Summary of the language and message framing analysis.

Based on the reviewed visual examples, the most important aspects for a clear language and message framing were considered to be the suggestions or instructions set in the right context and realistic; short and simple sentences; gender inclusivity; and direct, specific and concrete message. While other aspects, such as directing for more information and the emphasis of the here and now impacts were not considered as important.

4.1.1 Good practices

More precisely, the majority of the material reviewed, scored high in terms of some aspects of language. They were written in a gender inclusive language and provided messages that are appropriate to diverse communication means (e.g. Facebook, Instagram, Twitter) beyond the traditional posters, brochures and leaflets. They kept sentences relatively short with most instructions being direct, specific and concrete. Also, several of the materials employ words that are familiar and culturally appropriate for the intended readers. A few of these are written in conversational style. Also, most materials made use of sources that are trusted by the readers, coming from authoritative and well respected national and international bodies.

4.1.2 Bad practices

Structure formed one of the weakest point of the majority of material reviewed. More precisely, many materials did not provide the context first around Covid-19 nor did they explain why it is important that these instructions are followed for the benefit of public health. Some materials lacked accessible further guidance on the measures proposed or guidance on where to get further information if needed.
In terms of language, several of the communication materials may be difficult to be understood. These materials use only plain text and adopt a technical language (from medical sciences). These will likely not to be understood especially by disadvantaged communities and people from a low-education background. On top of not considering the reading skills of the information recipients, many of the materials reviewed did not frame the main message in a friendly or positive tone. A few of the materials reviewed, did also convey contradicting and misleading messages that neglect cultural aspects. For instance, "adopt a friendly behaviour without physical contact but always with *a smile on your face*... *The use of masks is recommended everywhere" was included in a material from a Latin American culture*. In cultures, such as Latin American ones, in which hugging, kissing and handshakes are used to express a 'friendly behaviour' such messages are confusing and would be worth suggesting safer alternatives.
Regarding the social impact of the language and message used, some materials failed to emphasise the health impact of Covid-19 here and now. As a result, they did not encourage immediate action to be taken by the intended readers.

4.2 Visual Design

The analysis revealed that structure aspects, such as clear message framing and consistent and clear structure, of the message was considered as an important aspect while transmitting the message. Whereas the impact aspects, such as making the materials visually appealing and using the appropriate visuals, within the design would require more attention.

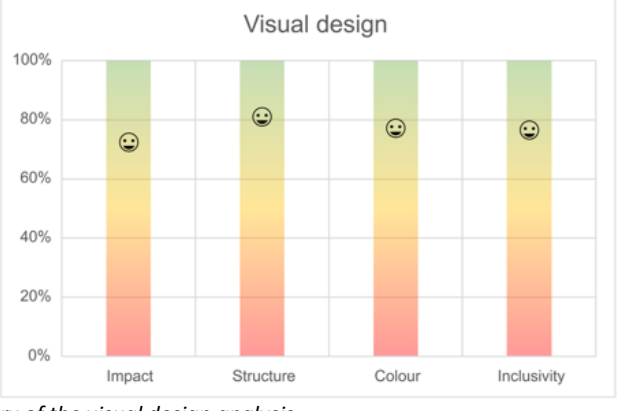

Figure 3. Summary of the visual design analysis.

According to the reviewed visual examples, the most important aspects for a visual design were considered to be a consistent style and structure; obvious path for the eye to follow; and gender neutral or gender inclusive. While other aspects, such as the size of the material and its elements; reader's diminished or limited colour perception; and the text-visuals relation were the least taken into account.

4.2.1 Good practices

In terms of the visual design most material followed a clear and consistent structure offering and easy path to for the eye to follow on the document. Also, those material, which included charts or figures, made good use of these by incorporating ones that are simple and easy to understand. The majority of the materials included legible text and colour, using legible fonts and appropriate contrast of colours. Also, several of them used colour sparingly, employing a maximum of five colour palette. Examples of these aspects are shown in the discussion section.

4.2.2 Bad practices

One of the least scored areas among the materials analysed was visual design. More precisely, the images used, such as photos, illustrations, etc., did not relate directly to the information and conversely, they did not use effectively the visuals to reinforce the key message. Moreover, the visuals in several cases were not culturally appropriate for the intended readers, as they give instructions that do not make sense or are not possible to be followed in the context as our examples illustrate. As such, the visuals employ in certain cases are nor appropriate neither compelling for the intended audience.

In terms of structure, several materials did not consider the size, shape, and general look of the material designed with its purpose and users in mind. Simple visual design practices, such as depicting more important elements in larger size were ignored. Also, some material included visuals that were unclear, cluttered, and inconsistent in style. In most of these cases they visuals were a direct copy paste from other sources without any editing or processing taking place.

Regarding colour, this was generally well applied, except for circumstances where it was used in an inconsistent and unintentional way, (for example using colours randomly without a clear purpose such as in drawing attention to a specific message or instruction, etc) diminishing the meaning of their messages and decreasing their impact.

As far as inclusivity, this was not applied universally and often seemed to be an afterthought. For example, many materials did not take into account that some readers are likely to have diminished or limited colour perception (i.e. colour blind, older people vivid colour limited perception). Gender inclusivity was another issue with several material, which had made use of visuals, being either gender biased or gender exclusive. The lack of diversity is also noticed regarding social, linguistic and ethnic group backgrounds.

4.3 Analysis per Country and Region

Although assessing the official Covid-19 public health communication messages and visuals of each country is beyond our intention, we include the Figure below of the countries analysed, as it provides some useful insights. First it emerges that only about a third of the countries we reviewed their material score consistently for both the message/language framing and visual design. Most of these which scored high for both elements, seem to be countries in North and South America. Also, it becomes clear that most countries did better in terms of language and message framing when compared to their scores in visual design. This highlights opportunities for improvement and the need for more involvement of design researchers and designers in the development of public health communication material for Covid-19.

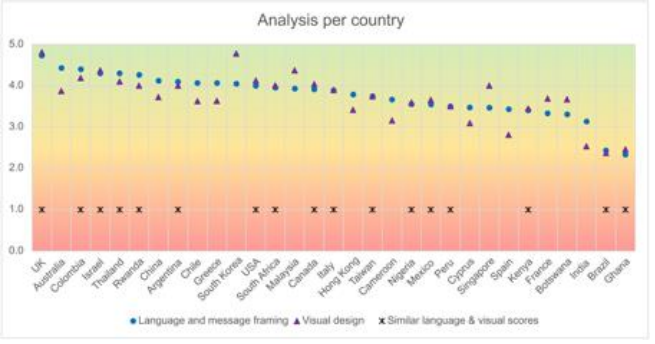

Figure 4. Analysis of language and message framing vs visual design per country

The analysis by countries show that there is a wide segregation between those countries that performed well and those that did not. More than half (17) of the countries had similar scores between language and message framing and visual design. Nine countries gave a higher importance to language and message framing, while five gave it to visual design.

4.4 Analysis of Covid-19 public health communication examples

In this section we present a representative sample of some good, mixed, bad and ugly examples[1] in terms of message and language framing as well as visual design.

4.4.1 Good examples

In terms of message and language framing, the following example, from the Rwandan Ministry of Health on 'The Do's and Don'ts of face mask guidelines', demonstrates several good visual design and communication features. It features a consistent visual style, with an

[1] For more visual samples collected worldwide visit: http://imagination.lancaster.ac.uk/wp-content/uploads/2020/04/Good-Bad-Ugly-Presentation-Analysis.pdf

uncluttered layout that incorporate an easy path for the eye to follow. Important icons are bigger in terms of size and use contrasting colours to help readers distinguish clearly what they can and cannot do. In terms of message framing, the instructions are very practical and culturally appropriate and specific, as they provide a useful context on when, how to use, how to wash and procure, as well as common mistakes people make in all these points.



Figure 5. Communication material by the Rwandan Ministry of Health on The Do's and Don'ts of face mask guidelines

Although there were not many examples of this, offering a variety of complexity levels for the same message are particularly useful. The example below from the Italian Ministry of Health provides granularity of content and instructions on handwashing, which enables readers to access various levels of information at their own pace.



Figure 6. Multilevel communication material by the Italian Ministry of Health on handwashing to prevent the spread of Covid-19

The example, below, from Yukon, Canada answers a single question well, by making use of gentle humour does not detract from serious points. It employs culturally relevant image using a practical, recognisable huskies to demonstrate the two-metre social distance rule, whilst maintaining gender inclusiveness in the visual.



Figure 7. Communication material by the Yukon regional government in Canada on social distancing

4.4.2 Mixed examples

Several materials featured mixed practices, with some good elements but also some message or visual design issues. For instance, the poster in Figure 8, provides culturally relevant image and slogan urging taking action now. It also includes a positive message framing and it is available in both French and English (the official languages of Kenya). Despite these, it includes, at the bottom of the poster, visuals which apart from being gender-biased are too small to see, as are the captions that accompany them.



Figure 8. Poster by the Kenyan Ministry of Health on supporting the fight against Covid-19

In another example, from Peru, with the support of the Ministry of culture two general posters were translated to four Quechua dialects and Ayamara (official languages of Peru), and eight minority native languages. This is very positive in terms of inclusiveness and reach in the wider population of the country. However, the translation of the language did not follow with 'translation' of the advice to the local practices of these indigenous communities; as most people in these minority groups do not have access to running water in their homes rendering the guidance culturally irrelevant.



Figure 9. Communication material by the Peruvian Ministry of Health on protecting oneself from Covid-19 (Left: Quechua language from central Andes, approx. 1 million speakers), (Right: Yine language in the Amazon, approx. 3000 speakers)

4.4.3 Bad examples

The following self-quarantine document targeting the public in Ghana, utilises the third person which although makes it authoritative, it makes the instructions that appear in it impersonal. To make matters worse there is a mix of first and third person confusing the readership and the messages it provides. Overall, the language used inappropriate for the wider public and the everyday person. Following this, there is inconsistency in terms of the advice given, as there is a mix of specific and clear with unclear and unspecific advice. Lack of visuals further add to this, as their inclusion could potentially help in enhance understanding on the practical advice found in the document.



Figure 10. Communication material by the Ghanaian Ministry of Health on self-quarantine

The following example, from Brazil's Ministry of Health website, presents several issues. All information is provided as plain text. So, the guidance is not inclusive as literacy is a requirement for understanding and is still a problem especially among disadvantaged communities. Some proposed measures present higher exposure to risks, compared to standard ones such as "*Keep at least 1 (one) meter-distance from other people in public and social places"*. Also, part of the advice provides confusing and mixed messages. For instance, there is the advice to "*Avoid hugs, kisses and handshakes, adopt friendly behaviour without physical contact, but always with a smile on your face*" and the last preventative measure recommends wearing masks everywhere. Safer ways of greeting during the pandemic should be suggested since a smile cannot be always recognised behind a mask and Brazilians are used to warmly greet people in person as a way of being friendly.



Figure 11. Online communication material by the Brazilian Ministry of Health on how to protect from Covid-19

In the example below, the poster is too busy in terms of visuals, whilst several of the clipart used are too small to see as is their corresponding caption. Some of the advice provided, such as '*Maintain at least 1 metre distance in marketplaces, medical stores, hospitals, etc*' are unrealistic given the high-density population of cities in India. Another issue in this example, is the use of visuals, where the characters featured in them, do not represent the country's population demographics, as they feature only white persons. This is an element which has been observed in several materials from several countries from the Global South who seem to have copied and pasted messages as well as visuals from Global North countries' material.



Figure 12. Communication material by the Indian Ministry of Health on not overstocking

4.4.4 Ugly examples

In relation to the example discussed above, the following one from South Africa does not include do consider ethnic diversity in its visuals, illustrating a predominantly all white family. Furthermore, there are no signposts on where or how to get more information and the text in the centre in white appears blurry due to incorrect application of antialiasing. Lastly, the message it provides appears to be distant '*WHO advise people to...*' as it does not directly address the population and does not call for immediate action.

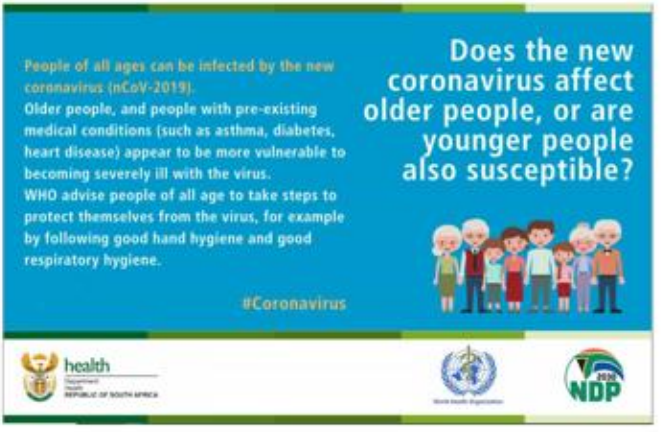

Figure 13. Communication material by the South African Department of Health on Covid-19

The example below, presents a too busy layout design and incoherent messaging. There is an inconsistent style that mixes cartoon with real images. The main image occupies most of the poster whilst not being essential. In fact, the cartoonish doctor clipart contradicts the seriousness of the message that is being portrayed. In terms of visual layout, the composition of the five small images at the bottom of the poster lack alignment. The text for getting more information and the contact number are too small to be read.



Figure 14. Communication material by the Taiwanese Ministry of Health on hand-washing

4.5. Other health related visual examples

The Royal College of Paediatrics and Child Health (RCPCH) has been working to raise the awareness of the impact of air pollution on child's health, particularly to those with respiratory allergies such as asthma and rhinitis. The '*The inside story: Health effects of indoor air quality on children and young people*' campaign was launched in January 2020, just before the COVID-19 pandemic started. Hence, it results appropriate to compare the visuals from this campaign to those presented here.

They have produced an extended report, however, the graphic content is used to advertise this campaign. They successfully use appropriate message and language framing, as well as visual design. A similar analysis as the one presented in this work revealed that the key areas are for the **language and message framing** were the use words appropriate for the intended reader; the suggestions are specific and realistic and are gender inclusive. However, there are some parts that would be benefit for more emphasis such as the impact here and now. While for the **visual design,** the visuals were gender neutral images; have a clear structure

and eye path; reinforce the information presented; and have a defined colour palette used consistently as shown in the Figure 15.

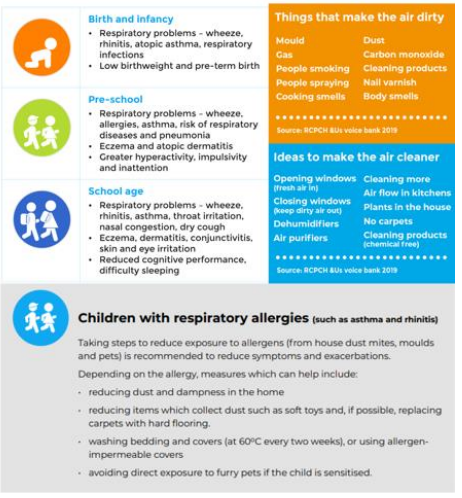

Figure 15. Communication material by the RCPCH for 'The inside story: Health effects of indoor air quality on children and young people.'

5. Discussion and Draft Recommendations

Based on the findings and the examples presented above, we propose a set of draft recommendations for the design of public health communication material for Covid-19

Although there are still a few steps to be completed in the development of a full list recommendations for the public health communication material for Covid-19, our initial analysis reveals some patterns and insights that are emerging. We discuss these below.

First, ***give the context first, and incorporate definitions into the text***. As mentioned above several material did not provide any context regarding Covid-19 or included any definitions in layman terms. Most critical is the clarification of why should individuals, and the public as a whole, follow the guidelines and instructions offered in the material. This is because, even the most valid and reliable scientific information may be ignored, minimized, or processed in a way that results in unanticipated public responses when a communication plan overlooks the reasoning strategies of the audience of the message (Vaughan & Tinker, 2009). Lessons from past health campaigns demonstrate, that these are most successful when communication addresses motivations, emotions, and ideas that might contribute to desirable behavioural change but also are compatible with individuals' reasoning strategies (Vaughan & Tinker, 2009).

Second, ***provide clear messages that consider the cultural aspects, and instructions that are specific, realistic, and culturally appropriate for the intended readers***. Our findings revealed that many materials provided often instructions which were not culturally appropriate and guidelines which could not be practically implemented within the targeted socio-economic groups they were targeting. During a pandemic, the way new information is filtered, processed, and evaluated is influenced by individuals' daily life circumstances, cultural and psychological risk orientation and traditions regarding health practices. Guidance from socio-ecological, social cognitive models, suggest that health communication is more effective when it is relevant to people's personal and social contexts (Neuhauser et al, 2009). As such the messages themselves must be compatible with the cultural orientations and socio-economic priorities of affected populations (Vaughan & Tinker, 2009).

Health communication materials are intended to solve ''wicked'' problems in highly changeable sociocultural, political environments among very diverse people. However, they are often not designed to meet the needs of diverse population groups (Neuhauser & Kreps, 2014). Reaching vulnerable populations, who usually bear the brunt of the effects (financial, health, social) in pandemic situations is very important. Yet, reaching these populations and communicating effectively with them is a critical public health challenge (Neuhauser et al, 2009). The following recommendations consider ways of tackling these.

Third, ***use creative mechanisms that engage and involve readers*** (i.e. stories, quotations, analogies, etc.). Our analysis revealed that this was one of the weakest elements in message and language framing. A handful of material made use of creative devices to engage and involve readers, such as the example form Canada, which used Huskies to provide an analogy for physical distance embedding gentle humour. Still such mechanisms and especially inclusion of narratives and storytelling are very powerful and have in the past been employed in health communication (Edgar & Volkman, 2012; Walker, 2019). More precisely, data suggest that narrative message design encourages information sharing as they are perceived as having a story structure and being more understandable and less information overloading, and more transporting (Barbour et al, 2015). Therefore, mechanisms such as storytelling, form compelling tools for adding credibility and authenticity (Edgar & Volkman, 2012) to Covid-19 public health messages, especially as they are found to be emotionally evocative and thus more likely for us to act on the message(s) they contain. Furthermore, they provide us with a better understanding about a situation for instance, the experience of suffering from Covid-19, which in turn helps us understand more about the disease itself.

Fourth, ***write them as simply as possible, taking into account the reading skills of the intended audience***. Matching readability more closely to users' literacy levels (Neuhauser et al, 2009) is a key component, which several of the materials reviewed did ignore. As already mentioned some material, especially in Global South contexts, literally translated material into the local languages. This increased the message and language complexity. Instead linguistic adaptation should be employed to incorporate culturally relevant concepts, and adapt rather than simply translate messages (Neuhauser et al, 2009).

Fifth, ***use visuals that relate directly to the information in the material and which, reinforce the key messages evoke affect appropriate for the intended audience***. Visuals (photos, illustrations, symbols, and other images) and data visualisations can dramatically shape how risks are perceived. Many of the materials analysed did not take that into account, as there were examples, as illustrated in the sections above. In fact, there were cases where language-based content communicated one message about risk, while the visual strategies used communicate a very different message. Effective use of picture is influenced by the context they are used, the level of literacy skills and the extend they are combined with written direction, and the graphic form of the picture whether a line drawing, cartoon, photo, etc. (Walker, 2017). Incorporating culturally relevant visuals (Neuhauser et al., 2009) as well as use of scale and the simplification of images can attract attention and stimulate curiosity (Walker, 2017) and generate affect.

Sixth, ***use active voice and emphasise the health impact here and now to encourage action now***. Emphasising the health immediate impact in a way that encourages the intended readers of communication material to take action now is absolutely critical. Pandemics are, ultimately, disasters, and the critical role of immediacy that is central to effective disaster response is also inescapable (Sutton et al., 2020) in the case of Covid-19. Much research indicates that using the active voice makes content livelier and easier to read and understand, than the same text written in the passive voice. It can also suggest link with the reader (Walker, 2017; Walker, 2019).

6. Conclusion and Limitations

It is clear from past health epidemics, that trust and accurate information can significantly help the public in following public health measures which help decrease the spread of disease. However, in the COVID-19 pandemic we witness an 'infodemic', which has confused both the general population and policy makers.

Our study presents the positive and negative aspects regarding language and visual design of COVID-19 public messaging in a variety of countries. It also provides draft recommendations on how to effectively plan communication and frame messages that are compelling and actionable to the local audiences considering their social, cultural and economic circumstances.

The analysis presented in this paper focuses on visual communication aspects identifying features that contribute to success and failure of public messaging. There is still the need to understand to which extent visual communication is effective in mitigating pandemic impacts considering for instance dissemination (e.g. web analytics, number of accesses, downloads). This is something we are exploring at the time of the paper write and we aim to present in future papers, once that analysis is also completed.

Mitigation of risks is also influenced by other aspects such as cultural, social, economic and political determinants, including politics and policy. Thus, visual communication works in a two-way relationship combined with other contextual factors that should be considered. Moreover, information should also be accessible considering disabilities. We have also started work on testing some of the material with members of the public and experts, which will be reporting in future work.

In the next pandemic, be it now or in the future, the single most important weapon against the disease will be a vaccine. The second most important will be communication (Gesser-Edelsburg et al, 2014). We envisage that our work will contribute towards the latter.

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Acknowledgements: we would like to thank all researchers and Design Research Society members, especially in the Global Health Special Interest Group for their contribution to the research effort.

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"United in isolation. An online letterpress festival". A community response to the Covid-19 pandemic

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Abstract | This contribution aims to investigate the experience of 'United in isolation. An online letterpress festival' which was held during the lockdown caused by the Covid-19 pandemic, and its subsequent development.
In recent years, letterpress has experienced a renaissance: at an international level, several realities have recovered and reused machinery and tools of this ancient technique for quite different purposes. As this is a specific field that is only explored by a few people, the community has developed strongly and reached an international dimension.
Starting from the initiative of a few individuals, a weekly festival has been organised, in which in each episode four or five printers from different parts of the world streamed live from their workshops, showing spaces and tools that are difficult to share publicly in any other way. The ten episodes were well received by the public, representing a concrete response in terms of human relations and the advancement of specific knowledge on the subject.
The online archive that was created represents an important starting point for the study of the contemporary letterpress, as well as the repository of an irreplaceable network for issues such as the history of typography and printing.

KEYWORDS | COMMUNITY, COVID-19, LETTERPRESS PRINTING, MOVABLE TYPES, ONLINE FESTIVAL.

1. The concept of community in letterpress

In the last decades of the 20th century, relief printing was gradually replaced in commercial printing by other, better performing technologies. In particular, movable type printing, which had remained largely unchanged for around five hundred years, became less and less widespread; during this phase, the tools of the so-called art of typography were discarded, and a wealth of widespread technical knowledge became, within a generation, the preserve of a few.

In recent years, there has been a gradual rediscovery of letterpress printing on an international level, which has led various realities to recover printing presses, movable type and everything necessary for the use of this technique (Passerini, 2014). In fact, only a part of these realities has continued to use letterpress in continuity with the profession's past; more commonly, the reasons for this revival lie in historical and cultural issues. In particular, they reside in the relationship with the field of new craft (Bonini Lessing et al, 2019), with the history of typography (Heller, 2019), with the didactic dimension (Marzotto Caotorta, 2007) and with the search for new forms of expression (Barmettler, 2017).

The adherence of many geographically dispersed entities to the letterpress revival has led to the creation of groups of people united by common interests and practices. By its very nature, a phenomenon of collective re-appropriation of craft skills and tools that have declined due to technological obsolescence entails, on the one hand, the search for sources and masters, and on the other, a marked tendency towards self-education: hence, in relation to one's own community, the sharing of knowledge and the need for comparison. For these reasons, in the last two decades, virtual spaces have appeared to serve these purposes: platforms serving the community (two above all: Briar Press and Letterpress Commons), video tutorials dealing with technical issues of printing and machine maintenance (e.g. the Youtube channel of Boxcar Press), Dafi Kühne's site dedicated to sharing information on FAG proof presses produced from the 1940s to the 1990s. In addition to the creation of dedicated spaces, printers have always used more immediate tools such as social media (originally Flickr and later Facebook and Instagram).

In particular, beyond the other best practices, it is worth highlighting the case of 'Drukwerk in de Marge', one of the most successful projects serving the letterpress community. The printers (*drukkers*) in the geographical area of the Netherlands and Belgium represent a clear case of a community that builds its own spaces for dialogue and sharing: they have developed a support network for printers and for the enhancement of the typographic heritage – also musealised – with both research and dissemination purposes.

In addition to a bimonthly physical magazine, Drukwerk in de Marge is a website where members are able to buy and sell printing material, share events and their own printed production, consult a map of participating realities, a forum and an archive section of historical and photographic material (samples, instruction manuals, spare parts for machinery). The functions seem to respond to the needs well expressed by a community

that is able to recognise and organise itself, and, more broadly, to problems that are common to all those who print with this technique, regardless of the geographical factor.

It is clear that the internationality and cross-country character that the letterpress communities themselves possess is due to the fact that, with a few exceptions, they do not share the same urban area. The letterpress community therefore appears to be a group of individuals from a heterogeneous origin who organise themselves above all virtually: this is made possible by the universality of the technique and tools, which makes it possible to overlook national and continental borders, as well as by the strong shared attitude to the protection of the material and immaterial typographic heritage that *typophiles* have in common.

Events such as *wayzgoose* (cycles of conferences, workshops and activities aimed at printers, of which there is a strong tradition in English-speaking countries) and international summits like Letterpress Workers have also contributed to the creation of a strong transnational letterpress community. The latter is an annual meeting held in Milan (Italy) since 2012 where, during a short artist residency, invited printers work together to share knowledge and cultural and design approaches.

The recent experience of 'United in Isolation. An online letterpress festival' fits into this particular and lively context.

2. The festival

"United in Isolation” was born in March 2020 with a simple Facebook post in one of the many groups dedicated to sharing experiences of the international community. A Norwegian printer wondered whether, given the emerging international situation, organising a series of live streams on the general topic of letterpress printing might be of interest. One of the first comments came from two Italian printers who, being already in quarantine – Italy was one of the first countries to be affected by security measures – gave their availability to hold a short talk from their home temporarily used also as a printing workshop and to help with the organisation. Since then, and for about a month, the three printers have worked together assiduously to set up the festival, arrange the technical issues and communicate the event.

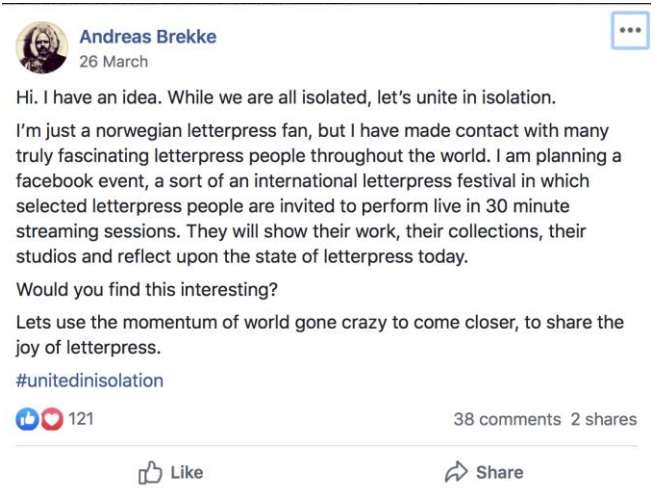

Figure 1. The post that marked the beginning of the festival, March 2020.

The festival format included four or five live streaming interventions via the official Facebook event page. In addition, an Instagram account has been created to advertise the event weekly.

In choosing the guests for each episode, it was decided to give priority to a geographical criterion, with guests representing as many different cultural realities as possible. Gender and racial issues were also strongly considered, although the latter was greatly facilitated by the geographical choices.

Furthermore, the presence in the same episode of very small realities and important institutions – in particular, Tipoteca Italiana Fondazione (De Michelis, 2019) and Hamilton Wood Type – managed to give a sense of the heterogeneity of the letterpress community, making evident both the differences in the means and approaches that the strong common attention to safeguarding the material and immaterial typographic heritage.

Each reality was given the opportunity, in the twenty minutes available, to freely choose the theme of the speech: if most of the participants chose to show their work tools or their production, there was no lack of more specific interventions and deepening on a single theme. In addition, many of the printers talked about their experience with the pandemic, directly informing the international public of the situation in their country of origin and talking about experiences of printing for charity to the reference emergency structures.

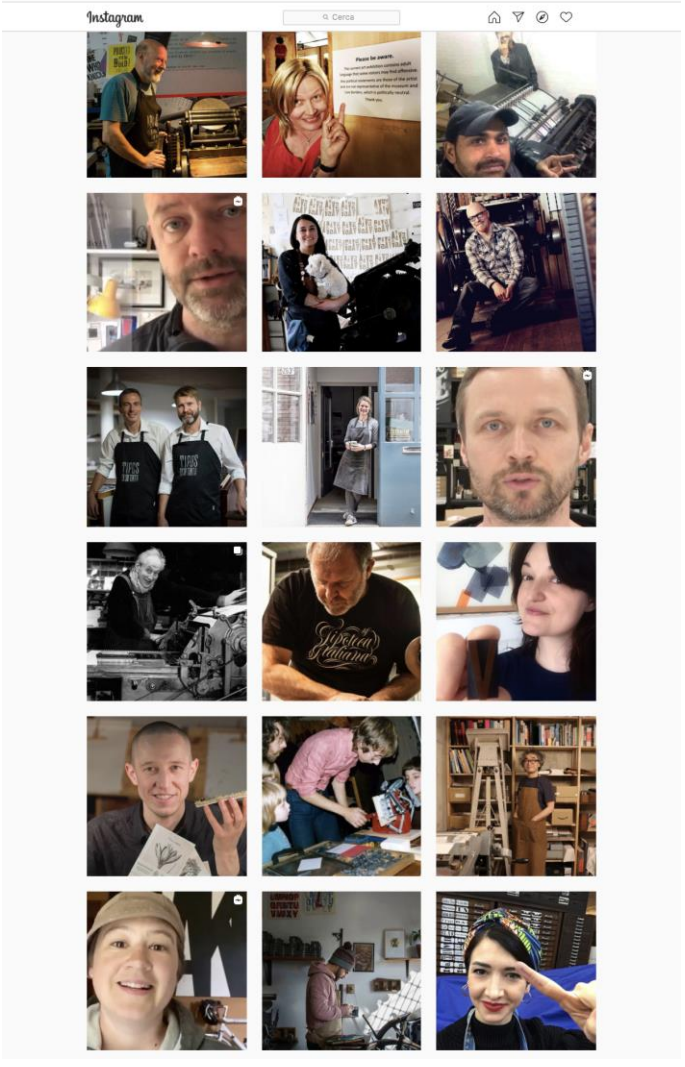

Figure 2. Instagram feed, photos of the printers who got involved are displayed with a promotional aim.

The first instalment was held on 18 April 2020. In addition to an introduction by the two Italian organisers, three printers from Australia, Russia and the USA were also guests: the latter two were later involved in the organising team, which was joined in the middle of the festival by two printers from England and Chile.

One of the festival's greatest achievements was to be able to connect printers from twenty-three different countries, guaranteeing representation from all five continents. Comparing such different experiences directly (one above all, a printer from Japan) has certainly made it possible to understand the differences and commonalities of letterpress printing.

Although a sense of belonging to the various letterpress communities was already strongly felt, this experience during the lockdown helped to generate the idea of a world community, in continuous dialogue and ferment.



Figure 3. A Japanese speaker showing his workspace in Tokyo.

3. Follow-ups

The audience, consisting of printers, graphic designers, students and researchers in the field of design, was extremely supportive of the idea of further development of the festival, leading to the organisation of a second season.

This new season saw some important improvements compared to the previous one. First of all, it has been decided to conduct thematic episodes, which would give the festival an additional degree of scientific relevance. The first episode, broadcast in November 2020, was focused on the contemporary production of movable type, and featured Dafi Kühne, Mark McKellier and Ryan Molloy. In particular, the use of numerical control technologies applied to various materials and the casting of new characters with plastic materials were investigated. Other episodes will be dedicated to topics such as different approaches in the

printing process and the archiving of historical materials. It was also decided to increase the number of minutes available for each speech to thirty, in order to allow a more in-depth presentation.

Finally, the live streaming on Facebook was joined by that on Youtube, extending the possibility of viewing even to those who do not have a social network account. This was possible thanks to the use of StreamYard, a platform for managing live streaming that also allowed a better direction of the live broadcast and therefore a better experience for both the audience and the speakers. Thanks to this platform, a live question and answer section was included, previously impracticable due to the nature of the Facebook live broadcast.

New hypotheses for the preservation of the audiovisual material produced in both the first and second seasons are also being investigated, in order to be able to consult the content more easily through the use of metadata and specific search filters (Dalla Mura, 2016) and to represent a more accessible primary source for both the scientific and the letterpress community.

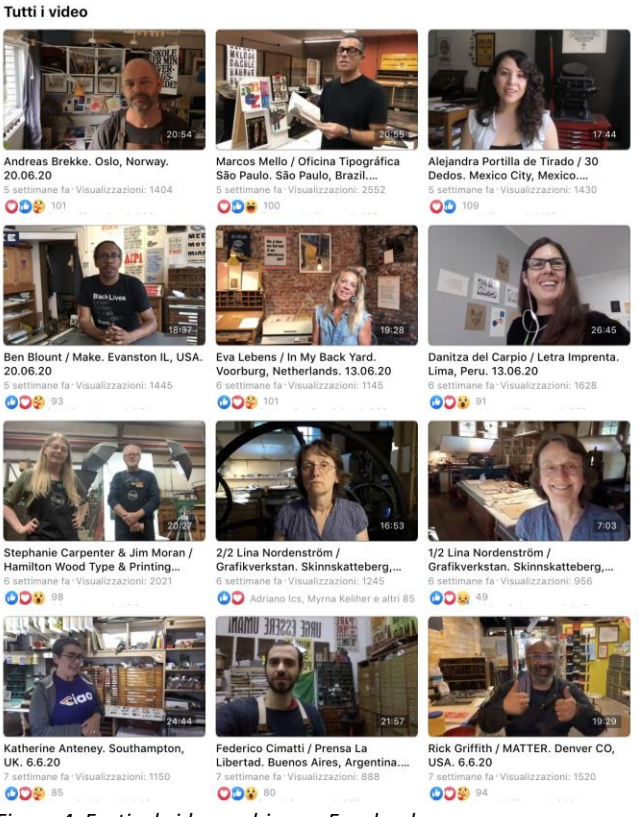

Figure 4. Festival video archive on Facebook.

While the need to find a more durable form of archiving than the feed of a Facebook page becomes evident, the hypothesis is also formulated that the festival could represent the first nucleus of a global archive of contemporary letterpress practices, constituting a form of digital enhancement of an analogue technology.

The festival also gave rise to the idea of a virtual group exhibition of prints related to the theme of the coronavirus, entitled "Letterpress printers responds to a pandemic", in which printers from all over the world, from New Zealand to South America, took part. The variety of the works presented and the processes used tell a lot about the heterogeneous nature of the community, which moves across the fields of art, craft and design.

Finally, the success of the 'United in Isolation' initiative has been documented in various articles and magazines, such as the Lockdown diaries issue in Printmaking Today (UK) and in the online publications of Typograp.her (New Zealand) and Letterpress Workers.

4. Conclusions

The experience of 'United in Isolation. An online letterpress festival' represents a concrete response of a community that found itself, because of Covid-19, only able to continue its activities to a small extent, some of the solutions adopted in other contexts, such as smart-working, being ineffective or simply impossible.

It is important to note the contrast between the peculiar concreteness of letterpress and the intangible dimension of the printers' response to the pandemic; a response that managed to exploit the adverse conditions not only to cancel spatial and temporal distances, but to create something completely unprecedented. It is clear that in no case could the sharing of workspaces – and the consequent assortment of presses, typefaces and tools – have found a better way. In fact, the festival formula shifted the focus from the final artefact to the design process, a fundamental element for fully understanding the specificities of this particular way of designing.

From a scientific point of view, the selection of participants in the festival (that in most cases occurred through self-candidacy) has no claim to completeness; but in fact, it constitutes a first nucleus from which to attempt to draw some minimal conclusions about the letterpress phenomenon in relation to the geographical areas to which they belong.

From all the speeches, it is evident that some issues are transversal to all printers and that nationality is not a decisive variable, while for others the country of origin has a decisive influence on some issues.

For example, the context in which one has chosen to set up the print shop actively affects both the themes of the artefacts and the environment of the workshop – for example, the possibility of setting up the print shop in the backyard or basement of one's home, which is

effectively impossible for anyone living in a metropolitan environment but quite common for those who, regardless of their country of origin, live in a rural environment.

The most important aspects linked to the geographical area concern some technical issues and others related to the equipment available.

In fact, each country has its own peculiarities, such as the type height (height of the physical characters), which must be taken into account especially when using equipment from other countries. In addition, each country had its own reference manufacturers, and therefore its own design, which contributed to the creation of that country's image. However, from this point of view, during the various live broadcasts it was possible to find several very interesting links from a historical point of view: for example, some companies, such as the Italian Nebiolo foundry, had a flourishing market in South America, and this is testified by the equipment of some of these printers; on the other hand, it is well known that often in some countries the design of foreign characters was copied almost integrally and brought back as new in their own reference market, a detail that did not escape the notice of some spectators at the festival.

Furthermore, some cases, such as those of the Japanese and Pakistani printers, were really interesting because they actually represent a unicum regarding certain economic and cultural issues.



Figure 5. A map that traces every printer and location of the first season; colors define the different episodes.

In synthesis, the archive of live streams, although with technical limitations and a spontaneous attitude, represents an unequalled repository on the phenomenon of

contemporary letterpress, which will hopefully constitute an authoritative primary source for any research on the subject.

Finally, the festival was an excellent way of responding on a human level to the pandemic, allowing relationships to be forged on an international level, regardless of geographical boundaries or prejudices. Against the backdrop of daily hatreds on social media, this network of people demonstrated their ability to not only appreciate but actually value diversity, ensuring an inclusive and shared experience.

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Acknowledgements: we want to thank all the colleagues that made part of the festival organisation team: Sergei Besov, Andreas Brekke, Myrna Keliher, Carl Middleton, Andrea Torres

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A Design Experience for Interactive Narrative Based on The User Behavior

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Abstract | Research on interactive narrative experiences in physical spaces is becoming more popular, growing into an established new media art format with the development of technology and evolution of audience aesthetics. However, the methods of designing interactive narratives are still similar to the basic video narratology of traditional designers, directors, and producers. This paper provides a design method based on the user's physical behavior and proposes an art installation by this method, where the aim of the installation is to transmit a more vivid story to users, presenting a new research inspiration of interactive narratology for designers and researchers.

KEYWORDS | USER BEHAVIOR, INTERACTIVE NARRATIVE, STORYTELLING, INSTALLATION ART

1. Introduction

The intervention of technology makes the story more vivid and even developed a new narrative method, named interactive narrative. However, research on interactive narrative is mostly theoretical such as (Gerrig, R, 2018), (Gervás, P, 2009), (Weyhrauch, P, 1997), and (Louchart, S. et al, 2004). even in 1970, Roger Schank had already proposed the prototype of interactive storytelling (García, R et al, 2014). Although recently, there has also emerged design practice, most of which are interactive computer programs focused on story plots, for instance (Ryan, M. L, 2008), (Delmas, G, 2007) and (Riedl, M. O. et al, 2013). Taking into consideration of user behavior interaction in physical space, we can also see some cases of interactive installation design, most of which are advertisements to attract users to participate with interaction and incentive mechanisms (Ojala, T. et al, 2012), (Zhang, Y.et al, 2018) and (Müller, J. et al, 2012). In recent years, there have been a lot of interactive narrative cases combined with VR, which is a good start to focus on user behavior, and makes possible the user's immersive experience[1] such as (Bates, J, 1992). However, VR is not a real physical experience but a way of interaction. The development of technology may give us access to multimodal sensors and experience more diversified stories. Because the essence of interactive narrative is both the user's immersion and fascinating stories. *Sleep No More*[2], an interactive stage play, sets a good example of excellent interactive experience.

This paper elaborates a design case of interactive narrative combining user behavior in physical space. In the course of our research, we attempt to find the mapping relation between user's natural behavior and narrative camera language, and to explore the possibility to apply it to an interactive narrative on the large display.



Figure 1. Interactive Installation — Still Walking

1 The VR game, Tree, https://www.media.mit.edu/posts/tree-treesense/
2 The interaction drama, Sleep no more. https://mckittrickhotel.com/

An interactive installation, *Still Walking*, is designed to explore the spatial interaction between the user and the story. The installation's narrative theme is based on temporal change, while the concept of "shadow" acts as the narrative glue to connect the story with the user. As a user approaches the installation screen, the shadow of a woman appears on an endless path. If the user revolves the screen and moves forward, the shadow moves along, the scene changing bit by bit from a child to an older woman. In this process, branching stories at different life stages—determined by the age—of the older woman are triggered by the different positions of the screen. We are taking advantage of this installation to present users with a novel and thought-provoking interactive experience. In this paper, I would dig into the process of designing this installation as well as our various thoughts and takeaways on interactive narrative design.

2. Narrative Design

2.1 Interactive narrative structures

In the traditional film narratology, the narrative structure is linear. Even it has enriched plots. However, the interactive narrative presents a broader range of plot types. It is typically composed of a structure where has multiple starting points that may lead to various outcomes, as illustrated in tree-structure, network structure, and etc. (Figure 2)

In *Still Walking*, the storyline is organized in the circular narrative structure. There are different branching plots in the entire story, and the interaction leads to different endings. The narrative structure is a similar circular network. (Figure 3)

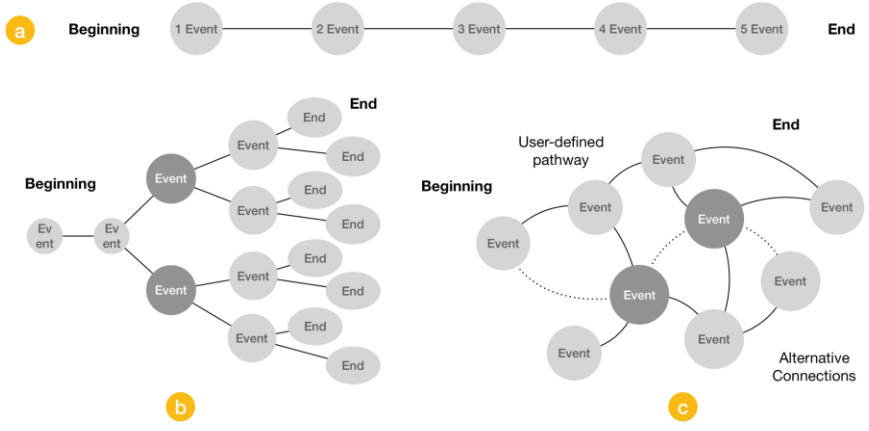

Figure 2. (a)The traditional narrative structure; Interactive narrative structure, tree (b) and network(c);

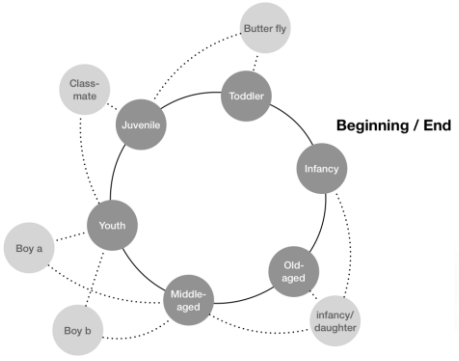

Figure 3. The narrative structure of Still Walking

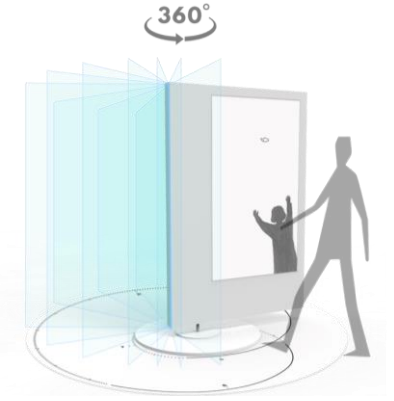

Figure 4. The concept of interaction

2.2 Interaction Design

The core purpose of narration is to establish an emotional connection after the audience has watched and understood the story (Bordwell, D, 2012). This can be realized, when there are clues weaved in the story, guiding the audience to piece together and establish emotional resonance with the whole story. In this design, we try to give back the interaction rights to the audience, make them users. According to the interactive plots and clue to guide the users to explore the story and build emotional connections.

The story of *Still Walking* is a life circle, and the users also need to come back to beginning point in the end. Therefore, we designed a circle road, utilized rotation and pause as the gates of the other plots. Additionally, the rotation of the screen brings out the shadow as a story clue moving along with the user, and guide the users by different states. (Figure 4)

2.3 Story script

The story concerns a woman's lifetime, which is divided into four sections. One rotation of the installation means the story completes for one time, the shadow changing form a girl to an old woman (Figure 5), which takes about 40 seconds. As the installation rotates, the user goes through the four periods in her life, namely infancy, juvenile, youth, middle-aged and old-aged life, each scene lasting 10 to 15 seconds. In other words, the interaction between the installation and the user lasts about 40 to 100 seconds. The whole story, with the help of mimicry and fixed camera angle, is unveiling a woman's growth, symbolized by the changes of the shadow. (Figure 6)

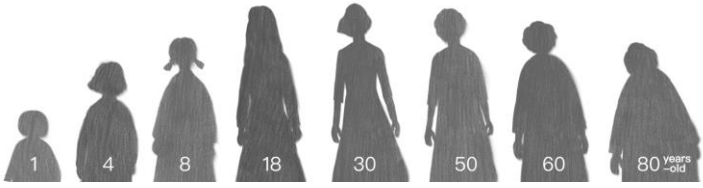

Figure 5. Images of women at different ages

Infancy: a carefree catch

The 4-year-old protagonist, no longer a toddling infant, is jumping joyfully. Suddenly, a butterfly appears ahead of the road.

- Keep walking: The girl is running after the butterfly and reaching her hands to catch it.
- Stop walking: As she stops, the butterfly flies away.

Juvenile: a friendly companion

The eight-year-old protagonist sees a girl in her class with a backpack.

- Keep walking: She waves her hands and catches up with her classmate. Then walking together, until her classmate's shadow fades away and finally disappears.
- Stop walking: If she stops, she can never catch up with her classmate.

Youth: a difficult choice

The eighteen-year-old protagonist finds the boy she likes. One of her hands is reaching to him but pauses halfway. She is about to chase after him.

- Keep walking: No matter how fast she runs, she can't catch up with him.
- Stop walking: Another boy will appear behind her. Accompanying her for a while, the shadow of the boy fades away and vanishes, leaving the girl to go forward herself.

Middle-aged and old-aged life: an affectionate change

The forty-year-old protagonist sees her little daughter walking in front of her. She is waving her hands to get her daughter's attention and wants to catch up with her toddling daughter. As the screen rotates and the user keeps walking, she realizes her daughter's change is much slower than hers, but then she ages quickly from 50 years old to 80 years old.

- Keep walking: As the screen keeping rotating, her daughter is getting close to the camera, while the shadow of the protagonist is backing out and fading away. Push the screen to the original position, and the protagonist becomes her daughter and starts a new circle of life over again.

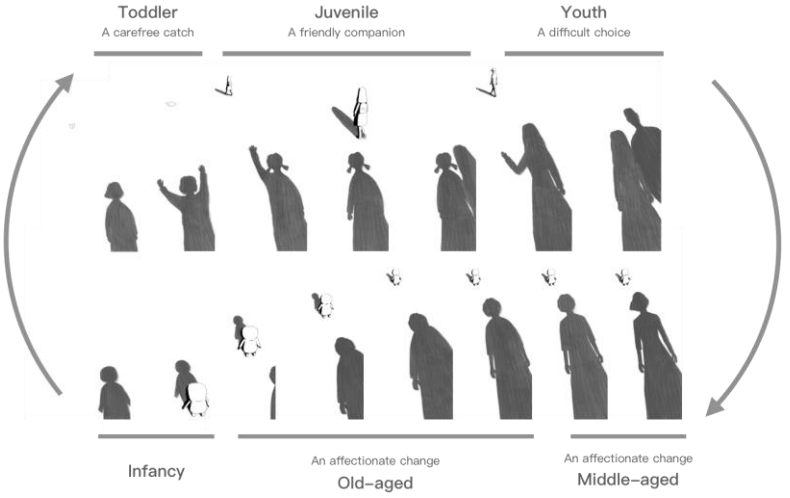

Figure 6. Overview of the story

3. Mapping Behavior and Camera Language

3.1 User behavior in interactive narrative

Created for the 2015 Melbourne Writers Festival and by J. Walter Thompson, Twists & Turns[1] is not only an app but also a case of large-scale, outdoor interactive narrative. This crafty design uses the location, direction, and movement of the user in a large space to deliver a story in which the user can choose the branching plots. To be specific, each street and every corner in Melbourne become twists and turns in the story. This case is an indirect proof that the user's natural behavior serves not only as an inspiration in the design process but also as a chance to develop a new interactive form, which is easy for the user to interact with and for the designer to create. The proxemic in (Ballendat, T. et al, 2010), (Hall, E. T, 1966) and (Vogel, D. et al, 2004) offers us a perspective that the user's natural behavior has both implicit and natural interaction with the installation in physical space. Based on this which many design forms of natural interaction are created for the users. Throughout our research, we take five factors into consideration to explain user behavior: distance, identity, location, direction, and movement. (Figure 7)

1 Twists & Turns, https://andyhincey.com/portfolio/melbourne-writers-festival-twists-turns/

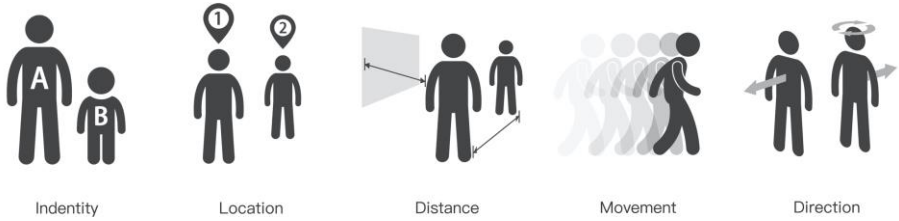

Figure 7. The 5 factors of the user behavior

In this research, we would use the camera language in filmology as the main content for mapping relationships. The camera language provides an opportunity for user behavior, enabling the user to participate in the plot. In traditional film narrative, the camera language includes the camera shot, angle, camera movement, and montage. The only way for the user to understand the camera language is to "watch". However, in this paper, we try to establish a mapping relation between the five aforementioned factors of user behavior and the narrative camera language, which provides the user with a vivid way to understand the story.

3.2 Distance, position and direction of the user VS. Camera shot and angle of the camera

The camera shots of the camera language, in a broad sense, include long shots, full shots, medium shots, and close-ups. Taking narrative patterns into consideration, there is a different system of shots, such as the detail shot, narrative shot, and environment shot. The wider the camera shot, the less the story tells; the closer the camera shot, the more the story expresses. There are also have different camera angle types, such as eye-level shot, low-angle shot, high-angle shot as well as frontal, side, and canted angle. Different combinations of camera shot and angles in traditional film narratives can present different levels of story content for the audience.

At the same time, research on large-display interaction indicates that the user's intention will be stronger as the distance is closer, that mentioned by (Ballendat, T. et al, 2010), (Michelis, D, 2011) and (Vogel, D. et al, 2004). Therefore, we combine the camera shot and angle of narrative language with the distance, position, and direction of the user in the narrative language. The change of user behavior may trigger the transform of camera shot and angle, reinforcing the user's experience.

We have two hypotheses. 1)The mapping between the user's distance and the camera shot: the farther the user keeps from the screen, the wider the camera shot changes, and it means less content in the story. On the contrary, the closer the distance is, the closer the camera shot changes, and it means more content in the story. 2) The position and direction of the user will determine the viewing angle, which has a mapping with the shooting angle. The change of the user's position results in the change of point of view in the story, which can improve the user's experience of story understanding.

3.3 Movement of the user VS. Camera movement and montage of the camera language

Besides the basic cinematography movements, namely zoom, pan, follow, tilt, dolly, truck, pedestal and rack focus, there are two basic forms of motion—mimicry, and spontaneity (table 1). Mimicry indicates the movement of a camera that follows the action of the character or other objects in the story, which makes it easier for users to participate as a character. Spontaneity is more about watching the development of the plot from a third-person point of view.

Table 1. Forms of camera motion

Forms of motion	Moving subject in the film	Camera movement
Mimicry	（1） Object	Stationary
	（2） Background	Synchronous
	（3） Line of sight	Mimic
Spontaneity	（4） Camera	Spontaneous

The camera movements can be combined with the user's physical movements. In *Still Walking*, the user's movement, or rather rotation, is designed to mapping with the "follow" of camera movement. The camera shooting the story moves along as the user continuously pushes the screen forward. Once the user stops, the camera stops as well. What's more, the shooting movement also changes with the speed at which the user pushes the screen.

Also, montage is a major feature of film narrative, using various combinations of images to stimulate emotions and lead the plot to a climax. In the interactive narrative, we attempt to apply the montage to piece together separate sections in different scenes into a continuous whole, for example, similar movement of users and camera shots.

3.4 Identity of the use VS Clue of the story

Table 2. The mapping relation between user behavior and camera language

User behavior	Mapped as	Camera language
Identify	Clue	Clue
Location/Direction/Distance	Point of view	Angle and camera shot
movement	Motion (mimicry, spontaneity）	Camera movement
Above all	Story flow	Montage

In the story, a user makes use of the clues to thread the plots, and in the same way, the interactive installation in the physical space can also use the clues to guide the user to explore the branching plots. And the clues can mapping with the user identity. While in *Still Walking*,

we take the shadow of the user as its clue, and the user can quickly get themselves involved in the story as the protagonist. (table 2)

4. Implementation

Compared with the traditional narrative, the interactive narrative depends more on technology to convey information that facilitates interaction between the user and story. The interactive technology supports tasks such as user behavior perception, data analysis, and information feedback. Interactive technology plays a supporting role in installation design, where we should focus on the theme of the work and procure suitable technology to present information.

4.1 Mock-Up

The technical design has a complicated process, and we have to predict hidden problems that may appear at different stages. Thus, it's necessary to have a mock-up before the formal implementation. We conducted a lot of tests during this phase, such as screen size, animation type, sensors, and main supporting structures.

In this phase, the main content was designing the animation composition. We stuck a 2-squares meter paper on the wall for testing. The first was to measure the distance between the user and the screen. In interaction, the user needs to push the installation to rotate, the distance between them is quite close. If the scene size is too large, it will be distorted and cause the vision burden to users. Therefore, scene composition needs to conform to the comfortable perspective, contain the size and position of shadow, and other characters.

The primary hardware is display device. We compared the effect of projection and LED screen. The projection can be resized, but it needs more space. The advantage of the LED screen is high-definition, but it cannot be resized and much heavier. However, we choose a large-size LED screen in the end, that means we have to consider the stability of the structure during the implementation.

4.2 Interactive technique

The core technique consists of two parts: the hardware and the software. The hardware here is a 65-inch TV screen rotating 360-degrees around a vertical axis and it is the main body of the installation. We have paid great attention to the safety issue and its power supply. For safety concerns, we have added extra weight on both the shaft and base to prevent the screen from falling. It's a steel plate with 1 m diameter and 3 cm thickness. For the supply of electricity, an industrial-grade slip ring allows the transmission of power. And we designed a special structure to break down the tension generated by rotation to ensure the safety of the slip ring. (Figure 8)

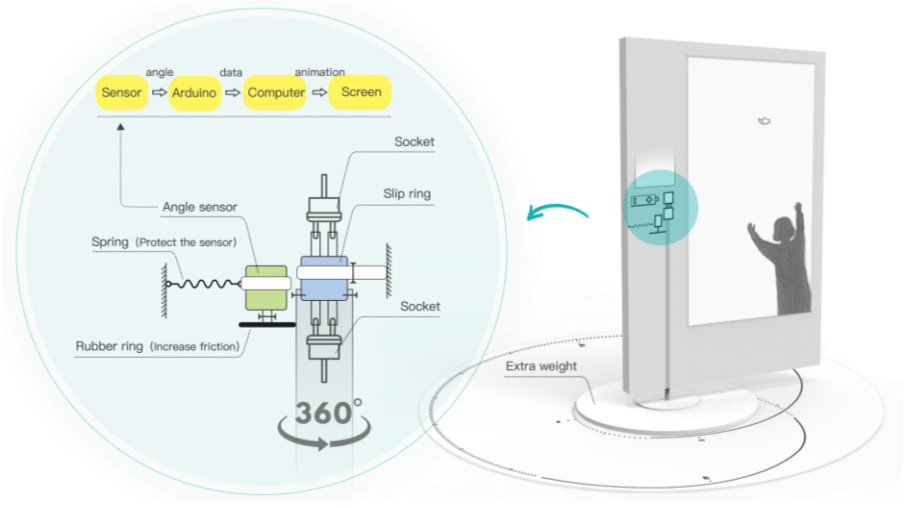

Figure 8. Technological principles in Still Walking

In software design, there are two pieces involved: Angle Sensor is used to register the angle data of rotation and transfer it to computer by Arduino. After that, the Unity3D would render the sequences of animation frames that according to our preset program. (table 3)

Table 3. The numbers of animation frames in each plot.

Age	**1** years old	**4** years old	**8** years old	**18** years old	**30** years old	**90** years old
Age Changes	30	35	34	30	66	
Walk	0	12	35	20	65	
Pause	4	4	4	4	4	4
Wave Hands	0	12	19	20	24	0
Other Characters	0	Butterfly 31	Classmates 10-35	Boy_a 20 Boy_b 22	Baby 4-60	

4.3 Installation

The installation has 1.8m high, 1.5m wide, and covers an area of 3m by 3m. And add ground stickers with age symbols. All surfaces of the installation are painted white to increase interactive immersion. It has a circle motion, the user can stand around and join it anytime and any angle. This display mechanism is quite light and easy to push, however, considering the safety of many young users, we have specially posted a warning banner.

In the interactive narrative, the design process has multiple feedback. Besides the visual feedback, it may get other sensory feedback concerning auditory sense, tactile sense, olfactory sense, and etc. All the feedbacks are using to enriches the users' experience and helps them to enjoy the story.

5. Observation and improvement

During the exhibition, more than thousands of people had experienced the interaction. Even there have audiences posted the video on social networks and watched by millions of people. Most of them would praise the interaction and moved by the story. However, there still have users doubts about the interactive method of the installation if there were no accompanying instructions. It is not easy for the users to figure out that they should interact with the installation through "push". People at different ages respond to the installation in different ways: children from 3 to 10 years old prefer active engagement, but most of them are attracted by the revolving screen and fail to explore it further. Young people from 15 to 25 years old make up their minds on whether or not to take the next step after watching how others may respond first. Middle-aged people over 40 prefer watching to joining. Based on user behavior in the first round, we put up signs "Push slowly" on the frame of the installation, which turns out to be a good reminder for young people and middle-aged people. For the aesthetic, the notice should be designed as part of the installation or put on the ground, rather than putting it up on the frame.

As for the story content design, some users failed to find out the branching plots. Even though they were informed of the interactive method in advance, some users still could not find the proper angle to stop the screen. Learning from this, we need a more attainable angle to trigger the interaction, and users should also have proper guidance on how to interact with the story. Despite all the defects above, the content and form of our story have been recognized by the users. The theme of time and lifespan was clear enough to be consistently understood by the users.

6. Conclusion and Future Work

We have discussed the feasibility of using user behavior as an interactive trigger on the large display. And we prove it can not only help the users to understand the story, but also make the installation more attractive and immersive.

In this case, we discuss the situation of one single person as part of the interactive narrative. However, it can also involve other users. The interaction among them and their user behavior will inevitably change the interactive storytelling.

In addition, we only discuss the interaction in a physical space. The future interactive installation may relate different spaces together, and the users' behavior in different spaces may trigger the interaction mechanism so that they can participate in the story together.

Finally, the interactive narrative method based on user behavior proposed in this paper is only an experimental exploration. It is just the tip of the iceberg in terms of studies on the new media and interactive narrative. We hope this case serves as a good start for further exploration of the relationship between narrative and user behavior.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

An answer to the complex representation of territory. The fertile ground of mnemotopes and design of communication.

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Abstract | The present article aims to be part of the multidisciplinary debate on the relationship between places and memory. It intends to investigate *mnemotopes* as cultural objects of vertical interpretation of the memory-place axis, capable of including the tension between places of memory and memory of places. After the analysis of selected mnemotopes, the article will focus on the important role of Design of Communication as a mediator of territorial past through significant examples of existing artifacts and projects. A mnemotopic communication, founded on geolocalized map-based systems, can interpret the stratification of places and succeed in translating and reactivating their memories. These practices can be useful to understand how the perception of the places of memory changes over time, reflecting on their entrance into contemporaneity. Mnemotopic communication design can be therefore a valid cultural practice and fertile ground for creative entities.

KEYWORDS | MNEMOTOPE, COMMUNICATION DESIGN, MEMORY, CULTURE, TERRITORY

1. Memory activating places: between reality and fiction

Even if memory may look like a phenomenon that mainly concerns temporality, a closer look reveals a constitutive and not accidental relationship with spatiality (Violi, 2014). Memory and spaces are strongly interconnected and every place can be read as a palimpsest of what has occurred in the past. Spatial localization is also one of the most important devices that supports our abilities to remember, and it would be very difficult to describe an event if one did not imagine the place (Halbwachs, 1997). Places not only help to remember, but they can be a mnestic anchorage and can even activate memories.

It is therefore not surprising that, since the times of ancient Greece and Rome, poets, oratories and politicians have relied on mnemonic systems, the *art of memory*, which made it possible to keep in mind vast stores of knowledge. Frances Yates (1993), emphasizes its importance on a communicative level, in historical periods in which, before the invention of printing, orality played a fundamental role. These internal remembrance processes, were founded only on mental activities and abilities, without the aid of devices, and were based on the invention of artificial places of memory, *loci,* set up in the mind and then populated by a series of objects and figures directly connected to the contents to be remembered. The "images were used for the significance of precise contents of knowledge, while the fiction places to give them order and the possibility of being recalled" (Assmann, 2002, p.331). Cicero himself stated that people wishing to train memory must choose certain places and form mental images of the things they wish to remember and locate those images in the produced places (Yates, 1993). The *images agentes*, "activating images", thus generated, ancient mental unions of concepts, images and spaces, were able to reactivate large amounts of information that could be transmitted as a result.

However, considering the ontologically technological nature of humans, which has always made up for their faults and failings, it is not surprising that, with the passage of time, the art of memory became a sort of "intellectual fossil" (Rossi, 2001, p.60), giving way to technically dependent mnemonic systems (Montani, 2017). This definition, without any negative meaning, helps to focus attention on the externalized segments of memory, which, detaching themselves from their own organic essence, enter into relation with inorganic and technological supports, useful to restore not only parts of the individual identity, but also entire collective areas. These types of mnestic practices no longer need to rely on imaginary places, but can count on real places with which establish a relationship of productive interdependence.

The constant externalisation of memory here introduced, together with the one of orientation, still feeds a lively techno-social issue (Montanari, 2019). This vivid debate finds in devices equipped with geolocation systems a focal point. For several years now, in fact, the precise and immediate territorial localization of information and contents is not only a matter of geographical coordinates and goes beyond the cartographic reason, becoming part of a more articulated discourse, negotiated by different disciplinary approaches, which

is generating a convergence between material and immaterial, between corporeal and localized (Montanari, 2019), surface and stratification. The protagonist of this intersection is certainly space, an aggregate of significant substance (Iacoli, 2017), in which reality, perception and elements of the imaginary densely coexist (Soja, 1996). A system of places (Norberg-Schultz, 1996) far from being considered mere positions, which manifest and develop as complex cultural agglomerations, made up of multiform data. The traditional conception of space as an inert void in which objects just exist, has given way to a new vision that considers it active and full (Kern, 1988), and for this reason the most advanced technological devices with geolocation have to deal with the territorial fixation of increasingly composite details. The principles of georeferencing are therefore no longer just a tool at the service of orientation, but become a new substance of expression, capable of producing original languages, contents (Montanari, 2019) and communication modalities.

Starting from these considerations, we can see that the deep and constantly moving flow of data coming from the content/location axis is generating an unexpected itinerary of personal memories punctually linked to the territory. A real underlying archive, not directly perceptible, of passages on places and spatial frequentations that can be interpreted as a generalized tracking of individual memories that enter into a collective narrative. A concrete example is the case of Google Maps, the main outsourced digital orientation tool, which allows to store and subsequently view all the places you have passed through since 2009. This process, most of the time not perceived, creates what we could provocatively call "the map of our life" (Lana, 2019), where you can see all the small movements, but also the long journeys archived with precision day after day. Let's see then how geolocation systems, not considering here the problem of compromised privacy, can become a useful tool for stabilizing memories and movements, which by their very nature would be fluid and difficult to understand, creating a new and original mnestic-spatial substratum of contents directly connected to the territory and fixed on it.

2. Mnemotope or mnemotopes?

Our preliminary discourse revealed the ancestral relationship between humans and geographical environment of which the connection between territory and memory is an integral and constitutive part. This theme, with a historically multidisciplinary vocation, has over the years seen the multiplication of reflections and debates in fields of knowledge such as cultural anthropology, geosemiotics, documentary photography and sociology. Maurice Halbwachs' (1997) considerations are involved in this last context. He strongly supports the importance of the localization of memory, affirming that places and the spatialization of memory play an important role in the stability of collective memory. The spatial substance in which memory is rooted, however, is not inert, but innervated by the thoughts and feelings of the people of the past (Truc, 2011) and the sociologist therefore distinguishes two different mnestic frameworks. On one hand we find the familiar and local past, “made of

objects, houses and stones" (Truc, 2011, p.149), which is therefore extremely vulnerable to the incessant passage of time. On the other hand, there is a more distant and less intimate memory, but consequently more robust and shareable. If, in order to have control of their perceptions, people usually need to get closer to the object, it seems that they need to move away from it to preserve a collective memory (Halbwachs, 2008). We can therefore define the first conceptual framework as "memory of places", a form of private remembrance, precisely linked to details of specific places, preserved in each individual, very exposed to temporal corrosion and subsequent disappearance. The second instead as "places of memory", less rich in details, but certainly more stable because subject to processes of institutionalization and constant symbolization (Truc, 2011).

A response to the singular relationship between places of memory and memory of places, can be conceptually found in the Greek calque mnemotope (Van Rookhuijzen, 2017), used by Jan Assmann (1997) to identify a culturalized object of territorial interpretation. The term lexically incorporates the source of tension highlighted by Halbwachs, making itself a potentially privileged reference point of a complexity hovering between reality and symbol, between individual and collective, between private and institutionalized. Mnemotopes, however, are not only traces, but real apparatuses (Agamben, 2009), mnestic devices that have a preferential relationship with the territories, going beyond the pure testimony and preservation of the past, to contribute to its active and complete reconstruction, as engines of renewed interpretations. These entities are susceptible to multiple formulations according to the specific sensitivities linked to different views, by culture, geographical and temporal determination (Violi, 2014) and this means that any general definition of the term mnemotope is, in most cases, definitely incomplete and sketchy, without recurring to a dynamic reflection on the different places and memories that may constitute a mnemotope.

Consider, for example, a preliminary, but significant, possible distinction. We are facing a proliferation of mnemotopes that we can call "with trauma", the result of a paradigm shift of the very meaning of traumatic event. If in the past trauma was what cannot be spoken of, today it is all that is spoken of (Giglioli, 2011), because the events are increasingly seeking a sense that makes them feel worthy of being transmitted and communicated. The places of traumatic memories are most often institutionalized through monuments and transformed into museums and memorial sites in which coexist, not without difficulty, the mnestic and evocative power immanent to places and the desire to re-propose the invisible, chronologically disappeared, through dissimulation and reconstruction (Assmann, 2002). A particular case is represented by the Museo per la Memoria di Ustica in Bologna, created by the conceptual artist Christian Boltanski and inaugurated in 2007. It did not rise directly on the site of the trauma of which it wants to be testimony but was deliberately build in the city that saw the departure of the plane, then victim of the disaster. The museum is a "complex semiotic object, which interweaves different dimensions of reading: museum, place of historical memory, funeral memorial, work of art, civil and [...] political testimony" (Violi, 2014, p.307) and this peculiarity contributes to demonstrate the mnemotopic stratification, inhabited by intrinsic complexity, which can be manifested in different ways. The strong

dialectic between material and immaterial also emerges, typical of memory itself, which in this case is revealed through an installation that involves space and visitors. The wreckage of the plane has in fact been entirely reconstructed and is located in the center of the museum, all the other objects found have instead been taken out of sight, closed in black boxes that surround the carcass of the aircraft. This operation excludes the physicality and materiality of the objects-relics, of which only the idea remains.

A very different perspective is proposed by the mnemotopes that we can call “without trauma”. Mnestic entities linked to positive aspects of the experience which, even if not pervaded by controversial and conflictual memories, are equally characterized by strong emotional experiences and that can be very important for the construction of cultural spaces of memory (Assmann, 2002). Multifaceted microcosms, they are interdisciplinary intersections in which territory, past, curiosity and technology coexist, often united by a strong commitment to conservation. There are various mnemotopic types without trauma that are not mutually exclusive, but enrich the places with further stratifications that, if codified, allow the development of new models of territorial reading. In this way the mnemotopes without trauma can remove the risk of illegibility of the places of memory generated by the breaking of the interdependence between memory and its living translation. We can identify as first category the cultural mnemotopes, places of geoattraction and subsequent geoaggregation of varied cultural phenomena, usually concentrated in a given time period. Points of transversal creative convergence are phenomena with socio-cultural implications that have characterized entire eras. Think, for example, of the Montparnasse district of Paris, which at the beginning of the 20th century saw the migration of the artistic community from the overcrowded Montmatre. It became what for Apollinaire was the neighborhood of les extravagates, the refuge of beautiful and free gaiety, simplicity, and carelessness (Shattuck, 1971). A circumscribed area where, in few years, collective ateliers multiplied, the hub of avant-garde experimentation, but also cafés, such as La Rotonde or Le Dôme, a spontaneous meeting place for painters such as Amedeo Modigliani and Chaïm Soutine, aesthetes, poets, patrons and art dealers, places animated by an overwhelming expressive vitality.

The same creative energy accompanied the experience of Bar Jamaica, in Brera district of Milan, which after the Second World War, lived the coexistence of important artistic personalities who were regular customers. Not far from the Academy of Fine Arts and the headquarters of Corriere della Sera in via Solferino, the bar became a catalyst for ideas and design meetings between artists, journalists, critics, writers. The white tiles that still cover the walls today, were the setting and stage for significant intellectual exchanges. Piero Manzoni, Luciano Bianciardi, Lucio Fontana passed through here. The famous photographer Ugo Mulas immortalized the bar and its clients in his black and white images, further stratifying its identity with a new photographic memory of reportage, which still today documents the period with great expressive power.

Within the macro-category of cultural mnemotopes, there are *literary mnemotopes*, places where inspirations and intellectual efforts have been concentrated in order to generate remarkable works. They are physical spaces, inhabited and experienced by the protagonists of the history of literature that, if mapped, can highlight original itineraries of intersections between places and ideas that "could only be conceived where they were materially born" (Pagani, 2019, p.11). This typology also includes places narrated by writers particularly rooted in a territory. An example would be Giovanni Testori's novels, concentrated in the streets of Milan's post-war suburbs. Iconic is the case of *Ponte della Ghisolfa*, a railway overpass that the writer has made the protagonist of one of his most famous stories (Testori, 2013). His characters live this common place, relocating it from being a simple passageway and making it an agglomeration of memories in which urban and social, private and collective experiences merge. The Ponte della Ghisolfa has been further stratified over the years thanks to the cinematic and theatrical transpositions of Testori's novels, including the famous movie *Rocco e i suoi fratelli* by Luchino Visconti, emphasizing even more how the mnemotope without trauma can be linked to creative experiences. In fact, this kind of mnestic-spatial entities invites to ask ourselves how much a place and its physical conformation can actually influence the generation of artistic and design contents, moving away from being a stage, but working as an active part in generative processes.

The same question can emerge when talking about *project mnemotopes*, historical places present and rooted in the territory, such as archives, museum-houses and museum-studios, protagonists of the past of industrial design. They represent important research centres, complex collections of materials of relevant scientific interest with great potential for dissemination, often unexpressed. This type of mnememotope is today at the centre of numerous attempts at systematization, useful to make them accessible to the general public. In this context, the "Design Storico" project was launched in 2019. With the support of Fondazione Cariplo and counting on a network of places of memory already active in the territory, it will map the relevant nucleus of Lombardy design activities and promote a series of events and exhibitions that will turn the spotlight on this heritage and on the territorial memory linked to the culture of the project.

Examples such as the one just mentioned, are the demonstration of a current proliferation of attempts to map not the works, but the places where they were thought or realized, itineraries between ideas and territories. These experimental processes demonstrate how much mnemotopes are involved in concrete and funded projects driven by the emerging need for memorialization and spatialization that engages various areas of knowledge.

3. Communication Design: a mnemotopic point of view

Communication design, "a mature discipline with its own identity that merges traditional know-how with technological innovation" (Baule & Quaggiotto, 2015), plays a significant role in this particular multidisciplinary context. In fact, it can deal with the description and

visualization of mnemotopes, but also with their translation, transforming them into articulated communicative systems that introduce individual memories into a wider and collective narrative. This field of knowledge is able to visualize new mnestic itineraries and consequently laying the foundations for real maps of places of memories, but also for innovative mnemotopic archives.

Through the practices of mnemotopic communication design, in fact, we can uncover significant details and contents of the territories by showing them through communicative artifacts with great expressive potential. These products are made up of various types of linguistic formats whose characteristics vary according to the data to be transmitted.

A nodal language for the transmission of mnemotopes, given the ancient relationship between images and memory, is the photo-narrative, a system of visual editing in which a particular spatial storytelling is concentrated. Gabriele Basilico's urban photographic projects are a significant example of this process, in which the relationship between the past and places becomes the object of visual reflection, giving shape to a scenario that borders on the metaphysical and materializes in bright contrasts between light and shadow and in the precise choice of a monumental black and white that returns a city only apparently uninhabited. Roberta Valtorta (2012) writes that his works are sensitive investigations aimed at that complex object that is the city, with which he enters into dialogue as he would with a person, with a living organism, a reading of that urban experience that somehow remains entangled in its architecture. A moment of exchange between photos and geography that evokes a real commitment to memory that makes images able to look into the stratified past of a territory.

Another interesting case is the *Memofilm*[1] used to reconstruct the individual stories of Alzheimer's patients. Twenty minutes of audiovisual materials that help the self-construction of the patient's identity through the editing and subsequent transmission of personal memories. Although this type of artifact is mainly related to clinical and neuroscientific research, memofilms are useful, within our discourse, to identify further formal characteristics for mnemotopic communication. In particular, perceptual aspects emerge as an important channel of remembrance, materializing in audiovisual systems. The union of sounds, static images and videos can be useful in the reactivation of mnestic contents also in the case of memory of places. An experimentation driven by the same objectives as the ones of Memofilm, has been recently designed in Gavirate, in the province of Varese, Lombardy. Before august 2020, in the square in front of the train station, there will be an old telephone booth, a bench and a mailbox, a corner of memories in which Alzheimer's patients

[1] *Memofilm* is an experimental project born in 2008 in Bologna from the joint commitment of Asp (Azienda di Servizi alla persona) and directors from Cineteca. Each memofilm is a twenty-minute video made to measure for patients by drawing on their heritage of affection, loved ones and familiar objects, assembled together in an evocative way. They aim to improve the behavior disorders associated with Alzheimer and other forms of dementia, being a positive part of the therapy. For more info: https://memofilmontheweb.wordpress.com/.

can find fragments of the past world and feel reassured (Landoni, 2020). In this case, the mnemotopic artifact is not a media, is not digital, but is designed and built directly on and *for* the territory, showing the great importance that real places still have in reactivating memory.

Another practical case is “Distretto Testori”, a project of DCxT, the Design of Communication for the territory research group of Politecnico di Milano. The project started after the proclamation of Milan as UNESCO Creative City of Literature in 2017, a recognition that immediately set in motion reflections on the possible mapping of places linked to the literary memories of the city. The work is focused on the works of the aforementioned Giovanni Testori, who described the places where the narratives took place in detail, up to often mentioning the addresses. It was therefore decided to create an original map-based web platform, made up of several different microformats.

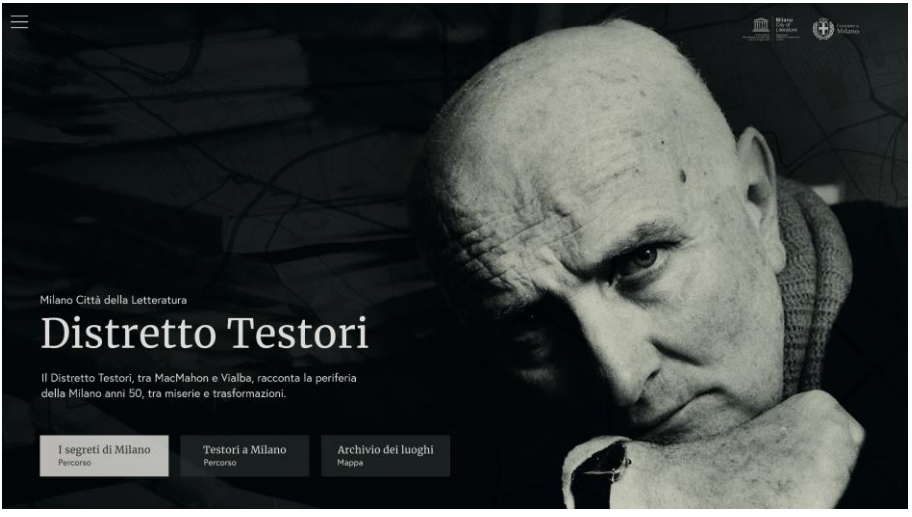

Figure 1. “Distretto Testori” web portal homepage. From this page users can choose between three different digital itineraries: geolocalized photo-storytelling based on the novels, photo documentary of Testori’s life, archive map of Testori’s literary mnemotopes.

Each of them is intended to be part of a collective archive of Testori's literary mnemotopes that can be read at various levels. After an initial and fundamental archival research, which brought to light peculiarities of the memory of the places identified, the most useful and significant materials have been selected. The next phase saw the design of the singular artifacts, eachone as an attempt to concentrate a particular level of the story by crossing literary memories with territorial ones. Three production lines were delineated: a geolocalized photo-storytelling, based on the quotes from the novel, the places described and the imaginary created by the writer, integrated with an interactive structure. A photo-

documentary of Testori's life fixed on a map, realized using original pictures and the author's memoirs. An archive map of Testori's literary mnemotopes, intended to be a new mnestic layer of Milan Creative City of Literature.



Figure 2. "Distretto Testori" web portal. Inside the photo-storytelling section, the user can interactively move in Testori's places, accessing different types of contents (archive photos, quotes, videos).

The project was previewed at the Annual Conference of UNESCO Creative Cities, which took place in Fabriano in June 2019, and is currently being implemented. It aims to become a model for territorial communication systems, capable of offering an innovative approach to the topic of "mnemotopes without trauma" making them more active and easily perceptible, allowing even mute places to speak again.

4. Conclusions

Memory is intimately and indissolubly related to places. The aim here was to outline that this connection can be read through the principle of mnemotope, understood as a culturalized object of territorial interpretation. As emerges from the cases presented in the article, mnemotopes can take many forms, from a bridge in Milan to a café in Paris, but they shared the capability to solve the tension concerning places of memory and memory of places. This duality is not a contradiction (Wüstenberg, 2019), is the way they take a position between the past and the future between individual and collectivity, between temporality and spatiality (Donohoe, 2013).

In this open context, Communication Design can supply tools and methods to design mnemotopes, metabolizing the metamorphic complexity of memory and places. As *images agentes* of the classical mnemonics techniques, could activate in mind a great quantity of memories, mnemotopes, technically dependent on communication design, are now able to interface with territorial past, interpreting its stratification. Considering the examples discussed above, what we have to study is how this discipline recalls the texture of the places (Adams et al., 2001), how it succeeds in translating and galvanizing mnemotopes, how it supports narratives for mnestic territories suffering from communicative insufficiency.

Under this perspective, mnemotopic communication design turns out to be a concrete cultural practice that, avoiding the stereotypes of nostalgic re-enactments, can open the doors to original multidisciplinary discussions on memory-places axis. In sum, designed mnemotopes are able to renew the experience of the territories, and the mnemotopic framework is a useful heuristic tool (Van Rookhuijzen, 2019) for understanding the topography of memory.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Attractive Factors in the Experience of an Online User-supported Learning Platform

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Abstract | The unprecedented growth in information and communication technologies (ICTs) has led to an expansion of online learning. Crowdfunding has been developed to increase self-learning to accelerate advancement in online learning. This research is conducted to understand attractive factors and users' kansei needs in user-supported online course platforms. Broadly, this research is performed in two steps. 1) Exploring user experience with the method of the user journey map (UJM) and the evaluation grid method (EGM). 2) Using a questionnaire design formed according to the map of kansei experience, two types of users, namely, with and without the experience of having taken an online crowdfunding course (experiencers and non-experiencers), are compared using quantification type I. The results show that both types of users highly value expectation as a primarily emotional component before the experience. However, experiencers care more for the sense of achievement during and after finding and taking crowdfunding courses.

KEYWORDS | ONLINE LEARNING, EVALUATION GRID METHOD (EGM), USER JOURNEY MAP (UJM), KANSEI EXPERIENCE

1. Introduction

1.1 Research Background and Motivation

Newly developed and innovative technologies have launched a new wave of a global industry. These new technologies changed the relationship between reality and virtuality and led to the integration of new digital information relationships among things. It is likely that technology will continue to become even more intelligent and indispensable in human life. In response, new learning styles are emerging. Digital instruction, no longer limited by time or space, now provides a range of courses that learners can take that are the product of successful virtual business practices. However, it has not yet been fully established how the needs of learners (users) of the online course platforms can best be met.

In recent years, as science and technology have rapidly developed, and the internet has penetrated ever further into daily life, work, communication and learning have all also changed (Chen, 2000). Demand for human development and professional competence has increased. The development of e-learning has changed how instruction is delivered and received. With technological support, users are less restricted by time and space. Learning, technology and the internet are now linked together, stimulating trends of integrating information into teaching.

According to the Digital Learning Output Survey Report produced by the Industrial Bureau of the Ministry of Economic Affairs of Taiwan, the annual composite growth rate of self-paced e-learning in 2015-2020 is 0.4%, indicating that the market continues to grow. According to the 2016 Digital Learning Output Survey Report, Taiwan's online education market was about 100 billion Taiwan dollars in that year and was expected to grow. The digital learning industry is exhibiting enormous market potential, and digital style is a necessary and essential development direction for contemporary society (Deng, 2017).

Data published by the research institute CB Insights in 2015 indicate that the scale of investment in global educational technology has been rising since 2009. The total investment through 2014 reached 1.866 billion US dollars. In the field of educational technology, the online education platform is a popular investment project, showing that online educational platforms have excellent market potential.

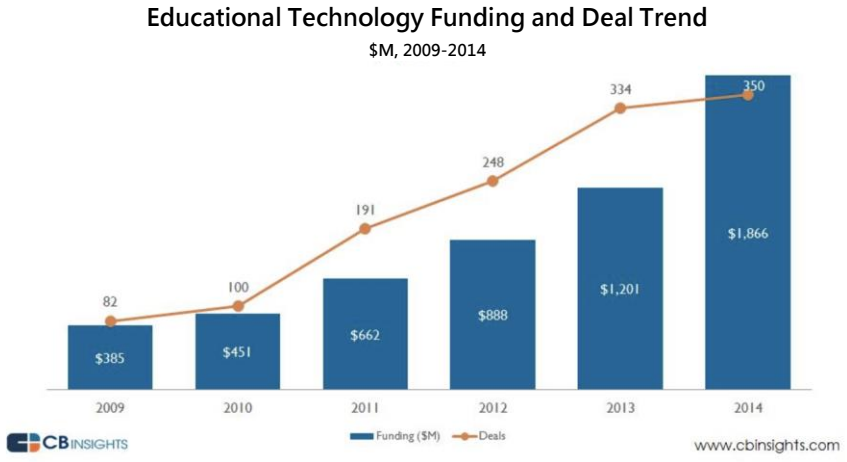

Figure 1. Funding for Educational Technology and Deal Trend (Image source: https://www.cbinsights.com/research/ed-tech-funding-record-2014/)

Along with the public interest of e-learning, the recent trend of crowdfunding is inspiring creative new models of online learning. Crowdfunding provides a web platform for a creative person or organisation to propose ideas and leverages the power of individual funders who can provide relatively small monetary donations to support the proposals (Antonenko, Lee & Kleinheksel, 2014). The user-supported structure for the Taiwanese online school Hahow, which was officially launched in 2015, is a good example. Hahow provides alternative types of experts and instructors with a platform that gives classes to learners for free or for a fee. The courses include subjects like design, business, technology, language and culture. Because learners are free to choose their paths of interest, the threshold for learning is relatively low, and learners are enabled to learn at any time. This enables learners to pursue self-study, self-enhancement and improvement of their professional skills.



Figure 2. Example of a User-supported Online Learning Platform (Image source: https://hahow.in)

Thus, user-supported online learning platforms demonstrate good business prospects and market potential. How to increase learner use of online course platforms and develop an improved learning experience is set as the research goal.

1.2 Purpose of Research

This study explores the factors that attract learners for a user-supported online course platform and assessed user experience with the design perspective of the user journey map (UJM), combined with the Miryoku Engineering, to summarise the users' Kansei experience in online user-supported courses.

To divide participants into those who have experienced the entirety of a course (experiencers) from those who have not (non-experiencers), this study divides interaction with the platform into three phases: before, during and after the course. This will allow the researchers to determine which qualities of the three-stage process are the most attractive elements and which feelings most typify learners at each stage. Using this, we can determine how to ensure the user-supported online course platform is in line with the users' Kansei needs.

2. Literature Review

2.1 User-supported Online Learning Platform

Digital or online learning originated in 1996. It has been defined as part of information and communication technology (Higher Education Funding Council of England, 2005), applied to support learners and improve their learning. This idea forms part of a conception of continuous development and evolution, using a range of understandings and interpretations of information technology. Normark and Cetindamar (2005) interpret digital learning as a system that electronically transmits, manages, supports and supervises education. Specifically, in this context, digital learning is the use of digital teaching technology by learners to break through barriers of time and space and obtain needed information; that is, it represents the opportunity to learn over the internet using computer equipment, regardless of location or time. Urh and Jereb (2014) argue that in digital learning, an essential relationship appears between learning time and average achievement. Today, online learning platforms and web-based applications provide users with direct access to information over the internet (Zamfiroiu & Sbora, 2014).

According to Schwienbacher and Larralde (2010), crowdfunding rests on acts of donation through the internet. In other words, crowdfunding is obtaining necessary funds by tapping a group of individuals rather than any professional institution as such, pooling amounts to support proposed projects or entrepreneurial actions. The crowdfunding platforms that these acts occur on are considered bilateral, meaning that there is an interaction between the two parties (funders and fundraisers) that is coordinated by the platform (Belleflamme et al., 2016). Crowdfunding provides a web platform for individuals or organisations to propose ideas and leverages the power of dispersed funders who provide relatively small monetary amounts to support the proposals (Antonenko, Lee & Kleinheksel, 2014). Such a platform reduces the previous need for cumbersome intermediaries, itself being the transparent intermediary between fundraiser and sponsor (Ordanini et al., 2011), bringing user sponsorship to the significant central position.

2.2 Kansei Experience

Kansei is a Japanese term which by definition from many dictionaries refers to sensitivity, sensibility and feeling (Lokman & Noor, 2006). Kansei deals with people's emotions, feelings and moods. It is about subjective, personal and self-centred experiences (Salem et al., 2009). Kansei also is interpreted as a combination of consumer perceptions, preferences, and attitudes towards objects.
Experience is a combination of various elements, such as the user's outcomes and their internal state (such as emotions, expectations) over time, with a clear beginning and end (Hassenzahl, 2006). User experience is a dynamic and continuous state because it is exposed to a variety of different systems, and the context and circumstances that follow, under changing usage conditions.

2.3 User Journey Map (UJM)

A User Journey Map (UJM) is a way of visually presenting user experience in relation to a product or service in stages. Design tools allow users to make individual assessments and improvements through interactions at every moment in their journey (Bruce Hanington, 2012). UJM is widely used in practical service management and design, including service process and experience. In the field of user experience design, it allows the analysis and understanding of user experience from the user perspective (Mangiaracina et al., 2009). It visualises all possible touchpoints between the user and any product or service (Alves, 2012), and each touchpoint relates to an attitude or feeling held by the user (Samsel, 2013), which enables the systematisation of user experience and design to obtain new customer experiences (Customer Champions Ltd., 2014).

The structure of a UJM varies depending on the designer because their design is not yet standardised (Samsel, 2013), so it can be designed in various ways, depending on the goal and scope of the project. UJM's framework is based on what the user does and can define a grinding process based on the user's daily activities (Heekyung Moon et al., 2016). This study uses UJM to take inventory of and organise the history of the subject's experience of the learning platform.

2.4 Evaluation Grid Method

The evaluation grid method (EGM) is used for personal interviews. It is an important research method for Miryoku Engineering and has been studied by the Japanese scholar Sanui. Kelly (1995) proposed the original method of construction, also known as the square method or the repertory grid method, which was developed to improve respondents' understanding of respondents. This method fundamentally involves in-depth interviews in highly dedicated groups, with the results of the interviews extracted using characteristics of paired-comparison products. The product's psychological cognition, perception and existence value are assessed, and then the traits of the target product are categorised (Kelly, 1955).

This research method is divided into two steps. First, the product is evaluated. The respondent's expression of product preferences enables differences in product to be understood views on the positive and negative aspects of the product to be presented. The second step is to clarify the meaning of the original concept or the understanding of the product through additional questions, then guiding the respondents to analyse their original evaluation concept and their feelings, as well as specific responses. The elements of the product that fascinate the respondent are investigated as well (Sanui, 1986). Using repeated series of questions and answers, the three levels of abstract feeling (upper), original evaluation item (median) and specific conditions (lower) that constitute the median are extracted, a network diagram of a hierarchical evaluation structure is gradually created.

2.5 Quantitative Theory Type I

Hayashi's quantification methods is a unique multi-dimensional data analysis method developed by Chikio Hayashi. Hayashi's Quantitative Theory Type I is a Categorical Multiple Regression Analysis Method, which aims to find independent variables of a specific objective variable and other qualities (1950). Take the approximate (linear) function relationship between the virtual variables of 1 or 0 and use the qualitative regression analysis to determine the intensity of the influence of each "quality project" on the "target variable". Each qualitative project consists of several categories and assumes that all samples are mandatory in each project (and only one of them can be selected), which can be used to establish regression formulas to predict data and event variability. The regression formula can be expressed as a function as follows:

Formula: $y = \sum \beta X + e$

y: Experimental predictive value

β : Class coefficient (weight score)

X: Different categories

e: Random variable

In the quantitative statistical results of category I, the "larger the value" of the Partial Correlation Coefficient indicates that the "category" affects the "target item" to a higher degree. The larger the value of the Multiple Correlation Coefficient (R), the higher the degree of reliability of the analysis.

Table 1. Relationship between R-value and reliability

R	***Reliability***
0.00~0.19	Predicted values exhibit "low" correlation
0.20~0.39	Predicted values are relevant
0.40~0.69	Predicted value exhibit "strong" correlation
0.70~1.00	Predicted value exhibit "very strong" correlation

3. RESEARCH METHODS AND EXPERIMENTAL PLANNING

The primary purpose of this study is to explore the attractive factors and KANSEI experience of the online learning platform. The steps used follow a UJM to check the learner's online course learning experience and combined with the EGM to reinforce attractive factors and

summarise the experience process table. Then, the perceptual experience table is used to design a questionnaire to further compare the needs of the experiencer and non-experiencer with quantitative type I analysis.

3.1 EGM Interview

Before the interviews, an online questionnaire is used to collect the outlines of the in-depth interview and conduct face-to-face EGM interviews. For the EGM interviews, seven highly involved learners on the user-supported online course with the experience of more than three user-supported online courses were selected. The average study time is more than three years. Each person's interview lasted about one hour. To enable the interviewees to focus on the content effectively, an interview outline was prepared and assessed according to the EGM evaluation construction method. The outlines are divided into two parts.

The first part compares the respondents' preferences to the online user-supported platforms they have used. It compares the respondents' feelings and specific answers to capture what factors of online platforms are attractive to the respondents. The second part investigates the respondents' feelings about the use of the online course platform. Therefore, during this interview process, the use of the online user-supported platform is taken to guide the respondents to think about their user experience.

3.2 Mapping the User Journey Map

To organise the learner's Kansei experience, this study uses a UJM as a framework. To compose a UJM, the focus group method is adopted to divide the overall process of using the user-supported online course platform into three phases: before, during and after the course to better understand the user and unify the original evaluation projects (median). Finally, the interviews are performed to establish the overall usage history.

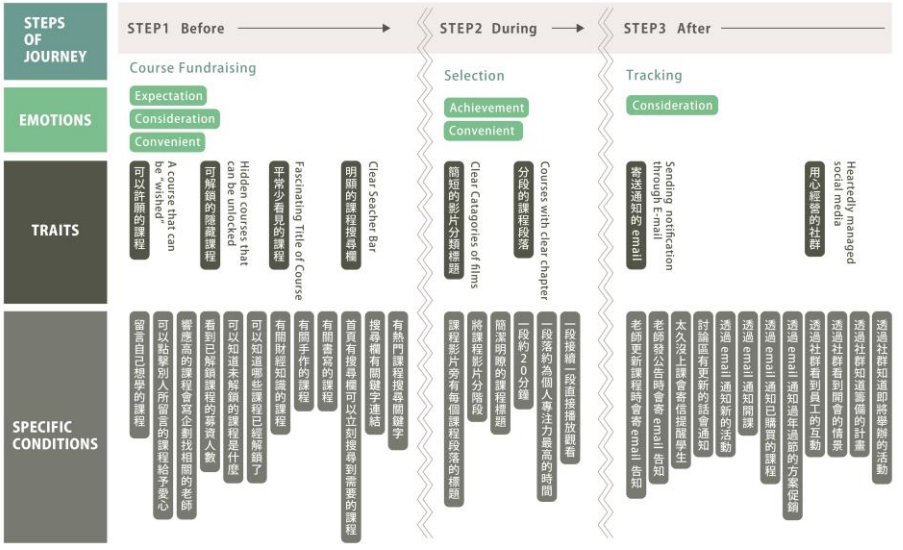

Figure 3. User Journey Map on user-supported online course platform (Simplified version)

3.3 Questionnaire Construction

This study uses a combination of UJM and EGM to draw a Kansei experience process table and to ask about certain subjects in order. The questionnaires are sent to respondents by email.

The questionnaire is divided into four parts. The first part acquires subject information, including their history of taking online user-supported courses. The second, third and fourth sections cover which items are attractive for the before, during and after course stages. Within the attractive factors item, abstract feelings at different stages are used as the central axis, and the corresponding original evaluation objects (median) and specific conditions (lower) are used for the item scores and category selection.

4. ANALYSIS

This study transforms the attractive factors extracted into quantifiable terms, combined with a UJM. The questionnaire and its analysis use quantitative means to understand the learners' most important feelings and attractive factors for the use of a user-supported online course platform, as well as the weighted of relationships among the attractive factors.

A total of 137 questionnaires were collected, of which 132 were valid, with 65 completed by male and 67 completed by the female; 62 respondents had taken courses on an online user-supported platform, and 70 had not. The analysis is divided into two parts:

1. The first part analyses experiencers in relation to the entire process of the use of the online user-supported platform.
2. The second part provides an analysis of the non-experiencer results. Because these learners have never taken a course on an online user-supported platform, and the overall process is not transparent, only the attractive factors before class are analysed to present that preferences and feelings of the non-experiencer.

4.1 Experiencers: Learning Experience Before Class

The combination of EGM and UJM presents the experiencers' three main feelings for the use process before class, which are termed "Security", "Expectation" and "Consideration". The multiple correlation coefficient of Expectation is the highest among all feelings, and 0.782 indicates a very strong correlation.

Table 2. The weighting of "Security" among experiencers before class

Item	Category	Category Points	Partial correlation coefficient
Clear Professionals' Information	Professionals' Experience	0.086	0.461
	Professionals' Background	-0.002	
	Professionals' self-introduction	-1.671	
	Showing Professionals' Facebook	-5.949	
	Provide Professionals' works	0.501	
Clear Introduction of Courses	Provide Course Outline and Planning	0.090	0.108
	Explain what you will learn after taking courses	-0.308	
	List the software and skills needed in the course	0.644	
	Explain who would be suitable for the course	0.106	
Free Trial Class	Provide Free Trial	0.208	0.345
	Know in advance the teaching style of courses	0.644	
	Know in advance the visual effect of teaching video	0.106	
Private information	Do not reveal the lessons you take	-1.018	0.236
	Prevent others from seeing the amount of class taken	-0.638	
	Be able to choose the personal information which you want to present	0.262	

Multiple correlation coefficient: 0.498
Coefficient of Determination: 0.248

The multiple correlation coefficient for Table 1 is 0.498, which indicates that the attractive factor "Security" has a strong correlation with the user-supported online course platform before class. Clear Professionals' Information has the most significant impact on the sense of security, followed by Free Trial Class. The category points indicate that in the Free Trial Class, knowing the teacher's class style in advance has a higher effect on the experiencer and allows the learner to feel the attractiveness of security.

Table 3. The weighting of "Expectation" among experiencers before class

Item	Category	Category Points	Partial correlation coefficient
A course that can be "wished"	Can leave messages to the course you would like to learn	-0.499	0.459
	Can click on others' wishing course to give heart	3.509	
	Invite relevant teachers for taking the course which is highly recommended	-0.359	
Hidden courses that can be unlocked	Show fundraising numbers for unlocked courses	-0.817	0.381
	Show the not unlocked courses	0.437	
	Can know which courses have been unlocked	1.815	
Fascinating Title of Course	Vocabulary for getting started	-3.925	0.582
	Vocabulary for professional	1.573	
	Course name includes "Guaranteed to get started."	0.111	
Reasonable and Preferential Price	Less than two thousand TWD	-0.442	0.504
	Fill in the questionnaire and send a discount coupon	3.538	
	Early Bird Discount	-0.074	

Multiple correlation coefficient: 0.782
Coefficient of Determination: 0.612

Thus, it can be seen that for the experiencer, professional vocabulary has the most substantial positive impact on the attraction of a course title. Therefore, the online user-supported platform can strengthen the description of professional vocabulary for the experiencer in during the course, such that learners can feel the attraction of expectation. In relation to reasonable and preferential prices, the learners reported that filling in a questionnaire and sending a discount coupon was the most attractive feature to them.

Table 4. The weighting of "Consideration" among experiencers before class

Item	Category	Category Points	Partial correlation coefficient
A course that can "be wished"	Can leave messages to the course you would like to learn	0.309	0.334
	Can click on others' wishing course to give heart	1.670	
	Invite relevant teachers for taking the course which is highly recommended	-0.980	
Special Columns of the Course	Learn more about teachers' professional fields	-1.312	0.472
	About the course information	0.928	
	Show the current trend	0.846	
Collectable Courses	Tags of course which can click to collect	-1.135	0.285
	can review the lessons you have collected	0.530	
	Learners could classify their courses' collection	0.698	
Customized learners' course recommendation	Recommend courses you might want to learn	0.126	0.315
	Recommend courses that may be of interest	-0.565	
	Recommend courses you might enjoy	1.831	

Multiple correlation coefficient: 0.572
Coefficient of Determination: 0.327

From the category points, it is clear that for experiencers, information about the course shows the most substantial positive influence in the item of Special columns. Therefore, the user-supported online course platform can include course-related information in its column section and allow learners to learn whether the courses are in line with current trends. For the desired course, learners report that being able to click on another's desired course to give heart would be an attractive trait for them.

4.2 Experiencers: Learning Experience During Class

Through a combination of EGM and UJM, it can be seen that the experiencers have three main feelings during the course: "Practicality", "Consideration" and "Achievement". Among these feelings, the multiple correlation coefficient for inspiring achievement is the highest.

Table 5. The weighting of "Practicality" among experiencers during class

Item	Category	Category Points	Partial correlation coefficient
Multiple learning methods	Learning with videos	0.040	0.220
	Learn by only listening	2.694	
	Learning through slides and texts	-0.410	
Arranged homework	Assignments for each class	0.047	0.150
	Must submit required assignments	1.662	
	Can review the assignment of each class in advance	-0.319	
Platform for timely submission of assignments	Upload assignments instantly	0.310	0.079
	Will know whether the job was uploaded successfully	0.156	
	Will know whether the teacher received the homework	-0.155	
Immediate evaluation	Open-ended question	-0.425	0.233
	2-3 multiple choice test	0.974	
	Ture / False question	0.644	

Multiple correlation coefficient: 0.314
Coefficient of Determination: 0.099

The category shows that for the experiencer, in the item of immediate evaluation, the 2–3 multiple choice has the most substantial positive influence. Therefore, in this item, the user-supported online course platform should incorporate tests with 2–3 multiple choice questions during the course to allow learners to develop a more robust understanding of the content during the study.

Table 6. The weighting of "Consideration" among experiencers during class

Item	Category	Category Points	Partial correlation coefficient
Detailed handout of courses	Can download handout's pdf file online	0.352	0.117
	Provide critical points of the course	-0.213	
	Can fill in the blank to complete the content of the handout	-0.186	
Interactive lesson	The platform mascot will appear as a reminder	0.042	0.022
	The teacher will pretend that someone is in class	-0.095	
	Teachers have a joking tone in the film	0.015	
Hand in homework privately	Teacher gives private feedback in addition	0.334	0.322
	Another platform for hand in homework	0.926	
The complete answer of the assignment	Provide complete answers for assignment	-0.223	0.143
	Provide information relevant to the answer	0.429	
	Provide additional supplementary information related to the answer	-0.302	

Multiple correlation coefficient: 0.334
Coefficient of Determination: 0.111

As shown in Table 5, for the experiencer, within the item, hand in homework privately, another platform to hand in homework is the most influential. An online course platform could incorporate a private platform for handing in homework during the course so that homework is not be made public, which will enhance the learner's willingness to hand it in. In relation to complete answers for the assignment, learners report that the platform should provide information relevant to the answer to be attractive.

Table 7. The weighting of "Achievement" among experiencers during class

Item	Category	Category Points	Partial correlation coefficient
Can see the pages of classmates' homework	Can review the homework submitted by classmates	0.599	0.166
	Can see the teacher's feedback to other students' homework	-0.571	
	Can see the opinions given by the students	-0.191	
Immediate Evaluation	2-3 multiple choice test	0.109	0.229
	Able to quickly jump to the section in the film which related to the answer	-0.223	
	Feedback will be given after the test	0.183	

Multiple correlation coefficient: 0.452
Coefficient of Determination: 0.204

The multiple correlation coefficient reported in Table 6 is 0.452 for the experiencer, indicating that achievement has a strong correlation with the user-supported online course platform during the course. It appears from the partial correlation coefficient that immediate testing has the most significant impact on the sense of achievement.

The category shows that for the experiencer, in relation to immediate evaluation, feedback will be given after the test has the most substantial positive impact. Therefore, in this item, the feedback given after the assessment is most attractive to learners.

4.3 Experiencers: Learning Experience After Class

The combination of EGM and UJM shows that experiencers have two main feelings in the use process after the course, namely "Achievement" and "Affability". Among these, the multiple correlation coefficient for achievement is the highest among all feelings.

Table 8. The weighting of "Achievement" among experiencers after class

Item	Category	Category Points	Partial correlation coefficient
Completion sign of the course videos	After watching the video, you can mark it for record	0.530	0.301
	Automatically mark completed after watching the video	0.036	
	Showing how many times you have watched	-1.270	
Positive feedback	Earn badges by reaching a certain score	-0.838	0.242
	Can collect achievement badges to rank	0.341	
	Achievements unlocked when you reach the course progress	0.356	
Ranking	Provide Taiwan rankings in the course evaluation	-0.522	0.361
	Provide Asian rankings in the course evaluation	-0.383	
	Provide a global ranking in the course evaluation	0.984	
Independent forum	Virtual identity card	0.951	0.182
	Can leave a message to discuss	0.221	
	Can give a response to others by clicking on the mark	0.273	

Multiple correlation coefficient: 0.537
Coefficient of Determination: 0.288

The multiple correlation coefficient in Table 7 is 0.537 for the experiencers, indicating that the achievement has a strong correlation with the user-supported online course platform

after the class. The partial correlation coefficient shows that ranking has the most significant impact on the sense of stimulating a sense of accomplishment, followed by completion sign of the course videos. The category shows that for the experiencer in the ranking results, provide a global ranking in the course evaluation has the most substantial positive influence.

Therefore, for this item, the user-supported online course platform provides a global ranking in the course evaluation, such that the learner can be motivated to complete more courses as a result of the ranking, thereby enhancing the attractiveness of achievement.

Table 9. The weighting of "Affability" among experiencers after class

Item	Category	Category Points	Partial correlation coefficient
Heartedly managed social media	Interactions between employees through social media	0.86	0.421
	Can see the plan in progress through the social media	0.055	
	Know about upcoming events through social media	0.089	
Sending notification email	Notify of new events	-0.048	0.168
	Notify to start a course	0.245	
	Notify of purchased courses	0.089	

Multiple correlation coefficient: 0.423
Coefficient of Determination: 0.179

The multiple correlation coefficient in Table 8 is 0.423 for the experiencers, indicating that affability is strongly correlated with the user-supported online course platform after class. The partial correlation coefficient for personally managed social media demonstrates that it has the most significant influence on the sense of affability. From this category, it can be seen that for the experiencers, in the personally managed social media, interactions between employees through social media are the most influential.

Therefore, in this item, the user-supported online course platform should create more posts on interactions between employees through social media, where learners will see the dynamics of the platform, thereby enhancing the affability.

4.4 Non-Experiencers: Learning Experience Before Class

Because non-experiencers have never taken courses on an online user-supported platform, and the overall process is not transparent, the attractive factors for these users are only analysed for before class, from which we can understand their preferences and feelings.

The combination of EGM and UJM shows that the non-experiencers have two main feelings in the use process before class, namely, "security" and "expectation". The multiple correlation coefficient for expectation is the highest among all feelings, and 0.591 indicates a very strong correlation.

Table 10. Weighting for security of non-experiencers before class

Item	Category	Category Points	Partial correlation coefficient
Clear Professionals' Information	Professionals' Experience	-0.026	0.277
	Professionals' Background	-0.944	
	Professionals' self-introduction	0.342	
	Showing Professionals' Facebook	-1.201	
	Provide Professionals' works	0.526	
Clear Introduction of Courses	Provide Course Outline and Planning	0.217	0.334
	Explain what you will learn after taking courses	0.138	
	List the software and skills needed in the course	-0.022	
	Explain who would be suitable for the course	-0.657	
Free Trial Class	Know in advance the teaching style of courses	0.761	0.334
	Know in advance the visual effect of teaching video	-0.313	
Private information	Do not reveal the lessons you take	0.943	0.342
	Prevent others from seeing the amount of class taken	-1.863	
	Be able to choose the personal information which you want to present	0.157	
Multiple correlation coefficient: 0.519 Coefficient of Determination: 0.269			

The multiple correlation coefficient shown in Table 9 is 0.519 for the non-experiencers, indicating that security has a strong correlation with the user-supported online course platform before class. The partial correlation coefficient shows that private information has the most significant impact on the sense of security, followed by the free trial class and clear introduction of courses.

This shows that the private information, do not show the course you took has the most substantial positive impact. Therefore, for this item, the user-supported online course platform should hide the courses taken by learners when it presents personal information and prevents other users from knowing this, thereby enabling a sense of security.

Table 11. The weighting of "Expectation" among non-experiencers before class

Item	Category	Category Points	Partial correlation coefficient
A course that can be "wished"	Can leave messages to the course you would like to learn	-0.820	0.225
	Can click on others' wishing course to give heart	1.580	
	Invite relevant teachers for taking the course which is highly recommended	0.067	
Hidden courses that can be unlocked	Show fundraising numbers for unlocked courses	-0.889	0.108
	Show the not unlocked courses	0.199	
	Can know which courses have been unlocked	0.138	
Fascinating Title of Course	Vocabulary for getting started	-0.405	0.354
	Vocabulary for professional	1.258	
	Course name includes "Guaranteed to get started."	1.683	
Reasonable and Preferential Price	Less than two thousand TWD	-0.606	0.195
	Fill in the questionnaire and send a discount coupon	0.149	
	Early Bird Discount	0.407	
Special Columns of the Course	Learn more about teachers' professional fields	-0.318	0.469
	About the course information	4.465	
	Show the current trend	-1.465	
Clear Professionals' Information	Professionals' Experience	0.142	0.078
	Professionals' Background	-0.337	
	Professionals' self-introduction	0.462	
Clear Course Introduction Clear Introduction of Courses	Showing Professionals' Facebook	-0.216	0.121
	Provide Professionals' works	-0.458	
	Provide Course Outline and Planning	0.939	
	Explain what you will learn after taking courses	0.513	

Multiple correlation coefficient: 0.591
Coefficient of Determination: 0.349

The multiple correlation coefficient in Table 10 is 0.591 for non-experiencers, indicating that expectation has a strong correlation with the user-supported online course platform before class. The partial correlation coefficient shows that special column of the relevant course has the most significant influence on the sense of expectation, followed by the fascinating course title.

It can be seen that for non-experiencers, in the column for the relevant course, talking about the course information is the most influential. Therefore, user-supported online course platforms should refer to the course information taught by a teacher in the column of the course to allow the learner to better understand the content of the course, increasing expectation for the learner.

5. DISCUSSION AND CONCLUSION

This study explores the attractive factors of a user-supported online course platform through interviews and data analysis. It addresses user experience through the design approach of a UJM, combined with the Miryoku Engineering, to summarise the users' kansei experience in the online user-supported courses.

The above analysis indicates similarities and differences between non-experiencers and experiencers and summarises the learning experience of learners in the stages before, during and after the course to meet learning needs among learners and construct positive learning experiences.

5.1 Learning Experiences for Experiencers and Non-Experiencers Before Class

Multiple correlation coefficients show that for the experiencers and non-experiencers, the highest degree of feeling before class is the sense of "Expectation". The creation of a sense of expectation is significant for learners before class, and it affects whether learners join the learning platform and begin online learning.

Table 12. Sense of Expectation for Experiencers and Non-Experiencers Before Class

partial correlation coefficient	Original Evaluation Item (Median)	
	Experiencer	Non-Experiencer
High	Fascinating Title of Course	Special Columns of the Course
|	Reasonable and Preferential Price	Fascinating Title of Course
Low	Clear Introduction of Courses	A course that can "be wished"

Although both experiencers and non-experiencers focus on expectation before class, they focus on different aspects to create the sense of expectation (See Table 11). According to the partial correlation coefficient, the user-supported online course platform must provide column information on the course before the class to allow non-experiencers to understand the course contents better, thereby increasing their expectation. This can increase their willingness to use the platform to choose and purchase courses. On the other hand, experiencers may wish to have professional vocabulary descriptions to the course names to develop the attraction of expectation and enhance their learning experience.

5.2 Learning Experience of Experiencers in Overall Process

The sense of expectation before class is relevant for the experiencers. Consequently, the creation of a sense of expectation can enhance the learning experience for the experiencer. The highest degree of correlation between abstract feelings during and after the course is the sense of "Achievement". It is clear that the sense of achievement is vital for learners

during and after the course, and it also further affects whether experiencers continue to purchase courses and learn on this online course platform.

Through the analysis, we can know that an online user-supported platform should provide immediate evaluation during the course. Furthermore, giving feedback is more attractive for experiencers.

After courses, the user-supported online course platform can provide a global ranking for the course evaluation, so that learners are motivated to complete due to the ranking, thereby enhancing the motivational achievement. If the sense of achievement is encouraged, the experiencers can thus complete the overall course content, avoiding stopping halfway, to achieve the goal of self-learning online.

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Acknowledgements: We want to thank all those who provided their time to participate in this study.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

City Branding and Fictional Layers: Reading Istanbul through Filming Locations

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Abstract | Triggered by the strategic use of filming locations for city branding, and with a specific focus on Istanbul, this research investigates the role of movies on shaping the image and perception of cities. It aims to consider how a city is depicted in different movies/genres and discuss how such representations affect the traditional image previously constructed through the cultural heritage and the built environment. Through the analysis of twenty-one international movies that were produced between 2000-2020, and were selected out of 3586 movies, the comparison of fictional layers with the traditional tourist attractions of the city were carried out. This research approaches Istanbul's urban visual culture and its many meanings, through Lynch's aspirations for imageability, visibility and legibility in the design and perception of urban environments. The findings underline the influence of the film industry on city's branding processes and perceptions through representations and imaginary layers.

KEYWORDS | FILMING LOCATIONS, CITY IMAGE, CITY BRANDING, FILM-INDUCED TOURISM, PLACEMAKING.

1. Introduction

Recent literature in placemaking underlines the importance of quality of life, amenities, and the social or cultural environment as major drivers for cities (Aubry, Blein, & Vivant, 2015; Glaeser, 2011; Markusen & Schrock, 2006; Storper & Scott, 2009). Placemaking provides tools including hard and soft layers for urban planners, designers and policymakers, for economic development and community enhancement through creative industries. Traditional literature in this field, have always presented hard layers as tangibles that are primarily regarded as the main drivers of economic development. However, recent studies (Bontje & Pethe, 2010; Edmonds, 2017; Murphy, & Redmond, 2009) underline the soft layers that are intangible in nature, and influence the identity of place, such as diversity of population and place, openness, tolerance, networking, as well as cultural and leisure facilities. Highly acclaimed authors, like Ezio Manzini and Richard Florida, consider creativity as a driving force for the global economy and for creation of new jobs, as "human creativity is a limitless resource of human capacity and a real source of economic value-creation" (Florida, 2005, p.4). In Manzini's technical definition of resilient societies "diversity, redundancy and continuous experimentation" are highlighted as the key elements to bring social innovation; nonetheless, he also maintains that such a resilient society "must be a diversified, creative one" (Manzini, 2015, p.21). The film industry as one of the creative industries plays a crucial role in processes of place branding and urban development, particularly by "shaping the physical and cultural renderings of place in material and imaginative ways" (Mathews, 2010, p.171).

Through this perspective, this research explores the ways the cities are depicted in different movies and how these representations affect the traditional image previously constructed through cultural heritage and the built environment. Our approach considers both the hard (tangible) and soft (intangible) layers of placemaking, and explores the pathways to city branding. This conceptualization allows us to discuss the role of visual culture, ranging from instances of art history to very recent movies, in affecting the visitor decisions of experiencing a new city. As the methodology for this approach, literature review, online desk research for data collection and mapping techniques for data processing were used. The case study selection criteria were based on the MasterCard Global Report, and the selection was narrowed down by the cities where the film industry is growing and that were listed in the Globalization and World Cities Research Network. Regarding these two intersecting lists, Istanbul was chosen as the focus of this case study in Turkey.

Therefore, the essential questions raised are as follows:

- How are the filming locations and their narrative values incorporated into perceptive constructions of place and place identity?
- How do the use of World Heritage Sites as filming locations, Istanbul in our case, and television series influence visitor decisions for travelling to such sites? How do they affect the perceptions of the visitors once they are at these locations?

- How do the fictional layers brought about by the film industry add to the processes of city branding?

2. Placemaking for City Branding through Film Industry

Placemaking has many definitions and aspects. It is widely associated with planning principles that focus on spatial interventions, urban design, morphology, public realm, landscape and infrastructural qualities. Silberberg et al. (2013) describes placemaking as a practice to improve the quality of a public place and the lives of its community in tandem. When integrated to practice, placemaking aims at improving public spaces, civic pride, creating connections within the community, cultivating health and safety, enabling social justice, encouraging environmental sustainability, and it brings out the authenticity of place as well as a sense of ownership (Silberberg et al., 2013). It appears as both a design strategy and an urban design practice for improving a neighborhood, city, or region, enabling people to collectively create public spaces by re-imagining and re-inventing (Project for Public Spaces, 2007). As mentioned by Pancholi et al. (2018), a comprehensive understanding of place enables us to rethink the layers in urban environments beyond hard factors. It is significant to consider intangible and soft factors in the form of social processes and interaction, as well as meanings created by the users and their perceptions (Pancholi et al., 2018). In the context of globalization, especially along with the *one-fits-all* strategies that have made every place feel and look the same, the role of physical and cultural assets becomes crucial to create distinctiveness and competitive advantage. The meaningful placemaking decisions and their acceptability have essential roles to play for the image continuity of a city.

The film industry, as one of the creative industries, plays a crucial role in processes of city branding and urban development, particularly by “shaping the physical and cultural renderings of place in material and imaginative ways” (Mathews, 2010, p.171). It provides a viewpoint through the representation, and the place it shows becomes a part of a broader strategy for placemaking, and “something other than what is captured at any present moment” (Mathews, 2010, p.185). Previous studies on a similar topic (Basset et al., 2002; Gasher, 2002; Beeton, 2006; Durmaz et al., 2008) assert that the film industry contributes to the development of cities, and boosts the growth of tourism, through the cultural and heritage quarters, which indicate historical and symbolic context and building types. Countries and cities where the film industry significantly contributes to creative development are listed as City of Film project as part of the wider Creative Cities Network (UCCN) launched by UNESCO. One of the common characteristics of these film cities is the availability of infrastructure related to cinema, such as film studios and filming locations. Durmaz et al. (2008) claim that while the film industry improves global networks, social and economic interactions of creative people, it brings uniqueness and distinctiveness of that place, and enhances its reputation and attractiveness (Durmaz et al., 2008). Their findings,

such as Vancouver's success as a result of geographical proximity to Hollywood, and the government funds, or Auckland's popularity as being the filming location of 'Lord of the Rings' due to its natural assets, prove the essential roles of both hard and soft layers in placemaking through filming locations. Furthermore, the Distillery Historic District in Toronto, which is a famous space for arts and creativity in the city, also became an important resource to the film industry. For the same filming location, Mathews' research (2010) reveals that filming locations affect the way we see the site and show a different, possibly re-inventive, viewpoint "affected by the lure of film" (Mathews, 2010, p.173). Moreover, since the South African film industry is clustered in the metropolitan areas, the city of Cape Town has gained a reputation of being an ideal location for the feature film and commercials market abroad (Visser, 2014).

Considering these recent film city examples, the awareness for the city image and its attractiveness became crucial for tourism-induced development. Recently, there is an increasing attention to city image within local governments and public authorities (Hanna & Rowley, 2011) where they aim to create uniqueness in order to differentiate a city from the others. Ashworth (2009) emphasizes that one of the main objectives of city branding is to improve the quality of public spaces as well as the wellbeing of the residents. Similarly, Baker (2007) mentions that city image and identity are crucial for making a city remarkable among various alternatives. He emphasizes that the aim of city branding is to create a better image for the city in the competitive world with its culture and history. Anholt (2016) also highlights that image and identity of cities closely related to places, safety, public opportunities and other variables affecting the city brand. City branding and image have crucial roles that help to increase the sense of ownership and identity. In this respect, crucial actors can be mainly defined as stakeholders, local people and visitors (Van Gelder, 2011). Dinnie (2010) mentions that city image is important both for city identity and branding. There is a link between the image and attractiveness of a city as a place to travel and invest (Dinnie, 2010) since the city image creates a sense of identity, that attracts attention and makes a place remarkable (2018). The combination of hard and soft infrastructure integrated into historical and cultural amenities and qualities, especially a blend of a symbolic production of culture and vernacular spaces is hard to quantify, and changes with different viewpoints of residents and visitors, however, it presents an alternative dimension to placemaking. Moreover, urban environments in the twenty-first century are rendered attractive with a vast array of graphic objects, ranging from graffiti to billboards, serving many functions. They inform, persuade, entertain and educate, as well as contributing to what Kevin Lynch called the "city image" (1960). Lynch sought to define the image of the city, through identity, structure and meaning, with the concept of "imageability" indicating the qualities of physical objects that give "high probabilities of evoking a strong image in any observer," which he had based on the earlier ideas about the attributes of an artistic object.

Analyzing the city image represented in movies is a complex process involving an understanding of hard and soft layers offered by the placemaking strategies as well as fictional urban experiences presented in movies. The shortfall of *one-fits-all* strategies, the

lack of distinctiveness brought by globalization and also previous examples of film cities reviewed in the literature lead us to consider how these features play a crucial role in terms of city image, as investigated in the case of Istanbul.

3. Analysing Filming Locations: Istanbul as a Backdrop for Movies

In this analysis, the movies that were (partially) filmed in Istanbul were investigated (Table 1). For filming locations in Istanbul, we use the IMDb (Internet Movie Database), the database of information related to films, television programs, home videos, video games, and streaming, as part of our online research. The search enabled us to list 3586 results including documentaries, short movies and so forth that have been filmed in Istanbul. Data collection was conducted in November 2019. We refined our data set based on three criteria: a) the production year that ranges from 2000 to 2020, b) feature film as a type, and c) being produced and/or promoted as an international movie. Turkish movies were excluded from the search. Hence, our focus was limited to eighteen movies filmed in Istanbul. In the following analyses, the movies shot in Istanbul were listed and reviewed for the exact locations and how they depicted Istanbul. Later, the two spatial distribution maps, 1) Top Tourist Attractions Map and 2) Filming Locations Map, given below as Figure 1 and 2, were created.

The movies analyzed for this particular study that are filmed in a certain period of time (2000-2020) have wide variations in terms of their genres including; documentary, drama, romance, mystery, action, adventure, comedy, thriller and crime. Though recent research indicates the significance of certain genres for creating the touristic appeal of different types of destinations, and indicates that the role of movie genres define the appropriateness of movies for promoting such destinations, for the case of Istanbul, it can be said that this theory did not match the expected results. Istanbul is mostly depicted in action movies, which does not greatly appeal to city tourists (Redondo, 2012, p.724). The Basilica Cistern has the highest score in terms of the distribution of the filming locations in Istanbul. The Basilica Cistern was used five times as a filming location in the *Accidental Spy* (2001), *The International* (2009), *Skyfall* (2012), *The Water Diviner* (2014) and *Inferno* (2016). Following that, Grand Bazaar, Süleymaniye Mosque and Hagia Sophia share the second rank by appearing in four different movies.

Table 1. Table 1. Analysis of Filming Locations in Istanbul

Movies*	Year	Genre	Filming Locations
In July	2000	Adventure, Comedy, Romance	Ortaköy Mosque
The Accidental Spy	2001	Action, Comedy, Crime, Mystery	Hagia Sophia Ziya Kalkavan Vocational School

			Grand Bazaar The Basilica Cistern Pera Palas Hagia Irene Çemberlitaş Turkish Bath
A Touch of Spice (Politiki Kouzina)	2003	Comedy, Drama	Galata Tower Pierre Loti Four Seasons Hotel Istanbul at Sultanahmet Galata Bridge Tophane Mosque Haydarpaşa Station Hagia Sophia Kadıköy Neighbourhood Sirkeci Neighbourhood Church of St. Mary of the Mongols
Head-on	2004	Drama, Romance	The Bosphorus The Blue Mosque Grand Hotel de Londres
Crossing The Bridge: The Sound of Istanbul	2005	Documentary	Bosphorus Bridge Maiden's Tower Süleymaniye Mosque Grand Hotel de Londres
American Assassin	2007	Action, Thriller	Kennedy Street Galata Bridge Eminönü District Beyoğlu District Fatih District
The Edge of Heaven	2007	Drama	Atatürk Airport Zincirlikuyu District Tarlabaşı District Kadıköy District Taksim Square German Consulate, Gümüşsuyu Faik Paşa Street, Beyoğlu Grand Hotel de Londres
The International	2009	Action, Crime, Drama, Mystery, Thriller	Süleymaniye Mosque The Basilica Cistern
Tinker, Tailor, Soldier, Spy	2011	Drama, Mystery, Thriller	Istiklal Avenue Karaköy Neighbourhood Taksim Neighbourhood

Argo	2012	Biography, Drama, Thriller	The Grand Bazaar Bakırköy Neighbourhood Hagia Sophia
Skyfall	2012	Action, Adventure, Thriller	Eminönü Square Grand Bazaar The Basilica Cistern
Taken, II	2012	Action, Thriller	New Mosque The Grand Bazaar Çemberlitaş Turkish Bath Galata Bridge Legacy Ottoman Hotel
The Water Diviner	2014	Drama, History, War	The Blue Mosque The Basilica Cistern Süleymaniye Mosque
The Two Faces of January	2014	Romance, Thriller	The Grand Bazaar Istanbul University Istanbul Transport Museum (Rahmi K. Museum)
Innocence of Memories	2015	Documentary, Drama	Museum of Innocence Istiklal Avenue Golden Horn Süleymaniye Mosque
Inferno	2016	Action, Crime, Drama, Mystery	The Grand Bazaar The Basilica Cistern Hagia Sophia Topkapı Palace Kennedy Avenue Istanbul University Beyoğlu Neighbourhood Atatürk Airport The Blue Mosque
The Murder on the Orient Express	2017	Crime, Drama, Mystery	Sirkeci Railway Station
Charlie's Angels	2019	Action, Adventure, Comedy	Eminönü Neighbourhood Fatih Neighbourhood The Grand Bazaar The Blue Mosque Veliefendi Race Course

* The following movies have been excluded from the analyses due to the lack of identifiable and sortable data: Iranian movie Hatred (2012), American movies Hitman (2007) and The Rebound (2009).

The locational analysis presents how the above mentioned movies are distributed and their filming locations created attractions within the city. Istanbul Top Tourist Attractions Map (Figure 1) shows that firstly the “sights and landmarks”, and secondly the “museums” category of Trip Advisor, attract most of the tourists in Istanbul. As we reconsider the top tourist attractions correspondingly with the spatial distribution of the filming locations - Istanbul Filming Locations Map (Figure 2) the analysis highlights three major concentrations: 1) Bosphorus Bridge and its adjacent neighborhoods, 2) Historic Peninsula including the most famous landmarks such as the Topkapı Palace, Basilica Cistern, Grand Bazaar, and Süleymaniye Mosque, 3) Taksim and Galata area. In general, the filming locations coincide with the the spatial distribution of the top tourist attractions, and they spread through the entire metropolis, nevertheless, they expand on to many other subcenters and neighbourhoods to add a glimpse of everyday life of inhabitants on to film.

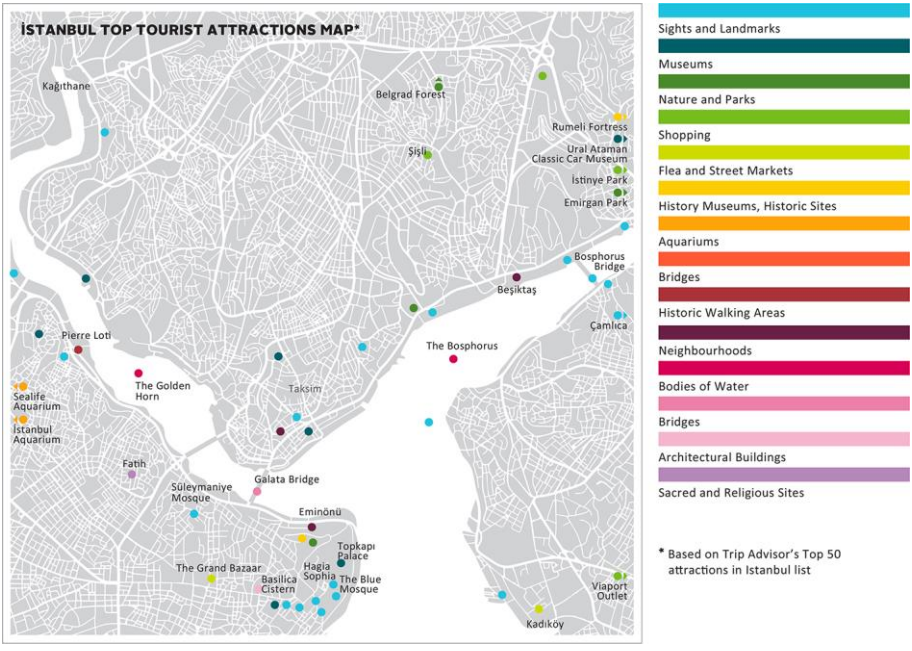

Figure 1. Map of Top Tourist Attractions in Istanbul.

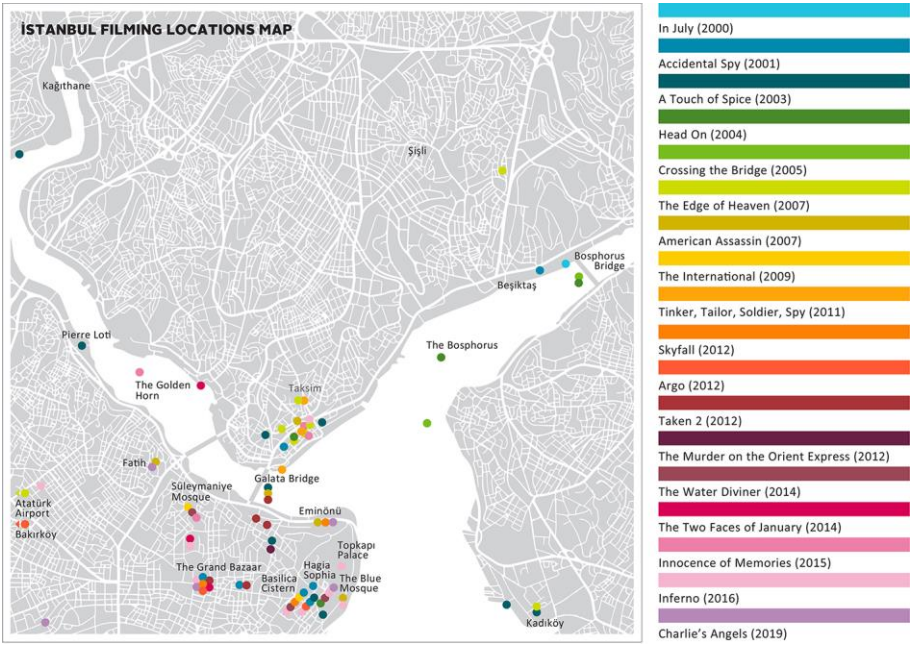

Figure 2. Map of Filming Locations in Istanbul.

4. Discussion

When we consider the perspective of visual culture, with its strong emphasis on cultural identity and its "weaker" sense of the visual that also considers social factors (Barnard, 2001), the scope of objects, devices or experiences that contribute towards an understanding of the city image is very wide. Urban visual culture emphasizes the products of advertising by foregrounding its relationship to architecture and design (Ward, 2001). This partial perspective takes a narrow view of design for visual communication in urban contexts, expanding the need for the further consideration of what urban visual culture might be. Through such an attempt, we can consider the role of movies in enhancing the city image, and the intricate relation between the filming locations and the fictional worlds that they portray through the use of actual urban settings. This relationship highlights the existence of an imaginary layer, or yet another soft factor of placemaking, that works through the visual perception of the inhabitants of an urban settlement, its visitors and the audiences of such movies.

This analysis provides an introductory exploration of Istanbul's urban visual culture and its many meanings, in relation to Lynch's aspiration for imageability, visibility and legibility in the design and perception of urban environments. Barnard (2001) had divided research and

theoretical work in visual culture into a “strong” sense, which focuses on the cultural production of values and identities, and a “weak” sense, which focuses on the visual aspects of contemporary culture, and the plethora of visual images and media available in the society (Serafini, 2017, p.8). Juxtaposing this distinction with the soft/hard factors suggested by earlier placemaking theories, this research aims to assess the appropriateness of movies for the promotion of tourist destinations, while it also undertakes the evolution of Istanbul’s city image from an oriental, imperial capital to a modern day, metropolitan center of attraction.

The difference lies in a Lefevbrian reproduction/representation of space in two different contexts: The oriental image of Istanbul, belongs to an era in which an image was conveyed and conserved through the visual arts, mainly oil paintings. As John Berger would emphasize, beyond being a demonstration of the virtuosity of an artist, these works of arts were also channels of communication that conveyed “owner’s wealth and habitual style of living,” as well as “what gold or money could buy” (Berger, 1972, p.131-132). Through depictions of the palaces, the Turkish baths and the harems, the wealth of impressive sultans, in older mediums of art, Istanbul was inscribed as the oriental dream, fascinating, ephemeral and unattainable. This image was maintained in earlier depictions of Istanbul in movies, such as *Topkapı* (1964) and the earliest James Bond movie to set scene in Istanbul, *From Russia with Love* (1963), and furthermore, it was fortified and engraved, so much that every time an oriental detail was needed in a storyline, the scene would jumpcut to a silhouette from the Bosphorus with the minarets of monumental mosques reaching to the sky, or a crowded scene of prayer in the patios of the Blue Mosque, all enhanced with a fade in to the sound of ‘ezan’- call to prayer.



Figure 3. Daniela Bianchi and Sean Connery in ‘From Russia With Love’ (1963) with the majestic Suleymaniye Mosque in the background, crowning the oriental city image.

However, in today's world, the way cities are depicted in movies stands more in line with the social media images, creating the sense and immediacy of everyday life. Though intertwined with a fictional plot, at least on the visual level, film scenes create the sense of attainability of the depicted experiences, locations and characters. In the sense of characters, this process is the well-known phenomena of identification and parasocial interaction with the hero/protagonist, yet in the sense of experiences, this phenomenon can trigger a tourist attraction value through filming locations. The sense of reality that only films can achieve, creates a feeling of proximity in the viewer, who in turn would come to think that visiting the same location could be an imminent way of *owning* the experience portrayed as well.

This research, by taking into account only the movies produced between 2000-2020, aims at understanding the transition from the imperial capital, to the contemporary metropolis. Based on the impact of movies and TV series on the global image of Istanbul, a city of outstanding universal value, we aim to compare the geographical locations of the filming locations with the map of top tourist attractions of the city, as identified by the most popular site for touristic advice, Trip Advisor, ranking number 270 in all web sites and number 1 in tourist advice, in terms of global internet engagement according to Alexa review.

Such comparison, juxtaposed with an analysis of the tourist poses tagged with #Istanbul on Instagram, brings about a new culture that is being designed through our contemporary, narcissistic culture, fueled by the social media: On online social networks, or mobile applications like *Facebook*, *Foursquare* or *Instagram*, capitalist competition dictates the communication of what is being consumed via digital images on a daily basis. This race of sharing triggers constant comparison and further competition. Yet social status today is determined by these images – digital images that lack even "the status and power of being a *proper* image" (Baudrillard, 2009).

Similar to the way that the oil paintings have inspired advertising photography, currently, advertising photography influences our social media photographs. Publicity, by showing us that people have "apparently been transformed" through the products that they have consumed, persuades us to believe that such transformation is possible. The state of being envied is what constitutes glamour. And publicity is the process of manufacturing glamour (Berger, 1972). This process of identification and envy is the driver of the social media/influencer impact, hence the correlation between the impact of movie scenes as they transform into social media posts. A regular tourist pose in front of a monument is no longer enough to trigger the envy, an imitation of the movie scene, through seven veils of fantasy, ignites the desire to *possess* that experience and make it one's *own*.



Figure 4. Tourist pose on Instagram, resembling scenes from James Bond movies.



Figure 5. Film still from the movie Skyfall (2012). Steve Turner, posing for his article on following James Bond's footsteps in Istanbul and an Instagram user imitating James Bond on the rooftops of the Grand Bazaar.

Interestingly, this shift in the oriental image of Istanbul has created a much bigger impact in the Orient, rather than the Occident, with incredible rises in the numbers of visitors from the Arabic peninsula in the last decade. Among other regions, the visitors from Middle East countries rose up to 22,6%, in 2019 (Istanbul İl Kültür ve Turizm Müdürlüğü, 2019). This rise, obviously, does not only depend on the international movies filmed in Istanbul, but also on the soft power attained through the popularity of the Turkish TV series in the Middle East, as well as in many other parts of the world. Yet, this phenomenon can be read in many different ways: On the one hand, the Turkish interpretation of Islam, which has always been relatively progressive than that of the Arabic countries, allows for a more "Western" lifestyle that creates an "attainable attractive" experience for the audiences in these countries.

5. Conclusion

Cities as filming locations, create imaginary interfaces for the viewers, and different perspectives for the people who experience the city and for the tourists who would like to experience it. In this regard, city branding provides opportunities to create distinctive qualities to represent and to narrate a place, to embrace the stories of those who shaped the place, to generate the meaning of time in a place. The main approach is to consider both the hard (tangible) and soft (intangible) layers of placemaking while exploring the pathways of city branding. This research investigates the ways cities are represented in different movies and its reflections on the cultural heritage and the built environment. It allows us to reconsider the importance of visual culture and its reflections for the decisions of possible visitors in terms of experiencing the city. Our case study for the city of Istanbul, Turkey, presents a long history of being a site of cultural assets that are significantly depicted in many movies for decades.

The analyses of filming locations in Istanbul illustrate different genres filmed in different locations. Although genres vary, the main representations of Istanbul do not differ, it remains as it is in many ways. Directors of the movies do not introduce their own interpretations of Istanbul, so the places in these movies are used as they are, with their genuine identities. This mainly shows us that Istanbul has a unique and strong city image with all its rich historical, cultural and vibrant qualities. Nonetheless, the soft power exerted by both the movies and the TV series, by strengthening a less Oriental image, increases the value of the fantasy in the other direction as well: Once the orientalist dream of the West, Istanbul somehow becomes an occidental dream of the East, as an eternal bridge between the two, in political, geographical and cultural terms. While most related research approaches the analysis of filming locations from their contribution to the placemaking, city branding and destination marketing processes, this research takes another path to determine the role of movies in the evolution of Istanbul image, mostly in the Western eye. Though such evolution would eventually influence the way the city is perceived and have an impact in the above mentioned processes, shifting the focus from the Süleymaniye Mosque to Grand Bazaar, from the religious emphasis to the urban daily life, create bigger ripples in the overall perception of Istanbul as an orientalist fantasy, than it does in its touristic charm. Our findings also prove that the clustering of filming in the city reflects the cultural assets existing in the urban fabric.

The role of city branding and city image is a crucial aspect of upgrading the investment oriented city attractiveness. In this respect, attention should be paid to the cities attractiveness for investment and it is clear that, positive city image leads to create new job opportunities as well as innovative design and service solutions for cities. The practical implications of this study refers to city branding as a part of a cultural planning approach to the city by being a matter of cultural governance and comprehensive mapping of a city's cultural assets. These assets would have a considerable impact on placemaking, and policy implication needs to address the visual culture to construct an identity of distinction. Policy

makers should consider these (filming) locations in accordance with the current and prospective goals and objectives for Istanbul, particularly related to cultural planning and tourism. Future studies might approach this phenomenon from a more quantitative perspective, and explore how these locations contribute to tourism development and social engagement as well as the ways in which they reshaped the place.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Co-Design processes for the inclusiveness of Rome's temporary communities

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Abstract | Social complexity is placing the role of Design in rethinking sociability in cities at the center of the debate. In contexts such as Rome - where urban communities are formed that share traditions, habits and ideas (Weber, 2005) - there is a need to build a change aimed at inclusion and integration. In fact, although these communities have managed to make some places their own, they still suffer from the lack of favorable environments for social innovation (Manzini, 2015).
From 2015 to 2018, the Research investigated this context by putting design good practices in contact with the temporary communities of Rome. Design becomes infrastructure (Morelli and Sbordone, 2018) to support initiatives that have developed products and services through Co-Design and Design Thinking approaches (Liedtka, 2018), resulting in a series of operations that have highlighted the role of Research in Design in connecting universities, citizens and municipalities.

KEYWORDS | INCLUSIVENESS, SOCIAL INNOVATION, TEMPORARY COMMUNITIES, CO-DESIGN, DESIGN THINKING

1. The city of Rome as a participatory Research field

The current political and economic condition, based on Capitalism and on the Neoliberal model, (Kempf, 2013; Klein, 2014) is progressively transforming the social models as known so far. This fact is favoring the social model of the commons, which veer towards a post-capitalist economy (Ostrom, 1990; Dardot & Laval, 2014; Hardt & Negri, 2014). Capitalism thus becomes both the cause of the Capitalistic model fall and the original point of the collaborative production growth that spontaneously came through network technology (Rifkin, 2014). In fact, technology has facilitated the formation of this model since it has given the possibility, quoting Mason (2016), to the educated and connected human being to act as "a new agent of change in history" (p. Xvii), tracing the footsteps of Cosmopolitan Localism (Manzini, 2014) and the interregional and planetary networking of place-based communities that share knowledge, technology and resources. This is contributing in make Design an autonomous discipline capable of "building the common as a design space" (Escobar, p. 186), thus overturning its capitalist and modernist heritage.

However, according to Fry (2015), lots of leaders and decision makers do not understand this quality of Design, making the communication work of academics and professionals more complex than it could be. The reflection on the methods and approaches that Design can adopt towards the different living communities starts from the hypothesis of Manzini (2018) that a virtuous circle can be triggered between social planning and "Politics" [1], in a set of various experiences that produce a change in the system where they operate (Transit, 2017). Consequently, designers would have to transform themselves into politicized agents of change (Fry, 2010) to overturn many deeply rooted political, economic, ideological and technological foundations. Self-generated movements provide practices and models that, with a view to preserving their social identity, must be able to be protected and cultivated by generating public services or even public policy (Selloni, 2018). In this sense, Design and Research are involved in the construction of co-design processes aimed to produce different outputs, depending on the reference context, in a form of social activism that develops a counter-narrative for social innovation (Fuad-Luke , 2009). Thus, a sort of Design activism develops that, according to Thorpe (2012), can become a tool in the public domain and a cultural, spatial and governmental tool.

Speaking of Commons, it is necessary to understand how the role of the designer, in a context of distributed and collaborative making, can design, modify and adapt products (like in the case of hacking design) and make them available to everyone.

Research tries to investigate the collaborative capacity of Design and its tools in a social context where the citizen is the core, but they have not been able to aggregate in a consistent form. This specific context is defined by the temporary communities of the city of Rome, where groups of people set up activities related to their interests or simply to their culture.

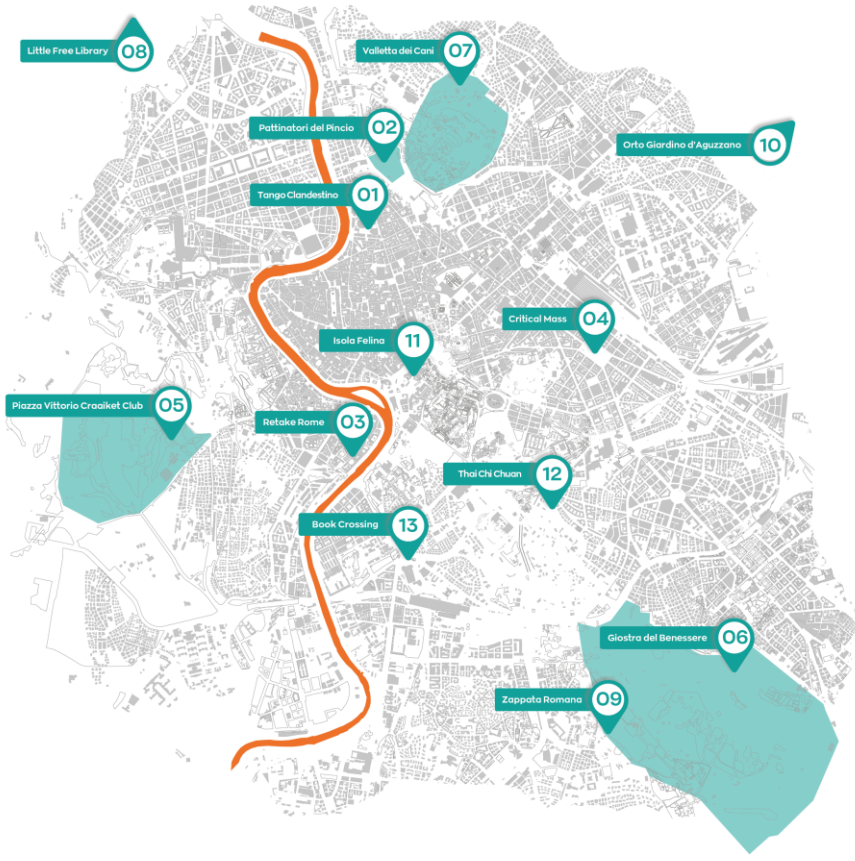

Figure 1. Mapping of the temporary communities involved by Design IN' Rome.

In this sense, Rome becomes an ideal field of investigation. Over the years, the City has in fact became a multicultural and multiethnic city. According to the 2015 CENSIS report, Rome has considerably increased its reception, as shown by the numbers that have described an increase in the number of foreigners registered in the registry, around + 115% compared to the same census in 2000 (Censis, 2015). This fact has consequently increased the constitution of temporary communities thus becoming an adequate experimentation field for this Research.

2. Design as a tool for the Capitoline temporary communities

According to a World Bank report (2013), social inclusion is the process of improving the conditions for the participation of individuals and groups in society, improving their skills, opportunities and dignity regardless of their identity. In other words, a given society becomes inclusive when all individuals are valued. It is in the face of situations of marginalization and exclusion that social innovation initiatives make sense in offering new alternatives. In recent years, this theme of social innovation has become an integral part of the vocabulary of urban regeneration, where space plays a radical role in the production of this innovation (Ostanel, 2017). Savoldi (2006) associates this inclination with a common distrust of institutions due to a reduction in forms of public investment.

Cellamare (2019) considers Rome as a paradigmatic case of this great process of retreat of the welfare state by insisting on the widespread and consolidated presence of alternative cultures and social experiences. Rome, as a "self-produced city" (S.M.U.R, 2014), constitutes an interesting context for developing reflections on redevelopment processes and forms of self-organization seen as a structural fact of contemporary cities.

In Rome, multicultural and cosmopolitan city, numerous urban realities and particular local actions were born; different forms of appropriation and reappropriation of the city and collective and organized urban practices, as forms of latent planning, in search of new conditions of mutualism. Public space and common goods - in a context that thrives on the delicate relationship between lawful and illegal - become informal places of change and innovation. Urban regeneration is a panacea for those solutions from above which over time have proved to be inefficient or deleterious, generating on the other hand a commodification of social life (Cellamare, 2018) which is accompanied by processes of gentrification (Semi, 2015) and disintegration of local cultures (Uitermark et al., 2007).

The Design'IN Rome workshop series promoted by the Faculty of Architecture of the University of Rome Sapienza has worked in close relationship with local communities on research-action projects, co-designing in different areas and neighborhoods of the capital. Design'IN Rome started from the Roman context, where urban communities share traditions, habits and ideas (Weber, 2005) with the aim of involving local communities in the design of specific solutions by exploiting technological discoveries (Smart objects and IoT) to improve livability in their areas.

From the assumptions thus presented, Design'IN Rome proposed to apply a series of design-driven methodologies for the design of solutions, including technologically advanced, for and with 13 temporary communities in Rome (fig. 1); the Aguzzano Garden, the agricultural community of Zappata Romana, the Little Free Library initiative, the Book Crossing community, the Thai Chi Chuan association, the Pattatatori del Pincio, the Critical Mass collective, the non-profit organization Retake Rome, the Isola Felina cat colony, the Valletta dei Cani municipal dog park, the independent outdoor gym Giostra del Benessere, the

independent sports community Cricket in villa Doria Pamphili and the collective of the flashmob Tango Clandestino initiative. 3 designers were assigned alongside each community

In a highly self-organized context such as that of Rome, design becomes a useful tool for understanding and developing social innovation by mediating public and private needs (Manzini, 2015). The city becomes a sort of laboratory for the development of ideas, products and services starting from the bottom and to support new behaviors and ways of aggregation to promote different forms of more sustainable urban life (both at an environmental and social level).

3. Ethnography, Experience and Speculation: action strategies for social innovation

Designers operated on three specific design levels, which guided the projects through three stages of evolution; a first phase of investigation, analytical and taxonomical of the context and of the assigned community, a second phase of experimentation and prototyping of project proposals, and a final phase of finalizing the new narratives established and project perspectives (fig. 2). Each design phase has been divided as follow.

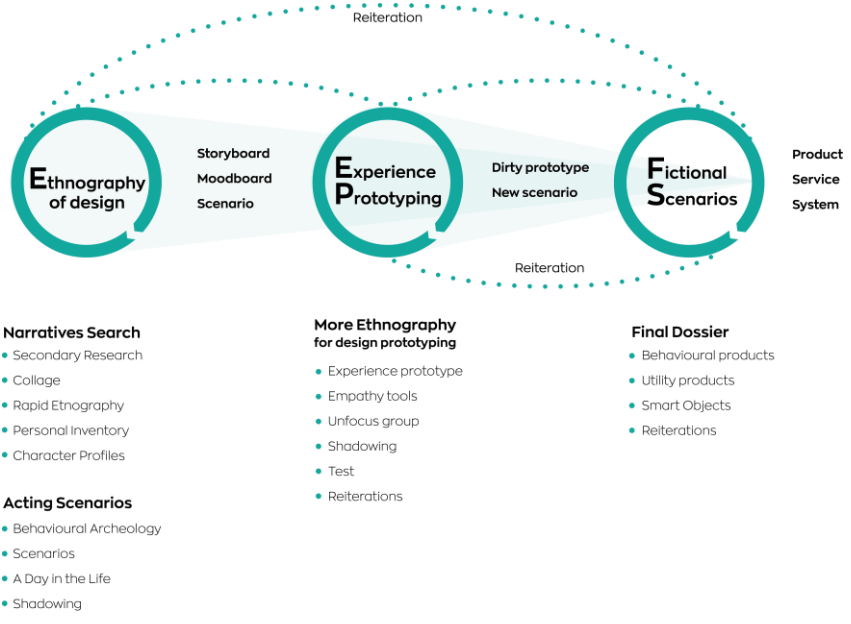

Figure 2. Schematic of the design methodologies applied during the Design IN' Rome laboratory.

3.1 Ethnography of Design

In the first phase the designers identify the narratives of the communities by adopting a restricted series of methodologies aimed at the ethnographic study by looking, interviewing and experimenting, developing a scenario that is as precise as possible. A man-on-the-street interview may not be immediately effective; therefore, a first phase of Desk Research is useful for the designer to prefigure timely and relevant questions for the reference community. People, places, actions and behaviors are then systematized by describing a general scenario of the community and highlighting the flows of interactions with objects and people, where micro-gestures become evidence of a lifestyle that reveals perceptions and values. The ethnographic study of the dynamics, rituals and meanings related to activities and artifacts results in intelligible storyboards, concept maps, behavioral archetypes (or personas) and moodboards composed of pre-existing artifacts.

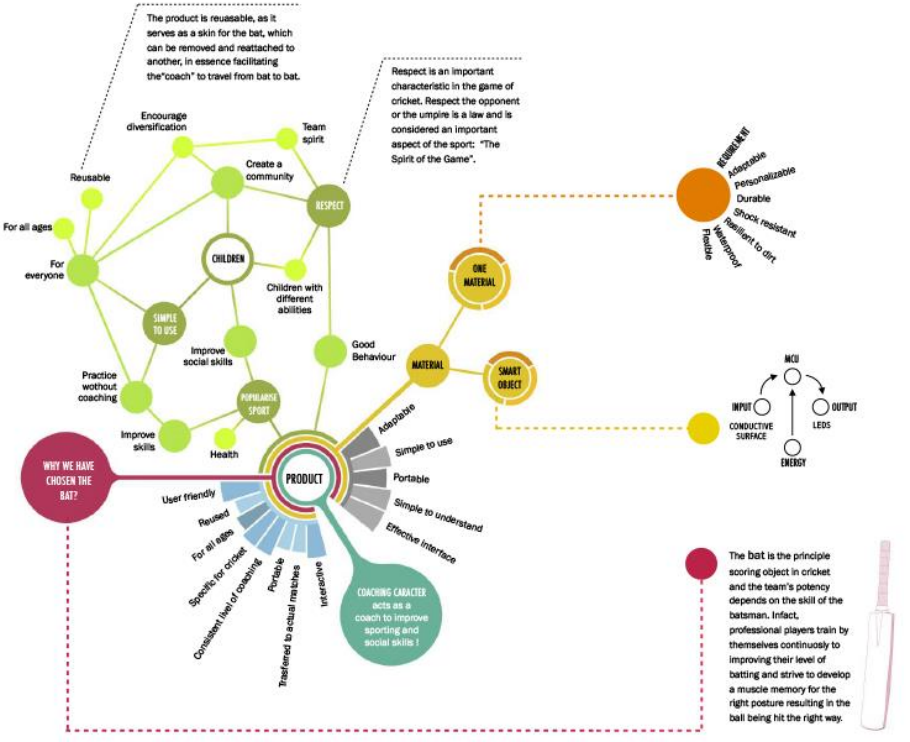

Figure 3. Concept map of the Nomi project by C. Rotondi, Anoop and M. Vasilena for the community of Cricket Players in Piazza Vittorio in Rome.

The *Noki* project by C. Rotondi, S. Anoop and M. Vasilena, has been able to identify the ethical and moral values of the historic game of Cricket, and the popular will of the community of Piazza Vittorio who practices this sport. The purpose of the community is to popularize sport and through this, to teach respect and integration among the people of the Roman community. The research activity of the team has identified within the game dynamics a potential connection with the younger generations who cohabit the surrounding public space, in search of leisure activities that know how to adapt to the frenetic rhythms of their daily lives (fig . 3).

3.2 Experience Prototyping

For the second phase, through fast implementation practices of physical models, experiential prototyping tools are introduced, through "dirty" and fast actions. Designers cannibalize and hack pre-existing products by operating through a series of iterations, bringing field experimentation together with communities through different research tools including Workshops, Empathy tools, Shadowing and Role play in order to produce a stimulating range of information fundamental to the of the project (Villari, 2013). Experiencing first-hand the difficulties of Roman cyclists during their own rally events, *Critical Barrier*, designed by D. Allotta, S. Ramezani, I. Demirsu and S. Negarestani, wanted to experiment with different ways of aggregation and reporting on the road, in order to make community events more visible in traffic and above all safer for its participants (fig. 4).

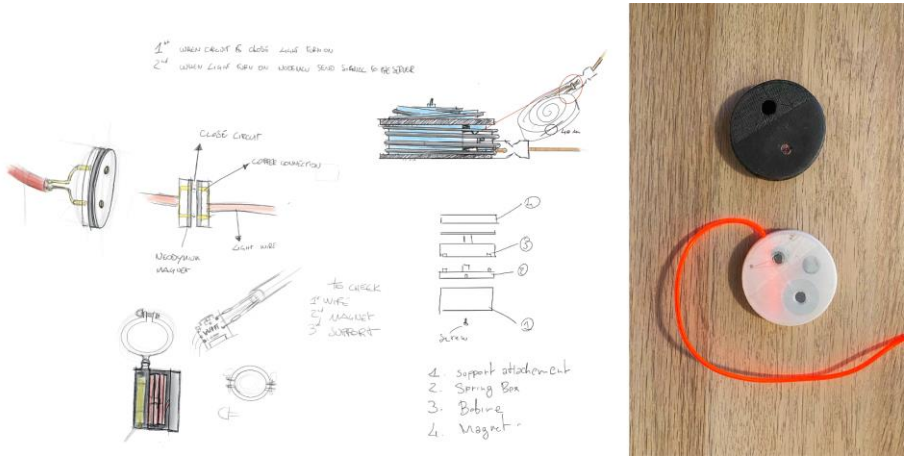

Figure 4. Sketching and prototypes of the Critical Barrier project by D. Allotta, S. Ramezani, I. Demirsu and S. Negarestani for the Critical Mass cycling community.

3.3 Fictional Scenarios



Figure 5. U.S.O.project poster (Unidentified Skating Object) by L. D'Elia, S. Doustani and A for the community of Pincio Skaters in Rome. Sayifi. Photo courtesy: Paolo E. Cenciarelli.

These documented experiences open up to new scenarios of use and behavior, identifying in the third and last phase "Fictional Scenario" the social and technological implications that the project brings with it. The designer therefore looks at the complexities of the community in a critical way as a prolific pool of behaviors and contradictions useful for an action of speculation that allows communities to visualize the real problems that are usually faced and considered as inevitable (Dunne & Raby, 2013), thus offering new possible solution scenarios. The critical view of the context implies a new awareness that is externalized and communicated through the products, services and systems generated by the co-design processes. The technological dimension takes over in response to the need to evolve and intensify an energy network (Rifkin, 2014).

The *U.S.O. (Unidentified Skating Object)*, designed by L. D'Elia, S. Doustani and A. Sayifi, wanted to speculate on the feeling of alienation experienced by the community of Pincio Skaters in their relationship with a public management that does not recognize the skater in the spaces shared neither as a pedestrian nor as a vehicle (such as a scooter or bicycle). Feeling "alien" and proud of this peculiarity, the project is dressed in attributes coming from the science fiction world to encourage new members and curious to a completely different

exercise activity, supported by new technologically enhanced actions and interactions (fig. 5).

4. Conclusions

The research and experimentation activities applied during the workshops have brought out from the Capitoline social fabric a latent planning of the communities and new design spaces which, together with the theme of social inclusion and the active role of the citizen, are issues addressed marginally by the Public Administration when it comes to social innovation (Balbo, 2015). In this open scenario, design can operate in order to reveal the needs and will of the community, transforming them into possible solutions of public utility. In 2016, the exhibition "Design'In Rome" at Casa della Città (fig. 6) exhibited the design results of the course, highlighting the role of academic research and design in connecting universities,



Figure 6. (above) Exhibition of the projects held at the Casa della Città, in Rome (below) Invitation made by (omitted for review) for the event.

citizens and municipalities, and in applying design knowledge in real contexts (Meyer & Norman, 2019). It is emphasized that research in design, in order to face the new ways of living in a social and innovative space, searches in the built spaces (both physical and virtual), products and services capable of taking into account the cultural value of the ethnic variety present in a cosmopolitan city like Rome, applying the best practices of Co-design and Action Research. This contribution presents an overview of alternative scenarios that are emerging and evolving on a global scale.

Note

[1] Ezio Manzini in the working paper of the conference "Social and Political Planning", organized by cheFare at the Milan Triennale on 19 October 2018, defines Politics (with a capital P) as "the set of contents, organizations and methods that allow a company diversified and complex to exist and, if possible, progress towards higher forms of civilization".

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Co-designing the future of a public space and its related services. The case of the Reggio Emilia Ducal Palace and its park.

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Abstract | This paper describes an extensive co-design process conducted by the authors, a group of researchers of the Polimi DESIS Lab, to imagine the future of the Reggio Emilia Ducal Palace and its park, in Italy.
As an effort to co-design *urban commons*, it implied two main challenges: the first one deals with how urban commons might be co-designed, being characterized by diversity of actors and interests; the second one is connected to exploring how urban commons can be complemented including (public) services as an integral part of them, and thus, how to deal with their 'intangible' facet, that is about the interaction that will take place.
The paper concludes reflecting on the opportunity of including the expertise of service design in creating the social and infrastructural conditions to foster the development of urban commons and to make it a standard for any project, since it contributes defining the public interest activities that shape an important part of the commons.

KEYWORDS | URBAN COMMON, CO-DESIGN, SERVICE DESIGN, SCENARIO BUILDING, MULTI-STAKEHOLDER ENGAGEMENT

1. Background knowledge: on urban commons, co-design and service design.

In the last decade, we assisted to the emergence of a variety of activities labelled as 'co-design processes', ranging from urban planning to community building and conducted under the auspices of the private, public and third sectors (Meroni, Selloni, Rossi, 2018; Trischler, and alt. 2018).
In this paper we discuss a co-design process developed by the authors for the Municipality of Reggio Emilia, a mid-sized town in the centre of Italy: its main objective was to imagine the future of the Reggio Emilia Ducal Palace with particular reference to its park, a huge public space in the outskirt the city.
This park is considered by the city inhabitants as an *urban commons*: a place of shared interest, critically important to the city environment, perceived as a symbolic space that gives a community its identity and facilitates social interactions (Ostrom, 1990; P2P Foundation, 2019).
The notion of urban commons is central for our argument, because we discuss one of the main challenges that urban commons currently face: i.e. how they might be co-designed, since, more than traditional commons, they are characterized by great heterogeneity of interests and participants, and need a support process to reach alignment and consensus (Foster, 2011; Iaione, 2012; Seravalli, 2018).
Urban commons may be considered 'new commons': Hess (2008) mapped the new commons out, identifying numerous categories, such as tangible and intangible commons, cultural commons, knowledge commons, global commons, infrastructure commons and many others. According to Hess, urban commons fall under the wider category of 'neighbourhood commons' that incorporates "both urban and rural commons where people living in close proximity come together to strengthen, manage, preserve, or protect a local resource" (2008, p. 16).
In particular, she argues that theories and practices of neighbourhood commons draw especially on the so-called literature of 'reclaiming the commons'. In the same line of thinking, Marttila, Botero and Saad-Sulonen (2014) identify a strand of commons as the activist/practitioner movement, which considers commons as a means for social change and democratic governance (Bollier and Helfrich, 2012; Bauwens, 2009). Therefore we can assume that urban commons are conceived not only as shared resources, but also as processes: set of practices focused on how to create (other) commons, how to support and govern them, that is a set of "collaborative arrangements for value production processes" (Seravalli, 2018 p.1.).

On the one side, we build on this approach to commons to discuss an experimental programme of co-design activities for the Reggio Emilia Ducal Palace and its park, conceived and implemented to design a place intended to be part of the urban commons. It is consolidated (Pór, 2012) that aligning interests between participants and educating people to participate in processes aiming at this are today two of the main challenges to co-design

urban commons. We can interpret this approach an evolution of the concept of 'community-centred design' (Meroni, 2008), in which design is recognised as a way to the facilitate a process of engagement and progressive learning between the members of a community and between it and the whole society. The continuous work of activating and structuring strategic conversations on the future is, in fact, a way to exchange value between people: this is functional to design a scenario, to find opportunities of reciprocal interest, to create relationship and develop mutually beneficial solutions (Pahk, Self and Baek, 2018) in a value co-creation logic that has network orientation and contextual nature (Vargo and Lush, 2016). Paraphrasing Vargo and Lush (2016), we can say that an effective community-centred design should support the actors of a given context to engage in a process of benefiting their own existence through benefiting the existence of other actors with service-for-service exchange or the provision of some output. The value so created is therefore an element of the 'new commons' and we assume it is maximised by the diversity of interests and views that find a way to co-exist.
The multi-stakeholder co-design process conceived and implemented for the city of Reggio Emilia involved actors from the private, public and third sectors, experts from the academia and associations from the civil society. They were selected and activated by the public administrators in order to consider different perspectives on the present and future of the Palace and the park. As Iaione and Foster (2016) state, in *urban commoning* implies having someone that plays the role of 'enabler' in managing negotiations and cooperation between participants with divergent interests. Here it comes the opportunity to conduct co-design activities with diverse methods and tools in order to allow multiple participants having different voices collaborate in a design process, applying an adaptive and iterative design approach (Meroni, Selloni, Rossi, 2018). This way, the activation of co-design initiatives can be seen as a service that the public administration offers to nurture the birth and flourishing of new commons.

On the other side, we explore, through this experimentation, possible relations between service design and urban planning, aiming at testing at the city level two of the very axioms of the service dominant logic (Vargo and Lush, 2004; Vargo and Lush, 2016):

- Service is today the fundamental basis of exchange and, therefore, goods are distribution mechanisms for service provision. In the Reggio Emilia project we assume "goods" to be spatial arrangements.
- Service-centered view is inherently beneficiary oriented and relational. In the Reggio Emilia project the value co-creation was intended to activate processes of reciprocity of exchange, facilitated by shared institutions (here intended as "rules, norms, meanings, symbols, practices, and similar aides to collaboration" Vargo and Lush, 2016, p. 6) that coordinate this exchange.

In fact, the challenges around the design of urban commons are not only connected to the related participatory process, but also to reconsideration of the idea itself of urban commons: the co-design process outlined for the project was aimed at conceiving the future

activities to be carried out in the park in terms of functions and services, rather than and prior to designing the public space in its physical aspects. This implies that the future common denominator of the production and exchange of value in the Ducal Palace and park was the application of specialized knowledge, mental skills, labour and the sharing of assets, "embedded" by the spatial arrangements.
Therefore, the starting point of the Reggio Emilia project was that an artful design of the activities that might take place in the future and qualify the area would have informed the design of the space with an increased awareness of the final users and of the visions of possible future stakeholders. This approach to urban commons, also, assumes that (public) services and relational activities are integral parts of urban commons, since (public) spaces are so. Not by chance, Iaione (2012) in defining urban commons not only includes physical resources as parks, squares, local streets, and public spaces in general, but also a diversified number of services, including public transportation, water service, urban health, gas and electric distribution and many others.
Overall, we assume that the Reggio Emilia project's combined approach of structuring collaboration processes, putting the service perspective prior to the landscape design and adopting a relational perspective, is a way to envision new ways to integrate and beneficially apply potential resources for a shared purpose.

2. The case study of "Rival(u)ta Rivalta"

"Rival(u)ta Rivalta" (a title that can be translated as "Re-value Rivalta") is the project we delivered as researchers of the Polimi DESIS Lab of the Department of Design of Politecnico di Milano for the Municipality of Reggio Emilia, which is part of the wider Ducato Estense development financed and promoted by the Italian Ministry of Cultural Heritage. Its specific objective was to renew and reinvent the Reggio Emilia Ducal Palace and its huge park, in the suburb of Rivalta.
It consisted of a process of strategic codesign of scenarios for the future of this space, conducted with local actors. It initially explored the varied and often conflicting perceptions, experiences and wishes of the stakeholders for the area (phase 1), and then defined, in a dialogue with the public administration, a first interpretative framework to orient the following design phase. On the base of this, through a sequence of co-design workshops (phase 2), 6 service-based scenarios were produced to inform the first phase of a landscape-design international competition concurrently launched (phase 3). As a final stage (phase 4), a codesign workshop, involving the designers and the team of the winning project (a group made up of Openfabric, Casana, F&M Ingegneria) was organized to develop 2 macro-scenarios, following the criterion of integrating the characteristics of the spatial proposal with the emerged imaginary. These final scenarios have the aim of stimulating a strategic dialogue around the Reggio Emilia Ducal Palace and its park and of guiding the final implementation of the project.

2.1 Phase 1: Generative listening

The expression 'generative listening' refers to the goal of broadening the scope of the initial analytical phase from the collection of information, in the traditional sense, to the stimulation of conversations about the perceptions, desires and expectations on the Ducal Palace Park. The process was structured as a series of interviews to 26 local stakeholders, selected in collaboration with the Municipality of Reggio Emilia among the most active and relevant actors in the cultural and associative field as well as among experts in more technical sectors.

In order to provoke and enable a generative conversation, each interview was structured by using a set of tools that had the goal of exploring both present and past conditions related to the area, as well as possible activities to be carried out inside and outside the palace. More in detail, the tool named 'The Ducal Palace park: yesterday and today' guided the dialogue around the map of the place, investigating distinctive positive and negative elements in terms of potential resources, barriers and criticalities. While the set of cards 'The Ducal Palace park: tomorrow' has been used as a stimulus to explore 6 thematic clusters of activities: agriculture and production, work and employment, art and culture, entertainment and recreation, sport and wellness, landscape and nature. Building on the expertise, knowledge and network of the actors involved in this phase, each thematic area was then discussed in terms of impact on the management and revenue model, on the accessibility and on the identity of the place.

The choice of identifying 6 themes emerged from the initial scoping phase carried on with the Municipality and from the analysis of existing data and reports. Results of the generative listening phase were, indeed, a baseline knowledge framework and an orientation towards different design hypotheses, which have been re-discussed with the Municipality and served as inputs for the following steps.

2.2 Phase 2: Co-design sessions

The second phase was planned as an intensive programme of workshops with diverse stakeholders to explore multiple service areas. Building upon the results of phase 1, we elaborated a preliminary map which was then implemented and adapted to the strategic orientations and policies set by the Municipality.

From this dialogue, a Scenarios' map emerged (Fig. 1). It presents 4 main directions: the central one represents the core theme (Park of the Nature), while the surrounding areas support the exploration of alternatives (Park of the Agriculture, Park of the History and Park of the Wellness).

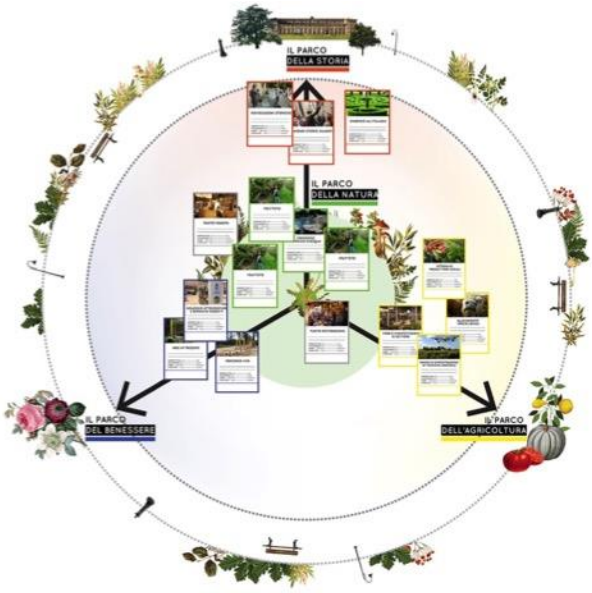

Figure 1. The Scenarios' Map developed to guide the co-design sessions.

In addition to the map, we produced a catalogue of cards (Fig. 2) representing potential services and activities, thanks to a preliminary study of existing case studies. This deck of cards, together with the Scenarios' map, were the main tools designed to conduct the workshops.

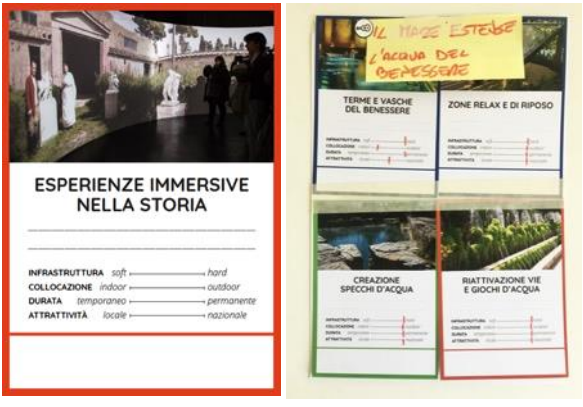

Figure 2. Example of the cards designed to explore services and activities and of the elaboration of a personal vision.

This phase comprised 5 co-design sessions and involved a total number of 42 participants, partially identified among the participants to the first phase, and partially among new relevant stakeholders belonging to cultural institutions, NGOs, universities and local authorities. Each session was organized around 3 main steps.

Step 1: the creation of a personal vision. After introducing the Scenarios' Map, each participant was invited to select, from the deck of cards, 4 activities, that combined together presented a personal vision for the future, in the form of a consistent series of services for the Ducal Palace park. Additionally, participants were asked to evaluate, for each card, some characteristics that might impact on the service model (type of infrastructure, location, duration and scale of attractiveness) and to enrich or modify the cards according to them (Fig. 3). Finally, the personal visions were placed on the Scenarios' map and discussed, merged and combined in a collective session. In this circumstance, participants have been aggregated in couples according to links between their visions, in order to start thinking to the stakeholders involved or impacted by the future arrangement.



Figure 3. The co-design sessions.

Step 2: the evaluation of the qualifying elements. The second step was focused on assessing the resulting visions according to 4 main qualifying elements. The Ducal Palace park should indeed also comprise the following qualities:

- Digital: the park is enabled by advanced technological solutions;
- Educational: the park has a strong didactic and popular approach;

- Recreational: the park offers opportunities for entertainment, conviviality, meeting;
- Sustainable and circular: the park is based on elements of ecological sustainability and circular economy.

These qualities emerged from the generative listening phase and from the dialogue with the Municipality: they contributed to characterize the range of activities chosen by each group.

Step 3: the analysis of the transversal areas and the definition of the Actors' map. The last step of the co-design session aimed at including into each vision a number of additional activities that relate to transversal areas and complete the map of the Ducal Palace park. These transversal areas are linked to the perception and imaginary associated to the park, and emphasise its being a place of relief and conviviality, active and inclusive participation, of accessibility, of openness, of entertainment and recreation.
As a last activity, groups focused on the identification of the stakeholders to be involved into the implementation of the scenario and on the various management models to be foreseen. The output of this phase was an Actors' map for each group in which they identified the key-protagonists of their scenario, outlined a hierarchy and a set of connections between them.

2.3 Phase 3: Scenario development and integration to the international landscape design competition

The third phase of the process was aimed to inform the international landscape design competition that was meanwhile conceived and launched to select a spatial design for the area. For this purpose, we developed 6 main scenarios (Fig. 4) building upon the results of the previous co-design process:

- The Mindful Park: a place of silence
- The Water Garden: history trough engineering and nature
- The Active Park: sport and social agriculture in action
- The Innovation Garden: an agricultural landscape to live and experience
- The Climate Oasis: a piece of nature within the city
- The Welcoming Garden: a path toward a collective wellbeing.

The description of these scenarios was further elaborated in a report that included: the narrative aspects of each scenario, a series of activities to be included as potential functions and services and some distinctive features with reference to architectural guidelines provided by the competition's brief. The report became therefore an integral part of the brief made available to the 5 finalists of the international competition. This way, the take-up of elements selected from the scenarios was assured, since they were supposed to be embedded in the final design of the proposal.



Figure 4. The 6 scenarios developed to inform the international landscape design competition.

2.4 Phase 4: integration to the landscape design-winning project.

The connection of the results of the co-design process with the landscape design competition was further elaborated in this last phase. After the selection of the winners, we engaged them in a co-design activity in order to converge towards a consistent and integrated proposal. More in detail, the 6 service-based scenarios were reviewed with reference to the characteristics of the winning project.

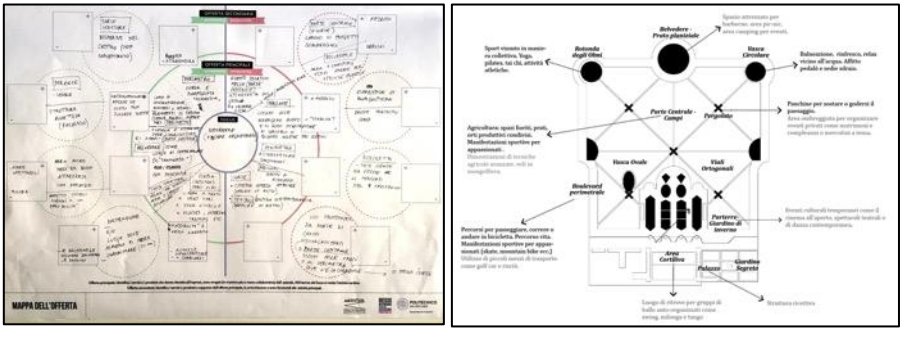

Figure 5. The Wellness Park offering Map (Polimi DESIS Lab) applied to the spatial project by ©Openfabric, Casana, F&M Ingegneria.

By using an expanded Offering Map (Fig. 5), primary and secondary levels of activities were identified. Then, building upon this work, the design researchers elaborated 2 macro-scenarios (Fig. 6):

1. The Wellness Park, which elaborates the themes of health and living well, mainly resulting from the scenarios 'The Contemplative Park' and 'The Active Park'.
2. The Habitat Park, which refers to the themes of landscape, nature and harmony between humans and the surrounding environment, mainly resulting from the scenarios 'The Circular Oasis' and 'The Contemplative Park'.

After being discussed with the landscape designers, they resulted in a comprehensive plan for services and solutions, meant to orient the final design of the park. At the same time, they can be seen as a powerful means to keep the narrative, vocational and poetic dimension of the initial scenarios within the project.



Figure 6. Visualization of the final macro-scenarios: the Wellness Park and the Habitat Park

3. Reflections and conclusions

The outcomes of this co-design process aiming at the generation of future scenarios for the Ducal Palace and park are, now, constrained by the stage of the work of the entire project, which is in the final development of the executive project.
Yet, they can be discussed with regard to the effectiveness of the co-design process that brought about the activation of a dialogue with the stakeholders, the generation of service-based scenarios that informed a landscape design brief, and the integration with the spatial design project.

Considering the whole experimentation as the first step toward the design of new urban commons, it can be first assessed against its capacity to generate strategic dialogues and outputs (specific scenarios) that could integrate different interests, perspectives and resources in a mutual beneficiary exchange. The evidence of the above can be summarised in the following points:

- The variety of perspectives emerged from the interviews (conducted in the first phase of the process) that we grouped in a set of reflections on the present situation, of opportunities for the future and of possible criticalities are a good evidence of the openness of the process that guided the participant throughout a reflection without imposing perspectives. In fact, the topics emerged as qualifying the present and the future of the place, transcended or sometimes neglected those suggested by the interviewers to prompt the conversation: topics as 'food', 'hospitality', 'technology' or 'sociability' emerged, while 'work' or 'job' were not considered as relevant.
- The even bigger variety of visions generated during the workshops (one for participant, for a total of 42, conducted in the second phase of the process) eventually grouped by the designers in 6 scenarios (in the third phase of the process), came out easily, often in a positive flow of conversation with the other participants of the same session, alternating individual and collective thinking. We can assume this variety to be encouraged by the numerousness and diversity of the activity cards provided for the co-creation: nevertheless, the nature and distinctiveness of the 6 scenarios is completely transversal to the proposed orientations and extremely rich of inputs that neither came out from the previous interviews and conversations, nor were provided by the designers.
- The criteria with which the different visions were clustered and arranged in scenarios were based on the actual and logical possibilities to combine a variety of comparable or complementary inputs in meaningful wholes. Each input represented an individual view and the related interests, including the resources (competences, assets, skills, and much more) that each participant explicitly or implicitly wished to put in the future system. By combining them together, we aimed to draft future service ecosystems (Vargo and Lusch, 2016) meant to generate value for all the stakeholders and for the citizens or visitors; this accomplishes the abovementioned logic of the urban commons as valuable because of the way they have been generated and because of their very nature. This work has been facilitated by initial reflections on the possible combinations of actors that could manage the activities in the future.
- The people involved in the co-design process, stakeholders and experts identified by the Municipality of Reggio Emilia, often knew already each other, but most of the time did not: whatever their condition was, the workshops were for them opportunities, often the fists, to talk together in a constructive and creative way about the future of the Palace and the park. As such, we may assume they were

> also opportunities to ignite future processes and purposeful connections, including the discourse about the future co-governance of the place.

Another way to assess the whole experimentation is against the relevance and the 'dominance' of a service design perspective and orientation in the design of the landscape and in the spatial design. This turns into evaluating how the scenarios, which were made part of the brief received by the 5 finalists of the international competition, actually influenced or even informed their final design proposal.
The scenarios were described as a consistent mix of temporary and permanent activities (and therefore services and relations) and in terms of requirements for the natural capital and the built environment. Looking at the material delivered by the team of architects and experts that won the competition, we can find a systematic review and elaboration of future activities to be implemented in the area, freely chosen from the proposed scenarios and organised by typologies and fields that draw from the them. The same are described in their duration in time, extension and possible economic return for the future management and the public administration. They are also narrated in terms of occupation of the space and needs for dedicated infrastructures and arrangements and are sketched in the design of the place, which has been actually conceived to change according to them. This made the design unique and notable for its liveliness and dynamicity, and let us deduct a good degree of permeability of the landscape design to the proposed scenarios. This descriptive material delivered for the competition was the basis for the following collaboration, aiming at merging the service and the landscape design.
In fact, as described in the section 2.4, by matching this design with the 6 scenarios produced in the third phase of the work, we proposed 2 "merged" scenarios that could have been better materialised by the design of the park. From here, we organised a final workshop with the project leader of the winning team of Openfabric, Casana and F&M Ingegneria. For the workshop, a very peculiar service design tool, the Offering map, was adapted to the circumstance by hypothesizing a placement of the different activities and services into the spatial characters of the landscape design, the so-called 'intensità progettuali' roughly translatable as 'design concentrations'. During the workshop, we acknowledged a good alignment of the visions with the architect, yet had to make an effort from both sides to merge, through the tool of the Offering map, the different mind-sets: one 'space driven', the other 'service driven'. Hence, the activities presented in the map were finally associated to the 'design concentrations', so to create a fully integrated space and service artefact. In the view of optimising the interaction for a future activity, this integration could be better designed in the template of the tool.

As a conclusion of the experience, two macro-scenarios have been delivered, each one characterised by slightly different meanings and activities and both suitable to be materialised by the landscape design. The very reason for being two rather than one is the acknowledgment that the civic process of development of the whole project of regeneration of the Ducal Palace and park is still far to finish. In fact, in parallel to the construction of the

landscape arrangement, the future management system and its 'institutional arrangements' will be defined: we may assume this will be a public-private partnership that is likely to start-up with a set of rules "that together constitute a relatively coherent assemblage that facilitates coordination of activity in value-co-creating service ecosystems" (Vargo and Lusch, 2016, p. 18). The two scenarios, therefore, are intended to activate and steer this future conversation, which will be coordinated by the public administration, following the logic to establish collaborative processes as an imperative for the creation of urban commons. Notably, the guiding and coordinating role of the public administration has been crucial throughout all the process with different strategic decisions:

- to carry out this process in order to contribute nourishing the projects produced by the teams of architects and expert. This decision was central, because it builds upon the idea that the design of a (public) space could be informed by the design of (its) services, and so the development of specific activities builds the identity of a space- an urban commons - in every aspect;
- to select the participants to the process, intentionally excluding citizens in this phase. They engaged, instead, subjects that aggregate different interests and experts, in order to start a conversation about the future on the base of knowledgeable and informed experiences and views;
- to dialogue closely with the researchers, in order to progressively define orientations and making decisions according with what was emerging from the co-design process, yet having a broader view on the city development as a whole.

In the perspective of creating the social and infrastructural conditions to foster the development of urban commons, we deem that the expertise in service design is crucial: in fact urban commons are shared resources and, at the same time, the collaborative arrangements that design them, the institutions that regulate them, and "the community that devises the institutions, both shepherding and benefiting from the resources" (Huron, 2017, p.2). Acknowledging that service design is the activity of planning and organizing people, infrastructures, communication and material components of a service (Sangiorgi and Prendiville, 2017), the systemic and collaborative approach embedded in service design as the one developed for the Reggio Emilia co-design process, could be considered a case to start from in order to make it a standard for any project, and in particular for those regarding public interests.
These activities are a "continuous process of building relations with diverse actors and by a flexible allotment of time and resources" that qualify the contemporary strategies of infrastrucuring (Hillgren, 2013 p.81). Furthermore, it might help creating in (not only) public organizations the social infrastructures that empower human beings to creatively and continuously support each other and taking projects forward (van der Bijl-Brouwer, 2017).

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Acknowledgements: we first thank Chiara Galeazzi, Martina Rossi and Marta Carrera, that took part in the Rival(u)ta Rivalta design project, without participating in the preparation of this specific contribution. Then, we like to thank the Municipality of Reggio Emilia, in the persons of Massimo Magnani and Nicoletta Levi among the others, the for the constructive and inspiring work done together. Finally, we like to thank the group made of Openfabric, Casana and F&M Ingegneria for the creative and amusing collaboration.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Collaborative Futures: a pedagogical model for delivering future-focused and citizen-centred design education

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Abstract | The authors present a pedagogical model for delivering future-focused design education, drawing on "Collaborative Futures" as a case study. This project brought together a cohort of final year design students and early career design graduates who worked in collaboration with the Glasgow City Council to explore and prototype future-based, citizen-centred scenarios set in the context of Glasgow 2030, which focused on data experience, people, place and practice. The collaborative nature of the project extended learning beyond the higher education design studio – providing the students with the opportunity to engage in professional practice through collaborating with early career graduates, and with an external organisation and industry-experienced designers. The authors critically reflect on the context-led project process, the collaborative design culture fostered, and the future-focused outcomes – theoretically unpacking the value and challenges of studio-based learning and multidisciplinary collaboration, insights from which are shared as a transferable pedagogical model for design educators.

KEYWORDS |: FUTURE-FOCUSED, DESIGN PEDAGOGY, CITIZEN-CENTRED, COMMUNITIES OF PRACTICE, KNOWLEDGE ARTEFACTS

1.0 Introduction

In this paper the authors present a pedagogical model for delivering future-focused design education, drawing on Collaborative Futures – a project delivered as part of the Masters of European Design programme at The Glasgow School of Art (GSA). This project brought together a cohort of final year design students and early career design graduates, who worked in collaboration with the Glasgow City Council (GCC), professional designers, and civic and academic stakeholders to explore and prototype future-based and citizen-centred scenarios set in the context of Glasgow 2030. With a focus on data experience, people, place and practice, the aim was to explore, evaluate and prototype emerging frameworks for open innovation so to inform GCC's strategic aim to be recognised as a well governed city that listens and responds to its citizens. The collaborative nature of the project extended learning beyond the higher education studio context – providing the design students with the opportunity to engage in professional practice through collaborating with early career design graduates, and with an external organisation and industry-experienced designers. This pedagogical model, now in its sixth iteration, has been implemented in a range of contexts. The first (in 2014-15) explored the future of social services in collaboration with the the design division of Hitachi; the second (in 2015-6), third (in 2017-8) and forth (2018-19) explored the future of banking in collaboration with the Royal Bank of Scotland (Ross, 2018). This latest iteration (2019-2020) is the first time, however, that a researcher (Author A) has been embedded in the project. Based on this research conducted alongside the project delivery, the authors critically reflect on the context-led project process, the collaborative design culture fostered, and the future-focused outcomes – theoretically unpacking the value, impact and challenges of studio-based learning and student-graduate collaboration in a multidisciplinary team. The relational and experiential proximity highlighted in this project is discussed through the lens of Communities of Practice (Lave and Wenger, 1991; Wenger, 1998) and Boundary Objects (Star & Griesemer, 1989; Binder et al., 2011; Brandt, 2006), insights from which are shared as a transferable pedagogical model for design educators. The paper begins by describing the evolution of the model and the key design practices informing it before setting out the research framework employed to gain an empirical understanding of the pedagogical process. The authors then present the case study and, through discussion, unpack their key insights. The paper concludes by the authors summarising the implications and value of their findings for delivering future-focused and citizen-centred design education.

2.0 Evolution of the Pedagogical Model

Design Innovation seeks to address complex social, cultural, political, economic and technological challenges through context-led collaborative and creative engagement with communities and individuals. As a practice, Design Innovation is underpinned by the ethos of

social design (Bannon & Ehn, 2012; Manzini, 2015) and participatory design (Binder et al., 2011; Björgvinsson, Ehn & Hillgren, 2010; Frauenberger et al., 2015; Simonsen & Robertson, 2013); drawing on co-design and speculative design approaches and principles as a critical exploration, examination and evaluation of the opportunities that may lead to preferable futures. Key here is recognising users and potential users of design and other stakeholders as experts of their own indigenous knowledge and "experience domain" (Sleeswijk Visser, 2009: 5), and their repositioning in the design process as equal collaborative partners with the designer (Sanders, Brandt and Binder, 2010). Collaborative Futures points more specifically to speculative (Dunne, 2008; Dunne and Raby, 2013) and transition (Foth, 2018; Irwin, 2015; Irwin, Kossoff &Tonkinwise, 2015) design approaches. As described by Dunne and Raby (2013: 3–6), speculative approaches are used to explore alternative futures so to better understand and critically reflect upon the present, whereby design is used to provoke and open up debate. Centred on embedding these approaches, the curriculum framework underpinning the project has evolved over a series of iterations. The intended learning outcomes for the students centred on developing professional practice through collaborating with external partners, creatively engaging with users and stakeholders, producing a range of designed deliverables, and communicating the outcomes of the project to a range of audiences.

At GSA, pedagogy is centred on the principles of social and collaborative learning in the shared and immersive environment of the studio (Lynas, Budge & Beale, 2013) that scaffolds a culture of exploration, experimentation and prototyping (Bull, 2015), and which seeks to foster a Community of Practice (Leve and Wenger, 1991; Wenger, 1998). Within this, as learners become more fluent in their design practice, they are engaging in a tacit sense-making and reflective dialogue between themselves and the making and problem-solving process, and with their peers (Budge et al., 2013; Schön, 1985; Shreeve, 2015; Zehner et al., 2009). Drawing on these key tenets of studio-based learning, the pedagogical model presented in this paper supported the student-graduate team to work on a live project, undertaken over three discreet phrases, and which required the generation of a series of designed deliverables described below.



Figure 1. 2015, 2016. Research Cards from Previous Collaborative Futures Projects.

2.1 Phase 01: Discover and Define

The aim of Phase 01 is to scope the context through combining quantitative and qualitative research methods – conducting desk research in parallel to ethnographic engagement and interviews with expert stakeholders. Research insights are then translated into a visual data bank that can be contributed to by the collaborators, as well as drafting emerging themes into a set of Research Cards. Research Cards have become a key component in this phase of the model over the last six years. Converting research themes, which at the early stages of the project can feel conceptual and abstract, into physically designed artefacts provides the student-graduate teams with analytical lenses through which to view, sort, and interrogate subsequent data through (see Figure 1). The Research Cards are subsequently iterated over the course of the project (used as an analytical tool in Phase 02 and presented to project partners as a designed outcome in Phase 03).

2.2 Phase 02: Develop

The aim of Phase 02 is to translate the research themes into a family of knowledge artefacts and refine these through conducting primary research. In-line with speculative design approaches, this includes prototyping a future world (in this project, an imagined Glasgow 2030), a suite of future citizens who would populate neighbourhoods in this world, and a set a scenarios forecasting narratives that characterise the citizens' behaviours, beliefs and

interactions. These knowledge artefacts are also used as speculative tools in the design of creative engagement workshops with participants (citizens and stakeholders) to further exploration. At touchstone points during this phase, expert input is provided by faculty, and by external designers and researchers, to support the student-graduate teams to synthesis and evaluate their research.

2.3 Phase 03: Deliver

Following the engagement workshops, the student-graduate team undertake formal analysis so to generate the final, fully realised, suite of knowledge artefacts. Other key project deliverables include producing a set of indicative design directions for the project partners, a range of materials setting out the project design process and the student-graduates evaluation and reflections of this, and a digital archive.

3.0 Research Design

In seeking to gain an empirical understanding of the pedagogical process, the embedded researcher (Author A), gathered experiential insights from the teams, with the aim to inform the design and delivery of the next iteration of the project and to answer the following research questions:

- In what ways does the pedagogical model support interdisciplinary collaboration between the student-graduate team, the Glasgow City Council, expert stakeholders, and external participants?
- In what ways can Design Innovation be embedded as an approach to future-casting the experience, needs and opportunities of Glasgow's citizens in 2030?

The insights presented in this paper were collected through observations, student-graduate feedback, reflective project blogs (with contributions from the students, graduates and GCC team) and from an evaluation group interview with the student-graduate team. In section 5, the authors draw on the theory of Communities of Practice (CoP) (Lave and Wenger, 1991; Wenger, 1998) to unpack key learnings pertaining to the relational proximity of collaboration that took place across the teams. As described by Wenger, CoP positions the social and collective nature of "learning as social participation", whereby communities are predicted on practice (1998: 4). As described in section 2.0, establishing and sustaining a CoP is core to studio-based learning – theory which underpins the pedagogical model presented in this paper. Building on this, Boundary Object theory (Star & Griesemer, 1989; Binder et al., 2011; Brandt, 2006) will be drawn on to sense-make the role knowledge artefacts played in future-focused engagement and the experiential proximity of exploring the near and distant future so to critically reflect on the present. As Star and Griesemer explain, Boundary

Objects can communicate across and connect diverse social worlds whilst retaining distinct and idiosyncratic meanings, as “their structure is common enough to more than one world to make them recognisable” (1989: 393).

4.0 Case Study: Collaborative Futures

In this section the authors present the Collaborative Futures case study before discussing the key learnings, implications and value of the project as a pedagogical model in respondence to the underpinning research questions set out in section 3.0. The case study is structured by the key touchstone activities that occurred in each phase, evidencing the relational proximity concerning the nature of collaboration, and experiential proximity concerning the role of knowledge artefacts in the context of future-focused, citizen-centred design education.

4.1 Discovering and Defining: knowledge landscapes

The Collaborative Futures project launched in September 2019 with an induction, where both teams collectively unpacked the project brief. As a key objective was to explore and prototype what a well-governed city might look like in 2030 pertaining to the role of data and how GCC could support greater citizen-centric decision-making, a panel of expert stakeholders were invited to speak on the key community challenges in Glasgow. This included a community engagement officer, a corporate service reform manager, a digital officer, a cancer-care expert, and a city development planner; key project stakeholders who were consulted through the project. Following the launch day, the student-graduate team immersed themselves in a period of desk research in the studio as well as engaging in site visits to observe community council meetings and interviewed a range of expert stakeholders. Over the course of Phase 01, the research was iteratively layered upon as the student-graduate team worked in a process of collective sense-making. This included moving between insights, interview transcripts and photographs that were physically tangible (see Figure 2), to digitally translating these into a shared online data bank. Here a process of thematic analysis and mapping took place and led to the construction of, what the student-graduate team referred to as, *knowledge landscapes* (see Figure 3). As the topic of the brief remained broad in Phase 01, this cyclical process was described by the team as intuitive and tacit in nature, whereby a “feely-ness” was needed when “swimming” in the research. The landscapes were shared with and contributed to by the GCC team, which became an online platform for exchanging ideas and knowledge between the teams. However, when reflecting on efficacy of this distributed way of collaborating, the student-graduate team highlighted the challenges of managing the virtual working space, with the need to often sift through and filter out content so to demarcate key lines of inquiry.



Figure 2. 2020. Collected Insights, Interview Transcripts and Photographs.



Figure 3. 2020. An Example of a Digital Knowledge Landscape.

4.2 Developing: design knowledge artefacts

During Phase 02, an additional cycle was introduced into the process in the form of synthesising and, as described by the student-graduates, “re-physicalising” the knowledge landscapes. One form this took was the first iteration of the Research Cards. The cards were used in subsequent workshops with the GCC team as a baseline to measure emerging insights against and to finally frame the project through the over-arching lens of *data*, *governance* and *citizenship* (see Figure 4). Another form this took was the development of designed artefacts to materialise the research into a tangible world with four neighbourhoods, each containing a range of prototyped objects that critically personified the neighbourhood themes. These artefacts were used to facilitate a co-design workshop with both teams, which become a key cornerstone in the project. Reflecting on this workshop in particular, the student-graduate team recalled how the artefacts themselves, in their unfinished form, were able to scaffold collaboration and a coalescence of ideas and consensus across the teams. Up until this point, the student-graduates had observed how the highly explorative and emergent nature of the project and studio-based working differed to the other team’s working practices; reflecting on the need to align expectations around, as described by the student-graduates, “embracing ambiguity”.



Figure 4. 2020. Research Cards and Co-designing the Landscapes.

Phase 03 centred on collecting primary research through the design and delivery of two workshops where the student-graduate team engaged with groups of citizens and expert stakeholders. The aim of the workshops was to explore with participants this future world, with activities framed around, as described by the student-graduates, “collective

envisioning". The knowledge artefacts developed in the previous phase were translated into a suite of workshop engagement tools. This included artefacts to enable participants to be metaphorically transported to the future neighbourhoods, where they could explore and reflect upon their values, fears and desires for the future of citizenship, modes of governance and data experiences, as well as explore their own ideas of a preferable futures (see Figure 5). The student-graduate team translated their research into a selection of tokens to connote, for example, data use in decision-making, digital applications, working practices, trust and perceptions of governance, and community participation. Participants were asked to build a picture of their values by choosing tokens that resonated with their present-day self. At the end of the workshop, the participants were invited to re-visit their pictures to reconstruct a 2030 vision of themselves. Following the picture-building activity, the participants explored each neighbourhood with the student-graduate team, facilitated by the use of design artefacts and narratives that embodied key tenets. As an example, in one neighbourhood narrative, citizen's emotional reactions are passively monitored by the council through skin micro-chips, a future concept that was role-played in the workshop by giving each participant a medical bandage to wear that had a chip (taken from the inside of a subway ticket) attached to it.



Figure 5. 2020. Workshop Engagement Tools.

Evaluating the workshop activities and their future-focused nature, the student-graduate team reflected on the participants' readiness to engage in speculative imagining and ideation. In some cases, the envisioned neighbourhoods, whilst based on collected evidence, were experienced as too far removed from reality for the participants to relate to or see as plausible. Or, conversely, in some cases participants found the neighbourhoods to be too close to reality and struggled to look beyond the present-day. Reflecting on the role of the

engagement tools as conduits to support the participants to suspend their disbelief, the student-graduates described the need for the tools to be more performative, sensory and "visceral" – so to provide participants with an immersive and empathic experience that could enable them to transcend their assumptions, perceptions, and boundaries of the present day.

4.3 Delivery: Glasgow 2030

Returning to the studio, the student-graduate team spent time analysing insights from the workshops, and, in collaboration with the GCC team, distilled these down into three core themes: *understanding data through citizens' experiences*, *data inequalities*, and *value exchange*. These themes were used as propositions in the final iterations of the neighbourhoods (see Figures 6). Within each neighbourhood belongs a suite of citizens who engage in a series of scenarios – knowledge artefacts used to communicate potential future narratives of Glasgow 2030.

The first neighbourhood was *Choicetoun*, which explored the theme of understanding data through citizens' experiences, where the council maps citizens using data from multiple sources and various methods of engagement. With *Choicetoun*, the council has resources and a database to analyse streams of data using a range of tools but allows people to have control in designing their level and mode of engagement and have the choice of what data to input. The second neighbourhood, *Localtoun,* explored the theme of data inequalities and the proposition of the council supporting citizens to take on more responsibility for their neighbourhoods through making data more transparent. Within this neighborhood and citizen narratives, the student-graduate team explored decentralised decision-making, and how citizens could be empowered by data. The third neighbourhood, *Efficiencity*, explored the theme of value exchange, where data has become a conduit between citizens and the council facilitated through online interactions and AI technologies in the home.



Figure 6. 2020. The Final Project Outcome: the three neighbourhoods and citizens of Glasgow 2030.

In summary, this Collaborative Futures case study evidences the emergent nature of a live collaborative project, and highlights challenges faced by the student-graduate team in terms employing future-focused and speculative design approaches. In the next section the authors discuss their insights surrounding the relational and experiential proximity of collaboration and the role of design artefacts, drawing on CoP and Boundary Object theory.

5.0 Discussion

In this section the authors discuss their key insights pertaining to the collaborative design culture fostered in the project and the future-focused outcomes – theoretically unpacking the value, impact and challenges of collaboration and the role of design knowledge artefacts. Returning to the underpinning research questions (see section 3.0) and based on the student-graduates' own recommendations, the authors reflect on the implications and value these insights have for the pedagogical model for delivering future-focused, citizen-centred design education.

5.1 Relational Proximity: cross-cultural collaboration

Reflecting on the relational proximity of collaboration, various forms and degrees of collaboration took place in this project – between the student-graduate team, between the student-graduate and GCC teams, and between the student-graduate team and the participants (which the authors will return to in section 5.2). Establishing a culture of social

learning within the studio-based context is a fundamental aspect of the project. However, and as evidenced in the case study, challenges emerged in sustaining this across the two teams. As reflected on by the student-graduate team, the relational proximity of collaboration was both geographical (as, for the most part, the two teams were based at different locations) and occupational in terms of understanding the value, conventions and structures of each other's working practices. Based on their shared educational experiences at GSA, the student-graduates have collectively developed a repertoire and instinct for handling the emergent, and often ambiguous, nature of an inductive project. Whilst this project's approach held a level of familiarity to the student-graduate team, this intuitive and shared understanding, at times, assumed a similar level of connection with the partner team, taking for granted that this was the partner's first time in engaging with this project.

Furthermore, the internal working structures of the two teams seemed to differ. Whilst the industry partner appeared more traditional in terms of defining roles and responsibilities, the student-graduates' was less hierarchical, enabling members to test out roles, rotate positions and work more freely together. When the two teams came together, usually in the format of a workshop, these factors could either lead to lively debate or inertia. It seemed that the project had brought together two diverse communities of practice, whose practices often remained independent as opposed to inter-dependant of one other. Over time, however, a shared project language became equally used by both teams as key deliverables began to materialise. This exchange of knowledge and adoption of language aligns with Wenger's theory of CoP and how boundaries of discrete communities can begin to cross and permeate each other through a process of brokering (1998: 105). As proposed by the student-graduates in their Design Recommendations, designing in mechanisms early on in the project to articulate and demonstrate to the partnering team the value of embracing ambiguity could have incited more meaningful collaboration. As a learning opportunity, the student-graduates recognised the potential benefits of designing a cross-team ice-breaker session at the start of the project as a way to unionise the two CoPs from the offset. Here individual working practices and assets, as well as anxieties, could be raised and externalised; and, based on these, a project trajectory could be negotiated and mapped out together so to align expectations more effectively.

5.2 Experiential Proximity: knowledge artefacts

The authors will now unpack the brokering role the design knowledge artefacts played as tools for engagement with the project participants, discussing the experiential proximity of speculative, future-focused co-envisioning by drawing on Boundary Object theory (Star & Griesemer, 1989). As set out in the case study, the engagement workshops brought together groups of citizens to critically reflect on their experiences and values based on the themes of citizenship, governance and data. The engagement tools were designed to support the

participants to test out their assumptions and to bridge these futures so to reflect on the present. Across the workshops, various degrees of participation took place, evidenced in how the participants were able to connect with, or not, to the future narratives and propositions contained within them. A key challenge highlighted by the student-graduate team was the provocative nature of the tools, which, in some cases acted as metaphorical vehicles to transport participants into the future, and in other cases became road-blocks.

As each participant brought with them their own latent subjectivities, the student-graduates had designed the tools with the aim of being generally understood by the wider workshop group as well as being reflexively interpreted on an individual basis by each participant – characteristic of Boundary Objects. The tools were most effective when they supported participants to go beyond how these narratives pertained to their own life-worlds, to explore as a group inter-subjective envisioning for the future. However, the student-graduates described the challenges of presenting new "variations on reality", suggesting that participants seemed less engaged in narratives proposing changes to intangible structures (such as alternative economies or societal models), as opposed to more tangible forms (such as technological devices and digital applications). In conversation with the student-graduates, they identified several short-comings in their workshop design and the degree to which the tools could facilitate a meaningfully experience for the participants in parallel to gathering rich research insights. In particular, whilst the tools acted as a form of consciousness-raising, they were limited in supporting more radical forms of speculation. The student-graduates recognised that suspending disbelief needed to be carefully calibrated as, in some cases, the tools asked participants to engage with narratives that were either too close to present-day phenomena or, conversely, too far removed from their realities to be conceivable. The tools were having to not only mediate the metaphorical proximity between present and future, but also between the believable and mythical.

5.3 Key Learnings for the Pedagogical Model

This iteration of Collaborative Futures has raised valuable insights that will inform the underpinning pedagogical model for future delivery in terms of how cross-cultural collaboration is set up and then sustained as a project unfolds; mechanisms to support cross-team knowledge and skills exchange; and the role design knowledge artefacts play in facilitating participation. Returning to the underpinning research question (as set out in 3.0), as a learning experience, it provided the student-graduates with the opportunity to engage in interdisciplinary collaboration with an external professional team, stakeholders and participants. Furthermore, it was equally an opportunity for them to build upon their design practice through undertaking a design-research process to future-cast the experience, needs and opportunities of Glasgow's citizens in 2030. A key area for future research is to track, measure and evaluate the impact of the project outputs in terms of informing GCC's future

work, and if and how they plan to adopt the proposed design directions presented by the student-graduates. Furthermore, the authors observed the development and confidence of the student-graduates' own critical voice – through prototyping, testing and evaluating their design approaches – arguably developing student-led contributions to the field of Design Innovation. Thus, this iteration of the pedagogical model fostered both deeply methodological learning as well as contextual learning. A future opportunity to extend professional practice as a learning outcome is to explore the potential of supporting the student-graduates to theoretically unpack their insights, which for them often felt tacit in nature, and mentor them in authoring their own academic outputs.

6.0 Conclusion

To conclude, the aim of this paper was to evidence the authors' key learnings for delivering future-focused and citizen-centred design education, drawing on Collaborative Futures as a case study. Framed around the themes of relational and experiential proximity, and drawing on theories of CoP and Boundary Objects, the authors have reflected on the challenges surrounding cross-cultural collaboration and employing speculative design approaches in a live project. As a transferable pedagogical model, the authors argue that this studio-based, phased project approach elevated the student-graduates' design and professional practice by developing their research skills, teamwork, capabilities in creatively engaging participants, and nurturing their criticality in evaluating their design approaches. So to position this model within the wider design pedagogical landscape, and whilst out with the scope of this paper to more fully explore, in future research the authors seek to further document and evidence the value and impact of Collaborative Futures (the next iteration taking place 2020-2021), in parallel to undertaking a comparative analysis of the previous iterations (building on the work of Ross, 2018) as well as researching models being delivered by other higher institutions.

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Acknowledgements: The authors would like to thank the students and graduates, and the team at CCI within the Glasgow City Council for their involvement in Collaborative Futures (2019-2020) – in particular, special thanks goes to Stevie McGowan and John Campbell.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Communicating social values to children using design solutions.

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Abstract | This research addresses the role of children in society as key players able in the next future to influence adults' behavior as ambassadors of good causes.
The main objective is to propose an innovative approach to design products to be used by children in public spaces. These communication products have to improve children's experience, facilitating social inclusion and cultural education on social and sustainable issues and local and territorial values. According to the sustainability point of view, the design solutions might teach children to respect people and the environment and take care of local tradition and culture to pass on in the future. Moreover, this paper intends to individuate open rules that could help designers, professionals, and authorities to work together to involve young people as active citizens of the future.

KEYWORDS | CHILDREN, PUBLIC SPACES, COMMUNICATION DESIGN, INCLUSION, CULTURAL VALUES

1. Introduction

1.1. Children: learning “good practices”

Since birth, the child is naturally curious; he observes and interacts with everything around him. He learns new practices and values through various experiences and activities using communication tools suitable for his psycho-physical and emotional development. Furthermore, children have an unstoppable need to experiment and learn, and adults represent their main point of reference. At the same time, the adult learns from the child; as a matter of fact, often the child becomes a little ambassador of "good practices" and sustainable behaviors that he has had the opportunity to experience, for example, at school, where he spends most of his daily time. In this sense, the child can even change the behaviors and habits of other children and parents, and adults in general.

School and education are decisive in transmitting acceptable practices and values, as listed in the "National Indications for the nursery school and first cycle curriculum". Already from the early years of school, the child learns the first behavioral rules to promote the development of identity, autonomy, and competence to start them towards the concept of citizenship (Ministero dell'Istruzione, 2012). A school with this approach allows the child to grow up in a recognizable pedagogical environment, where he can understand what surrounds him, learning both social and cultural values. The same document aims to promote and consolidate children's necessary cultural skills. Making our culture known to the younger means knowing values and learning more advanced and not limited knowledge. Although the ministerial indications refer to the school environment, it is possible to apply these indications to other areas. Even living places, as shown (Montessori 1970), have considerable influence on the people's behaviors and, therefore, children.

As a consequence, it is essential that even public and collective places where children spend their time could be designed in such a way to reproduce the same acceptable practices and knowledge that children have experienced in the protected and safe educational places, such as at school. In this way, they have the opportunity to consolidate and test their knowledge, learn to use it, and apply it daily in order to develop civic awareness and respect for places and people. In truth, the practice of learning by doing (Dewey, 2008) is the best-known method of learning widely used.

Therefore, the research focused on public and collective spaces in the urban environment and sought to identify graphic elements, tangible and digital products capable of connoting collective spaces by creating experiences and interactions. These aim to make children more respectful of people's environment, and be aware of social issues, inducing collaborative behavior respecting rules. This purpose follows the "National indications and new scenarios", "*citizenship education is promoted through meaningful experiences allowing to learn concrete taking care of oneself, others and of the environment encouraging forms of cooperation and solidarity*" (Ministero dell'Istruzione, 2012).

1.2 Children rights and participative research.

The ONU Children Rights Agreement, signed in 1989 for the first time in history, established references and guidelines for sustainable development of "children centered" cities. The agreement took effect on 2nd September 1990, and it was deposited in ONU on 5th September 1991. To date, the convention is in force in 196 States. The document describes, through 54 articles, the economic, social, and cultural rights of children.

This agreement profoundly changed the way to consider and respect children in society. Successively the concept of "children participation" in social life was introduced, and thanking this, the child became an active part of the community.

"Designer must be a good citizen and participate in the shaping of our government and society. As designers, we can use our particular talents and skills to encourage others to wake up and participate as well".

(Katherine McCoy, 2003)

In the last couple of decades, the design research got closer and closer to the user. As a result, the term "co-design" was born during the early 1970s (Stalberg, Sandberg, Soderback, & Larsson, 2016). Designing together with users means involving final users and their creativity in the design process (Sanders & Stappers, 2008). The participative approach is a central tool in the design research because it allows understanding the impact that a given project could have on the community and how the actors interact in the scenario. It is necessary to develop a project for the community working together with the community to make it feel "owner" of its places.

Symbolic values and social relationships always qualify the space. To understand the needs of a specific space, it is not enough to observe the different users; above all, it is necessary to dialogue and work together with them. As users of a place, children represent the determining factors to involve in a design process to reach sustainable solutions. Although referring to children, the ministerial guidelines refer only to the school environment, it is possible to apply the same concepts to different public spaces in which the child lives, and he can learn good practices and social values such as inclusion and respect for the environment.

During the last years, designers have realized that children can be viewed as essential participants with valuable knowledge and experiences. Nowadays, society more and more considers children's needs even if it was mainly adult-centered until a few years ago.

In order to design according to a child-centered approach, it is evident and necessary to involve little users in the design process. The co-design is a method useful to make children active social actors. Children can communicate in many different ways, and they are capable of influencing people with whom they interact, becoming vehicles for the transmission of good practices and social values. The territory and the cities should be emotional and interesting places for children to feel safe and at ease. According to this point of view,

children should easily enjoy public spaces because they are designed to consider their needs (Giraldi, L., Benelli, E., Vita, R., Patti, I., Filieri, J., Filippi, F. 2017).

Concerning this perspective, in fact, in Italy's last decade, the awareness of children's social importance increasingly spread. Therefore, in the design of public and private indoor and outdoor spaces, more and more attention is paid to children and family needs to improve as much as possible the experience in the environment.

In Italy, article n. 7 of the Law n. 285/97 provides measures and interventions aimed at promoting the participation of children and adolescents in local communities life through actions that facilitate the use of urban and natural spaces, removing obstacles to mobility, spreading the use of environmental, cultural, sports and social goods and related services. Since 1996, these themes have been developing by the Ministry of the Environment to promote the Sustainable Cities of Girls and Boys Project, to encourage a new childhood culture based on the important assumption: a "children centered city" is more suitable for everyone. The participation of children and adolescents is essential in creating projects for the urban environment. This one designed for and with children is better for the whole community and are an enrichment for the society.

The participative approach with children is widely used in designing a public place, especially in northern Europe, even if it is quite used as a design method and Italy, starting from the last years. A very interesting case study of participative research with children is the "Design for Outdoor spaces" project, carried out in Rotterdam (Holland) in 2016. The project aimed to design strategic solutions to be included in the outdoor public spaces of a defined neighborhood to create open rules applicable to different collective spaces. The research highlighted some guidelines to design strategic solutions to improve the security and the usability of neighborhood public spaces where children usually spend their free time.

2. The aim of the research

This research aims to propose a new approach in designing communicative products for children belonging to different cultures to be used in public spaces of various urban scenarios. These kinds of products have to improve children’s qualities of experience facilitating their relationship and cultural education on social and sustainable issues and, at the same time, on local and territorial values.

According to this previous statement, the research aims to individuate a series of open rules as a concrete referring tool available to be used by designers, public authorities, and professionals for different designing purposes and taking into account a multi-cultural language.

All the products designed following these open rules will have in common the capability of easily interacting with children communicating them with a different kind of practical and intangible information and at the same time exiting them in a pleasant way. These design

solutions have also to teach children to respect people and the environment, taking into account local culture and traditions to pass on in the future according to the sustainability point of view.

Consequently, the research proposes a new collaborative approach in designing for public spaces to integrate practical information, and intangible social and cultural values in pleasant emotional experiences, improving awareness among children helping them learn values.

Moreover, this work highlights the strategic role of design and communication, able to pass on practices and intangible values suggesting behaviors, relations, and interactions among young people and places, making them familiar and engaging them as active citizens of the future.

3. Methodology

The design research used a transdisciplinary approach to believe that solutions depend on the wise evaluation and analysis of all possible factors connected to the problems and related to the kind of main users in specific contexts.

Nowadays, children spend most of their life outside the home by living in outdoor or indoor public spaces. During this long everyday time, they live meeting and socializing with the others. Even if their experiences could be very different according to many factors, all the children have in common a series of recurrent needs.

Starting from these considerations, the design research follows a transdisciplinary method involving many disciplines as pedagogy, cognitive perception, education, economic, history, engineering. Besides, the design used the Human-Centered Design (HCD) approach and the co-working method to involve different actors, including children as main users in the design processes.

Allison Druin adapted the participatory design theory to suit children to have their direct input, thoughts, and feedback in the design process (Druin, 1998). According to the author, children can be involved in the design process in four different ways: a user, a tester, an informant, and a design partner (Druin 2002). Furthermore, Iversen, Smith, and Dindler also identified the role of "protagonist," according to this role, children have much more power during the design process (Iversen et al., 2017).

Lastly, Fenne Van Doorn theorized that, during the design process, children should have the task of "co-researcher." As a consequence, children are both researchers and final users (Doorn, 2016).

During the co-working activity, some important factors should be considered, such as children's age (Piaget,1970), the environment, and the activity itself. Because children's'

abilities and skills change according to their age, it is necessary to choose the type of activity suited to the characteristics of children involved and related to the final goals.

The environment is the second factor to take into consideration the success of the activity. For this reason, the choice of well-known places such as, for instance, schools may be reasonable, so that the child feels at ease during the activity.

Referring to the kind of activity as the third factor, low-tech methods, such as paper, clay, Lego, and crayons, represent a good practice to encourage all kinds of children to communicate according to Druin's theory. Moreover, during workshop activities, it is important not to judge the children; thus, they can feel free to express themselves.

Finally, the co-working activity should be ludic to entertain pleasantly and, at the same time, should make the child responsible for the project. Besides, the co-working activities with young people result strategically also for underlining the connections among children, behaviors, and emotions during a life experience in public spaces. The co-working approach has experimented with as described below during the development of the present work.

Due to the broad context of reference and different experiences, the research analyses children's behaviors and needs from the referring literature and through different activities with children 7-11 years old.

Reggio children approach (Edwards & Gandini & Forman, 1993), Montessori (Montessori, 1970), and Piaget (Piaget, 1970) gave us the basic referring theories on children's skills, needs, and behaviors at different ages and information on their psychophysical and cognitive development.

3.1 Applied method

The research has been divided into two main phases, and each one has implemented different kinds of activities.

The first phase was carried out involving two classes of children (from 8 to 10 years old) at Gianni Rodari primary school in Florence.

The activity concerned direct observations of children in different contexts, then it concerned co-working activities with young people. The co-working activities were found strategic not only for the contributions to the design research but also for underlining the relations among children, behaviors, and emotions during a life experience in public spaces. All the scheduled activities have experimented with as described below during the development of the present research.

1. Direct observations. The direct observation aimed to identify children's behaviors and needs during free time activities at the public garden near the school, including their walk along pedestrian paths (about 500 meters) between the school and the public garden and vice versa.

2. Co-working activities. Children were asked to describe and draw what they would expect to find on the path walk and at gardens to feel safe and autonomous from adults during an outdoor activity. Moreover, they had to indicate what could help them to live their experience pleasantly.

Besides, they had to describe in a few words what they would like to find in the gardens to play in security and make friends with other children also belonging to other cultures. During the activity, a special focus was devoted to the best methods to communicate and pass on local habits and traditions to children to make them understandable and applicable. In this way, one should unconsciously educate to respect the environment and to build a civic conscience, creating a sense of belonging to a place. Finally, they were invited to draw their ideal public space. During the activities, the children were supported by experts such as teachers, pedagogists, cognitive psychologists, and designers. The activities lasted for about two months.

The second phase of the experimentation activities was carried out with fifty students of the master design course at the University of Florence. The activity's object was to design strategic solutions, such as material and digital products, graphics, wayfinding systems, and services, to be easily used and understood by 7-11 years old children. The requested projects aimed to improve children's experience in public spaces, suggesting them good practices in relation to the respect of social values, environment, local culture, inclusion, and a more sustainable future.

The activities with students were structured into two steps and lasted for about five months. During the first step, students were asked to study children (7-11 years old) needs and behaviors concerning their psycho-physical development. During this step, they were supported by pedagogists and psychologists. Moreover, they investigated children's products and collective and public spaces dedicated to children or children used to visit. Finally, they studied the participatory approach and co-working as design methods, referring to significant examples.

Following these theoretical studies, students designed the "concept of products" for children to be used in collective spaces according to the set goals. The material and immaterial "concepts" aim to make the new generations more satisfied with their experience in collective public spaces.

During the design process, some of the students directly interfaced with associations and local authorities of the involved territory to use new solutions to welcome children in public spaces.

During the workshop, young designers proposed design solutions to be included or used in outdoor and indoor public collective spaces, which could teach children good practices regarding the context of reference. In particular, the proposals aimed, on the one hand, to make the child responsible for the place itself and, on the other, to encourage them to relate

to each other. In the proposals, the child becomes the essential active element in the place. Through some of the proposed experience, the child actively respects the environment by taking care of the plants.

4. Results

The design research process started from a transdisciplinary approach, involving various disciplines collecting different knowhow with the same final goal.

This approach believes in an essential exchange of techniques, methodologies, and know-how towards innovative design research. In particular, this method allowed us to find innovative solutions to educate children, communicating them with good practices related to passing on local values, respecting the environment, and including people in public and collective spaces.

According to these aforementioned purposes, designers should take into account the following design solutions using design elements for public/collective spaces:

- Orientation elements. Children need recognizable elements to guide their behaviors, feeling themselves at ease also outside familiar such as iconic graphics and pictograms, indicator signs, minimal use of words, simple, colorful shapes, and use of primary colors. All the products have to be placed on the decking and at a height not exceeding 1,2 meters.
- Information elements about practical and immaterial topics, such as iconic and symbolic signs, minimal use of sentences, illustrations. Children need to clearly understand all the rules to respect and good behavioral practice to act in public spaces. Moreover, these kinds of products are responsible for passing on local values and traditions, contributing to improving all the children's knowledge.
- Entertainment elements. The use of ludic and experiencing elements, as signs, texture tiles, interactive screens, and park equipment, allows children to interact with fun.
- Emotional elements: Multipurpose elements made of different colors, shapes, textures, functions, and materials allow for stimulating the child's creativity and imagination, making the environment reassuring and engaging through their synesthetic involvement.
- Inclusive elements: capable of improving collaboration among children, sharing of values and emotions, facilitating relationships, and welcoming of all kinds of children. These elements should have undefined shapes, capable of being interpreted by children according to their culture and origin.

All the above solutions can influence children and their behavior. They result strategic in designing products to be used in public and common spaces, and in all places where these goals are primarily.

In conclusion, the research aims to improve children's educational experience on important themes of inclusion, respect for the environment, sustainability, and cultural and traditional values. This research identified a set of open rules to design products to identify and render public and collective spaces children centered. The final purpose aims to improve children's educational experience on important themes of inclusion, respect for the environment, sustainability, cultural and traditional values. The research underlines that all the material and digital elements inside public and collective places determine children's living experience.

The more these elements result familiar and recognizable, the more the experience will be friendly and amusing, thus improving children's education and growth. According to this consideration, children's experience inside this kind of public space becomes a pleasant training for their future life. In summary, the research results point out that design solutions have a decisive influence on people's quality of life and particularly on children inside collective places. For the future, we hope that these design inputs could be of inspiration and advice for designers, researchers, public authorities, and professionals for the design of collaborative child-friendly environments. Moreover, the proposed design approach based on children's needs trains the community to be more proactive and explore new solutions to solve future problems. Finally, we would like to share these results in order to apply and to develop the proposed open rules for designing not only public spaces but also all kind of living collective places in order to diffuse the "children-centered" design approach.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Creating an inclusive learning environment to support transformative learning and encourage upward educational mobility opportunities for economically or academically under-resourced design students

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Abstract | While select students are groomed within design-driven learning environments, exposed daily to forward-thinking practices, many of their less fortunate counterparts lack the means or acumen to access those resources. The emphasis on inclusivity in the field of graphic design education assumes even greater importance in institutions serving economically or academically under-resourced students such as junior colleges, tribal colleges, and many other public institutions. This paper presents modifications to graphic design foundation courses developed to meet the needs of students whose educational, cultural, social, or economic situations hinder their educational process and make it hard to pursue their educational and professional goals. It is a portfolio of tools adaptable to different levels of preparedness that supports transformative learning and develops self-efficacy in students, along with a solid baseline in critical thinking, design processes, and technical capabilities. The goal is to support and encourage upward educational mobility opportunities for such students.

KEYWORDS | INCLUSIVE LEARNING ENVIRONMENT, EMPATHETIC CLASSROOM, STUDENT-CENTERED DESIGN EDUCATION, UPWARD EDUCATIONAL MOBILITY, TRANSFORMATIVE LEARNING ENVIRONMENT

1. Introduction: The journey of growth for economically or academically under-resourced students

New data published by The Brookings Institution indicates that in the USA only 46% of students from low-income households enroll in four-year institutions (Reber, Sinclair, Van Drie, 2020). At the same time, more localized research based on data from the state of Georgia, USA estimates that four-year-university students show a 20% household income growth by the age of 30 (Smith, Goodman, Hurwitz, p. 1). In reality, the journey of economic growth and mobility may be much more complicated and often can feel unsurpassable to economically or academically under-resourced students, especially in the field of graphic design, since it may not be commonly represented or supported within their social circle. City and community (junior) colleges provide a necessary opportunity for "(41 percent) of all postsecondary students (especially low-income and underrepresented students)" (P. Loprest, C. Hyman, 2018 p. 4) to obtain the credentials and knowledge base for transferring to four-year-institutions. These programs play an instrumental role in educating economically or academically under-resourced design students.

Students who come to junior colleges often have many exhausting responsibilities in addition to their studies, such as working more than one job to support their families, taking care of siblings or relatives, and having parental responsibilities. In addition, they may have limiting living conditions, access to food, technology, and medical care.

Many such students may also be underprepared. In 2016, for example, two-thirds of students came to community colleges not ready for college level work (CCCSE National Report, 2016 p.2). Therefore, maintaining an inclusive and empathetic learning environment that supports transformative learning practices and develops self-efficacy at the institutions and programs serving those students is very important.

1.1 Why this article

The design field today presents different types of challenges and opportunities. If only for this reason, we need different types of designers. We need designers who understand and practice diversity, and who possess diverse education and skills. As much as new designers should be ready to uphold the mantle of social and environmental responsibility that comes with this multifaceted occupation, they should also "share a core set of fundamental principles that sets it[design] apart …" (M.W. Meyera D. Norman, 2020 p. 14)

While select students are groomed within a design-driven atmosphere, exposed daily to the most forward-thinking design practices, their counterparts from under-resourced communities lack the means or acumen to access the same resources. These young designers often graduate before they are ready to take on responsible roles in shaping sustainable and formative systems for our future.

Under the weight of current global issues that affect everyone, as well as specific local issues amplified by the global pandemic, the need for change in the educational system, and design education specifically, has become imminently necessary. While Meyera and Norman, in general, call for "a program to move the design profession capable of fully realizing the value of design in the 21st century"(M.W. Meyera D. Norman, 2020, Highlights), the author hopes for a program that will specifically address the needs of students from underrepresented, vulnerable, or under-resourced areas and communities.

This article arises from the author's own experience teaching a demographic that includes academically underprepared students, students from different linguistic backgrounds, first generation students, and students with financial, personal, medical, or other hardships. These students' needs often go unmet within a typical design program because of their circumstances. This is why in her own classroom the author adjusts the program to fit those students specifically. That said, the challenge of serving students with needs arising from generations of disadvantage can be found in classrooms all over the world.

2. Methodology

The following are the methods the author currently uses to help students develop a solid baseline in critical thinking, design processes, and technical capabilities. This educational model aims to support transformative learning and develop self-efficacy. The goals of this effort are to assist and encourage educational mobility opportunities and help provide a clear pathway to a four-year-institution for students.

This adaptable portfolio includes the following educational methods: building on strength, developing professional awareness (the tactical consideration mindset), spiral course structure and content integration, no failure grading systems, tools to solidify general, cultural, and professional development, and other techniques such as progress grades, checklists, in-class and online collaboration assignments, lead-ins to facilitate constructive critique, design vocabulary and other practical resources, and extracurricular opportunities within the design classroom.

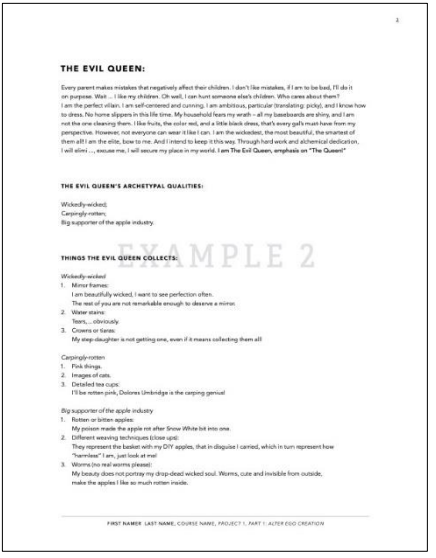
3. Building on strength: first projects should showcase students' natural talents and abilities

Since the skill range within one classroom may vary greatly, it is best to start a course with a short assignment that requires students to experiment with their skills, like an image making project. The goal is to allow each student to discover what design skills they are good at and then develop them further. After deciding which skillset to use, students can start a slow burn project (semester or half-a-semester-long) that relies on those skills. This project should only require thirty to forty minutes a week, so students have time to work on other

shorter assignments. Such a project creates the opportunity for students to utilize their best talents on a weekly basis, supporting their efforts in other areas of the program that might not be as easy or emotionally fulfilling yet. This method encourages students to deepen their perception of design, evaluate their own talents, and imagine their future within such a broad discipline from the get-go.

3. 1. Example:

My Alter Ego's Collection of Great Stuff. In this project, students are asked to select a style of image creation that showcases their strength and reflects their personality. The *Alter Ego* approach to the repetitive task of creating images in a selected style makes said task more interesting, and inspires students to create unique and thoughtful processes. It teaches them to follow a design process, pay attention to details, regard the project description carefully (it is the *Alter Ego,* not the student, who chooses the style, so the style should reflect the "author"), and curate their work for their final presentation. A semester long collection project is sometimes issued in traditional design schools in the United States. However, in a shorter junior-college level program, it is more difficult because of the time constraints. In a course that aims to prepare students with a wide range of abilities and skills, such a project serves as the glue for otherwise smaller and more technical assignments that students work on to advance their understanding and command of graphic design principles.



THE EVIL QUEEN:

Every parent makes mistakes that negatively affect their children. I don't like mistakes, if I am to be bad, I'll do it on purpose. Wait ... I like my children. Oh well, I can hunt someone else's children. Who cares about them? I am the perfect villain. I am self-centered and cunning. I am ambitious, particular (translating: picky), and I know how to dress. No home slippers in this life time. My household fears my wrath – all my baseboards are shiny, and I am not the one cleaning them. I like fruits, the color red, and a little black dress, that's every girl's must-have from my perspective. However, not everyone can wear it like I can. I am the wickedest, the most beautiful, the smartest of them all! I am the elite, bow to me. And I intend to keep it this way. Through hard work and alchemical dedication, I will elimi ..., excuse me, I will secure my place in my world. I am **The Evil Queen, emphasis on "The Queen!"**

THE EVIL QUEEN'S ARCHETYPAL QUALITIES:

Wickedly-wicked;
Carpingly-rotten;
Big supporter of the apple industry.

EXAMPLE 2

THINGS THE EVIL QUEEN COLLECTS:

Wickedly-wicked
1. Mirror frames:
   I am beautifully wicked, I want to see perfection often.
   The rest of you are not remarkable enough to deserve a mirror.
2. Water stains:
   Tears,... obviously.
3. Crowns or tiaras:
   My step-daughter is not getting one, even if it means collecting them all!

Carpingly-rotten
1. Pink things.
2. Images of cats.
3. Detailed tea cups:
   I'll be rotten pink, Dolores Umbridge is the carping genius!

Big supporter of the apple industry
1. Rotten or bitten apples:
   My poison made the apple rot after Snow White bit into one.
2. Different weaving techniques (close up):
   They represent the basket with my DIY apples, that in disguise I carried, which in turn represent how "harmless" I am, just look at me!
3. Worms (no real worms please):
   My beauty does not portray my drop-dead wicked soul. Worms, cute and invisible from outside, make the apples I like so much rotten inside.

FIRST NAME LAST NAME, COURSE NAME, PROJECT 1, PART 1: ALTER EGO CREATION

Figure 1. My Alter Ego's Collection of Great Stuff project, part 1, an OC (original character) creation, Alter Ego OC example: The Evil Queen.

3. 2. Reflection:

When students discover that they can produce quality work through careful analysis and thoughtful use of their existing talents, they learn to continue developing those talents and start looking at the world with a designer's eye. They tend to dig deeper into the program, discovering new interests and actively striving to develop their skills; they also learn to productively utilize them. They better identify the weaker areas in their own work. This method helps students to see their own worth as designers. From the author's experience, the *Building on Strength* approach is especially helpful for design students who begin their journey from an academically disadvantaged position to become capable professionals.

4. Developing professional awareness: the tactical consideration mindset

The vocabulary used in the classroom to discuss personal qualities, talents, abilities, advantages, and disadvantages is constructive and optimistic. It is essential for the students to develop their ability to recognize and acknowledge their own weaknesses. This is done through positive reinforcement and encouragement, as well as using a proactive and optimistic vocabulary that fosters professional and personal growth. Phrases like *'tactical*

consideration' help students understand that there is something that needs to be re-evaluated, but they also teach students that all those 'considerations' are a part of every professional designer's process, and such critique does not have any negative connotation. In a non-judgmental atmosphere, with the help of educational materials based on their particular needs, the students easily learn to take the actionable steps needed to address different challenges.

4. 1. Example:

A student is not schooled in academic drawing techniques, but unconsciously creates images in a style similar to works of primitivism. When this student is encouraged to develop their unique style of illustration, they begin to apply their newly acquired theoretical knowledge and compositional skills while effectively evoking elements of primitivism in their visual interpretations. As a result, this student's interest in their work increases, their projects are of higher quality than before, and they learn to embrace their personal style.

4. 2. Reflection:

Searching for possibilities hidden within students' own work, emphasizing them, and developing them into growth opportunities alleviates comparison anxiety and teaches students healthy critique strategies. When students receive positive guidance in strengthening their talents, unrelated to their level of preparedness, abilities, or aspirations, they begin paying attention to their weaknesses as well. However, they concentrate on the positive aspects of learning. They understand the value of their own work rather than comparing their work to the work of others, which expedites students' academic and creative development. This method teaches students some elements of design thinking and human-centered design.

5. Spiral progression and content integration

Usually the spiral approach is best employed as a long-term educational process. However, the timeframe and circumstances discussed in this article do not allow for that. Although there is no clear empirical evidence for the effectiveness of a spiral based curriculum (J. Howard, 2012, p.1), due to its nature, the spiral structure of learning process improves Transfer During Learning and Transfer of Learning (D. Sousa, 2012) directly by reinforcing and refreshing the understanding of concepts, gradually introducing complexity in a shorter period of time (a single course) *(Figure 2).* If combined with some elements of content integration, a spiral progression prepares students for a four-year institution. Transfer processes, according to the neuroscientific education theory, allow the brain to reorganize itself upon receiving new stimuli. The student's brain discovers new connections between old and new knowledge, leading to creation of new networks and patterns of thought and action, thus "add[ing] beauty and clarity and… forge[ing] isolated ideas into spectacular

visions." (D. Sousa, 2012). By integrating related materials from other disciplines and courses to a graphic design foundation course, the author builds on the transfer abilities of the brain (D. Sousa, 2012). For students dealing with the challenges described at the beginning of this paper (1.1), spiral progression and content integration can alleviate stressors like fear of failure or the pressure of learning a new academic subject. Because students revisit new concepts often, review and test them with different levels of complexity, they know that they have time to understand and practice any topic. An approach based on transfer qualities of the brain also allows the instructor to analyse the class's strengths and weaknesses regularly and adapt the rest of the program accordingly.

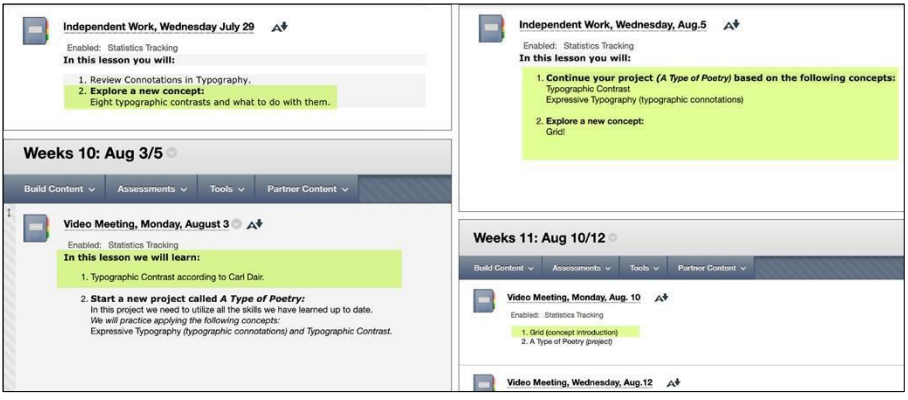


Figure 2. Typical spiral order of content presentation: ***A.*** *Independent work: concept exploration – Typographic Contrast.* ***B.*** *In class lesson: Typographic Contrast. C. Independent work (homework): assignment based on the topic of Typographic Concept, etc.*

5. 1. Examples:

An integrated assignment can be an overview of a design movement connected to a specific period in history (including but not limited to design history), with principles of visual composition originated or best represented during that time; or a visual analysis of a project by a current designer of choice from a provided list, related to a topic in a visual composition course. Other possibilities may include building connections made through learning technical skills specifically related to the history of typography (setting text for a specific reading process, or choosing a typeface most suited for small screens, etc.); or understanding typographic classification through hands-on activities that help explain the reasoning behind their design (block printing using compositions with modern serif vs slab-serif typefaces); or studying basic principles of trade, psychology of collective memory, and cultural meaning of images as a part of an introductory course on brand and identity design. A more specific example based on current affairs might be the following topic: How the protest posters from

the American Civil Rights Movement (1950 – 1960s) inspire the work of designers today, and what other examples of such relationships we can investigate.

5. 2. Reflection:

Instilling an ability to connect ideas and use those connections productively is the final purpose of content integration. Rather than studying a single concept in depth (the depth of understanding can be achieved later in educational process), we build the skills to cover a wide breadth of investigation and the ability to transfer the learned tactics to other projects.

6. Grading system to inspire student's success

If students struggle with attendance or class/homework, they often have a history of academic failure and rejection. These are usually the reasons why said students encounter problems and why they haven't mastered the executive skills to maintain a good record. This situation becomes a never-ending cycle where one issue leads to another. Failing such students in the classroom will not serve them well in the long run. They are accustomed to failure. It does not motivate them to do better next time. "Personal relevance, some control of the learning process, and a sense that one can master—and is mastering—the material." (C.Wieman, 2013, p. 1) affect students' learning success going forward. Therefore, instead of failing, the students are encouraged to make small efforts, implement minor changes in their approach to school, and if necessary, are provided with a personal learning plan that allows students to move forward, to clearly recognize their accomplishments, and finally, to finish the course successfully. This approach helps the students restore their sense of purpose and desire to succeed again.

6.1 Progress grade:

One of the most difficult habits to break for students with emerging visual literacy and limited ability to engage in the culture of design is the tendency to rush through the design process. It is not that the students do not want to explore the design challenges in depth, but rather that they have never independently done a thorough investigation of any kind before and cannot yet comprehend how to approach it. Therefore, when a student shows great effort and substantial progress in their process, they are assigned an extra grade for such achievement. This grade usually allows the student to raise their final grade and motivates them to continue developing their design process capability by widening and deepening their field of investigation. Progress grades can also be assigned to acknowledge formal or conceptual growth based on the exerted effort.

6.2 Reflection:

There are, of course, cases when no support or encouragement is enough to help a student to overcome their situation or circumstances, but even then, students learn to look for solutions rather than give up. *Persistence is not only an important personality trait, but also a catalyst for successful design methodology or an educational endeavour.*

7. Tools of the trade

Following is the list of educational tools, techniques, and activities that the author has found helpful and productive for both in-person and online classroom environments.

7.1 Checklists

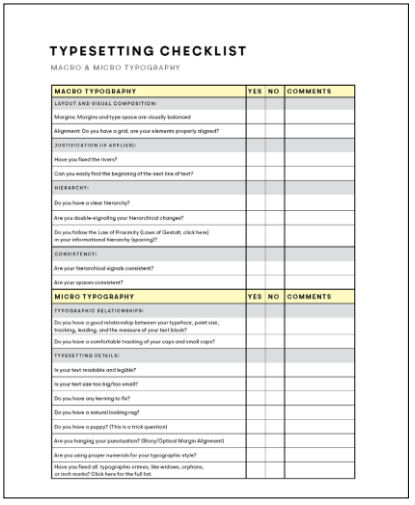
Original checklist, compliments of Inna Alesina (Stevenson University School of Design). When the author began the process of adapting her program for graphic design fundamentals to meet the needs of junior college students, she received an example of a Project Checklist from a colleague and friend *(I. Alesina).* Since then, the author has realized that her students react better to checklists than rubrics, and a well compiled checklist can serve as a multifunctional tool in design learning and critique processes.

Checklists are very handy for students who have just began to practice abstract thinking, visual conceptualization, formal principles of graphic design, and rules of composition. Checklists help students to receive a clear and concrete critique, as well as provide the ability to refer to the components and requirements of a successful assignment at home in the simplest form *(Figures 3, 4).* They also assist in peer critiques by helping students self-reflect.

CHECKLIST FOR ALTER EGO CHARACTER CREATION:

	DRAFT 1			FINAL		
	YES	NO	COMMENTS	YES	NO	COMMENTS
Originality of the concept and literary style:						
Language consistency:						
Design consistency:						
Relevance to the project description and all the requirements *(file naming, titles, etc.)*:						
Clarity of communication:						
Relevance of the object selection for each archetypal quality:						
Is the object selection specific enough to create a focused image collection?						
Accessibility/availability of the objects to the designer *(how easy will it be to 'collect')*:						
Extra, NON-COMMUNICATIONAL elements:						
Copyright issues, attributions:						

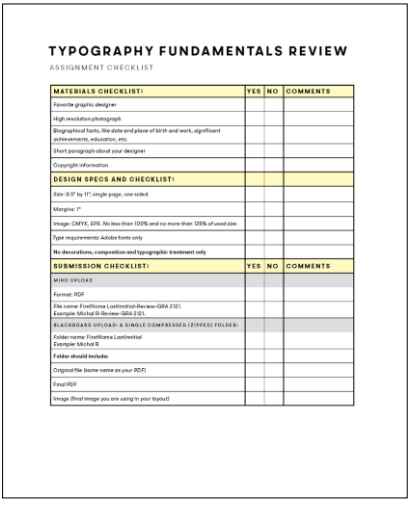
Figure 3. Alter Ego: character creation checklist.



TYPESETTING CHECKLIST

MACRO & MICRO TYPOGRAPHY

MACRO TYPOGRAPHY	YES	NO	COMMENTS
LAYOUT AND VISUAL COMPOSITION:			
Margins: Margins and type-space are visually balanced			
Alignment: Do you have a grid, are your elements properly aligned?			
JUSTIFICATION (IF APPLIED):			
Have you fixed the rivers?			
Can you easily find the beginning of the next line of text?			
HIERARCHY:			
Do you have a clear hierarchy?			
Are you double-signaling your hierarchical changes?			
Do you follow the Law of Proximity (Laws of Gestalt, click here) in your informational hierarchy (spacing)?			
CONSISTENCY:			
Are your hierarchical signals consistent?			
Are your spaces consistent?			
MICRO TYPOGRAPHY	**YES**	**NO**	**COMMENTS**
TYPOGRAPHIC RELATIONSHIPS:			
Do you have a good relationship between your typeface, point size, tracking, leading, and the measure of your text block?			
Do you have a comfortable tracking of your caps and small caps?			
TYPESETTING DETAILS:			
Is your text readable and legible?			
Is your text size too big/too small?			
Do you have any kerning to fix?			
Do you have a natural looking rag?			
Do you have a puppy? (This is a trick question)			
Are you hanging your punctuation? (Roxy/Optical Margin Alignment)			
Are you using proper numerals for your typographic style?			
Have you fixed all typographic crimes, like widows, orphans, or rich marks? Click here for the full list.			



TYPOGRAPHY FUNDAMENTALS REVIEW

ASSIGNMENT CHECKLIST

MATERIALS CHECKLIST:	YES	NO	COMMENTS
Favorite graphic designer			
High resolution photograph			
Biographical facts, like date and place of birth and work, significant achievements, education, etc.			
Short paragraph about your designer			
Copyright information			
DESIGN SPECS AND CHECKLIST:			
Size: 8.5" by 11", single page, one sided.			
Margins: 1"			
Image: CMYK, EPS. No less than 100% and no more than 135% of used size.			
Type requirements: Adobe fonts only			
No decorations, composition and typographic treatment only			
SUBMISSION CHECKLIST:	**YES**	**NO**	**COMMENTS**
MIRO UPLOAD			
Format: PDF			
File name: FirstName LastInitial-Review-GRA 2121. Example: Michal B-Review-GRA 2121.			
BLACKBOARD UPLOAD: A SINGLE COMPRESSED (ZIPPED) FOLDER:			
Folder name: FirstName LastInitial Example: Michal B			
Folder should include:			
Original file (same name as your PDF)			
Final PDF			
Image (final image you are using in your layout)			

Figure 4. Typography Fundamentals: typesetting and design analysis checklists.

7.2 Extra opportunities within the design classroom:

Learning the basics:
The competencies for design foundation courses do not include many hands-on skills. Usually those skills as well as other design related techniques are offered in separate courses, like photography or printmaking. Since some students often need to decide between coming to class and going to work, the author has included projects and workshops that involve elements from other creative disciplines. The only three considerations in the selection of which course flourishes to include are: the role of the technique in graphic design, the logistics of producing the work during the class period, and the price of the materials.

Collaboration for an inclusive classroom environment:

Collaboration is a crucial part of an inclusive classroom, in-person or online.

The following are examples of in-class collaboration for different projects *(Figures 5, 6).*

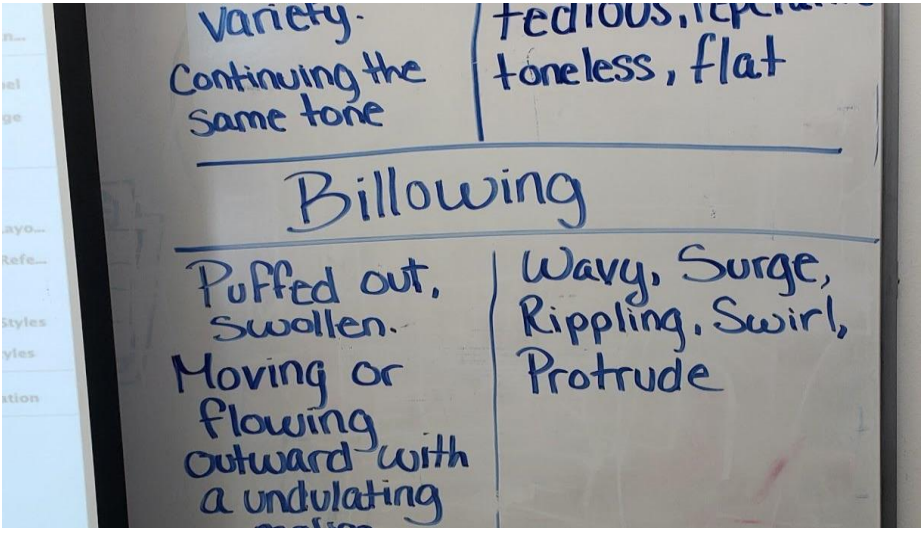




Figure 5. ***A.*** *Words & Meaning, research. Spring/Fall 2020. Group exercise. (**B**: Online whiteboard, Miro.com). Students investigate different meanings of a set of antonyms, to help choose the meaning that inspires the best visual interpretation of those concepts.*

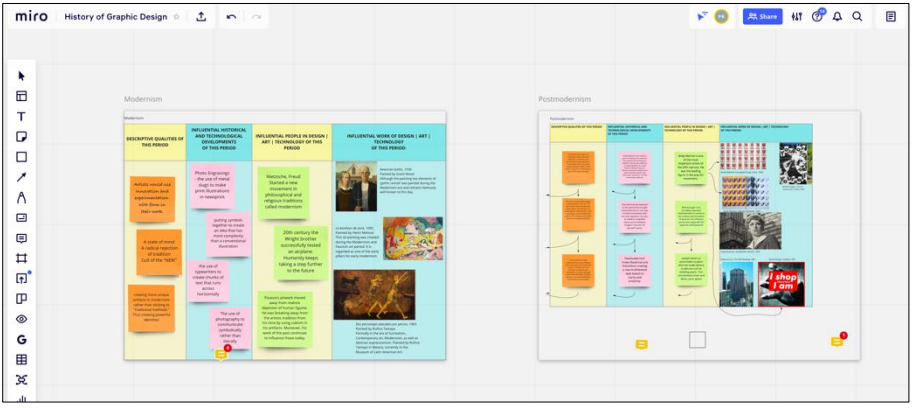


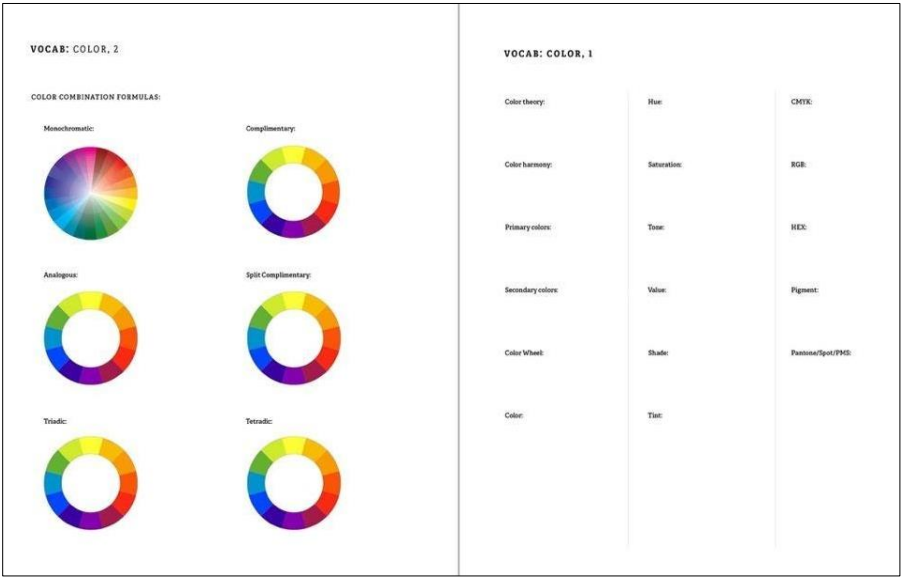
Figure 6. Traditional Design History. Fall 2020. Group research using online whiteboard tool, Miro.com. Students compile their own references on the different periods of design history.

Design vocabulary

In the beginning of a course, students are provided with a design vocabulary file. It is an ongoing interactive list with links to external references and resources. Students are encouraged to use it in discussions and verbal critiques. Among other benefits, it is a great help in learning new design terms.

Questionnaire-based readings and video lessons

To help students with different levels of reading comprehension, the author employs reading and video questionnaires. Each questionnaire is compiled to help with text/video analysis and develop a mindset for independent analysis *(Figure 7).* This approach helps students on different levels: students who need support with informational analysis use the questionnaires as a guide, as well as a checklist; students with an aptitude for informational analysis always use open ended questions to add different perspectives to class discussions. This helps all groups to learn from each other and supports the diversity of opinions in the classroom.



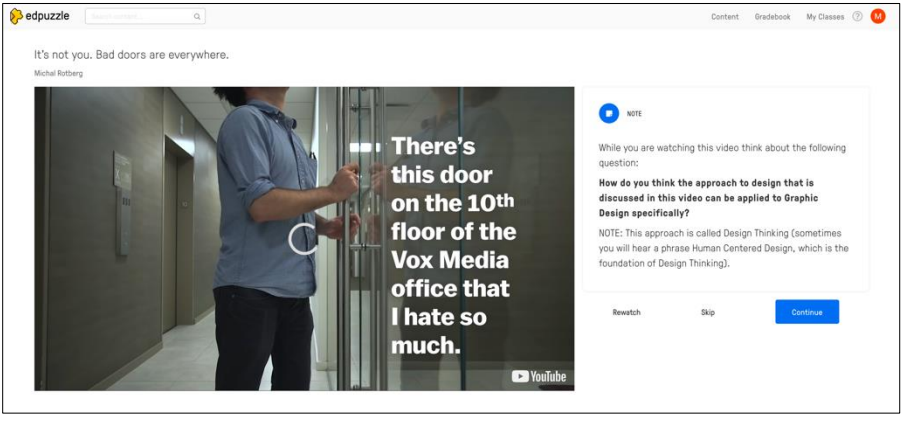


Figure 7. ***A.*** *Learning color. An example of a simple questionnaire.* ***B.*** *Introduction to Design Thinking, video lesson. The video used, by Posner, Mars, & Barton for Vox.com, 2016, includes an interview with Don Norman. A single question questionnaire, lesson created using Edpuzzle.com.*

8. Conclusions

In addition to a multidisciplinary knowledge base, graphic design education builds on formal and visual skills like cultural awareness and critical thinking. The author's initiative is meant to create a transparent graphic design classroom through empathetic learning practices, real-time program modifications, and other student-centered methods of instruction that help students to improve their visual literacy and reach other milestones in their professional growth.

Adapting methods of information delivery, critique, and evaluation to the needs of a specific group of students brings the freedom to introduce more complex topics and substantial studio assignments. Building on students' strengths helps them deepen their perception of design, evaluate their own talents, and realize their potential place within the industry.

Spiral progression in learning ensures students' ability to retain and connect complex topics. Content integration (e.g. cultural, ecological, historical, etc.) lays a contextual foundation for the students' conceptual and formal growth.

A systematic approach to analysis and evaluation tools, like reading/video questionnaires and checklists, teach clear and actionable steps to address design challenges.

All of these strategies are student-centered and aimed at creating an empathetic learning environment. Originally, the author developed them for junior college design students with different levels of preparedness, who undergo many external stressors that hinder and sometimes prevent their educational progress. Because the author's approach is focused on inclusive methodologies and flexible content, these strategies can be tuned to other areas of design education and educational communities to help students with similar needs.

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Acknowledgements:
I would like to express a great appreciation to the special individuals who provided valuable advice and great moral support throughout the writing process of this article: Sarah Avery, Ph.D., Sarah Leah Borodiansky *(New College of Florida),* and Eva Rotberg who all helped considerably with the editing process; and especially to Inna Alesina *(Stevenson University).* I also would like to thank all my students for working very hard to achieve their educational goals.

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Cultural Differences as Challenges and Design Drivers in the Development of Smart Assistive Technology for an Ageing Society

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Abstract | Cultural differences are important in terms of working processes and practices, and in order to achieve innovation and market success. The MATUROLIFE project is seeking to explore, understand, and embed cultural differences when designing smart assistive products to improve the independence of older adults. As a case study, the project explores cultural differences between user groups and stakeholders in different European countries, as well as in the collaboration of partners from different disciplines and organizations. Co-creation and service design have been employed to mediate these differences. The case study outlines a design management process that has accommodated scientific innovation and complexity whilst acknowledging cultural diversity in end-users and between disciplines and partners. This paper demonstrates how design can be understood as a culturally situated practice where cross-cultural differences can provide challenges but are also opportunities to drive changes in practice, innovation and enable positioning in a European wide market.

KEYWORDS | CULTURAL DIFFERENCES, ORGANIZATIONAL CULTURES, SERVICE DESIGN, CO-CREATION, DESIGN MANAGEMENT

1. Introduction

Culture has extensive and various definitions. From a wide ethnographic viewpoint, Edward Tylor (1871) interpreted culture as an umbrella term embracing the social behavior and norms of human societies, also including knowledge, belief, art, law, customs, and any other capabilities and habits acquired by those within a society (Bennett, 2015; Tylor, 2010). Hofstede et al. (2010) defined culture as "the collective programming of the mind that distinguishes the members of one group or category of people from others". National culture refers to similar individuals, institutions and organizations across countries (Hofstede, 2011). Organizational culture is a mixture of organization practices and management structures arising from the interactions of people with their work environments and it may vary per country (Tomek, 2011; Weiner, 2005). Despite the classification of culture, many studies have indicated that cultural differences are significant and influential but the effect may not be conscious and well recognized (Lachner, Saucken, Mueller, & Lindemann, 2015; Stahl, Maznevski, Voigt, & Jonsen, 2010).

Hofstede (2001) argued culture and cultural values play an influential role over almost all aspects of human life, and the realm of design is not an exception. The impact of cross-cultural differences has been discussed in research areas such as sociology and psychology with a growing interest in design (Halskov & Christensen, 2018). When an organization successfully integrates design, a design culture can emerge. This may be rooted in design thinking and be characterized by design activities as well as through the interaction of actors as well as local norms, values and assumptions (Elsbach & Stigliani, 2018; Manzini, 2016).

Comparative research on cross-cultural differences in design is often considered from a theoretical perspective rather than in terms of practical application (Lachner et al., 2015). This paper explores the impact of both working and living cultures on design. Cross-cultural differences are considered within the context of the EU funded MATUROLIFE (Metallisation of Textiles to make Urban living for Older people more Independent and Fashionable) project. The project is making use of innovations in smart materials, and techniques developed to metallise fabrics to develop new assistive technology products for older adults across Europe. In this case study, cultural differences have been considered in two dimensions:

1. The work or organizational cultures of the project partners
2. The country-based cultural differences between our product end-users

The product development process adopted within the project considers cultural sensitivities and differences amongst the potential users of the MATUROLIFE products. Whilst the project management approach adopted considers cultural differences between partners and their working approaches. The project consortium is comprised of 20 partners from 9 European countries and includes a range of subject expertise including electronics, printing, electrochemistry, material science, design, clothing, footwear and furniture manufacturing.

The project team is developing assistive technology prototypes to help older people age independently at home through the use of smart materials and big data. In order to equip everyone in the project with the necessary design tools to prioritize human needs and interactions, co-creation and service design have been employed through an iterative process. The approach seeks to align and connect end-users, different organizational partners and a variety of disciplines and stakeholders.

2. Literature Review

The working environment has become multicultural, cross-generational, and multidisciplinary in order to address new and emerging challenges in a globalized world (Tomek, 2011). As posited in Erez & Earley's theory (1993), culture is a shared meaning system. Individuals working in the same team have a common cultural ground, whilst team members working in a multicultural work environment may need to develop a shared meaning system beyond their different national cultures (Erez & Gati, 2004). New forms of organizational cultures have emerged through projects from international to multinational and transnational levels, requiring high levels of interdependence and team-working (Ochieng & Price, 2010; Shokef & Erez, 2006; Tomek, 2011).

Increasingly research explores multicultural team work from a globalized cross-cultural perspective, for example the experiences of project managers from a case study of UK and Kenya (Ochieng & Price, 2010); or multicultural groups involving participants from American and East Asian cultures (Aritz & Walker, 2014). However, Gobel et al. (2018) argue there has been little research on cultural diversity in terms of meanings, values, and identities in the European context. European culture is not simply "western culture", the majority of EU citizens conceive their continent as distinct and unique in its diversity whilst sharing elements of collective culture (CAE, 2018; Eurobarometer, 2007). In fact, existing cultures in the European context are broader and defined by different historical, political and economic circumstances, with many national cultures co-existing under the European umbrella (Gobel, Benet-Martinez, Mesquita, & Uskul, 2018).

Cross-disciplinary, collaborative research and innovation is a prominent theme in the 21st century. There has been a shift in research from an individual endeavor to a team effort due in part to the multidisciplinary skills required to create novelty and innovation. Multidisciplinary collaborations are seen to develop new knowledge and address complex problems through diverse expertise (Klein & Falk-Krzesinski, 2017), alongside interdisciplinary and transdisciplinary collaborations (DeHart, 2017). These forms of collaboration add new dimensions and considerations in the understanding of a work culture, and bring new challenges and opportunities to project delivery in a European context. Through funding schemes such as Horizon 2020, researcher collaboration across disciplines and with other stakeholders is encouraged to heighten innovation, as well as bridge the academic and industry sectors for improved impact, sustainability and

competiveness (DeHart, 2017; Klein & Falk-Krzesinski, 2017; Stokols, Hall, & Vogel, 2013). Whilst varied intellectual and disciplinary cultures can spark innovative responses, the research and practice process can be challenging (O'Rourke, Crowley, Eigenbrode, & Wulfhorst, 2013). The combination of different perspectives and the complexity of implementation can highlight issues of communication across disciplinary boundaries, and linguistic and cultural differences (DeHart, 2017; O'Rourke et al., 2013).

It has been argued that the application of design increasingly represents the uniformity of mass globalization rather than cultural difference and diversity (Carlson, 2011). In addition to the multicultural and multidisciplinary work environment in which design may be undertaken, cultural differences and diversity are also important to inform design. De Souza and Dejean (1999) argued that end-users are not just physical and biological beings, but socio-cultural beings, hence cultural diversity appears in all human action, including in the products designed and developed by humans. Szántó (2001) further argued that “innovation starts with people, not with enabling technologies, and the designers’ main role is to mediate between technology and culture and to add ethics and aesthetics to technology”. Knowing whom you are designing for and the reasons why users would or would not want, need and use the end product are critical for effective innovation and market success. Designers typically consider a range of human factors issues when designing for, and with people, including their physical needs, social behavior, emotional requirements, etc. A key factor often ignored is culture variation (Bettio & Plantenga, 2004; Kokkoris & Ku¨hnen, 2013). The consideration of cultural factors could facilitate product innovation and help achieve product acceptance and user satisfaction (Moalosi, Popovic, & Hickling-Hudson, 2006).

When considering ways to embed cultural awareness into design, one might consider service design as a means to reflect an awareness of the importance and impact of innovating customer / end-user experience (Stickdorn, Hormess, Lawrence, & Schneider, 2018). Service design is rooted in design thinking, and utilizes knowledge from other disciplines focusing on services. It brings a creative, human-centered process to service improvement or designing new services and offers a holistic, multidisciplinary and integrative approach (Miller, 2015; Moritz, 2010; Segelström, 2010). In the MATUROLIFE project, service design has been considered as tool to not just enable product innovation but to enable partners who are not traditionally involved in design to be involved in, and improve the design and development processes within the project.

In many service design projects, user-centered and participatory design approaches have been used to investigate user needs. Co-design integrates different perspectives to understand both the requirements and demands from users and customers, and how technologies and processes can be employed by partners and collaborators. A wide range of benefits is attributed by co-design, such as improving customer relationships, reducing costs, increasing wellbeing and helping to organize innovation processes more effectively (Steen, Manschot, & Koning, 2011). Co-design and co-production between designers, technologists

and end users are increasingly used for new product design and service development as well as high technology research and development in a range of domains (Freire & Sangiorgi, 2010; Rahmani, Roels, & Karmarkar, 2017; Steen et al., 2011). Here it is applied in the integration of advanced materials into products to support older adults, whilst service design has helped consider the wider service to sit around those products and to enable our multidisciplinary team development approach.

3. MATUROLIFE as a cultural case study

The MATUROLIFE project aims to develop and integrate smart materials to enable discrete and effective collection of health and well-being data to guide user behavior and support independent living by older adults. The design process whilst accommodating scientific innovation and complexity acknowledges cultural diversity across Europe as well as factors associated with ageing and later life. The project brings together a multicultural and multidisciplinary team of 20 partners from 9 countries (Belgium, France, Germany, Italy, Poland, Spain, Slovenia, Turkey, and United Kingdom). The team has 9 different first languages and represents a range of different types of organizations (including Small and Medium Enterprises, Research and Technical Developers, Manufactures, Non-Government Organizations and Higher Education Institutions).

Following desk-based design research to understand user needs, semi-structured interviews were undertaken with 37 older adults from six countries (ensuring representation of Northern, Southern, Eastern and Western Europe). During these interviews cultural differences between older adults were explored from different perspectives such as economic status, social cognition, approaches to the care of older adults, digital literacy, design preferences, fashion trends and technology adoption.

To build on this initial understanding, co-creation and service design were employed as the main design methodologies. Through the co-creation process, team members from different organizations and disciplines came together with end-users to conceptualize design ideas for desirable assistive technology products for older adults. Concepts were centered on assistive clothing, footwear, and furniture, as products that could utilize smart materials and areas in which the consortium held manufacturing capability.

Service design activities were undertaken within workshops attended by partners (designers alongside other disciplinary specialists, e.g. material science, engineering, human factors) to develop working processes, resolve technical decisions and balance conflicting requirements.

3.1 Co-creation workshops

The co-creation workshops built on insights and functional requirements collected during 37 interviews. In order to cover all project partner countries, ten workshops were scheduled with one in each partner country and two in the UK (as illustrated in Figure 1).

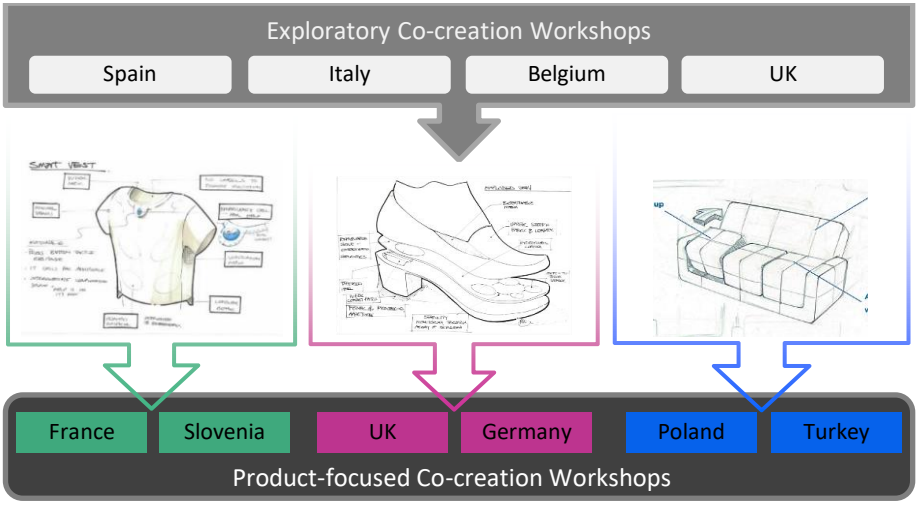

Figure 1. Two sets of co-creation workshops scheduled with each partner country

The first four workshops was used to explore participant perceptions of independence and scope initial requirements for smart assistive technology products that would address real needs identified by the users themselves. The team was interested to understand if there were differing needs or priorities in different countries. This led to a first version design brief for a product, furniture and clothing based product that focused on shared needs, but also identified country-based differences. The second set of six workshops, focused on prioritizing product requirements (for each of clothing, footwear and furniture) and co-creating design ideas in response. Prior to these workshops the design brief was translated by the designers into a series of initial ideas which were used in the workshops to prompt and encourage participants to develop ideas together with the designers. The process from semi-structured interviews to co-creation workshops is summarized in Figure 2.

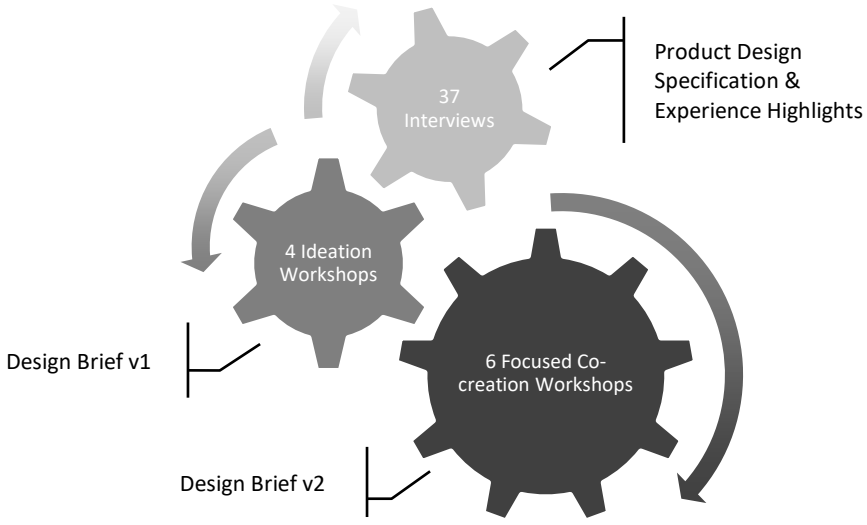

Figure 2. Design process from semi-structured interviews to co-creation workshops

With both MATUROLIFE team members and participants coming from different national and subject backgrounds, the workshops were refined and adapted to the local needs. For example, images of existing products country-sold were used to prompt discussions. These were selected by local partners to represent local tastes and trends. The workshops were run and captured in the language of the participants and translated after the session.

It was understood during the co-creation process that people contribute at different levels depending on their level of expertise, creativity and personality. Therefore, the workshops aimed to encourage discussion and participant ideas. Initial ideas were presented by product designers in sketch form communicating their status as works in progress and therefore encouraging comment and involvement from participants.

The workshops employed various design tools (a workshop setting is shown in Figure 3 and explained further in Callari et al. 2019) (Callari, Moody, Magee, & Yang, 2019) to provide a framework to encourage collaborative exploration and dialogue between workshops participants. These tools aimed to be readily translatable for use in different countries and enable comparison of outcomes between countries.



Figure 3. Participants co-creating ideas with footwear manufacturer

After design ideas were generated for product lines in footwear, clothing and furniture, the project partners refined the designs to embody the color, style and material preference specified by the older adults, whilst planning how to develop and embed the required assistive functionality in an effective, safe and usable way.

3.1.1 Reflections

The design research and semi-structured interviews highlighted regional variations in cultures and traditions, and key differences in how older adults are cared for in different countries. There is limited design research exploring trends and attitudes in terms of design and technology for different regional older adults, yet their needs in terms of maintaining independence and potential spending power should be acknowledged.

The four exploratory workshops demonstrated that although the participants have different national cultures, they reached a consensus on the understanding and definition of an independent living that involves good health, mental capability, physical wellbeing, autonomy and social connection. A number of common challenges were also identified by the participants in terms of age-related factors, environmental factors, societal factors and economic factors that may affect their well-being and independence. As a result of aligned views, health-related priorities could be formulated and taken to the second set of workshops to be validated by participants from different countries.

Concept ideas were then further developed through the six product-focused workshops. In order to reduce stigma and likely abandonment rates, these solutions focused upon

improving independence (including safety, health and/or security), at the same time being inclusive, light, comfortable, attractive and desirable – priorities for all.

There was found to be no significant differences in the contribution made by participants from different countries or based on age or gender. Similar needs were identified, however the co-creation workshops highlighted some cultural differences between countries in terms of style preferences and tastes, and in terms of acceptance of technology with some examples below.

- Clothing workshops: France and Slovenia

Participants in France and Slovenia showed quite different responses to the examplar images presented. In France, participant ideas included adding removable layers to enable something to be worn in different seasons or adding a higher collar to cover the neck in winter. They preferred designs that were adaptable and 'stretchy', not tight or restrictive. Participants emphasized the needs for clothes to remain elegant. *"When you are elegant you stay young"*. [FR, Workshop #5] In Slovenia, participants wanted the garments to be shaped to the silhouette, and dresses and skirts to fall over the knee. In contrast, a looser shape was preferred in Paris.

- Furniture workshops: Poland and Turkey

Differences in interior furnishing emerged. In Turkey, participants preferred to consider the design of a multi-functioning sofa with a flexible head cushion, integrated storage, and encouraging the user to get up and be active. They explored embedding functions to detect air quality, contact family members when needed, and give visual feedback on household dangers. In Poland, participants were more concerned more about the furniture providing ergonomic support and the size of it "*lightweight and easy to move around*" [PL, Workshop #4] rather than additional functionality. The nature of soft furnishing and desire for removability of covers etc. appeared to vary in different countries.

- Footwear workshops: United Kingdom and Germany

Despite the common requirements for footwear, there was contrast in how receptive participants were to technology. In the UK, there was a lot of discussion about technology and how it could be used to address the requirements by embedding functionality in the shoe. In Germany, there was less emphasis on using technology to solve these issues whilst participants focused more on the physical structure design of the shoe and the selection of materials as a way of addressing aches and pains in terms of feeling steady on one's feet. German participants indicated more distrust in relation to how their data might be used.

The process of co-creation was in some senses used here as a means to reach consensus rather than design for difference. However, through the process, differences in preferences, attitudes as well living conditions in different countries (e.g. temperature) were found to affect how a design might be developed and packaged for the user.

Following the co-creation workshops, three multidisciplinary sub-teams (Figure 4) were formed to enable the ongoing product development focusing on assistive footwear, clothing and furniture. Smart materials, sensor and electronic technologies, associated data processing and user feedback were collaboratively incorporated in co-designed product concepts with continuing users and stakeholder involvement. The ongoing development was supported by a service design approach.

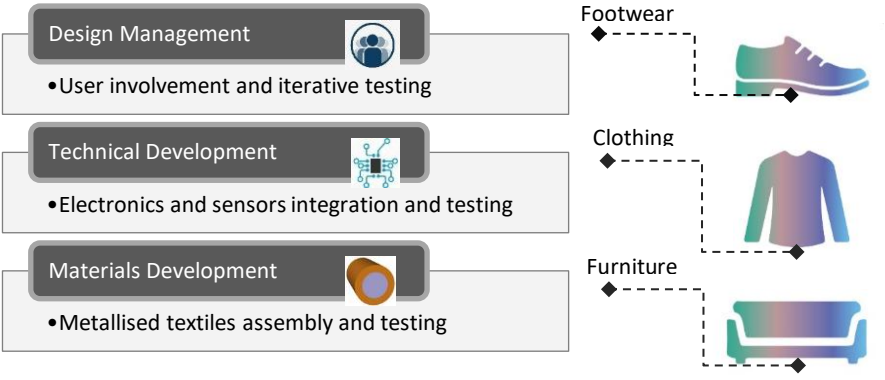

Figure 4. Three multidisciplinary sub-teams for three product design and development

3.2 Service design workshops

Service design was used as an approach to align the varying cultural perspectives of partners through design tools that would prioritize user needs and build these into a shared set of interactions which the project team could work to. It is argued that with the growing complexity of products and product services (Norman, 2011), innovation and competitive advantage is best achieved through a shared understanding across a diversity of stakeholder knowledge (Self, 2019). This was achieved through both the co-creation process and through the use of service design.

The MATUROLIFE consortium is large (40 +people) and varied in partner backgrounds and working practices (20 organizations). Each of the partner groupings (e.g. origination type, size, subject discipline, language) have different ways of working and communicating and bring different perspectives to the development of the technology. A collaborative working approach was embedded through a series of design and development workshops supported by regular virtual meetings (i.e. Convene and Zoom calls). An online shared working platform was created to share work in progress (MATUROLIFE SharePoint) and to create a working culture and synchronized knowledge.

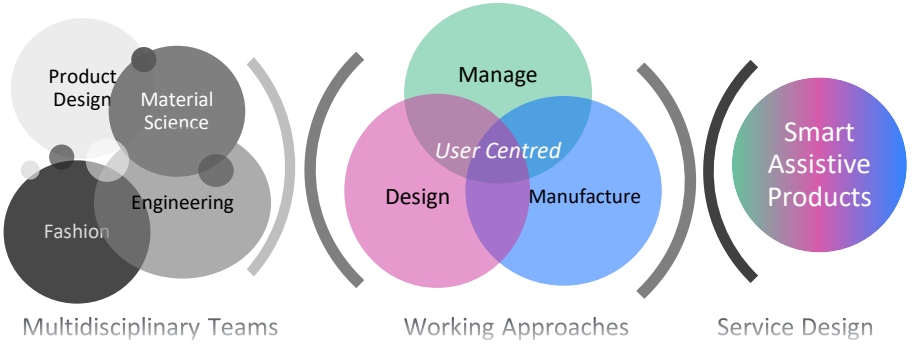

Figure 5. Service design crossing exemplar discipline boundaries

Service design was employed as a tool iteratively through the project lifetime during consortium meetings and development workshops. Service design approaches have typically focused on one system level at a time (Patrı´cio, Fisk, Cunha, & Constantine, 2011). The way it was utilized here was focused on two levels:

1. Designing for the user experience
2. Integrating differing working cultures between partners (as illustrated in Figure 5).

3.2.1 Reflections

The service design approach led to a series of maps or blueprints of the assistive product functionality and accompanying service. These were supported by detailed user journeys that interpret the interactions between the end users and proposed products. These provided the basis for future development. They have been reviewed at each consortium meeting to remind partners of the shared vision, to be updated according to necessary design changes, and to provide the framework for future planning (for example the data management structure for the emerging products).

The project team has reflected regularly on their working approach and the role of design management and service design within that. Some of the biggest challenges in the project were perceived by partners to be *"scale"* [TR, Partner #a] and *"communication, because these are subject areas that are not normally put together"* [UK, Partner #c]. It was felt that this type of large-scale and multidisciplinary high-tech project could constrain the imagination of designers and challenge non-designers. Feedback from partners after workshops suggests that the design approach has been effective in bringing people together to create a shared vision and direction.

> "With a project as ambitious and complex as this to deliver, methods to bring together and align the consortium and our research and development goals are essential. We see effective design management as a way to optimize our vision and ensure the user remains at the center of our development approach and ongoing delivery strategy." [UK, Partner #b]

Some of the key working differences that have been addressed through this approach are:

Partner languages: English is not the first language of most partners. Both English and a partner's local language are used during day to day project work. Reporting and email communication are undertaken in English. The discursive, diagrammatic and visual ways of working have enabled minimal use of text and supported partner communication.

Subject-specific language and terminology: Subject-specific language (knowing what we meant by specific terms e.g. scientific processes, design approaches) has proved another communication challenge. This is further compounded by country differences in meaning. For example early in the project, there was a significant debate about the definition of assistive technology. A co-creation approach was adopted to reach an agreed definition. The use of visual maps and icons has enabled a shared understanding.

Decision making and working approach: Partners demonstrated different ways of thinking, planning and decision making. For scientists this may be heavily evidence-based. Other disciplines are able to rely on more intuitive approaches and less structured. The service design approach created alignment and identification of elements of the project that had to be evidence and user-driven, and others that enabled creative expression.

User-focus: Whilst the focus on the end-user and customer is central to organizations working in design, it is not necessarily a central consideration in chemistry or electronics. The MATUROLIFE project is centered on the needs of older adults and the service blueprints that have emerged hold the partnership to the needs and journey of users when making decisions.

Organizational/ company priorities: Organization types vary in their capacity to be nimble and adapt, and in terms of the support infrastructure and bureaucracy. There is also variability in the capacity and inclination to innovate away from existing processes. The service design approach placed limits on the product scope that were necessary to manage resources and deadlines.

4. Conclusion

In this paper cultural differences from several different perspectives have been considered within the context of the MATUROLIFE project. Although the impact of these factors in

design has been studied in previous research, how they interact with each other in has received less consideration. Co-creation and service design approaches were employed in the project to reconcile these differences, in order to build understanding and empathy for older adults across the partner countries in terms of their acceptance and expectation of assistive technology products and services, also to establish a collaborative working relationship between different disciplines and various groupings within the project consortium.

The findings reveal that cultural differences were presented at multiple levels, encompassing end-user perception, design activities, work environment and product values. The co-creation workshops highlighted differences between the tastes of participants from different cultural backgrounds, and the varieties due to geographical and socio-economic factors. Exploring these differences more extensively is not the core focus of the study but does have critical implications for design. Project collaboration and communication has been supported by a service design approach and this has helped overcomes some of the challenges to working across countries, disciplines and organizational cultures.

Design is not only about crafting products and systems, but an approach to open innovation that enables complex and interactive experiences, processes and systems (Freire & Sangiorgi, 2010; Moritz, 2010). Design in this context is complex; culture can be a resource for design innovation and inspiration. It is hard to design with a range of cultural factors intertwined, but it is argued that through the MATUROLIFE project these challenges can drive innovation by using design management as a strategic tool.

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Acknowledgements: The research activity described here was approved through the Coventry University ethical approval system. The authors wish to thank the participating older adults who gave their time to the research as well as to our collaborating partners. This publication is based on work performed under the MATUROLIFE project, which has received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreement No. 760789. Any dissemination reflects the authors' view only, with no intention to represent the position or opinions of the MATUROLIFE consortium or any of the individual partner organisations.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Data visualisation and knowledge sharing in participatory design to improve people liveability in urban places.

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Abstract | People living in urban areas are expected to highly increase in future. Society in urban context becomes more complex, and newer social, cultural and economic challenges occurs while decision-making processes become more difficult due to the increase of actors involved and plenty of information flowing by ICT networks and media. In such crowded environment, people can be very close to each other and, at the same time, might not know about urban issues due to different backgrounds or lack of knowledge. Looper demonstrates how an ICT and Urban Living Lab integrated approach can be enforced by environmental design methodologies that start from user needs and improve knowledge proximity and physical proximity. The Verona study case, described in the paper, shows how a collaborative usage of ICT allows a better comprehension of different points of view, enhancing a fertile co-design process avoiding the creation of "cultural bubbles" that hinder cultural proximity.

KEYWORDS | CO-DESIGN, KNOWLEDGE SHARING, DATA VISUALISATION, INTERACTION DESIGN, USER CENTERED DESIGN

1. New challenges in the design of urban spaces

Since the ratio of people living in urban areas is expected to increase from 55% in 2018 to 68% by 2050 (United Nations, 2018), it is becoming always more important to understand how to design - and transform - urban spaces to realise the most liveable urban environments for this increasingly population.

Due to this growth forecast, nowadays the design of urban spaces is characterised by different tasks that need to be faced. Following the SDGs from the United Nations it is possible to see how a main challenge - SDG 11 - is that of creating more sustainable and liveable cities, by also reducing their adverse environmental impact. This has to be done both with regard to the impact that a city has on global terms, and both with regard to the community level. SDG 11 target 11.3 says: "By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries" and its indicator says: "Proportion of cities with a direct participation structure of civil society in urban planning and management that operate regularly and democratically".

To reach this goal then it is necessary to apply participatory approaches - that have been used since the '70s but are only now becoming more widely diffused - that can help to trigger changes in the built environment. To have a successful participatory approach then there is the need of a wider involvement - or the creation, depending on the existing socio-cultural environment - of the bottom level, since changes with participatory methods are triggered with bottom-up approaches - as further shown by the Looper project described in this paper.

Our idea is to check how these challenges can be faced by using culture of proximity to approach environmental design to create more liveable urban places.

2. Culture of proximity for liveable urban places

To manage and deal with the abovementioned new design requests, there is the need to evolve an organic methodology based on the bottom level approach. The features needed to create this new environment are:

- urban phenomena knowledge, not only on a larger urban scale but mostly at a small local scale that allows a better knowledge of the neighbourhood. This knowledge of urban phenomena needs to be not only theoretical but more direct, practical and material;
- exchange and transfer of knowledge, to be combined with knowledge storage not to disperse what was done previously;
- avoidance of "cultural bubbles" to create a fertile ground for the exchange of knowledge between parties.

In our vision the cultural environment that is created by these features is a possible interpretation of culture of proximity. This concept of proximity can then be understood in two different ways, and both ways are complementary to define culture of proximity. Proximity can be:

- "proximity of space"
- "proximity of people"

Proximity of space is related to the knowledge of the local area in which someone lives. This proximity aspect is about the nearness of someone to the investigated area. Residents of the investigated area are then the main actors when *proximity of space* is triggered.

Proximity of people is about the ability to exchange knowledge between users of the same space - the closeness allows the reciprocal learning between people living and using same places. This proximity allows people to feel closer one another as they are working towards a common goal and they have a mutual understanding.

When both a *proximity of space* and a *proximity of people* is found, then it is possible to activate a functional - and functioning - culture of proximity.

An example of triggered culture of proximity are Urban Living Labs (ULLs) were residents, that have a more direct understanding of a certain urban place, can share their knowledge - by allowing a *space proximity*. In the same way, since different stakeholders are involved in ULLs, a wider knowledge sharing can take place within ULLs. This then allows a *proximity of people* since individuals with different backgrounds, and that use the project area for different needs, can gain deeper knowledge on the place and can share a different point of view from the resident's one.

Urban Living Labs are not the only expression of culture of proximity, they are more of an example of organised triggered culture of proximity. The contemporaneous existence of proximity of space and proximity of people can take place also in a more organic way, when people are willing to make a place more liveable even for a short period of time, or to allow others to take back their places - e.g. festivals, events. This need to retrieve public places to create a better urban reality based on physical and cultural proximity was partially expressed by Michael Sorkin (1992) that talked about proximity to encourage cultural creativity triggered by these fluid connections.

This paper will then focus on how to activate culture of proximity for designers that are willing to create more liveable urban places through participatory design.

3. Strategies to activate a culture of proximity

How is then possible to activate this culture of proximity inside a design process? To benefit of the culture of proximity what can be used are Urban Living Labs - as aforesaid - and

different tools for data storage, data visualisation and knowledge sharing. These two approaches are suggested to be used simultaneously to reach better results.

Like said before, Urban Living Labs are a fertile ground for both proximity of space and proximity of people. This can happen because ULLs are able to create a neutral terrain for people living close-by, where they are able to share their knowledge with other actors of the urban environment change, but they can also allow the exchange of knowledge between other stakeholders that might not be residents.

The involvement of cultural proximity in urban design then gives better results when the new shared knowledge basis - given by the presence of both residents and other actors - allows the mitigation of social, cultural, technical and economical differences. Once these differences are mitigated then the cultural proximity can be used to work towards a shared goal.

To create the necessary background for the growth of culture of proximity, also different ICT tools can be used. Indeed, to share knowledge - when it comes to urban environment changes - there is the need to have both visualisation tools, that can allow an immediate sharing of information, and storage tools, that can allow a longer-term sharing. ICT tools usage starts from a carefully designed data collection phase - that gives better results if it is centred on a participatory approach, that then allows the visualisation of the acquired knowledge - based on a combination of qualitative and quantitative data. The information gained with both the data collection and data visualisation, are then used to co-design and co-evaluate possible solutions to make urban places more liveable.

4. Culture of proximity's activation strategies as applied in the Verona case study within the Looper project

This concept of culture of proximity has been applied and tested in a European research project. The Looper project is co-founded under the JPI Urban Europe program and it focuses on three pilot cases: Manchester, Brussels and Verona. In this section, to better describe our concepts, the Verona case study is used and in particular the area of Verona Sud is considered in the framework of the project.

The area of Verona Sud (Figure 1) is mainly influenced by air quality and noise pollution issues, and there are multiple neighbourhood associations which have a conflictual relationship with public partnership and policymakers. This contrast is due to misunderstandings which are raising from lack of shared knowledge by both parties.

Hereinafter a real-life application of the culture of proximity concept to Urban Living Labs and to different tools is described.



Figure 1. Verona location with reference to the Venice and Milan, and a zoom-in of the Verona Sud area that is divided from the city centre by the Verona former freight yard

4.1 Urban Living Lab

Within the Verona ULL the actors where linked by both a proximity of space - i.e. residents - and by a proximity of people - i.e. between residents and public administration, NGOs, commutes and other final users. Verona ULL's actors were: citizens and citizens' associations as bottom level stakeholders; Verona City Council as public administration and local governance stakeholder; Legambiente - an NGO actively working on environmental issues - with the role of stakeholder and of support to organisers; Università Iuav di Venezia in the role of researchers and organisers.

Having all these different actors working together was challenging in the beginning, because there were many different points of view at the same table, but once all stakeholders understood the benefits they could gain, the meetings started to be more constructive. The knowledge sharing given by culture of proximity was the one thing that triggered the willingness of actors to actively participate at meetings, because they understood they could be empowered by what was happening during the meetings.

Different activities were done during each ULL meeting, and to support culture of proximity within these activities different tools were used. Activities faced topics of data collection, data visualisation and analysis and design of possible solutions to improve the urban environment liveability. The tools that supported the ULL activities allowed a levelling of knowledge between different actors.

4.2 Data driven design of support tools

The tools used within Looper ULL differed based on the activity they supported. They can be divided into three main groups: data collection tools, data visualisation dashboard and co-design tools.

Data collection hardware tools were low-cost and official body sensors to collect quantitative data about pollutants, and these quantitative data were integrated with a web

app to collect qualitative data about the perception of urban spaces. This app has been very helpful to better understand the knowledge of residents, allowing to link objective data to the knowledge shared by people. This stage was essential to the process because it was possible to support with quantitative data the space proximity knowledge. Indeed, at the same time it was possible to link space proximity and proximity of people because some misunderstandings about pollutants were repressed.

Moving on with the process, the visualisation dashboard was an interactive web map were all data previously collected were freely accessible to allow an exchange of knowledge between all actors of the process, and not only a sharing of knowledge between people with a proximity of space. This tool showed not only data collected with official body sensors, but also data collected with participatory sensing. This data visualisation was the first real moment of confrontation were proximity of space and proximity of people gathered together to benefit of the culture of proximity concept.

Then, for co-design, both online and offline tools were used. For what it concerns a culture of proximity point of view, the online part is of more interest. The used online co-design tool was developed by a third party, and it allowed to link the proposed solutions with a particular location within the project area. This online tool allowed both a share and a storage of knowledge. The knowledge sharing was intrinsically possible due to the online characteristic of the tool, this meant that anyone could propose their idea even if they could not attend the offline meetings. The tool also worked as storage of knowledge, because it was possible to upload the solutions proposed during ULL meetings. This possibility to store, and not only share, is a focal point for culture of proximity because it allows to reach new participants.

5. Data driven tools for co-design

5.1 Looper data driven tools design strategy

For the design of the Looper platform, a multidisciplinary team was formed involving architects, digital technologies experts and design experts (all partners of the Looper project). Particularly, technical developers worked alongside with visual/data interaction designers who also held specific technical skills that helped in avoiding one of the typical problems in this kind of scenario that is the delegitimization of the role of designers in the development of ICT tools. This issue is clearly investigated by Gasson (1999); during the implementation of IT tools, which are “purely technical” tools, the technical developer does not take designer's contribution into consideration, neither in terms of defining the data model nor of interaction design.

Gasson (1999) argues that, in many cases, the User Centred Design (UCD) approach can be adopted in a more formal than substantial way; in the case of Looper, UCD was applied from

the very beginning in the conceptual modelling phase of the platform by using a special survey aimed at knowing what data and knowledge were needed for the three ULLs.

Following the first step of user research, a UI mock-up was designed and developed (Figure 2). The first prototype was then presented to participants of ULLs to get feedback about it, and it was then implemented following the suggestions collected from this second round of user experience observation. This participatory UCD was done following the typical Living Lab approach of design, test and implementation inside the real environment.

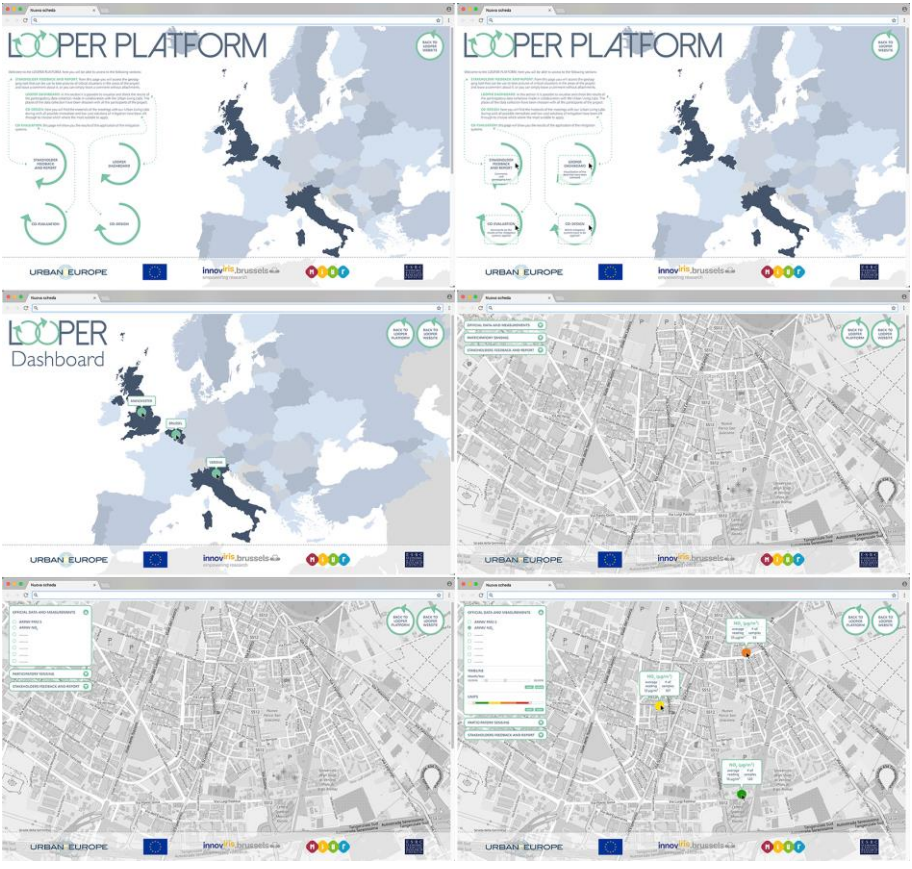

Figure 2. Looper platform mock-up. Here the initial design of the UI is shown

The issues that can arise in trying to obtain an optimal proximity of people within ULLs are manifold; some of them are related to the use of technological tools and digital interfaces by very different users with very uneven digital skills while others are more related to the

specific content, sometimes very technical, that the ULL must deal with. These issues can be summarized as follows:

- Language differences in actors with more technical profile and non-technical ones, belonging to different contexts or ordinary citizens;
- Usability and understanding of rich-content information and possible excessive cognitive load;
- Differences between datasets collected by different ULLs, and the complexity of defining a data model that allows to manage them in an integrated way;
- Previous mistrust between involved actors.

Differences in cultural backgrounds are strictly related to the proximity of people aspect. In Looper, actor's cultural inhomogeneity in some ULLs was an underlying design condition and it has imposed the development of a multilingual platform as well as a special data structure capable to manage contents in four different languages. However, in most cases, verbal language is not the only key point; indeed, also for the graphic language and maps visualization a special approach is needed to improve proximity of people. In map visualization symbols are frequently used, while styles' meaning is explained with a legend; when users have very different cultural backgrounds, this can be an issue and a limitation of graphic effectiveness. Therefore, minimizing the use of symbols whose meaning is not immediate is mostly recommended.

The problem of the too high cognitive load generated by graphic visualizations is known and well described by Mazza (2017) who argues that to achieve "good communication goals in HCI we aim to lower cognitive load on an interactor because this better support information memorization". Using map visualization, the too high cognitive load can be a more severe issue since there is often a tendency to overlap several information layers to obtain a more comprehensive synoptic view about different aspects or to highlight their mutual correlation.

The three study cases give us a scenario with a wide variability of themes data to be collected for monitoring tasks. The indeterminacy and variability of the data to be managed by the Looper platform forced to design a "flexible" data model that would allow to access different types of georeferenced data in different ways. The risks highlighted by Gasson (1999) relating to the technical approach in the development of Information Systems, have been mitigated by the strategic choice to subordinate the technical development to the content design and the definition of multi-actor data collection methods creating an effective "peer cooperation" between IT team and design team by involving a designer with specific technical skills. As Curtis et al. (1988) said while arguing about the "expert designer", the cohesion of the team can be greatly improved if the designer holds special IT skills because this allow him to proficiently and effectively interact with the technical developer.

The last identified main issue concerns frequent situations of distrust or contrast between actors that hinder fruitful cooperation. As well described by Mayr et al. (2019), issues about

“trust” in data usage is mainly related to provider credibility and its good relationship with the final user. However, also transparency is a key factor, and it is related to the possibility to access original data from which a processed information is obtained. This means that the willingness of actors to positively accept some provided data is related both to the acceptance of the source and to the way data were processed.

5.2 A user-centered data model

Bertin (1977) has clearly shown that information has a multi-layered structure. Basically, the main layers are two: entities and relationships - concept also known in database theory. This means that to design new IT tools, information designers must work very closely with technical developers. Cases such as Looper demonstrate a key point: the database structure modelling phase belongs to the content design, rather than the container design; this means that it is a task that designers must carry out, rather than the technical developers, as happens in most cases.

As already mentioned, the User Centered Design approach in developing the data model in Looper specifically aims at improving proximity of people. The first method used for this purpose was called “Problem Framing” and focused at designing the data structure needed to store and process the data coming from the multitemporal monitoring campaigns carried out by ULLs. As shown in Figure 3, the Problem Framing is fuelled by the results of a preliminary phase aimed at finding the issues on which the ULL wants to work.

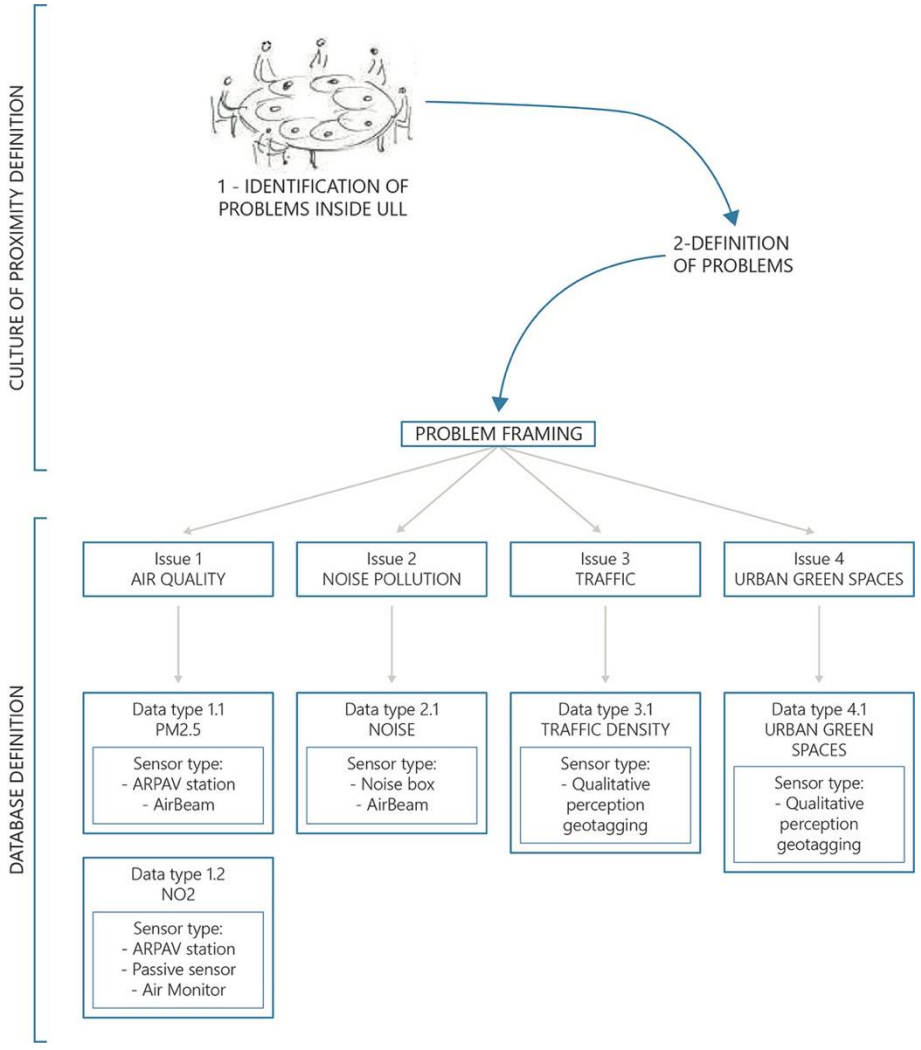

Figure 3. Data model of the Verona case study. Here data to be uploaded in the database are defined to allow a common framework for the three study cases.

A two-layer - issues/data-type - data structure came from the results of a special survey aimed at finding needs of each ULL. The semantic relationship between the two layers is the capability of each data-type to support decision process about one or more issues. More in depth, the data model structure is further divided into other entities: from data-type to raw-data, sensor-type, campaigns, sensors and, as regards geolocation, measuring-spots (for point geolocation) and grids (for distributed geolocation).

5.3 Data visualisation tools

Designing the Looper platform, as result of the problem framing, some choices have been made regarding the data model definition, however, other choices made are more related to visualization and interaction concerning map layers structure, data processing, interactive tools and maps symbology.

In terms of map layers structure, the choices were basically two: the separation of all data into simple layers by type of measured phenomenon (only one type of information for each map layer) and the layers grouping by source. The separation of different sources helps to perceive the difference in data accuracy implicitly related to the collecting methods, and it allows to simplify the symbology as much as possible so to reduce the cognitive effort endured by the user (cf. Ware, 2004).

The choice not to process and integrate datasets, providing simple and direct - uninterpreted - layers is intentionally aimed at increasing credibility of the source and trust in the end user-provider relationship (cf. Mayr et al., 2019). It also eases to apply quantitative symbols according to Rensink's "carriers'" definition: "visual property that conveys quantitative information" (Rensink, 2018), which maximizes the effectiveness of visual communication of measured phenomena.

As regards to interaction, according to Kirsh (2004), the goal is to "reduce the complexity of choice" in the perception of how to explore data and better understand map content. Furthermore, to reduce the usability gap between more and less digital skilled users, map based interaction has been limited to the two basic actions: "click to get info" and "drag to pan", leaving out other typical functions such as "drag to select", "drag to zoom-in" etc.

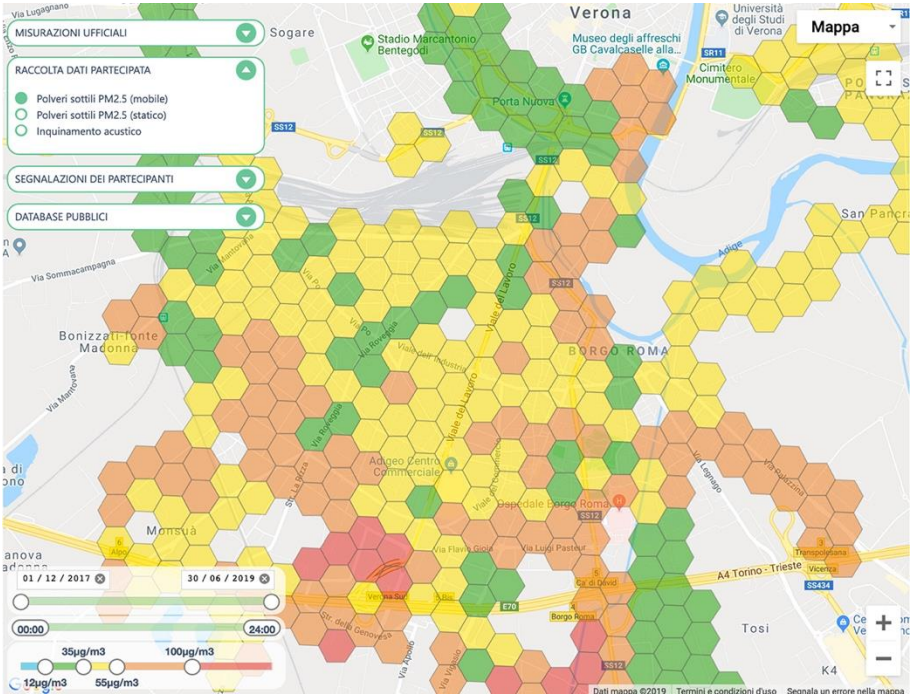

Figure 4. Example of visualisation of data collected with a participatory sensing tool that works with a continuous in movement method. Each hexagonal cell shows one value that is the average of all data collected within the area defined by the cell, and in the timeframe defined by the scrollers on bottom left.

In some cases it was necessary to make some data pre-processing because of visual and technical ineffectiveness of displaying raw datasets; this is the case of all distributed monitoring campaigns resulting in millions of point data that had to be interpolated upon a fishnet layer (Figure 4) and styled using the colour carrier (Rensink, 2018). In this particular case, a special tool has been developed in order to enable users to customize styles in real time - mitigating the perception of viewing already interpreted data.

5.4 Co-design tools

Like the display section of the Looper web platform, the co-design section is also designed as an asynchronous multi-actor remote repository, that is a dynamic and implementable storage system of useful digital resources that can support ULLs decision processes.

Even if hosted on the same platform, the two sections have been deliberately kept independent; no data available in the co-design section is dynamically linked to any other stored in the monitoring section, precisely to enhance interpretation of live data during ULL

activities carried out in a participated way leading to the development of solutions through direct interaction of the actors.

Technically, the online co-design tool, developed by Urbanista, was developed using a WordPress plug-in (Figure 5). This tool was chosen due to the possibility of adapting styles according to the main website, its easy integration and user-friendly mode with few steps needed to insert a new idea.



Figure 5. Example of the online co-design page that firstly shows a map with the proposed ideas localised in the project area, and by scrolling down shows a grid with the ideas and their description.

The proposed solution or ideas can be easily uploaded by filling few fields of the format as per the following Figure 6. Out of the seven fields only four are mandatory - 1. Category, 2. Title, 3. Description and 4. Name or nickname - while the others are optional. The category field is a drop-down menu from which to choose a category, this allows to later evaluate the proposed solutions easily as they can be grouped. The title and description fields instead are free fields and have no minimum or maximum number of characters.

The structure of this online co-design tool also allows a storage of the solutions proposed during the offline meetings, as it is possible to mark them by using a nickname that refers to the meeting date.

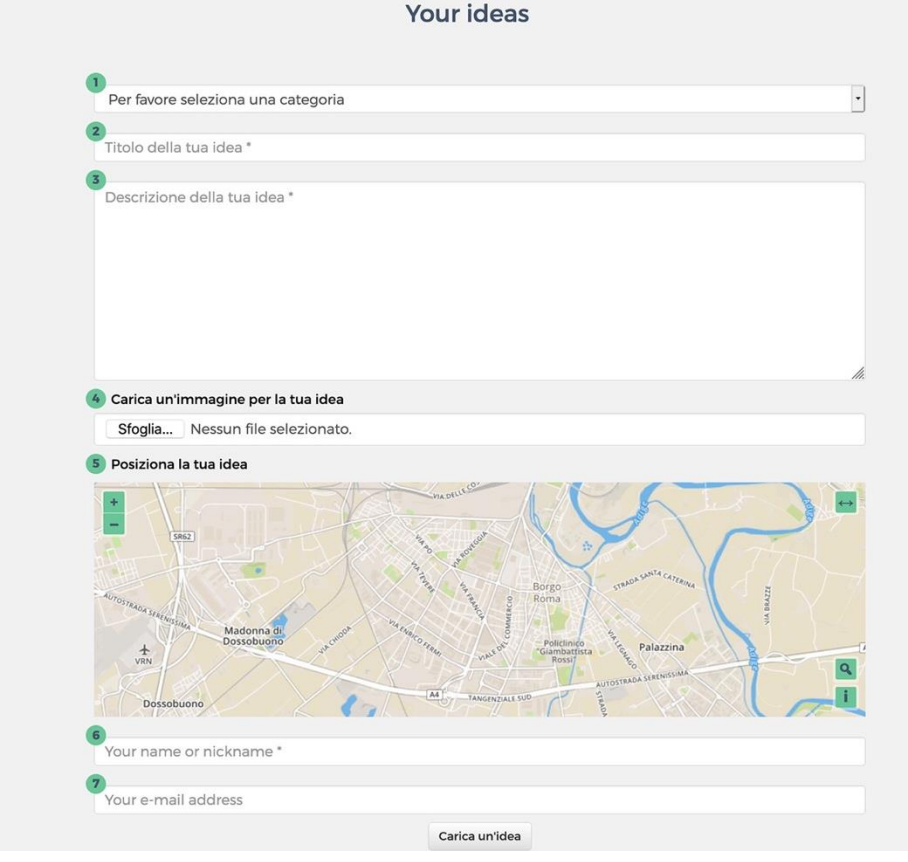

Figure 6. Ideas upload format. From the map, users can add the location for the proposed solution.

6. Conclusion

Within this framework, ICT and interactive tools need to be designed and inspired not to support activity of collaboration between people further away - and to create a global network, but need to be designed to support a culture of proximity that is focused towards the improvement of people's liveability in urban places.

Within the Looper project it was possible to have an evaluation of the platform from a co-creation process point of view (Figure 7), since the aim of the platform itself was that of enhancing participation even for users who could not come to offline meetings.

ICT tools are then of mixed use due to the proximity concept, meaning that they are feasible both in their online version and in their collective usage during offline meetings.

HAS BEEN THE PLATFORM USED BY ORGANISERS?	
Comments	*Organisers mostly used the platform as it helped to organise and keep a focus during the workshops done with stakeholders. The platform was also used within internal meetings to always have control of what was happening during the project* *This happened both during the first and second loop*
N° of data layers	*13 (first loop)* *15 (second loop)*
HAS BEEN THE DASHBOARD USED BY USERS?	
Comments (by organisers)	*Users used the dashboard both during the first and the second loop*
N° of accesses	*1607 (2018)* *714 (2019)* *23 (2020)*
Its usage during living labs sessions?	*The dashboard was mostly used during living lab session of the first loop*
USABILITY	
Comments by (organisers)	*Users asked the implementation of the scrollers (timeline) for a more detailed visualisation of the AirBeam data in different periods, they also found interesting the acoustic zoning layer once added*
User feedbacks	*They found the dashboard feasible and user-friendly for their needs*
DOES THE DASHBOARD TRIGGERED LEARNING PROCESSES?	
information ('know-what')	*Participants learned the importance of the participatory data collection as they could see how many data they could collect all together* *This happened both during the first and second loop*
networks ('know-who')	*No. The dashboard did not allow direct interaction in-between different stakeholders since it is a visualisation tool.* *This happened both during the first and second loop*
skills / resources ('know-how')	*Participants learned how to read collected data in a clearer way* *This happened both during the first and second loop*
norms / goals ('know-why')	*Based on the shown results, participants better understood why official sensor are not positioned too close to each other.* *This happened both during the first and second loop*

Figure 7. Platform evaluation for the Verona ULL

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Acknowledgements: The support of Brussels Capital Region – Innoviris (Belgium), Ministero dell'Istruzione dell'Università e della Ricerca (MIUR) (Italy), the Economic and Social Research Council (UK) and the European Union is gratefully acknowledged.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Democratizing design: lessons from a case study in the Alpine area

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Abstract | This paper focuses on the democratization of the design culture through the design knowledge transfer (DKT) analysing the empirical activities of an academic design research laboratory as a case study. The analysed laboratory is born as a research and development project, mainly funded by the local government for introducing the human-centred design culture through service design at a local scale. As a result, a strategy for introducing service design in the local systems is identified. The strategy can be also considered a scale of complexity for transferring the design knowledge and a possible way for democratizing design to the local entities that do not systematically use design. Despite this aspect needs more investigation, the strategy is actually adopted by the laboratory as their free offering system to be experimented with the local entities by envisioning and following the conceptual framework of 'Research through Transfer through Design'.

KEYWORDS | DEMOCRACY; DESIGN KNOWLEDGE TRANSFER; SERVICE DESIGN; COMPLEXITY; PUBLIC POLICIES

1. Design and democracy: a premise

The interest of the design community in the convergence between design and democracy is giving the opportunity to defend democracy as a value through the design culture (see Manzini & Margolin, 2017, 2018). Using design as a tool for democratization in the way of design of, for, in, as democracy (Manzini & Margolin, 2018) also means spreading the design culture in all the complex contexts the contemporary society is involved.

The authors of this paper argue the transfer of design research activities helps to work on the convergence between design and democracy. From this, transferring design knowledge facilitates the spreading of the design culture; consequently, it facilitates the use of design as a tool for democratization.

1.1 Democratizing design

The concept of democratizing design can be addressed according to different perspectives such as:

- democratizing knowledge; in terms of knowledge transfer, its generation process through participative experiences and its meanings under democratic principles (for a further understanding of this perspective see Elden, 1983; Gaventa & Cornwall 2008; Ginwright, 2008; Guzman et al., 2016; Zamenopoulos & Alexiou, 2018);
- democratizing innovation that moves from the market-oriented concept of product (or service) innovation addressed by von Hippel (2005) to a different approach related to long-term, situated and "on the go" participatory approach (for a further understanding of this perspective see Björgvinsson, Ehn, & Hillgren, 2010) that improves collaborations between bottom-up initiatives and against an elitist control of innovation;
- democratizing design; in terms of the democratization of the design discourse through the design practice; in other words, the process of democratizing the design knowledge.

The concept of democratizing design, in this paper, differs from the way of understanding the democratization of design as the democratization of technologies that facilitate the processes of designing and producing artefacts; not even with the meaning of social product development (Forbes & Schaefer, 2017). Neither it is treated as a topic for investigating the states and future of the designers and/or the design education (see Fleischmann, 2015; Kelly, 2019). For democratizing design, the authors mean the act of rendering democratic (Democratization, n.d.) the design knowledge. Democratization as a systematic open-ended series of processes (Ciprut, 2009) for spreading the knowledge related to design research and opening the design culture through the democratization of the design discourses and practices.

1.2 Why democratizing design

Knowledge can be considered a resource of the power (see Gaventa & Cornwall 2008); and, sometimes it is a monopoly of expert knowledge producers (see Fals-Borda & Rahman, 1991; Hall, 1992 in Gaventa & Cornwall 2008). In this way, design knowledge can be considered a resource for breaking the monopoly in designing in a culture and preserving the democracy of designing. This concept drives the authors in considering the democratization of the design knowledge as a way for breaking this monopoly and spreading the design power for preserving the convergence between design and democracy. These are the reasons why this paper focuses on the democratization of the design culture through the design knowledge transfer (DKT), analysing the empirical activities of an academic design research laboratory (lab) as a case study.

2. Methodological approach

How is it possible to democratize design at a local scale to support the relationship between design and democracy and introduce the design culture in complex contexts?

According to this question an academic design research lab was considered as a case study for hypothesizing relevant discussions for the answer. Therefore, the actions of the analysed lab were considered the phenomena to be studied within its real world context (Yin, 2018) with the aim of understanding if it is a case of democratization of design at a local scale. The DKT process of the lab, its potentialities and limits, and future developments were analysed with an inductive approach. The early years of the lab activities were critically analysed with the support of empirical data emerged during the activities organized in collaboration with the local stakeholders, design partners and entities.

Therefore, the establishment of the lab, the evolution of its research process and the activities provided with the local agents were considered as a set of empirical data. With the aim of providing a critical analysis based on data triangulation (Denzin & Lincoln, 2018; Yin, 2018) the empirical data were compared with different resources in design literature through references related to (i) design ladders (Design Council, 2013; Kretzschmar, 2003; Nusem, Wrigley & Matthews, 2017; Ramlau, 2004; Wrigley & Straker, 2017); (ii) cases of governmental innovation labs (Puttick, Baeck, & Colligan, 2014; Selloni & Staszowski, 2013); (iii) models of orders of design (Buchanan, 2001), design domains (Jones & Van Patter, 2009; Jones, 2014) and levels of design content (Young, Blair, & Cooper, 2001; Young, 2008).

3. The case

The analysed academic lab was born as an experimental project of research and development, mainly funded by the local government to introduce the human-centred

design culture through service design in the education, production and public policies systems at a local scale. The laboratory is hosted by a humanities department at the local university and its mission is to transfer design knowledge encouraging the usage of service design among entities that do not systematically adopt design. The goal is to support the transition of the local agents from a product-based economy to a service and knowledge-based economy.

From a global perspective, this project can be framed in a wide and contemporary discussion related to the growth of fields such as design for public and design for policy (Bason, 2016; Kimbell, 2015; Buchanan, Amatullo & Staszowski, 2019) where design thinking (often service design) can play a determinant role in the innovation process of complex public and governmental contexts (Buchanan, Junginger & Terrey, 2017; Junginger, 2013; Kimbell & Bailey 2017; McGann, Blomkamp, & Lewis, 2018; Rebolledo, 2016). Despite the relationship between design and the public sector is growing (Buchanan et al., 2019), it is still difficult to identify systematic ways to embed the design culture from a public perspective on small scale contexts (such as rural and urban Alpines areas) where design is still not systematically used. However, fostering service design thinking throughout the organizations is in line with the recognised relevance of service design given by the European Commission as a "key driver of service innovation, social innovation and user-centred innovation" (Dervojeda et al., 2014). Therefore, the analysed lab adopts service design as a strategic stimulant to encourage innovation in public and private organizations. Also, this follows the Action Plan for Design-Driven Innovation of the European Commission (2013).

3.1 The context of the lab project

The regional context of the analysed lab is under an autonomous province jurisdiction, in the northern side of Italy. The province is characterized by low population density, due to the mountain territory (Alps), its remote valleys and the high number of small-dimensions villages. In this province, there is no presence of specific entities advocating to spread the design knowledge and improve the local design culture. There are only specific courses in some degree programmes and two different small academy branches, which have not the DKT as the main purpose.

3.2 Design research and design knowledge applied at a local scale

Among the definitions of design research (Archer, 1981; Findeli, 2010; Jonas, 2014), the analysed lab deliberately refers to Manzini's (2009, 2015) working definition on design research i.e. "an activity that aims to produce knowledge useful to those who design"; this kind of knowledge is 'design knowledge'. As suggested by Cross (1999, 2006), design knowledge resides in people; processes and products. They are "three sources of design knowledge as research loci" (Cross, 2006). Therefore, the analysed lab refers to Cross's design research taxonomy (design epistemology, design praxiology, design phenomenology) to identify what to transfer to the local entities. Respectively the transferring process

focuses on (i) the designerly ways of knowing (Cross, 1982, 2001, 2006) and the design attitude (Boland, Collopy, Lyytinen, & Yoo, 2008); (ii) practices of design; (iii) form and configuration of the artefacts (services and systems in the case of the analysed lab). And service design is assumed as a strategic resource to be transferred.

3.3 A knowledge transfer point of view

The knowledge transfer activity of the lab is partially framed in studies related on how to embed design capabilities (often related to service design) in different kind of contexts and organizations (cf. Bailey, 2012; Giordano, 2019; Junginger, 2015; Lima & Sangiorgi 2018; Malmberg & Wetter-Edman, 2016; Mortati, Villari, & Maffei 2014; Warwick, & Djaelani 2016). However, "capability is an integration of knowledge, skills, personal qualities and understanding used appropriately and effectively [...]" (Stephenson, 1998; also in Mortati et al., 2014) and "transmission of design knowledge throughout organizations is expected to support non-professional designers to increase their design competences" (Lima & Sangiorgi 2018). Therefore, it is possible to frame the lab activity from the perspective of the knowledge transfer as a way to support the spreading of human-centred design capabilities paying attention to understanding how other entities design, what is their own design knowledge and their design legacies (Junginger, 2015).

3.4 The knowledge transfer process

It is possible to understand the DKT process of the analysed lab through the Nonaka and Takeuchi (1995) model of knowledge conversation. Indeed, observing design knowledge in two forms i.e. 'tacit' and 'explicit' (Polanyi, 2009; Liyanage, Elhag, Ballal, & Li 2009), the lab found a proper balance between its tacit and explicit knowledge transfer according to the key components "i.e. the source or sender that shares the knowledge, and the receiver who acquires the knowledge" (Liyanage et al., 2009). Canonically, the sender is the lab body of resources (e.g. the lab researchers and their tools) and the receivers are the local actors that collaborate with the lab through the provided design actions. However, it is also possible to observe an alternation of roles between senders and receivers that is when the lab body of resources convert the design knowledge acquired from people, processes and 'products' through activities exploited with the local actors.

3.5 The lab research approach and the action model

The research approach of the analysed lab can be framed in the design research studies adopting the research through design (RtD) (Frayling, 1993; Findeli et al., 2008; Jonas, 2007; Manzini, 2015) approach as a form of action research (Archer, 1995; Reason, & Bradbury, 2008; Stewart, 2014; Swann, 2002).

According to these premises, the lab designed a proper set of actions for transferring design knowledge to local entities in three phases i.e. (i) setting-up; to improve the interest in

service design; (ii) experimenting; to improve the autonomy in service design; (iii) modelling; to embed service design.

Each action can be applied according to an action model (figure 1) that the lab designed with the aim of engaging local agents, understanding and analysing their needs, designing and applying specific actions, evaluating the experiences. The phases of the model are:

- Engaging, to build design partnerships with local stakeholders;
- Analysing, to optimize design praxis and theoretical activities;
- Applying, to implement a series of theoretical seminars, workshops and design experiences (DXs);
- Evaluating, to analyse and reflect about the data gathered through in-field activities.

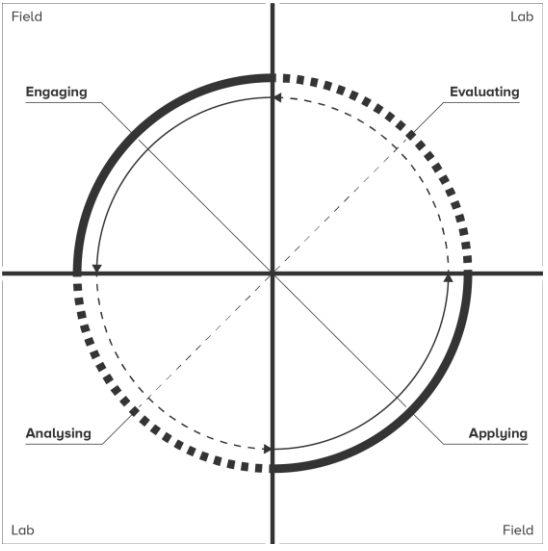

Figure.1. The action model adopted by the analysed lab.

3.6 The lab project development

The case presented in this paper refers to the early years of activity ('setting-up' step) of the analysed Lab. What follows summarizes the main activities provided through the action model.

In the 'engaging' phase the lab promoted service design at a local level with the aims to (i) engage potential stakeholders; (ii) collect interest for consecutive design partnerships from public and private entities; (iii) understand opportunities and needs of potential stakeholders; (iv) acquire human resources (such as design researchers).

In the 'analysing' phase, the lab started an intense programme of analysis with the aim of building shared theoretical foundations, research approaches and a practice framework for the design activities. Events such as seminars and theoretical workshops were designed with the aim of spreading a local design discourse among the local actors.

In the 'applying' phase, the lab team implemented the activities designed in the previous phases in contexts where design is not systematically applied according to the following main set of actions (figure 2). All the activities were provided to involve (for free) as many local actors as possible.

Theoretical Experiences (TXs). With the aim of supporting local design discourses and professions, thirteen TXs were organized among (i) seminars in collaboration with national and international speakers about different topics such as innovation, design research, service design, philosophy of design, interdisciplinary research; and (ii) intensive workshops with professionals and researchers in design about data visualization, design thinking, service design.

Design Experiences (DXs). Six DXs were organized with five local design partners from the public and private sector among the three systems (education, production, public policies). They were engaged in collaborative design practices (e.g. co-design workshops, design ethnography) simulating human-centred design processes (in service design) applied to real problems, needs and contexts through a learning-by-doing approach.

Stand-alone (one-off) project. A stand-alone project was developed in collaboration with the local government and their stakeholders in the field of public policies. The lab provided design-based visual tools to help a forum of experts engaged to identify strategies for the innovation of the local research and development policies.

Pilot study. The stand-alone project is a case study of an undergoing pilot study addressed to explore (i) how the local policy makers design public policies; (ii) how service design can contribute in this context; (iii) how the findings can be applied for the renewal of the local public policy sector.

Design probes. Following the directions previously identified in a forum of experts organized by the local government, experimental design probes were designed and applied to explore the design context of the local cultural sector in favour of a future redesign of the public cultural policies.

	ACTIVITY	Sector	Area	System	Format
THEORETICAL EXPERIENCES	TX1	Public/ Private	Open learning	Education	Seminar
	TX2	Public/ Private	Urban environment	Education	Seminar
	TX3	Public	Public innovation	Public policies	Seminar
	TX4	Public/ Private	Data visualization	Education	Workshop
	TX5	Public/ Private	Social media management	Production	Workshop
	TX6	Public/ Private	Design Thinking	Production	Workshop
	TX7	Private	Business	Education/ Production	Workshop
	TX8	Public/ Private	Design Research	Education	Seminar
	TX9	Public/ Private	Interdisciplinary Research	Education	Seminar
	TX10	Public/ Private	Philosophy and design	Education	Seminar
	TX11	Public/ Private	Design Research	Education	Seminar
	TX12	Public/ Private	Semiotics	Education	Seminar
	TX13	Public/ Private	Culture and contemporary art	Education	Seminar
DESIGN EXPERIENCES	DX1	Private	Local ICT company	Production	Design review
	DX2	Public	No-profit association	Public policies	Design check
	DX3	Public	Inst. research and experimentation	Public policies	Design workshop and Design seminar
	DX4	Public	High school	Education	Design studio
	DX5	Private	Trade association	Education	Design studio
STAND-ALONE PROJECTS	STP1	Public	Local research and development	Public policies	One-off
PILOT PROJECTS	PP1	Public	Service design for policies	Public policies	Pilot study
DESIGN PROBES	DP1	Public	Local cultural system	Public policies	Experimental format

Figure 2. A resume of the activities provided in collaboration with the local actors.

In the 'evaluating' phase, the lab team evaluated all the activities provided in collaboration with the local actors through mainly qualitative techniques. The participants' feedback, comments and suggestions were gathered through unstructured and semi-structured interviews, questionnaires, and focus groups. Also, data gathered and design results were analysed in the lab and data related to the DXs were deeper investigated with the Logical Framework approach and a gap analysis. The results were discussed comparing them with

the design research literature and the needs emerged through the experiences with the local actors.

3.7 Early results and impact

The main result of the early years of activity is the identification of strategic details that facilitate the DKT process. There were identified:

- a dissemination framework with different areas of interventions (i.e. discourses, publications and design formats);
- five design formats for the DXs (i.e. Design Check; Design Seminar; Design Workshop; Design Review; Design Studio);
- a format (theoretical framework, approaches, processes, toolkit and guidelines) for the application of the design probes for the DKT;
- fifty-three gaps, eight critical areas and five criteria for developing DXs with the design formats;
- ten requirements to develop DXs with inclusive criteria.

More than 200 people among the education, production and public policy systems were involved in collaborative design-based activities and more than fifty activities among the three areas of the Dissemination Framework were provided. Around 180 hours of collaborative activities were provided as part of the knowledge transfer process. As a main impact, the participants increased the interest in service design and requested 320% more collaborative hours in respect to the total amount of hours exploited during the firsts months of the lab activities.

4. Results and findings

The main results of the analysis of the lab as a case are (i) the identification of an overview of the main features that allow to recognize the laboratory as a strategic place for the local development; (ii) the identification of a strategy for introducing service design in the three local systems.

4.1 The lab overview

The analysed lab focuses on delivering activities with and for stakeholders in contexts where design is not part of the organizations and communities culture. Therefore, it operates with an inclusive approach in contexts where there is no use of design (see Kretzschmar, 2003; Nusem et al., 2017; Ramlau, 2004); or the use of design is recognized for a specific need in a one-time project (see Nusem et al., 2017) for solving discrete problems (see Design Council, 2013) and in general where design is perceived as ‘styling’ (cf. Kretzschmar, 2003; Ramlau, 2004). Moreover, the lab could potentially play a strategic role at local scale as a part of

innovation teams (see Puttick et al., 2014) in public innovation spaces for research, communication, networking and capacity building (cf. Selloni & Staszowski, 2013). Finally, the lab refers to (see figure 3); (i) the third order of design focusing on experiences, activities and services; (see Buchanan, 2001); the design for value creation, focusing on services (see Jones, 2014); the design of systems and services (the D2 level in Young, 2008).

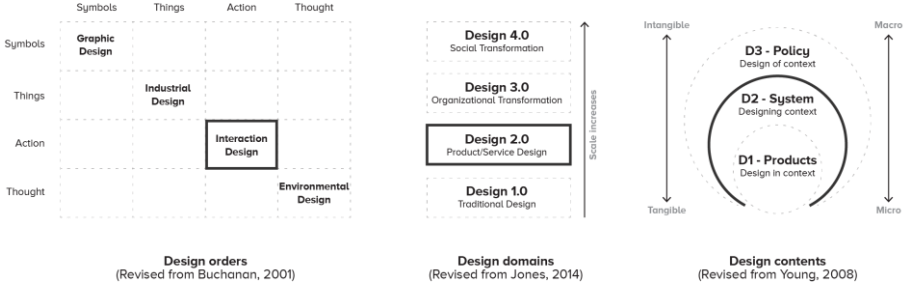

Figure 3. The analysed lab in relation to three different references.

4.2 The strategy for DKT

The analysis of the lab as a case study allowed the identification of a strategy for implementing a DKT process. The strategy is built in three macro-categories i.e. (i) discrete design tasks; (ii) training formats; (iii) projects. All the three macro-areas follow the goal of the laboratory with different specific objectives and complexity for each activity. All the three categories (except for one activity - see Figure 4) are supported by empirical cases previously provided by the same laboratory.

Indeed, the categories of the strategy are the result in observing the activities provided with the local agents and their feedback in terms of design needs related to what they experienced and what they were called to provide.

MACRO-CAT.	DISCRETE DESIGN TASKS		TRAINING FORMATS		PROJECTS	
Activity	Design probes	Stand-alone design-driven tasks	Theoretical experiences	Design experiences	Pilot projects	Research and development projects
Experienced	✓	✓	✓	✓	✓	
Seeked						✓
Cases	1	1	13	6	1	None

Figure 4. An overview of the strategy background.

4.3 Discrete design tasks

The first category is based on activities that allow the laboratory to activate processes for probing and exploring the design contexts through in-field design-driven experiences. It contains:

- (a) design probes to understand specific design contexts with design-based methods for probing and exploring;
- (b) stand-alone design-driven tasks to solve discrete problems with a specific design discipline, also used as probes for gathering in-field data about the design partners' approaches in designing.

4.4 Training formats

The second category is a set of different training formats. It includes:

- (a) theoretical experiences (i.e. theoretical seminars and theoretical/practical workshops);
- (b) design experiences (i.e. simulations of human-centred design processes through a learning-by-doing approach).

4.5 Projects

In the third category there are structured projects addressed to change a situation, piloting and developing design solutions. It includes:

- (a) pilot projects;
- (b) research and development projects.

5. Discussion

The identified strategy can be considered as a scale of complexity for (i) designing the strategy actions; (ii) transferring design knowledge to the local entities that do not systematically use design and (iii) understanding how the local entities generally design and what they need in order to introduce a human-centred approach to their design process (figure 5).

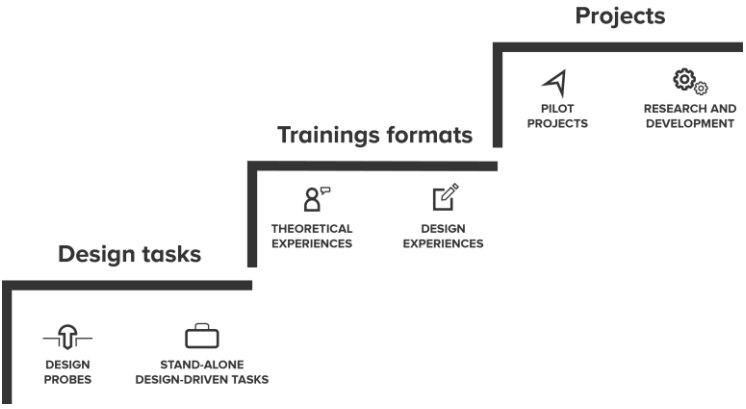

Figure. 5. The DKT scale of complexity.

As a discussion of the main result, the following reflections are related to the application of the strategy. In fact, from the knowledge transfer perspective it is still not clear if this strategy should be applied according to a specific sequence. The authors provide an early evaluation about this aspect in the following considerations:

- If the strategy is applied as a structured process according to a sequence of actions, its application starts from the design probes and rigorously follows the subsequent actions (figure 6). For instance, if the main goal is developing a pilot project, the design of this set of actions for DKT should consider specific actions that precede the pilot project in the scale.
- If the strategy is applied as a semi-structured process according to a sequence of categories, its application starts from the first category but not necessarily from the first activity of the category (figure 7). Therefore, while the sequence of the categories follows the steps of the scale, the sequence of the actions is randomized and it depends on a case-by-case evaluation.
- If the strategy is applied as an unstructured process according to any given sequence, the actions are applied randomly (Figure 8). This means that the sequence of the actions is collaboratively selected and designed case by case with the partner of the knowledge transfer through the design process.

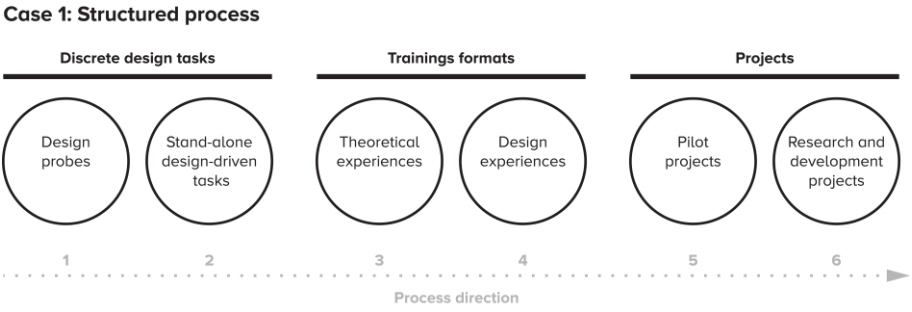

Figure 6. Case 1: structured process.

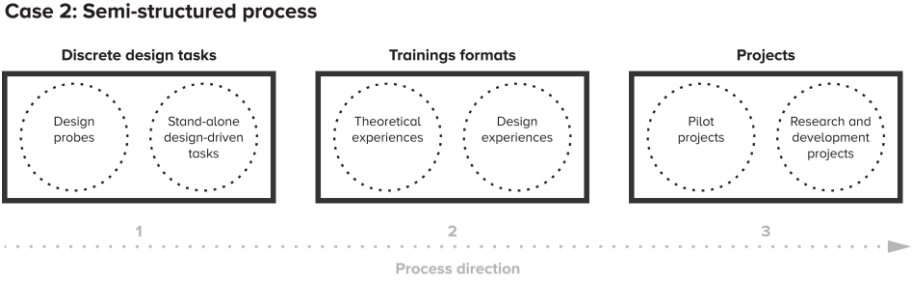

Figure 7. Case 2: semi-structured process.

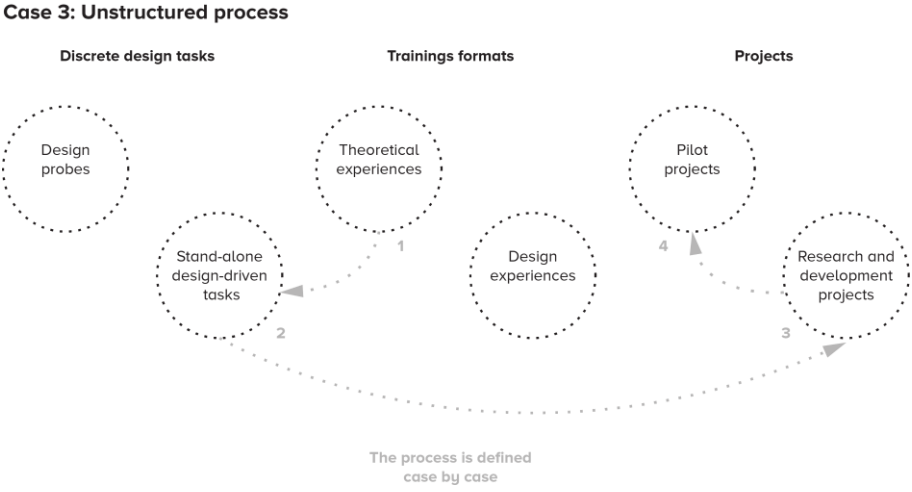

Figure 8. Case 3: unstructured process.

Every case presents advantages and disadvantages. For instance; the last case is the most participative and democratic among the hypotheses because it gives more decision power to the local agents.

However, according to the experiments conducted in the analysed lab, the actions of the macro-categories should be considered sequentially. Furthermore, it is still not possible to consider the strategy as a customizable instrument and additional data needs to be gathered through more in-field experiences. Moreover, according to the logic of the scale, all the activities can be considered a tool for probing the local contexts and refining the offering actions step by step.

From a practical perspective, if an action of a macro-category is assumed as the final objective of the transfer process, the previous actions need to be considered as previous steps of the DKT process. Every category is conceptually the container of a set of activities that work as medium for the DKT process with different levels of complexity. For this reason, the identified categories allow to apply a strategy for transferring knowledge through the practice of design.

6. Conclusions

In conclusion, according to the findings described in this paper, it is possible to proceed with experiments of democratization of design at local scale in the case that all the actions of the strategy are correctly applied by the identified sequence. However, this aspect needs more investigation and it is part of the agenda for future inquiries. For this reason, the strategy is actually adopted by the same analysed lab as its free offering system to be experimented with the local entities as an open-ended, inclusive, participative and free instrument for a design-driven local development in the three systems.

Also, the analysis of the lab as a case study for the democratization of the design culture, opened two working concepts that are (i) the DKT through design; and (ii) the democratization of the design culture through DKT. Both the concepts require investigations from a design research perspective envisioning an innovative conceptual framework. Indeed, the analysed lab is mainly adopting the RtD approach with the aim of transferring the design knowledge to the local systems. Therefore, the lab is adopting ‘research through design’ where for ‘design’ is meant the design of the 'knowledge transfer process'. As it is mentioned before, the 'DKT process' can be considered a 'DKT through design'. Consequently, the lab is following a ‘Research through Transfer through Design’ (RtTtD) approach for developing design research and democratizing the design culture.

Finally, a generalization of the RtTtD concept allows to conceptually envision its design research extension that is the ‘Research for/through/about Transfer for/through/about Design’. This can be the subject for future inquiries in DKT.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design for Promoting Pro-environmental Behaviours of the Georgian Domestic Workers in Ankara

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Abstract | In this study, we worked with Georgians coming to Ankara, Turkey as live-in domestic workers whose work and private life was tangled. There are many layers to investigate in this case, like the adaptation process to the new culture and country. Another layer is the transfer of knowledge and behaviours between home and migrated country. The design proposal we made with Plentifulness Cards aims to ease the knowledge sharing process and strengthen the relations between immigrant domestic workers so that the pro-environmental behaviours would be encouraged and spillovered from the private domain to the work domain. Narrating on this research through design project, the article demonstrates how boundaries between places, roles, and cultures can be reawakened and reshaped with the help of designed artefacts.

KEYWORDS | DOMESTIC WORKERS, IMMIGRANTS, PRO-ENVIRONMENTAL BEHAVIOUR (PEB), SPILLOVER, CULTURAL IDENTITY

1. Introduction

The increased pace of life and high workload change the everyday life patterns of individuals (Muster, 2012). As work and private lives interpreted with another, the line between them gets fuzzier. Dissolving borders have resulted in the diffusion of behaviours and values from the private life sphere to the work-life sphere and vice versa -as defined as spillover effect in the literature (Edwards & Rothbard, 2000). As one of the diffusing behaviours, pro-environmental behaviour (PEB) -actions that will benefit the environment or make the least harmful impact as possible (Steg & Vlek, 2009)- can be spillovered in different spheres of life. Elaborating the effects of the transgression of behaviours and understanding the motives behind the pro-environmental behaviours (Kollmuss & Agyeman, 2002; Steg & Vlek, 2009) of sustainability-oriented employees will be the topic of this paper.

Interestingly, in the case of the live-in immigrant workers, one place (house) becomes a setting both for work and private life, and these two became inseparable from the other, which lead us to focus on the spillover of PEB of immigrant domestic workers in this project. Almost all of the studies in the sustainable consumption in the workplace setting targets the office setting, and non-office work setting remained undiscussed. Because of this gap in the literature, we preferred to work on domestic workers' sustainable consumption behaviours.

This paper presents the process and outcomes of research through design project as a part of a graduate studio course in the Industrial Design department of Middle East Technical University. The research project aims to promote PEB of the Georgian domestic workers in Ankara, Turkey through design practice. The research questions of the project are:

1. How cultural differences between the worker and the employer affect workers' PEB in the case of an immigrant worker?
2. How the workers' PEB spillover when a place (house) becomes setting for different life spheres?

The topic consists of many different layers because it grounds where the boundaries between places (e.g., home, work, country), roles (e.g., householder, worker, immigrant), and cultures are highly blurred.

To find answers, we conducted field research with five Georgian domestic workers who live in their employers' houses as caretakers or helpers, using semi-structured interviews and observation methods. According to Nair and Little (2016), domestic workers' cultural background determined their behaviours and sustainable consumption patterns since consumption - which constitutes a critical role in the identity construction - can be traced back to the culture. Consequently, identifying the characteristics of this group; their educational, economical, family background, and the way they reflect their own culture and identity in "X" city become essential for the sake of this research.

2. Literature Search

This literature review will start with the definitions of keywords in this context, such as sustainable consumption (Cohen, 2001; Muster 2012), pro-environmental behaviour (Steg & Vlek, 2009), and spillover effect (Edwards & Rothbard, 2000). Next, sustainable consumption in the workplace setting will be examined as discussing the interactions between work and private life. How this interaction affects people's pro-environmental behaviour in different workplace settings (Kirk & Barton, 1982) will be discussed. Finally, it will conclude with underlining the knowledge gap in the sustainable consumption behaviour at non-office workplace literature.

2.1 Background of the Sustainable Consumption

Sustainable consumption has been defined differently by a myriad of authors, and there is a rich terminology used for describing similar terms. Sustainable consumption, (Cohen, 2001; Muster 2012), conscious consumption (Ellen, Wiener, & Cobb-Walgren, 1991), socially responsible consumption (Roberts, 1995), responsible consumption (Marchand & Walker, 2008) and green consumption (Nair & Little, 2016) are some of these terms used in the literature. Pro-environmental behaviour (PEB) is the term used by Steg and Vlek (2009) to describe the activity that aims to have a positive impact on the environment, or if it is not possible, do the least harm. According to Kollmuss and Agyeman (2002), PEB is a conscious act that is performed to reduce the negative outcomes of one's action on the environment. Although there is various terminology used to define sustainable consumption, they all indicate quite similar things that lead to PEB.

2.2 Spillover Effect

As Tudor, Barr, and Gilg (2007) highlighted, there are various studies on PEB in different settings, but most of them focused on the house rather than the workplace. Tudor et al. (2007) also stated that how environmental behaviour is affected when people change the setting from home-to-work or work-to-home has a little place for itself in the literature. In that point, spillover effect, which defined as the transfer of mood, behaviours, skills, and values from one domain to another (Edwards and Rothbard, 2000), is a valuable term to explain how PEB can spillover between homes and work settings. Viola and Ulf (2011) demonstrated that when environmentally friendly behaviour learned and performed in one domain, similar actions can be triggered and strengthened in the other domain.

As an extension to Viola and Ulf's (2011) assertion about spillover of people's environmental behaviour from private life to working life, Tudor et al. (2007) stated in his study findings that a strong connection between sustainable environmental practices of people in home and work settings exists; moreover, fundamental pro-environmental behaviours and values of people mainly determine that secure connection. Therefore, it can be concluded that spillover of PEB can be seen both from home to work and from work to home

2.3 Pro-environmental Behaviours (PEB) in Different Workplace Settings

In this section, sustainable consumption behaviours in the workplace setting will be discussed in two parts, which are office and non-office settings. Starting with the office setting, Felstead, Jewson, and Walters (2005) defined the office work setting as working in a defined place for a prescribed period -more specifically "sitting in an office, or at a desk, with a name-plate on it" (p. 2). Companies which operate in office-based settings develop strategies for promoting pro-environmental behaviour of their workers. Both employees and companies tend to perform PEB, and the motives behind these behaviours are examined by Harland, Staats, and Wilke (1999). They found that ethical norms are among the most critical motives behind employees' PEB in the workplace.

Even if it is limited, there are some studies on sustainable consumption behaviours in the office setting. However, in a non-office work setting, the examples are even fewer - almost none. Since the visibility of non-office work setting as a workplace is very low, we focused on this area. Therefore, in this part, a non-office setting will be investigated for domestic paid work, which breaks the boundaries between work and home since it keeps being a home for the house owner while it is a working environment for the domestic worker (Cox, 2013). In addition to the place, domestic work signifies different meanings for different roles. Cox (2013) stated that "The employment of paid domestic workers highlights the close relationship between consumption and work in the home. Work for one person, the employee, is the consumption for another, the employer." (p. 821). Additionally, Nair and Little (2016) looked from the perspective of sustainable consumption and said the roots of behaviours and sustainable consumption patterns need to be searched in the cultural background of people.

3. Methodology

We conducted field research with five Georgian domestic workers who live in their employers' houses. Two of the participants are taking care of older people, one of them taking care of a bedridden person. One of the participants is the helper for housework, and one of them is unemployed. We used personal connections and snowballing for recruitment.

In the study, interviews (semi-structured) and observation methods were used. Most of the interviews took around two hours; therefore, they were long and dense enough to comprehend the user group's characteristics and their approach to PEB. After the interviews, participants showed their house and their homemade products, which we talked about during the interview. Interviewing in their house and work environment during their work time was a challenge and an opportunity for us at the same time. It was a challenge since they must take care of their employers during the interviews. Consequently, interviews were interrupted a couple of times. On the other hand, we had the chance to observe them while

they were working and interacting with the employers and doing their regular work at the house.

After all interviews were transcripted, researchers coded transcriptions on hard copies, mostly using process coding and motif coding methods for analysing. During the coding process, the first and second cycle coding were used simultaneously because researchers had already known the data very profoundly from participating in all the interviews together and transcribing them in a short time. Therefore, finding connections and patterns between interviews was possible in the early stages.

4. Field Research

Data gathered from the interviews and observations helped us to understand the living conditions of a Georgian domestic worker in Ankara whose private life and work-life dissolve into one another. For that reason, we investigated the nature and level of PEB among these employees and its transference to other domains of their life (spillover effect). When we use the term PEB, we are referring to the behaviours that respect nature, producing on your own, buying locally, supporting drug-free agriculture and consuming natural products, and so forth. Questions were asked about resource consumption, waste management methods, repairing habits to learn the types of PEB that participants execute. After learning the types of PEB, factors affecting the spillover of it is examined comprehensively.

4.1 Types of PEB

As the interviews are analyzed, PEB of participants were gathered under the categories of cleaning, gardening, shopping, cooking, waste management, resource management, DIY, reusing, repairing, second-hand, homemade. Since some of the categories were emphasized more than the others, researchers chose five of them to work on, which are cleaning, gardening, shopping, cooking, and DIY.

To start with the cleaning category, participants were highly concerned with the hygiene of the house since they are working for people in need of nursing due to their age and sicknesses. They are both responsible for residents' hygiene and health and also house's hygiene and order; consequently, lots of different cleaning products are required, but some of them find a way to make their product to make it more "natural" and less "harmful" as they indicated. For example, P1 showed us her homemade cleaning cream consists of soft soup, hot water, and some readymade cleaning cream. Moreover, P1, P2 and P3 indicated that they are using white vinegar regularly for cleaning the floors, washing the curtains or disinfecting greens or vegetables. However, P2's employer does not approve the use of vinegar and wants her to use detergents instead.

When it comes to gardening, most of the participants seemed to had experience about it back in their home country: however, some of them cannot maintain their habit because (1)

in the migrated country they live in the crowded city where there is no place for gardening, (2) their employer does not want to consume vegetables grown in the pot, (3) or employer already has a gardener for these tasks. On the contrary, the ones who have access to soil, use this opportunity to grow their vegetables and herbs like P3 and in the case of P1 pick fruits from trees to make marmalade for the winter or let them dry for later consumption as P2.

When researchers asked their shopping habits, P1 stated her preferences for going to the bazaar for vegetables and fruits while buying eggs, milk, and related products from local producers, which she finds healthier and more natural than the market products. Also, P5 said that she is buying groceries from the bazaar with her employers. P3, on the other hand, used to buy from bazaar rather than market back in Georgia, but since she has a language barrier and does not feel comfortable communicating with stallholders, she preferred to go to the market in Turkey.

For the pro-environmental cooking habits, researchers found out that participants tended to use methods for containing food for longer periods of time, like preparing canned food such as pickles or making jams from the fruits in the employer's garden or simply drying the fruits. P2 stated that in Georgia, they are not used to find vegetables or fruits in every season, that is why they are canning or drying most of them at the end of the summer. It is seen that these behaviours are also taking place in Turkey where they are spillovered.

Lastly, within the DIY theme, participants' repairing and reappropriating behaviours are exemplified. For example, they are finding alternative ways of using old towels as a dust-cloth or making them cleaning gloves or using old clothes for patchwork, as in the case of P2. P5, on the other hand, said she is saving leftover soap pieces to make a mixture for washing clothes. P2 was also interested in repairing things in the house like a broken iron and a chair, while P1 also wanted to repair instead of throwing away but did not know how to repair broken stuff.

4.2 Factors affecting PEB

It is found that Georgian domestic workers living in the migrated country are having concerns like buying locally produced food, using "natural" and handmade cleaning products, decreasing waste by making second use of old, unused products, which are indicating that they have certain PEB that spillovered from their home country. These kinds of behaviours are mostly spillovered from their home/private life to work life, from their own country/culture to their new environment. While some of the participants easily keep practicing their PEB, some of them having difficulty to do so. Here in this section the factors affecting the PEB of Georgian domestic workers will be discussed. When data gathered from interviews is analysed, it has been found that there are several factors effecting PEB and its spillover which can be listed as follows:

Personal background of workers includes information about their family, education and worldview. Also, we found out that their settlement place in their home country have a significant effect of PEB practices. For example, if they were raised in the village, performing PEB is more likely compared to city settlement. In the village life they mostly have their own garden in front of their house where they produce their fresh food and use homemade goods for cleaning instead of buying commercial products. This is also related to financial concerns of participants which is another factor affecting PEB. They expressed that homemade products and producing their own food in the garden or in the pots are cheaper than buying from the shops.

Moreover, since they were using employers' money for shopping, they were feeling more cautious about spending it for house expenses. Situational factors cover the accessibility to farmer's market, availability of recycling boxes, and infrastructures related to gardening activities. Health concerns of workers related to cleaning of the house and food consumption were also affecting their PEB because they were responsible for not only their health but also residents of the house who includes ill or older people and children.

4.3 Someone between employer and family

The relationship between workers and employers can have different levels and modes. When employers provide a space for workers to express their personality and culture, workers feel belonging and commitment to their employers and consider them as their family. Therefore, worker-employer relation becomes a family relation. In the case of a positive connection between worker and employer, the employer can have different roles such as supporter, mediator, and teacher in terms of helping workers in the process of learning a new language and adaptation to another culture.
However, in the condition of a negative relation between Georgian domestic workers and employers, workers experience difficulty in performing their habits. The attitude of employers towards workers has a significant effect on employers' daily life practices. For example, two of the participants said that they had challenging experiences when employers have strict rules for their shower time and frequency and washing machine usage. Finally, it is seen that the relationship between employer and worker and matching or clashing personalities has a significant effect on the spillover of workers' behaviours from their life in the home country to the migrated country.

4.4 Somewhere between work and home

In addition to Georgian domestic workers' relations with their employers, they form an attachment to the house they work in. The mode of the link between worker and house depends on various conditions, and according to that, workers' behaviours change in the house setting. For example, one participant feels like the house is hers, and she prefers to stay there on her leave day instead of going out because she feels very comfortable in the house. Also, she hosts her guests at the employer's home. When it is the worker who

provides the order and control over the house, the possibility of spillover of her PEB practices is increased because the worker feels a kind of ownership over the house and feel free to express her culture and bring own practices to the house. For instance, a participant said that she brought special spices from her home country and used their traditional cooking recipes in the house she works. Also it is identified that if a worker lives only with the employer, work and home settings become more inseparable because she considers the whole house as living space. However, if relatives of the employer like grandson or daughter live together with them or stay over so often, the worker divides the house visibly as our bathroom/daughter's bathroom, as one of the participants stated.

4.5 Something between cultures

The transition between countries also means a transition in language, culture, and lifestyle. In the case of migrant domestic workers, adaptation to this transition can be challenging, especially in their first months of arrival. The adaptation process may even be longer since some participants feel insecure about their residence or work permit. To add more, having the language barrier to communicate with their employers makes it harder for a Georgian domestic worker to feel attached to this new country. It is found out that when it is difficult for the worker to reflect her own culture and identity, then the possibility of PEB spillover is less likely. On the other hand, when the workers are supported by their employer or by the other Georgian domestic workers in the same city in the process of learning the language and traditions, their adaptation period is faster and more peaceful.

Having (Georgian) friends and creating a network can help to promote PEB and spillover of them. To illustrate, P2 indicated that she learned a lot from her other Georgian friends over the phone or their weekly meetings on Sundays and exemplified as "I have learned that beans are served with pickles in traditional dining culture here thanks to my friends here". Also, knowing neighbours and expanding the network seemed to have a contribution for a better adaptation process. Again, P1 was telling us that their neighbour and market owner in the neighbourhood are mediators for giving leftovers to animals. Here is where we realize social relations and network effect PEB positively since it eases the sharing of tips and tricks, experience, methods, and knowledge -which have a significant effect on the spillover of PEB.

5. Design Phase

5.1 Plentifulness Cards

It is concluded that some Georgian domestic workers face the problem of reflecting their cultural identity and adapting to a foreign country's culture. In the adaptation process, workers' PEB is hard to spillover since there is a subtle conflict between employer and employee about having control and creating an order in the house. If the former has power,

then the latter has no space to keep up her PEB and culture. Contrarily, when the workers have a chance to share their knowledge and strategies about daily PEB practices with their employers and friends, the possibility of the PEB's spillover is more likely.

In order to ease the knowledge sharing process and strengthen the relations between immigrant domestic workers, which lead spillover of PEB, we developed Plentifulness Cards as a design proposal. We chose our target group as Georgian domestic workers in Ankara; (1) who live in the employer's house permanently and (2) whose working and private life become tangled.

We created the design process by setting our design brief which is informed from the field research analysis. Then, we developed personas for creating design ideas for our user group. Afterward, we made some mock-ups for promising ideas and took them to our participants for testing. According to feedback and further exploration of the concept, we improved our design proposal.

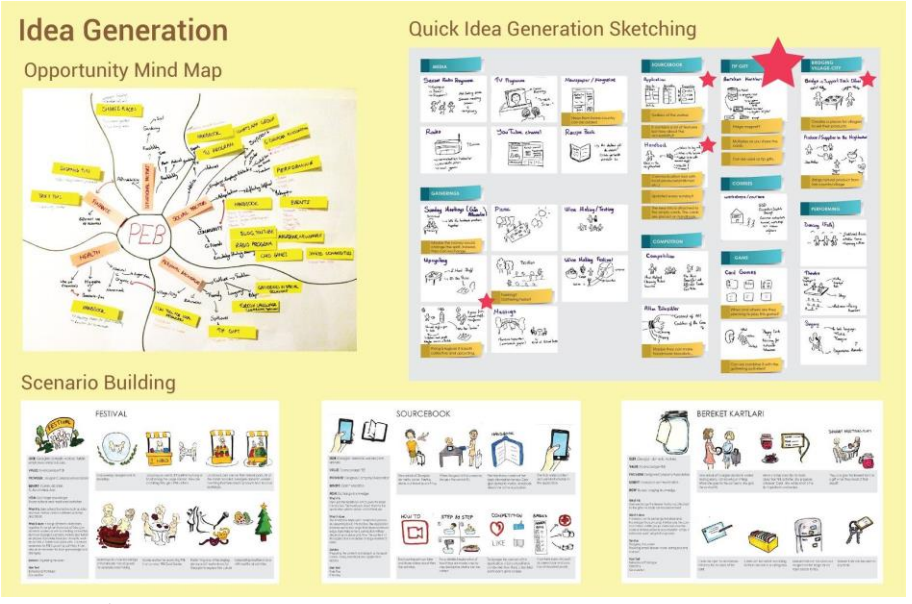

Figure 1. Idea Generation

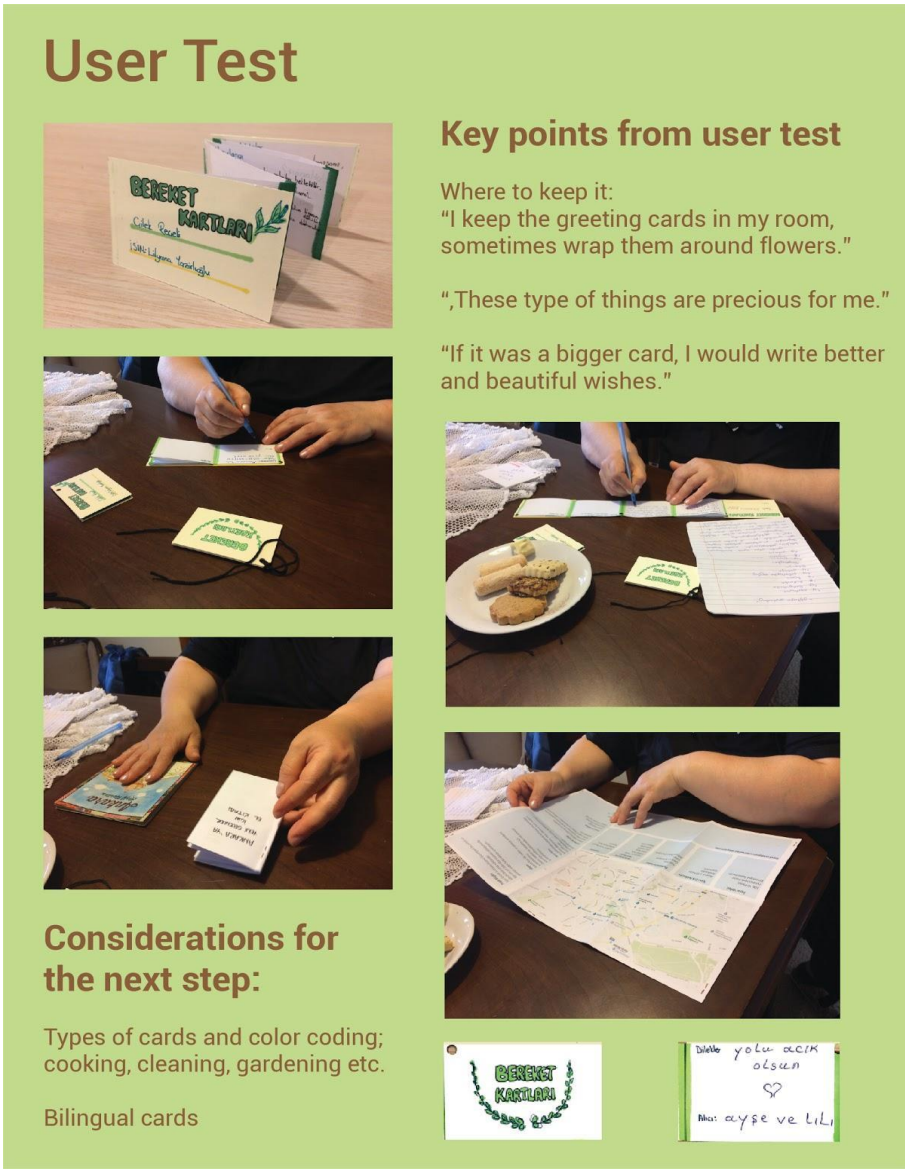

Figure 2. User Test

Cards are given in five categories: cleaning, gardening, DIY, shopping, and recipes which consist of tips and tricks about the new place Georgian workers migrated to and, more specifically, the neighbourhood they will work and live in. One can use the cleaning card for sharing the making process of natural cleaning handmade products: which ingredients to

use, how to make it and where to use it etc. With a gardening card, one can share her experiences and suggestions about these topics: what is the right time for planting, how to plant and how to grow it. The shopping preferences: where to buy fresh vegetables, where to find second-hand goods and more can be shared through that card while DIY card helps to share the knowledge about repurposing and reusing unused stuff. Lastly, recipe cards are for sharing the natural and healthy food recipes.



Figure 3. Plentifulness Cards

Each card is written in two languages -Georgian and Turkish. On the front page of the card, the category is explained and the postcard info is expected to be filled by the sender of the card. In inner pages following information is given: ingredients, how to prepare, where to use, the tips & tricks and lastly, the experiences of the sender while applying the recipe. On the back page, the Plentifulness Cards is explained, all the categories are shown and how to find these cards is described.

When it comes to the usage scenario, it all starts with the receiving of the Plentifulness Cards Box. They can be found in the companies which are mediators between Georgian domestic workers and their employers. Within the box, Plentifulness Cards and card display are found. In the cards, it is explained what these cards are for and how to use them. When a worker has something to share about her PEB activities, she fills a card and even can add a relevant gift to it. For example, if she is filling a gardening card about how to grow greenery in the pot, then she may also add some seed along with it. After filling the card, she can give the card to her employer, colleagues or neighbours. On the other side, as a card receiver, the worker can put her favourite card to the card display in various ways to try them later or keep them as memories. Moreover, if she has something to add to the card, there is a space for writing her own experiences about that recipe.



Figure 4. Usage Scenario

6. Conclusion Remarks

In this research through design project, we experience the strong connection between research and design phases and we benefited them iteratively. When design proposals are based upon the real connections between designer and people, ideas are articulated in a meaningful way. The design proposal we made by Plentifulness Cards aims to ease the understanding of status-quo rather than being an absolute answer to the problems that immigrant Georgian domestic workers struggle on. In a way, our role as designer was to be

the navigator of the complex situation, and we try to see the user as experts of their own daily practices and find a way to materialise the insights gathered from the users' experiences. Therefore designed artefact –Plentifulness Cards- was a tool to reflect on the problems and communicate with our user group more easily without a barrier. Because we experienced some limitations like participants' insufficient knowledge of Turkish language. Also, they mostly feel insecure about us questioning their work in a migrated country. Also, we could only reach Georgian domestic workers who have better living conditions and the number of participants was limited. Since we had restricted time for the project at the time of the course, we did not allocate more time for increasing the number of participants. Therefore, that topic can be further studied with more Georgian domestic workers since it is such a fruitful area for including different actors, cultures, and lifestyles into the research through design area.

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Acknowledgements: This project is conducted as a graduate studio course project and we are thankful to the course instructors Pınar Kaygan and Harun Kaygan together with the teaching assistant Duygu Vatan for their time and invaluable feedback. Also, we would like to express our gratitude to our participants.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design projects as drivers for organisational change in the public sector.

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Abstract | The demand of a new generation of public services is leading to a systematic exploration of what design can do for public organizations. The article presents and discusses, through the analysis of two design projects conducted in the Municipality of Turin, a design-based theoretical framework for organizational change based on the conduction of long-term processes of engagement and exposition of public sector employees to the design culture.
The two cases show that the growth of innovation capacity in the public sector based on service design practices must consider the necessity of coping with long-standing challenges, i.e. the innovation of/in public bodies; the peculiarities of organizational learning processes and of the absorptive capacity of the organizations; and the overall resistance to change in people and organizations.

KEYWORDS | PUBLIC SECTOR INNOVATION, CO-CREATION, ORGANIZATIONAL CULTURE, EXPERIENTIAL LEARNING, INNOVATION CAPACITY, DESIGN THINKING

1. Introduction

Confronted with a range of complex challenges, public administrations (PA) are faced with increasing pressure to improve their innovation capacity (Cavenago et al., 2016; Potts & Kastelle, 2010). The emergence of the "co-society" paradigm, nurtured by open innovation and digital technologies, has given way to completely new citizen behaviours (Geraud, 2016), such as mobilization for the "commons", data sharing and service sharing. Hence, the user is no longer simply a receiver or a spectator but an actor (Fluicity, 2015). This new trend is questioning both the decision-making and the implementation processes in the public sphere and is putting increasing expectations of greater citizen participation in the design and delivery of public services meant to address societal challenges that require new solutions.

As a response to these challenges, many PAs have introduced design practices as a tool, with a particular emphasis on the development of a more citizen-driven approach to innovation in order to build a better society (EU commission, 2013; Bason, 2010; Puttick et al., 2014; Tõnurist et al., 2017).

However, many barriers continue to prevent the development of an agile citizen-centric approach to innovation.

The difficulties and barriers that arise from public bodies adopting new and alternative principles like co-creation that are rooted in design and represent a more "horizontal" approach, are notably linked to their complex, vertical and often fragmented structure as well as their organizational culture.

Participatory activities for their nature contain a high potential to tackle exactly this complexity faced by governments and public institutions. Moreover, they have the capacity to include unused knowledge and ideation resources into innovation processes despite - or exactly because of - their contrasting nature, typically clashing with the existing culture and processes. On the basis of these premises, we argue that the focus on end-user/citizen's innovation skills (Bason, 2010) to address the need for an agile and citizen-centric culture in PAs poses the problem that little reflection is being made on how public organizations can internalize and integrate the new knowledge, and how the transformation process can be fostered or managed: this omission could easily lead to reject the new practices, or confine them to a cosmetic role (Deserti & Rizzo; 2015).

In this article the authors present and discuss the results obtained from a long-term programme of design projects that they are developing in the Municipality of Turin.

The programme is based on the assumption that the introduction of a user centric innovation culture (Deserti & Rizzo; 2019) in the public sector can rely on developing a long-term process of interaction between the culture of the public sector and the culture of design.

In the following, the theoretical framework at the basis of the implementation of the design programme in the Municipality of Turin is presented. Consecutively, the development of the programme through the implementation of two projects is discussed examining the results with respect to the previous findings and the theoretical framework. Finally, conclusions are identified for the long-term experimentation and validation of the framework.

2. Expanding innovation capacities in the public sector through Design Thinking

Even though there are evidence of an increased rate of experimentation of user centred innovation methodologies within the public sector (Bouwman & Grimmelikhuijsen, 2016), it remains unclear under which conditions these become institutionalized practices. How organizational environments authorise and legitimize innovation practices by way of learning and education remains one of the most relevant challenges. To address this issue, the authors propose a programme of design projects that relies on the idea that introduction of innovation capacities in the public sector, should be based on their practice, or else in a learning-by-doing framework that can be complemented with reflection to achieve a sustainable transformation. This is not only in line with generic organizational learning principles (Schein, 1999), but also with the construction of innovation knowledge and culture, which is historically bound to practice. In such a context, the role of experience, a core ingredient of the design disciplines, can be regarded as key to knowledge creation and appropriation.
The programme under development in the Municipality of Turin proposes to combine advanced human centred service development with a learning framework to set up a learning environment (Beckman & Barry, 2007) in which to make possible for a range of diverse actors operating in the organization to experience the processes of innovation. Design Thinking (DT) is particularly effective in this perspective because of two main reasons:

- it grounds the innovation process in co-design activities that are human centred and involve multiple actors and perspectives, which is not only useful to better develop new solutions, but also to enable interaction, sharing of information and mutual learning.
- it is based on an experimental design/prototype/test/redesign loop that can be effectively connected with triple loop learning, which is particularly valuable within complex settings and organisations.

DT is today becoming a mantra in the different areas of innovation (Owen, 2007), including social and public-sector innovation (Manzini & Rizzo, 2011; Deserti & Rizzo, 2015). Design-led innovation approaches are currently being experimented to tackle societal challenges, trying to better manage complex participatory processes involving many actors and stakeholders in a frame of tensions or open conflicts. These processes go beyond the established principle of designing for context-dependent problems, extending the idea of participation to include: 1) the relationship between the context of the problem to be addressed and the design of the network that will co-produce the solution; 2) the experimentation of different configurations of that network until a robust partnership is individualised and established in some institutional form. In this perspective, DT emerges as a suitable approach to user centred innovation.
The DT innovation cycle is based on 2 main pillars: (i) a human oriented approach to innovation that considers the end users of the solutions those who possess the fundamental expertise on the problem/challenge to be solved; (ii) a context based approach to innovation

that considers actors from the external environment as well as the tangible and intangible PAs infrastructures and resources (people, processes, technologies, procedures, knowledge) as enablers or barriers to innovation (Deserti & Rizzo, 2019). DT pursues the activation of the ecosystem as strategic in the process that move from innovation ideation to its real implementation. The design programme developed for the Municipality of Turin interprets the real practice of the iterative design cycle as key for the introduction of design methodologies and tools to support the development of a co-creation culture in public organizations. To reach this objective, the programme integrates the DT methodology, in the form of an iterative design cycle, with Kolb's (1984) model of experiential learning. In other words, the programme is based on the idea that design-led innovation processes can be exploited to set up and pilot experiential learning within organisations.

3. The Design Programme in the Municipality of Turin

In the following sub-sections, the description of two design projects implemented by the authors in the Municipality of Turin are reported. The projects have been conceived as a learning by doing experience: the adoption of the DT cycle (from ideation to implementation) for the development of two new services has been observed and monitored as a process of implicit development of innovation capacity in the Municipality. Impacts affecting both the culture of the organization and the competences of its employees have been detected and are discussed in section 8.

3.1. First project. TO-Home: a service for vulnerable citizens at risk of eviction. 2016-2017

Turin is the third largest Italian city well known in the world as the hometown of FIAT automobiles. The crisis of the automotive sector that started in 2007 led to the delocalisation of the production and to a relevant increase in the level of unemployment, which has become the biggest challenge for the city. Under these premises, one of the objectives of the Municipality in 2017 was to develop TO-Home a service meant to responds to the complex needs of vulnerable citizens at risk of eviction (families or individuals that received an eviction notice or are at risk of receiving it) due to insufficient income. Politecnico di Milano mentored the Municipality through a service co-design process as a way to develop innovative solutions based on an integration between the employment, housing and social services, which are traditionally approaching the risk of eviction with different perspectives (a labour issue vs. a housing or a social one). The mentoring run through 4 phases: analysing the challenge, envisioning new solutions; detailing the design, prototypes. In phase one participants were supported to understand the challenge from the end user perspective. In the second phase participants were guided to the envisioning of new solutions with end users and the co-design of initial concepts for the new service. In phase 3 the focus was on moving from ideation to implementation in the context of the

organisation. The last phase included the support to prepare the tender to implement the service and the design of the service experimentation with end users. The analysis of this first experience shed light on a few critical issues: (i) the employees' difficulty in assuming the point of view of the end users as an alternative perspective from which to analyse the current services and design the new one; (ii) the employees' difficulty in overcoming internal resistance to change and barriers bound to the current organizational structure; (iii) the employees' difficulty in reconnecting the design of the new service with its real implementation. In particular, during the design of the service blueprint - the synthesis tools used to represent the final configuration of the service - participants were unable to come out with effective solutions to four main problems, which could ultimately affect the delivery of the new service:

1. Individualising competences of the operators that should deliver the new service.
2. Making the service visible and how to communicate it to the end users.
3. Obtaining the availability of enough houses to accommodate fragile families.
4. Engaging the users of the services in co-production mechanisms.

3.2. Second project: the redesign of the register services. 2019-2020

Being reputed one of the Italian excellent centres of innovation, the Municipality of Turin aims to improve the general access to fundamental services for citizens, also providing new ways of accessing them remotely. The Central Register Office in Turin provides a range of services directly to the citizens that involve a wide range of public entities at the regional and national levels. Services provided regard the civil status, the registration and change of residence and the issue of identity cards. Offering a range of fundamental services not just for Italian citizens but for all residents in the city, the context is multi-ethnic, multilingual, and hosting citizens of all ages. Following the growing need of citizens to carry out procedures remotely, different from most other Italian cities, several services to the citizens are offered online supported by the national digital authentication system, but the system still lacks integration with the services provided on-site, that are left behind. Having a strong connection behind the scenes of on- and offline procedures, conflicts cause all operations to slow down or face obstacles. Long waiting times for service delivery are paired with more practical problems on site linked to the building itself, its organization, and spaces. Having been constructed as a psychiatric hospital the monumental building has been reconditioned to host the central public offices of the registry office. Hence the architectural structure of the building itself bears a challenge in managing and organizing the spaces according to its new purpose without changing the landmarked structure itself. The project aims at facilitating the citizen's access to the offered services and the comprehension of the procedures. The project, divided in different phases starting from an introductory workshop with employees, followed by a period of user research, further workshops to co-create the new services with the stakeholders and a final phase of development and implementation.

The potential and critical issues identified in the first project conducted in 2016-2017 have been used as a foundation of this new one. Having already gained a set of insights on existing and potential barriers in the systems of the Municipality, a knowledge base was available for the set-up of the following activities. Different from the first project, the second one, extensively reported in the following, is aiming at improving and eventually complementing a wider range of existing services in the Registrar's Office in Turin.
The entire project is informed by different techniques of co-design applied to innovation in the public sector following 4 key principles:

1. Co-design with users
2. Analysis of the context of interaction
3. Approach based on piloting
4. Service design as a driver for organizational change

3.2.1. Project description

The entire project is oriented towards a redesign of the access to the public services in the central Register's office in Turin set up as collaboration between Politecnico di Milano and the Division of Innovation of the city of Turin.
The reason for this is that major difficulties have been found in citizens facing difficulties in identifying, accessing, and comprehending the services leading to dissatisfaction and confusion. The main services provided by the Register's office are the change of residence, the issuing of identity cards and official certificates. The services are offered in the central office in the city centre and 13 smaller, decentralized offices in the city. All these services are producing documents do not just allow citizens to identify themselves and benefit from other services in the city, but the services themselves, their organization and planning is therefore closely linked to various entities and designed and delivered by different and specialized team of employees not connected among them. These highly specialized teams are usually focused on one specific element rather than working in groups with mixed competences. With respect to these observations the aim, beyond improving the actual services, is breaking out from old schemes of designing services and introducing new ways and instruments that are following the key principles described in the previous chapter.
The project for the register office was set with a duration of 13 months, from January 2019 until February 2020 including execution and testing. The objectives were on one hand to redesign the access to the services provided in the building while introducing competences for design-driven innovation and collaboration across co-design processes inside the organization. The project developed from 2 initial assumptions coming from literature (Cilliers & Greyvenstein, 2012; Stone, 2004) as well as from the evidence of the first project:

- the quantity of the entities necessarily involved in the entire service delivery is one of the main barriers in adapting to change.

- the strong organizational culture characterizing public services based on silos is completely opposite to the principles of design.

The second project was also meant as a learning environment were to cope with these two main barriers to transformation. The entire project is divided in three main phases, now only the first 2 have been implemented specified as:

- Research and design.
- Execution.
- Piloting and testing.

3.2.2. Project outputs

As an outcome, three of the four suggested dimensions of intervention have been tackled. The first one linked to the physical space that creates discomfort for users and an improper working environment for operators. Dividing the spaces of the operators strictly from the waiting areas the issues with privacy, noise and distress are tackled (Fig.1). A system of digital and physical wayfinding is creating a friendlier atmosphere eliminating handwritten notices and supporting the user in finding his way through the labyrinthine building (Fig. 2). To support comprehension and transparency, the forms have been redesigned (Fig. 3) indicating the important elements for the user supported by an informative leaflet with a checklist of documents applying gamification for assistance throughout the procedure.



Figure 1: Waiting room developed for the intervention in space



Figure 2: Wayfinding system designed to improve the communication on-site

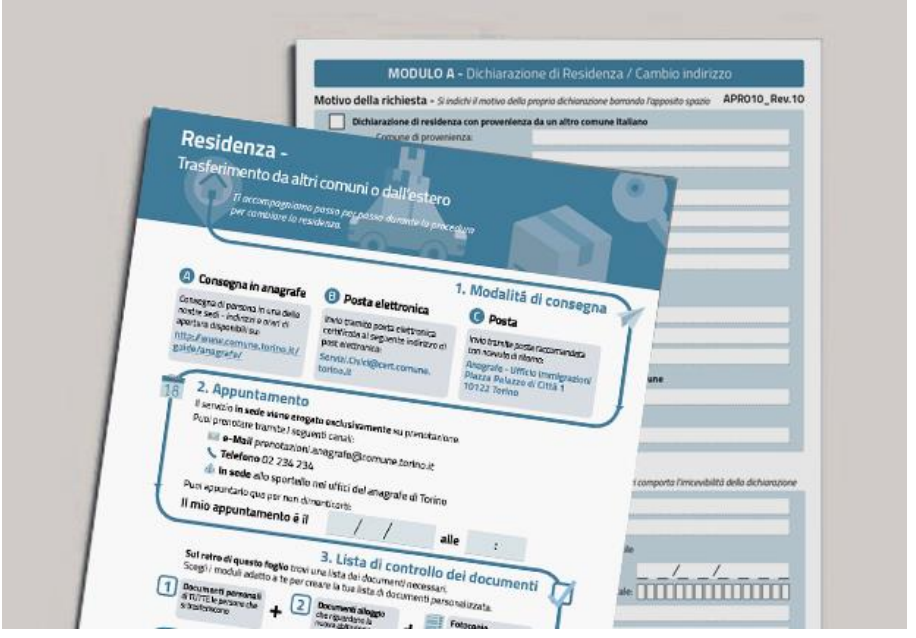

Figure 3: Form and leaflet guiding through the procedure

4. Main findings and issues emerged

Especially the research phase and the transition from design to implementation shed light on some issues demanding a closer look and analysis. Already the initial research phase zoomed in on the disconnected and highly fragmented structure of the public office that later appeared to be interconnected to several other obstacles found during the process. Some of these elements are listed in the following to be then explained further:

- Vertical hierarchical structure.
- Missing culture of holistic planning.
- High specialization.

For the first insight the authors notice that the structure being organized in a strictly vertical hierarchy did seem to hinder the building of new capacities especially at the level of civil servants. Having the impression of being purely executing other's decisions and plans has found to be a barrier to the building of new capacities. Building the team/s with the skills and motivation to develop the solution/s was one of the biggest challenges for the project. The employees who had actively participated in the workshops did not feel enough incentive to keep developing the solution deciding to take a role in driving the development. In this second project the development of the innovations was taken on by a smaller group of actors, who were willing and asked to commit to a longer-term process of developing and testing the innovation. The larger groups of employees that participated in the phase of ideation did not take part in that of implementation, not only due to their will but also to the sheer lack of resources and the need to employ them in day-by-day practices. As consequence the project failed in creating a sense of ownership as the level of engagement decreased moving from ideation to implementation of the innovations. In particular, the top management of the register officer became the leader of the project. This insight reflects a larger issue in the process of co-creation, which often sees the phase of ideation being characterized by an intensive and active involvement of all the actors while - as soon as the process moves to implementation - decision, responsibility and power remain in the hands of the top management, impairing the opportunity to transform the organizational culture (Sangiorgi, 2010).

The second insight talks about the absence in the Municipality of a systemic approach to innovation at the level of the middle management, which could help oversee complex processes and think across organizational silos. Instead, an established approach to fragmenting and splitting competences and roles has found to be one of the main barriers in the adoption of the design culture, which claims holism as one of its pillars (Stickdorn, 2011). The redesign of the register office has been based on the attempt to match the grassroots experimentation with the larger strategic vision of the Municipality of introducing a user centric prospective in which the public actors, the citizens and the local stakeholders work together in envisioning and co-producing new solutions. This attempt has been driven by the

strategic dialogue with the top management of the organization and the Deputy Major to innovation. The implementation of this strategic approach has, in turn, questioned the cultural transformation of the organization as the development of new skills among staff and workplace innovation called for a need to overcome silos. The insight then shows that having a strategic vision and a plan to implement it can be not enough if the introduction of the new knowledge is not complemented with the management of systemic and organizational change.

The last relevant point the authors identified is the evidence that high specialization of departments, typical not just for public organizations (March 1991), hampered the adoption of different points of view (e.g. the perspective of users or other stakeholders) and the capacity to consider all necessary factors. This difficulty to change the perspective from where to develop services is closely linked to an issue that emerged mainly in the implementation phase of the project, i.e the non-perception of the various parts of the project (as those presented in figures 1, 2 and 3) as interconnected elements of a whole to create a coherent experience for the citizens. The management of the register office has in fact decided to significantly modify what has been designed together with the researchers and the designers in the phase of ideation due to insufficient budget available for the implementation (the budget could not be defined in the beginning, even though the whole project was conducted with a “frugal” approach). Furthermore, extant public procurement procedures obliged to split the execution in parts realized by different subjects, which require a high level of attention and holistic coordination not always applied due to the necessity to involve different areas that are used to work in an independent fashion. The interconnection of the various elements and its importance for the functionality of the designed experience has hardly been perceived mainly because of the lack of experience of the management in new service implementation. As already seen in the first project, the passage from ideation to implementation (Deserti & Rizzo, 2018) is rarely run relying on internal competences of public organizations. The pervasive adoption of externalization as a strategy to cut costs in the public sector has negatively affected the capacity of the employees to follow a cycle of design-implementation and redesign, transforming them in mere executors of solutions conceived and implemented somewhere else. In quite a few cases, the same execution is externalised, leaving the organization with fairly limited knowledge about some of its processes. In this case especially the struggle to allocate human resources, overcome unplanned architectural hurdles and retrieve financial resources for the realization of fundamental elements of the service experience notably impacted on the executive phase and showed the difficulties in linking and uniting the research phase with that of project development and with putting ideas into effect.

5. Conclusions

This article discusses a design-based theoretical framework to face organizational change by conducting long term processes of engagement and exposition of employees from public sector organizations to the culture of design. The framework combines advanced human centred service development (DT) with a learning framework to set up a learning environment in which to make possible for a range of diverse PAs and actors to experience processes of innovation, building knowledge and fostering organizational change. Considering the results of the experimentation conducted so far, and connecting them with existing knowledge, the authors recognize that the development of credible pathways and effective actions to support the growth of innovation capacity in the public sector must consider the necessity of coping with long-standing challenges, i.e. the innovation of public bodies; the peculiarities of organizational learning processes and of the absorptive capacity of the organizations; and the overall resistance to change in people and organizations (Albury, 2005; Brown & Osborne, 2013; Sørensen, & Torfing, 2012). The approach proposed shows that a possible solution to this problem is to reduce the gap between the strategic management and governance structures of public organisations and the everyday implementation of innovation by developing internal processes, spaces, procedures, profiles within public organisations to better integrate the two levels. This reflection will be at the core of further experimentation, for which the authors are currently preparing new research and innovation proposals, which will integrate the proposed design and learning framework with an organizational change framework.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design when you are the other 90%, a student's perspective

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Abstract | *Design for the other 90%? Design with the other 90%?* But what does it look like when you are the other 90% trying to study design? South Africa is rated as one of the most unequal countries in the world resulting in the 'other 90%' sitting side by side with the '10 percent' posing many challenges for educators. This paper interrogates the strategies, to assist disadvantaged students, implemented by an Industrial design program in South Africa, by hearing from the students and looking at projects. Lessons are captured around the topics of access, teaching and exposure. The area where the most opportunity for change appears to be is how themes, in a project-based pedagogy are chosen. A *project determination model* is proposed as a result and aims to produce more contextually diverse topic themes in Industrial Design education, making projects easier to engage with and improve learning for all students.

KEYWORDS | DIVERSITY, OTHER 90%, EDUCTION, PROJECT-BASED LEARNING

1. Introduction

Design as a profession has seen a growth trend toward human-centred, socially cognisant design processes and solutions. This could be described as a culture shift in design, from a focus on elite solutions to more democratised human-centered, self-directed solutions (Campbell, 2017, p. 31). In many ways answering Papanek's call for design to solve real world problems (1984, p. xv). Many designers, design programs and design firms have begun to, and do tackle problems which typically fell outside of formal design practice. Some of these, bottom of the pyramid, design challenges and solutions were captured in the exhibition, and accompanying publication, *Design for the other 90%* (2010). This was then further humanised by a Cumulus Conference hosted in Johannesburg which borrowed and adapted the title to *Design WITH the other 90%* (Breytenbach & Pope, 2014). This conference and accompanying exhibition showcased various projects and strategies which saw design practitioners designing alongside the communities and people who the solutions where intended for. Although Sanders and Stappers show that co-creating as a design approach has existed for some time, but has been slow to be adopted (2008, p. 7). As they note it requires "… that one believes that all people are creative" (Sanders & Stappers, 2008). This concept is furthered by the book by Ezio Manzini, *Design when Everybody Designs* where Manzini shows that designer's roles are becoming more how to assist others in designing better (2015, p. 2).

But what happens when the 'other 90%' are coming into the world of the '10 percent' and are now being taught design? What does design, or more specifically design education look like when you ARE the 'other 90%?' The context in South Africa is somewhat unique as a result of high levels of inequality (World Bank, n.d.). Using the terminology of 'the other 90%', there exists two parallel worlds of both '10 percent' individuals and 'other 90%' often side by side. This has become particularly evident in the tertiary education sector where there has been increased access to tertiary education by previously disadvantaged individuals (van der Berg & Gustafafsson, 2019, p. 34)(Padayachee, Matimolane, & Ganas, 2018, p. 289), i.e. 'the other 90%'. The specifics of this dichotomy between the '10%' and the '90%' would be impossible to define as the concepts of rural and urban are somewhat underdefined (Atkinson, 2014, p. 5), with people moving between and still remain connected to rural areas even if they themselves are 'urbanised'. However, many of the students who hail from more rural backgrounds face many challenges when coming to study design. Limitations in terms of exposure to technology, formal design and the economic challenges, have many consequences. These 'other 90%' individuals should be considered valuable as they can spread a culture of design, with its potential for bringing meaningful change, in areas seldom reached by the '10 percent'. There is the potential that these students could present an opportunity to adapt and extend the 'design with' approach taught in industrial design programs in South Africa (Campbell, 2008, p. 97). Some of these students have an experiential understanding of some of the typical challenges that many of the 'bottom of the

pyramid' projects aim to address. But with the odds stacked against them, how can those from rural areas, enter, learn and then bring about considered change (design) in the areas they hail from?

The tendency is for these students to transform and conform, thereby assimilating into the '10 percent'. However, this misses the opportunity for design to have a distinctive positive impact, and even be transformed by those doing it, both as a profession and in the training thereof. These students could be some of the "lay-designers" Campbell refers to (2017, p. 31). Improving access to formal training could lead to professionals from marginalised communities helping those communities design better.

This paper investigates the case of some students, who could be described as coming from the 'other 90%'. These students come from more, rural areas in South Africa, but through mostly state funding systems were given the opportunity to study Industrial Design. The dramatic leap in exposure and learning that was required of these students, meant their journeys were not simple. For example, a student not having used a computer prior to the first day of class, is still expected to do 3D parametric computer modelling within six months. These students are not unique, with urbanisation and development in the global south, prospective students will continue to come from rural areas to cities for education, so this phenomenon is likely to increase. However, this inequality between the students who might be sitting side by side in class poses many challenges. As an Industrial Design program, various strategic choices have been made to address this diversity and inequality in terms of culture, exposure and wealth.

In order to refine and possibly improve these strategies feedback from the students was used. One could describe it as: redesigning, Industrial Design education with the 'other 90%', even if only in a small way. Various lessons are extracted and grouped into three themes: access, teaching and exposure. Some projects are also used as examples.

2. The University and Program

The Tshwane University of Technology is one of the biggest contact universities in South Africa, accepting about 60 thousand students annually (TUT, 2020). Located in the city of Pretoria also has geographic implications. As the most northern city of Gauteng, which is the most populous and urbanised province of South Africa (GCRO, n.d.), Pretoria, acts as a kind of gateway for the more northern provinces which are generally more rural. This has the potential implication that many of the students who attend the Tshwane University of Technology come from these rural areas.

The Industrial Design program was started in 2008 with the first graduates qualifying in 2010 (C Duff, personal communication, February 13, 2020). As a relatively young program with a focus on innovation and entrepreneurship, the program aims to produce graduates who have both theoretical and practical understanding of design. The emphasis on making and

the practical application of knowledge necessitates workshops, equipment and materials. In order to best accommodate students, especially those relying on student loans or bursaries (many of the disadvantaged students are often from more rural areas) the strategic choice was made to include as much of the costs as possible into the formal fee structure. This then reduces the need for students to go out and buy their own materials and these can be bought in larger quantities thereby reducing costs.

In order to increase exposure and access, the program aimed to provide each student with a workstation which includes a desk, computer with all the relevant software, and internet connectivity. The rest of the studio environment includes printers and scanners, 3D printers (although their use is restricted to specific projects) and what is called the *concept lab*. The *concept lab* is located adjacent to the studio and is a 'light' workshop with basic equipment. Then during working hours students have access to a workshop with a range of equipment for prototyping in wood, plastic, foams, metals etc. They also have access to a shared lab, which is loosely based on the FabLab principles and includes a flatbed CNC router and metal cutting laser. Specialised labs and equipment from other departments, can also be accessed for specific projects, resulting in the students having access to an enormous range of facilities. The acquisition and development of the facilities has been part of the strategic drive of the program since its inception with the aim and hope that students will be able to learn better, with greater access to equipment and facilities.

The teaching approach of the program is predominantly project-based. English and Kitsantas note that this type of pedagogy is useful for knowledge acquisition and in "supporting the development of important real-world skills such as solving complex problems, thinking critically, analyzing and evaluating information, working cooperatively, and communicating effectively" (2013, p. 29) which are all skills useful for Industrial Design graduates. Although it does rely on self-directed learning and motivation (English & Kitsantas, 2013, p. 131). The relatability of a project theme could be a factor influencing student motivation. This project-based learning is conducted in an environment like the studio-based teaching strategy used by many architecture schools (Kuhn, 2001, p. 349). The students spend most of their time in the studio area, at their workstations or in the various workshops, with the offices of the lecturers adjacent to the studio so that students can easily access to teaching staff. The projects that are given to the students are determined around specific learning objectives and planned and adapted continually. The learning objectives are defined as the *factors of design* originally defined by lecturer Philip Oosthuizen. These factors are use, business, manufacture, environment, society and design expression. Projects almost always include prototyping and 'real-world' testing as a focus of the teaching strategy.

3. Interrogation of Strategies

The program has been in existence for just over 10 years, it was therefore time that these strategies were interrogated. Also, as a result of student protests in 2016 there were many

calls to decolonise curricula (Padayachee et al., 2018, p. 289). Although the project-based teaching pedagogy of the industrial design program, teaches graduates many skills that allows them to adjust to the changing contexts and conditions that Padayachee et al. refer to (2018, p. 290), it was also important that the themes of projects also be contextually relevant to students.

In order to interrogate these, a series of informal discussion with students were conducted. Initially a key student, who has completed their undergraduate studies, was consulted on the concept of being the 'other 90%'. This student, who can be described as coming from the 'other 90%', was the student referred to in the introduction who had not used a computer prior to the first day of class. This student then recommended other current students who could also be described as coming from the 'other 90%'. The study is qualitative as it relied on the experiences and perceptions of specific students. Therefore, the lessons and recommendations cannot be applied universally although they still provide specific insights into how these strategies are working for the students they are aimed at.

The discussion questions were grouped into the themes of access, teaching and exposure. Students were often asked to give examples of projects, so that the lessons extracted can influence the types of projects given to the students in the future, and with that the teaching within the program. All participants had limited or no exposure to using a computer prior to coming to study (Participants 01, 02 & 03, personal communication, February 6, 2020). For many the exposure and use of the equipment was also a first time (Participants 01, 02 & 03, personal communication, February 6, 2020). As noted, these students come from a spectrum of rural to urban with those who participated coming from more rural environments. For example, one participant explained that where he grew up had unpaved roads and they still relied on wood fires for cooking as electricity was only recently implemented in the area (Participant 02, personal communication, February 6, 2020).

4 Access

The access to the studio environment was considered important although it was identified that the high level of exposure can have the potential to be a distraction. Students who did not have access before, and now have unlimited access, are potentially more susceptible to the distractions associated with the internet and digital media (Participant 02, personal communication, February 6, 2020). However, it also true that those with limited exposure to computers need more time with computers to 'catch up' to their more privileged, peers (Participant 01, personal communication, February 6, 2020) making this access very important.

The integration of the costs into the fee structure was seen by all participants as valuable and important (Participants 01, 02 & 03, personal communication, February 6, 2020). One participant noted that it is not just the costs associated with purchasing materials themselves, but also the ability to transport the materials. As most of these students would

have to use public transport (Participant 01, personal communication, February 6, 2020). Having access to these materials without having to bear the costs directly, means students have scope to make mistakes, remake and refine although this can lead to wastage (Participant 02, personal communication, February 6, 2020). This aspect of being able to make mistakes and learn from them, is a major motivating factor for the cost integration, as it aligns with the programs *DESIGN, MAKE, TEST, REFINE* (Brand, 2018, p. 91) process. This is a typical iterative design process and relies on making and testing.

The close integration of the teaching staff and students is also seen as important as the participants noted the relational nature of the program (Participants 02 & 03, personal communication, February 6, 2020). The small class sizes in the industrial design program (not more than 30) allows for what is described as "… makes us like a family… you are close to us, you can see if someone is lacking" (Participant 01, personal communication, February 6, 2020). This appears to be particularly important as it was repeatedly noted that students from more rural backgrounds are apprehensive and possibly intimidated or overwhelmed (Participant 01, personal communication, February 6, 2020). Implementing systems and processes that encourage this relational attribute of the program is important to overcome these potential hurdles for the students.

5 Teaching - Projects

The project focused teaching with its' practical, making implications appears to be valuable and relatable to students. The familiarity with, what is being asked of the students to design, seems to either hamper or encourage students in those projects (Participants 01, 02 & 03, personal communication, February 6, 2020). Some of the projects highlighted as examples:

5.1 The Walking Stick Project



Figure 1 Walking Stick Prototypes - photo by author

The students referred to this project as a more neutral project where almost everyone would be familiar with the concept of a walking stick (Participant 01, personal communication, February 6, 2020). The original brief for this project asked students to design 'a device for assisting someone while walking'. This broadened what could be interpreted by the brief and did not limit the solutions to only walking sticks. This project aimed to teach user interfacing elements, as well as wood working skills and the properties of wood and its potential uses. The relatable nature of the project meant students could easily engage with the theme and only needed to overcome specific challenges around materials and interfacing using prototyping (Figure 1).

5.2 Rotation Moulding Competitions

Annually, the Association of Rotation Moulding in South Africa runs a student design competition (Armsa, n.d.). The competition is integrated into the curriculum for second year students. Participants noted that the potential for the students to learn and do well in the competitions is linked to how familiar the students are to the brief theme. For example, one of the briefs looked at sport (in general) as a theme for the project. This was cited as relatable and therefore easier to engage with by participants (Participant 01, personal communication, February 6, 2020). In contrast the theme of 'the beach' was not very relatable as many students, living in inland areas, had not seen or experienced the seaside (Participant 01, personal communication, February 6, 2020). This lack of experiential

understanding of the context and theme for the project put 'other 90%' students at a distinct disadvantage.

5.3 Umqombothi (traditional beer) bottle

The intention with this project was to teach principles of size and proportion as well as volume. The brief specified that students design a bottle for traditional African beer. Most of the students, who could be described as 'other 90%', have real-world experience with traditional beer. This, therefore, put them at an advantage and even meant their more privileged peers consulted them for information and insights. Participants highlighted this project as an example where they could better relate and therefore engage more easily (Participant 03, personal communication, February 6, 2020).

5.4 The Rocket stove project



Figure 2 Double Plate Rocket Stove Prototype, February 2020 – Photograph by Author

Initially inspired by the Tshulu stove project (Makonese & Bradnum, 2017, p. 21), which was exhibited at the *Design WITH the other 90%* exhibition. This project aimed to embrace the concept of Design when you ARE the other 90%, by relying on students who have experienced the context where these wood fire stoves might be used. Students were divided into groups, consisting of both 'rural' and 'urbanised' group members. This distribution was self-determined by the students. Students were given the internal functional element of the stove, based on the dimensions and functional strategies of the *Tshulu stove,* defined by the lecturer in consultation with Chris Bradnum, the designer of the Tshulu stove. However, the

stove was made into a two-pot version, as it was evident from the 'design with' research conducted in the development process of the *Tshulu stove* that often households needed to cook in two pots simultaneously (Makonese & Bradnum, 2017, p. 22). Students were asked to design and prototype the rest of the stove, including the interface and insulation (Figure 2). This project was one of the first experiments of a 'design when you are' as opposed to a 'design with' project brief. This needs to be further interrogated as a potential strategy for future projects.

6. Exposure

Students find visits to manufacturers and other excursions valuable (Participants 01, 02 & 03, personal communication, February 6, 2020). One observation noted by participants was the ability to talk to those working at a manufacturer in their home language (Participant 01, personal communication, February 6, 2020). These factory workers likely have a tacit understanding of a manufacturing process which they are then able to explain in a local dialect, thereby removing jargon and translations issues for students for whom English is a second language. This is a valuable insight as often the hosting individual taking students on a tour is not necessarily from a disadvantaged background and would be using primarily English to communicate. Requesting that student be allowed to interact more directly with those working at a factory is something that should be implemented.

7. Lessons

It appears many of the interventions are helping, even if only in a small way. Most of the students considered themselves to be at an advantage when comparing themselves to peers studying in other programs (Participants 01, 02 & 03, personal communication, February 6, 2020). The lower student numbers contribute to this, it should therefore be retained, as far as possible. The infrastructural challenges associated with providing adequate levels of access, in order that the 'other 90%' individuals have ample opportunities to catch-up, will always be present. The factors influencing these would be financial, institutional policy and simple practical implications of available space. Although many of these factors fall outside of the immediate control of the staff team, it should remain a strategic drive of the program and opportunities should continually be sought to improve access.

As noted above the value of excursions and visits to industry are clear. However, enhancing and encouraging interaction between the students and those on the 'factory floor' is something that should be further explored.

The area with the most opportunity for change, and the easiest to effect, is that of the projects given to the student as part of the teaching strategy. The projects need to be looked at in terms of their relatability and accessibility, in addition to the teaching objectives

already established. Figure 3 is a proposed *Project Determination Model* based off the lessons of this research. Previously projects were predominantly determined by teaching staff members, with the staff member relying on historical precedents of projects and often choosing themes for projects haphazardly, mostly focusing on the teaching objectives. Often better projects were developed mostly as a result of the experience of the lecturer designing the project. This model provides a series of questions and a way to compare project briefs so that a diverse range of projects are developed not just in terms of teaching objectives, but also the thematic attainability of the project. Thematic attainability refers to the level at which students can actively engage with the project theme. A more diverse range of projects, in terms of theme, can easily be argued as fairer as well as better for learning.

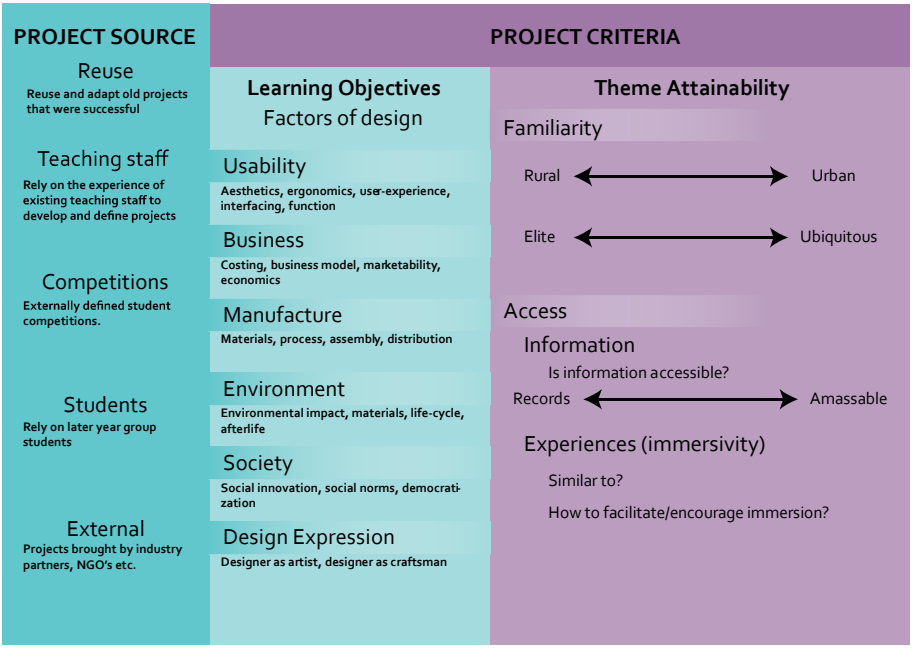

Figure 3 Project Determination Model – Illustration by author

Looking at the model the first column is the *project source*. This is where or how the idea for the project originates. The different listed sources have their advantages and disadvantages but, by using a combination of these would once again result in better more diverse projects. Currently the project source strategy relies predominantly on reuse, teaching staff, competitions and external entities. The addition of students is something that will be implemented as a result of this paper. A system for project suggestions, based on specific teaching objectives, will be developed so that later year group students (who have already completed the proposed project, during their previous years of study) can propose project

themes. The hope is that unique and relatable projects will emerge. The teaching staff will have to then look at these proposals and adjust them as needed to fit with learning objectives.

The next column is the learning objectives. These as described earlier are a broad grouping of the various factors that influence the value of a design solution. Addressing these factors in various projects is, in effect, a key teaching strategy of the program. Interrogating these specific teaching objectives is not within the scope of this paper, but they are included in the model as they are currently used to determine projects.

The last column *Theme Attainability* was a major addition to the model. Here the theme of the project is dissected in terms of how relatable it is, as well as, how accessible it is to students. While interviewing participants, the relatability of a project (with its context) was a factor identified as making a project easier or more difficult to engage with, especially for students who could be considered as from the 'other 90%'. The second attribute of access was determined from an example given by one participant. Recounting a project where they were tasked with designing wall sconces, the participant noted that hardly anyone knew what it was (Participant 01, personal communication, February 6, 2020). However, after being encouraged to search for images of wall sconces, they were able to quickly understand what it was and design accordingly. This example highlights the importance of access to information. Can information on the design problem be found? This information should not only be recorded information (books and internet), since self-amassed information is equally valid, and it would also teach students basic research skills. Another aspect of access is how accessible the context is for immersion and thereby allowing for experiential understanding of a problem or context. Using the example noted earlier of the project with 'the beach' theme. Effective immersion for inland based disadvantaged students was impossible. However, by asking the questions 'what is similar?' and how do you 'facilitate/encourage immersion?' will draw focus on the actual accessibility of the theme. This might mean the theme needs to be altered or designed around a specific immersion experience made available to students. Asking these questions, as part of the model means the selected themes for projects should have a wider variety. It could also have the effect of expanding the contextual scope of projects, thereby improving learning for all students.

Conclusion

Design, despite its increased humanisation and democratisation remains somewhat reserved for the wealthy or elite. Training and equipping students who could be described as 'the other 90%' is a strategic opportunity for a culture of design to spread in contexts that have little exposure to formal design. However, these students do face many challenges and need assistance. The interventions already implemented by the Industrial Design program are helping but could be further refined and adapted. The themes for projects appear to be the areas where the most change can occur. The *Project Determination Model* aims to address

this by drawing specific focus on the theme attainability of a project. By better selecting more diverse themes for projects, the culture of design, as a result of the complex proximity of the 'other 90%' alongside the '10 percent' could change for the better.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design with Social Justice in Mind. The Case Study of Furniture Design in Elementary Schools

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Abstract | Many studies have demonstrated the importance of considering the physical environment, more specifically classrooms, as a significant factor of influence in academic success and educational experience. Within a social justice in mind, this paper presents a case study on furniture design in Québec's (Canada) public elementary schools conducted over the past two years. The results show that classroom design is categorised by a spectrum of flexibility, from a classic layout to a flexible one. Issues of a variety of furniture models, overloaded classroom and disappearance of places for pupils are observed in classroom. While flexibility is important to consider in the design of a classroom, it must also be organized in such a way as to avoid excessive spatial and visual complexity. Therefore, it would be necessary to introduce a greater concern for harmonization as social justice principle into classroom and furniture design.

KEYWORDS | FURNITURE DESIGN, ELEMENTARY SCHOOL, SOCIAL JUSTICE, INCLUSIVE DESIGN, CLASSROOM DESIGN

> "The evolution of a school system can only be properly directed if we begin by knowing what it is, what it is made of, what are the conceptions that underlie it, the needs it meets, the causes that have given rise to it. " (Durkheim, 1999; 123)

> "Spatial innovations, detached from their pedagogical sources and justifications, pose more problems than they solve[wind]. " (Derouet-Besson, 2000; 27-28)

1. Introduction

Many studies, including the work of Peter Barrett at Salford University in Manchester, have demonstrated the importance of considering the physical environment, more specifically classrooms, as a significant factor of influence in academic success and educational experience (Barrett & al., 2019; Barrett & al., 2015). Barrett and Zhang (2009) indicates that the layout of a classroom should allow it to be adapted by a variety of teachers with specific, yet diverses groups of pupils. In this sense, a newly built school must account for the adaptations that take place in its spaces and classrooms. Only when spaces are conceived to support learning and creating a positive experience for both pupils and teachers can it be said to have been successfully designed (Barrett & Zhang, 2009).

Based on teachers' and pupils' perspectives regarding their classroom environments, Pointon and Kershner (2000) find that classrooms often reflect teachers' different pedagogical visions. Thus, the design of classrooms is generally left to teachers; and yet, by overlooking idiosyncracies, an apparent consistency emerges between the desire for flexibility in spatial layout, according to activities, the spatial and visual complexity of classroom environments more generally.

According to Barett and Zhang (2009), the flexibility of elementary classroom layouts has a significant impact on learning. The level of flexibility of a classroom is related to the degree of adaptability that the space offers in accomplishing the various pedagogical activities undertaken at any given time. The level of complexity of a classroom's layout refers to the way in which the different elements of classrooms combine to create visual coherence and a structured environment. For example, Barrett and al. (2015) estimates the impact of spatial and visual complexity in classroom layout on pupils learning at approximately 12%, with flexibility of layout accounting for 17%. In this study, they also mentions organization as a meaningful factor to be considered. Roskos and Newman (2011) reports that the quantity, arrangement and organization of physical space influence human behaviour.

Therefore, while flexibility is important to consider in the design of a classroom, it must also be organized in such a way as to avoid excessive spatial and visual complexity.

More than the design issue, as the school system in Québec is mainly public funded, it must provide pupils from all backgrounds an equivalent learning environment that supports their

success. In this sense, furniture design in elementary schools should be oriented to support social justice as much as it can be.

> "Social justice may be thought of simply as "the common good through the equalization of goods or services" (Sadeghi and Price, 2007: p. 4), or it may be more elaborately defined as "the fair distribution of opportunities, rewards and responsibilities in society, as well as principles and institutions for the distribution of meaningful social goods – income, shelter, food, health, education, the freedom to pursue individual goals (Hudson, 2013: p. 432)" (Barak, 2015).

With this perspective in mind, this paper presents a case study on furniture design in Québec (Canada) elementary schools conducted over the past two years.

2. The Context

SCHOLA is a 5-year, $2.5 million research project funded by the Ministry of Education and granted to a team of researchers at Université Laval (Québec, Canada). Led by Carole Després, professor at the School of Architecture, the ultimate goal of the research project is to develop a decision-making platform for school architecture and design based on scientific evidence (Després & al., 2016).

There are more than four thousand school buildings across the province of Québec. Facilities and infrastructure are aging and have reached the end of their useful life. The majority of elementary schools were built during the baby boom period between the 1940s and 1960s.

In response, the Québec government has recently undertaken an ambitious school construction and renovation project with major investments planned. These initiatives are part of a new Policy on Educational Success (MEES, 2017).

With the evolution of society and repeated reforms brought to the public education system that beginning in the 1960s, and which include the improvement of programs, the gradual inclusion of women into the labor market, the introduction of school daycare services, as well as the challenges related to integrating pupils with special needs and immigrant populations, schools are under increasing pressure to allocate their space in a functional way that take into account a wide range of needs (Després & al., 2017).

To meet these transformative challenges, the SCHOLA team has been formed to bring together researchers with expertise in architecture, design, education and partnerships from the educational, associative and professional sectors.

3. A Case Study of Furniture Design in Elementary School

3.1 Mixed Methods

The research adopts a comprehensive perspective and an inductive approach to portray classroom environments in relation to the educational experiences of teachers and pupils (Bisson & Gagnon, 2005). Based on an inventory of furniture in 66 classrooms in 19 elementary schools and semi-structured interviews with teachers, pupils as well as non-teaching staff, the team identified several issues related to the diversity of the facilities and furniture found in classrooms. A questionnaire for a web survey was also developed and a codesign activities with pupils. The web survey collected responses from 496 teachers from across Québec based on a simple random sample.

Table 1. Data collection

Methods	Sampling	Type of data collected
Inventory of furniture	66 classrooms	Type and number of furniture classify by seating, work surface, storage and communication material Description (material, colors, manufacturers) Good or bad conditions (needs in terms of repair)
Non-participant observation	19 classrooms	Space configuration grid, sketch and note of the uses of spaces and furniture
Teachers Interviews	19 teachers	Classroom layout, furniture appreciation and educative experience in general in relation to material resource in the classroom
Pupils Interviews	19 pupils	Classroom layout, furniture appreciation and educative experience in general in relation to material resource in the classroom
Codesign activities with pupils	48 pupils	Prospective activity – designing their ideal desk and chair
Management staff interviews	8 managers	Issues of acquisition
Material resource department director interviews	7 directors	Acquisition and maintenance issues
Concierge interviews	6 concierges	Maintenance issues
Daycare service	1 educator	Sharing resource material, acquisition and maintenance issues
Web Survey	496 teachers / n=195 schools	Classroom layout and furniture appreciation, use and needs

The inventory method allowed to collect more than 2000 objects that were grouped into categories. In order to classify the numerous models, a characterization system has been developed, based on a syntagmatic relationship analysis of the objects whose main components that define them were divided: seating (seat, back, leg and glides), work surface (table top, leg, cabinet storage and glides), storage (cabinet, opening and glides) and communication material (format, orientation, support and chalk rail). An observation grid has also been developed to sketch class configurations. In order to facilitate the understanding of the educational experience, i.e., what is happening in the classroom, as well as the perception of these activities by teachers and pupils, 2 hours of non-participant observations were conducted. This observation period was followed by a semi-structured interview with the teacher and a selected pupil.

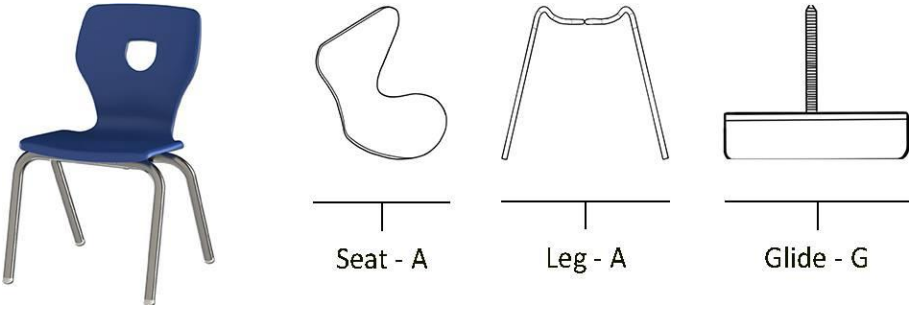

Figure 1. Syntagmatic analysis of seating. Source: Schola. Université Laval. 2019 ©

4. Results

The article will focus on general results. The codesign activities and experience of comfort are detailed in the study conducted by Coulombe-Morency (2019), the analysis of learning spaces are detailed in the study by Rousseau (2020) as well as the analysis of wall displays by Cadoret (on going).

4.1 A spectrum of flexibility

Classroom layout in Québec schools is characterized by a spectrum of flexibility:

- from the classic classroom with a row desk layout,
- to the semi-flexible classroom with several dedicated areas for educational activities and a cluster desk layout,
- to a flexible classroom with a zonal layout and no place assigned to pupils.

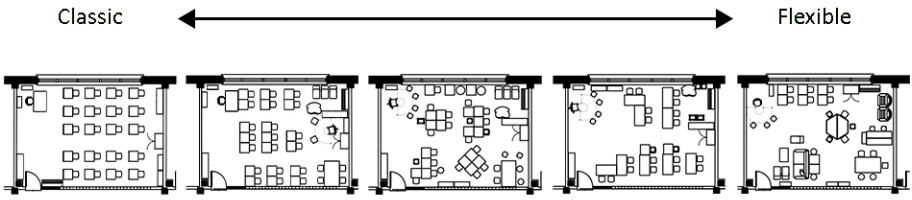

Figure 2. Spectrum diagram of classroom layout types, from classic to flexible. Source: Schola. Université Laval. 2019 ©

Classrooms are generally organized into activity zones, the number of which varies according to the uses of the space: teaching space, teacher's space, computer area, reading area, documents area, assembly area, active work zone, storage, collaborative work area.



Figure 3. Different areas in one of the classrooms visited. Source: Schola. Université Laval. 2019 ©

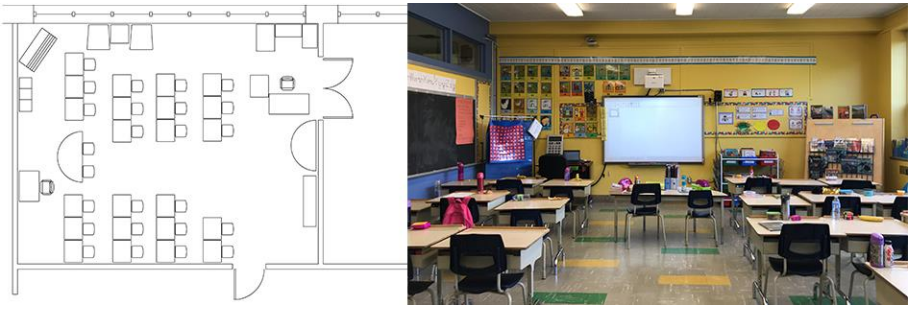

Figure 4. Layout diagram and picture of one classic design classroom. Source: Schola. Université Laval. 2019 ©

A. Classic layout

The classic classroom layout is composed of furniture that can be described as traditional. It primarily consists of desks and chairs arranged in rows facing the teaching area and the communication board. Dedicated areas either are absent or very modest in the room, the teaching (or learning) space being largely occupied by individually assigned desks, i.e. the pupil's is typically assigned a desk, with the pupil's name on it, at the beginning of the school year. Furniture is relatively homogeneous with little variety with respect to seating and work surfaces.

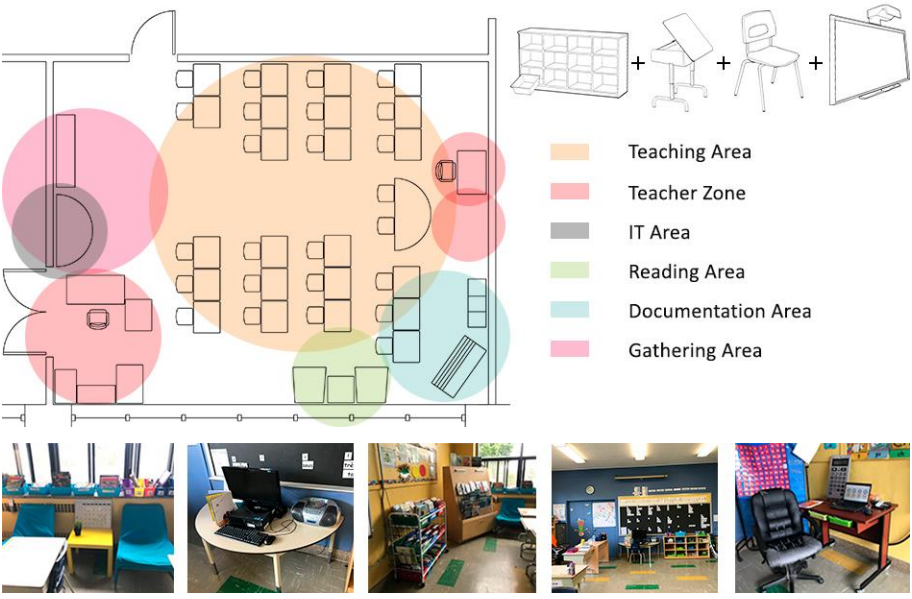

Figure 5. Some dedicated areas of the classic layout and their typical school furniture. Source: Schola. Université Laval. 2019 ©

Issues of classic layout classroom:

- The layout offers little or no recess space.
- The pupil can easily identify with his/her own desk, but little with the rest of the classroom.
- Little or no space for collaboration, but desks can be grouped together for this purpose as needed.



Figure 6. Some issues observed: wrong chair/desk combination, wrong stool/desk combination, need of elastic band, difficult to use storage and tray falling over. Source: Schola. Université Laval. 2019 ©

B. Semi-flexible layout

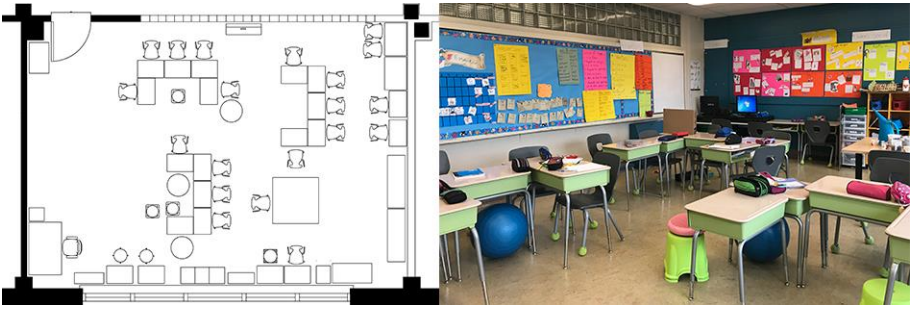

Figure 7. Layout diagram and picture of one semi-flexible layout classroom. Source: Schola. Université Laval. 2019 ©

The semi-flexible layout is a hybrid between classic and flexible layout. These classrooms tend therefore to be very distinct, but have similar characteristics, such as: 1) the presence of a desk and a chair for each pupil (although not necessarily assigned to each pupil), 2) a variety of seating and work surfaces, and 3) dedicated areas are more common and occupy the extra space left vacant by the tighter grouping of desks. In addition to the traditional furniture of the classic layout, there is also furniture for moving around (stability balls, wobble stools or floor seat), various objects imported from the domestic milieu, including tables and additional storage to meet the needs of a larger number of dedicated areas.

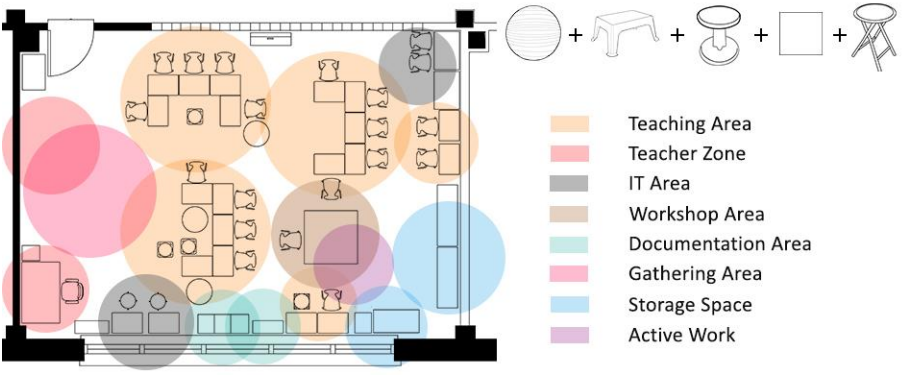

Figure 8 . The semi-flexible classroom layout with additional furniture that are added to those present in the classic classroom. Stylistic referents from the domestic milieu and sporting environment are added to the classroom. Source: Schola. Université Laval. 2019 ©

Issues of semi-flexible layout:

- The introduction of additional zones causes distinct challenges for class management.
- The variety and quantity of objects in the space complicate the layout of the classroom both visually and functionally.
- Although the semi-flexible layout responds to all the functions of the classroom, there is no prioritization or hierarchy of its functions in space.



Figure 9. Some issues of the semi-flexible layout: overcrowded desks, need to add dividers for evaluation, bed lifts, different heights of work surface. Source: Schola. Université Laval. 2019 ©

C. Flexible layout



Figure 10. Layout diagram and picture of the flexible layout classroom. Source: Schola. Université Laval. 2019 ©

In contrast to the classical classroom at one end of the spectrum, the flexible classroom marks a disruption in the spatial organization of a classroom. There are only a few pupil desks and few or no chairs with typical scholastic references. The flexible classroom is characterized by the presence of a variety of seating and work surfaces of varying heights and dimensions. The school-type objects of the classic layout are abandoned in favour of furniture found or acquired by the teacher's own means, often coming from the sporting or domestic reference environments.

Issues of flexible layout classroom:

- The management of space has to be well structured by the teacher as pupils constantly change place. Some use a privilege system to grant place to pupils.
- The management of place by privilege could be discriminatory for some pupil.
- Some scholastic desks are reserved only for pupil with learning or adaptation difficulties and located apart in the space.
- Sharing the space, material and the equipment at the school material resource management are difficult. Introduction of distinctive models of furniture and very personal layout designed by the teacher is a problem of material resources management.

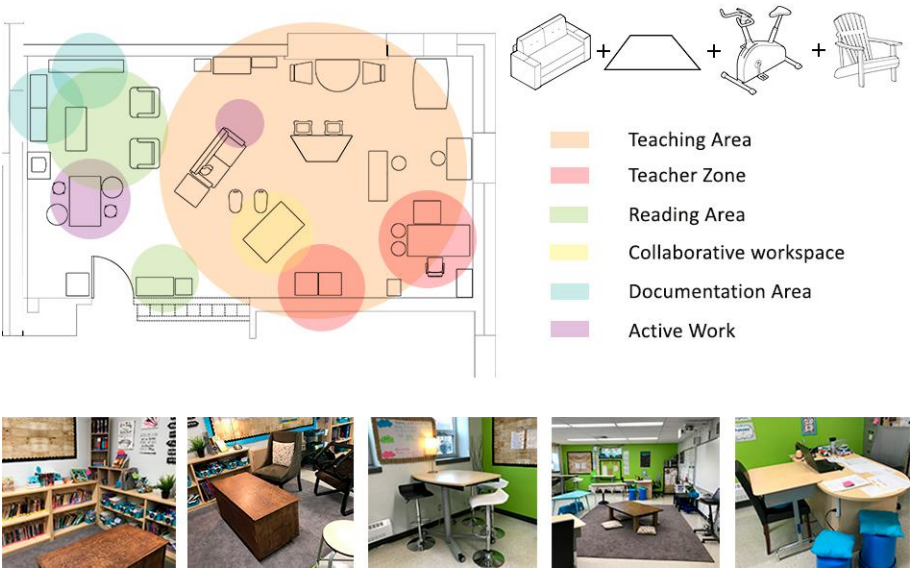

Figure 11. The flexible layout: household objects are more present in a flexible classroom than objects with scholastic references. Classroom has a very wide variety of seating arrangements. Pupils do not have a chair and a desk each. Source: Schola. Université Laval. 2019 ©



Figure 12. Some issues related to adjustment when writing in flexible layout classroom: in a bean bag, collaborative work in a couch, writing on an armrest, diversion of use and poor fit. Source: Schola. Université Laval. 2019 ©

4.2 A variety of furniture models

As the analysis of inventory confirmed, different stylistic references of school furniture appear in classroom layouts.

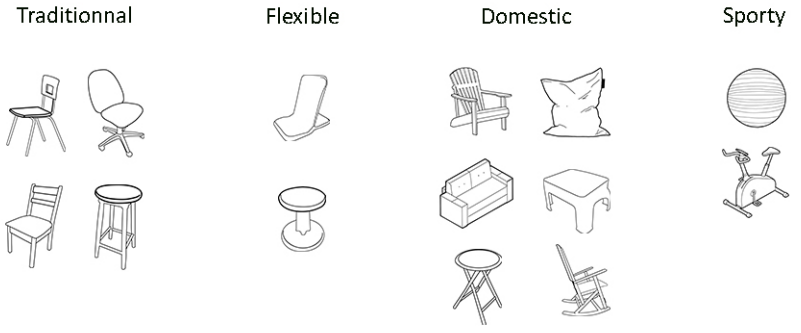

Figure 13. Diversity of furniture in the classroom. Source: Schola. Université Laval. 2019 ©

The traditional one refers to the kind of furniture that are generally associated to school and office: standard pupil chairs and desks, stools and teacher chairs and desks. Nevertheless, a new trend was observed in classic classroom: some teachers use some stability balls, wobble stools or floor seat to replace regular chair.

With the semi-flexible and flexible classrooms, two new stylistic references are incorporated in the layout: domestic furniture like sofa and ottoman and sports accessories and equipment.

The identification of different models in the space, according to the categories of objects, also appears problematic. For example, on average in a single classroom, it is possible to find 6 different models of chairs, 6 different models of tables, 5 different types of displays, and 9 models of storage units. The figure below shows the number of models observed according to the types of objects categorised in one classroom.

Table 2. Number of different models of furniture in one classroom

	Seat	Work surfaces	Communication material	Storage	Partitions
Minimum	3	3	3	5	0
Mean	6	6	5	9	-
Maximum	15	12	9	22	2

4.3 An overloaded classroom

In addition to this, spatial organization is becoming more complex with the addition of dedicated zones. The semi-flexible classroom is being the most crowded with furniture.

A high visual load is also apparent through the many posters, display surfaces and decoration that leave little unused space and a rather dispersed visual organization. The team is currently completing the analysis of the visual organization of the walls displays based on visual parameters such as complexity level (quantity and organization), relevance (utility and quality) and flexibility (functionality and adaptability). The preliminary analysis shows a high to medium level of visual complexity in the room design. While studies show that a low to moderate visual load is desirable to promote attention and concentration, we observe a physical and visual over-crowding of the space generating impacts with respect to comfort (especially ergonomic issues and postures), maintenance and attention (Barrett & al., 2015; Fisher & al., 2014).

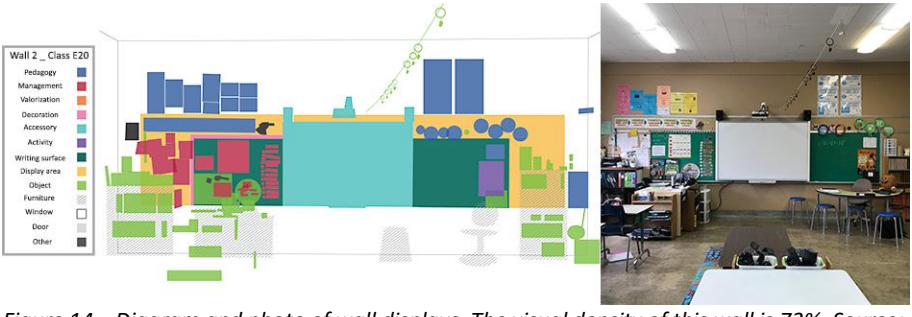

Figure 14. Diagram and photo of wall displays. The visual density of this wall is 73%. Source: Schola. Université Laval. 2019 ©

4.4 Disappearance of assigned places for pupils

It seems that classrooms in Quebec schools are changing to make more room for collaboration and greater individual choices for both pupils and teachers: in rows with individual desks (13.6%), in rows of two to four desks (27.9%), in blocks of three or four (9.5%), in blocks of varying sizes (18.4%), in groups (15%), other (15.5%). Nevertheless, the mobility of the pupils in classrooms induced by a greater flexibility of space reveals a trend that means the disappearance of the assigned desk for the pupils. In other words, the pupils tend to lose their seat, and must learn to find a place according to the rules of the teacher's classroom management and the change in pedagogical activities.

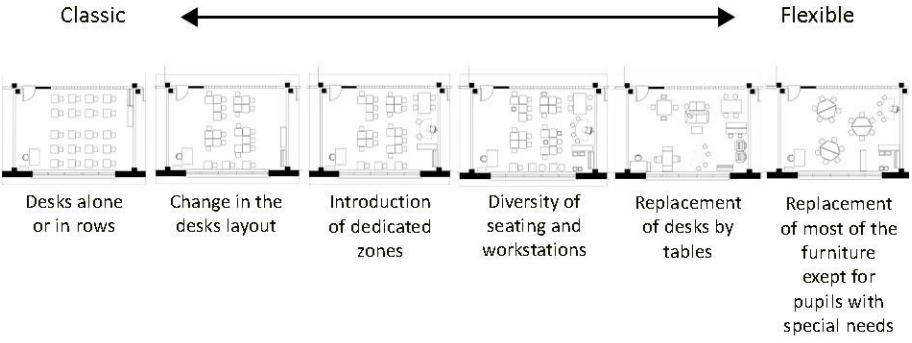

Figure 15. Spectrum diagram of classroom layout and the disappearance of assigned place. Source: Schola. Université Laval. 2019 ©

Although this observation emerged from the analysis of the observations and the inventory data, this concern did not emerge much from the interviews with the teachers, who seem to value their autonomy with regard to classroom design. However, the codesign workshop and interviews with pupils shows that they would like more privacy (Coulombe-Morency, 2019).



Figure 16. Examples of chairs designed by pupils with additions to allow more privacy for their chair. Codesign activity. Source: Schola. Université Laval. 2019 ©

Table 3. Issues of greater flexibility in classroom design.

CLASSIC LAYOUT	FLEXIBLE LAYOUT
FOR PUPIL	
Assigned seat	Management of places by privilege
Appropriation	Issues of stigmatization of special needs pupils
FOR PEDAGOGICAL ACTIVITIES	
Individual activities, teaching lecture and evaluation	Collaborative and autonomous activities
	Issues of privacy and concentration
FOR MATERIAL RESSOURCE MANAGEMENT	
Ease of sharing spaces and uses	Difficulty in sharing spaces and uses

	Less reversible and more unusual design

5. Discussion

Weinstein & al. (2011) based on Steele (1973) report six functions of a classroom: 1) security and shelter 2) task instrumentality 3) social contact 4) symbolic identification 5) growth and 6) pleasure and comfort. They argue that the physical, psychological, pedagogical and educational dimensions of learning environments for teachers and pupils are interrelated and materialize in the form of diverse spatial organizations. The spaces observed try to support these dimensions with different degrees of success and can sometimes conflict.

While these functions are part of different planning strategies that enable pupils to mobilize a set of learning activities, it must be recognized that the juxtaposition of all of their strategies without harmonization poses more challenges than one might think to the spatial and visual quality of the classroom.

We can wonder about the impacts of the pupil's place, the privacy (the security and shelter function, and symbolic identification), concentration and cognitive load, as well as the privilege management in spatial mobility inflicted on a daily basis (task instrumentality).

Our observations also raise an important concern about the stigmatization of the most vulnerable pupils, because only children with special needs kept their desk in a flexible environment.

If flexibility is introduced in a classroom, it generally implies a more unique and idiosyncratic arrangement that also induces significant challenges on a larger scale. These arrangements are in fact not easily reversible and make it more difficult to share space, furniture and equipment on a school material resource management point of view. From that perspective, it should be important to consider year to year demographic variations that modulate the opening, twinning or closing of classrooms.

Finally, the addition of furniture to the classroom is currently based on a relatively limited supply source. In fact, two manufacturers across the province are ostensibly taking over the entire market for school furniture. To seek to diversify their facilities, teachers and school organizations must therefore turn to foreign manufacturers or equip themselves with non-institutional distributors such as IKEA, Walmart or Amazon, thus making inventories of school amenities very heterogeneous.

In this context, our team puts forward the idea that it would be necessary to introduce a greater concern for harmonization as social justice principle into classroom design. Design recommendations should be linked with the relationship of the classroom to pupil wellbeing and school material resource management overall.

How then, can we ensure that we design furniture that offers a certain degree of uniformity throughout the school material resource management, so that all pupils can benefit from the best facilities even if the pedagogical approaches are different?

How can we promote a form of unity in diversity that avoids individual discrimination of children and support the work of the teachers?

6. Design for Social Justice in Mind: A Need for Harmonization

Some will wonder why the team is addressing the school furniture design problem by taking a kind of universalist design stance. The designer's responsibilities in a public context lead one to think about how to preserve equal opportunities and therefore to consider solutions that involve considering pupils who all have the same rights. In this sense, the effort of differentiation, which is strongly associated with one of the economic values in design, therefore deserves to be questioned, because it is strongly anchored in a market approach where design serves to sell rather than to serve social justice. In this respect, several design authors are beginning to highlight the links between design and inequalities, suggesting that such concerns should be addressed within the larger spectrum of social justice (Julier & Kimbell, 2019; Williams, 2018; Fisher & Gamman, 2019). Others call for reflection on design considerations in the context of public good where access to an equivalent service is needed no matter who delivers it (Gagnon & Watkins, 2017; Kimbell & Julier, 2019; Srinivas & Staszowski, 2019). Being caught between an industry that functions within a market framework and the government that works for the public good is a difficult position for designers. Finally, however contradictory the notion may seem, it may also be possible to orient the design of school furniture by allowing for stylistic and functional adaptations within a furniture system that can support several forms of teaching and classroom organization, while maintaining general criteria, such as a public purpose to be addressed and integrated into design propositions.

In this way, uniformization could be seen as a systemic design strategy for management, that addresses inevitable cost concerns, and in some aspect, equity between all pupils and teachers all across Québec.

Differentiation, on the other hand, should be seen an adaptive strategy to meet the needs of different types of learning and pedagogies, as well as distinctive identities of schools that can translate into stylistic changes or functional adjustments to the whole system. This strategy could be an easy way for the industry to appropriately service scholastic objectives. However, it should be initially important to consider an inclusive perspective as a prior design principle to avoid discrimination and eliminate segregation as much as possible, and finally to promote an equal delivery of public services to all pupils.

An effort at harmonization is certainly desirable at the classroom level, especially since some educational positions question the need for excessive differentiation from a pedagogical

point of view. According to certain studies, the notion that pedagogy must be differentiated to meet needs is not unanimously accepted: good pupils succeed almost within any pedagogical framework, because they already benefit from superior resources, those displaying more difficulty generally succeed with more explicit instruction. Explicit teaching, according to these studies, would therefore be beneficial to all (Gauthier & al., 2013; Gauthier & al., 2005). These perspectives on pedagogy are subject to debate, and the questions they raise can hardly be exhaustively detailed here. Nevertheless, bearing in mind these data, we should perhaps be concerned to promote, in all facilities, design that promotes explicit learning while allowing for adaptations.

It is therefore from this perspective that the team proposes to frame the design of the furniture by prioritizing design principles that allow a spatial organization permeable to the spectrum of flexibility observed while always allowing for classroom reorganizations, in such a way as to structure pedagogy in an explicit and more classical manner.

Finally, although the study focused mainly on space and layout, many parameters must yet be considered in order to harmonize school environments. In this regard, the analysis of colours, materials, technical considerations and environmental concerns should be addressed in further researches.

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Acknowledgements: This project is part of a broader project initiated by the Ministry of Education in Québec that involves a transdisciplinary approach and many partnerships with the community. Schola is a 5-year, $2.5 million research project led by Carole Després, full professor of architecture, (Université Laval, Canada).

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Evolving future city-based retailing via design thinking: A Chinese hybrid model approach.

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Abstract | This paper forms part of a three-year on-going research project which critically examines how design thinking is integrated into the development of city-based retail models. Through the selected three Chinese hybrid retail primary case studies, by considering the higher level of human needs and social contexts, brands could develop a sustainable core value, and it will enable brands to continue to innovate. Compared to traditional product-focused strategies and brand storytelling strategies, this research identified a full-spectrum interaction strategy which leverages the brand core values and social interactions. It allows brands to plan city-based retailing activities with careful consideration of full-range of human needs from physical, emotional, personal and social needs. Followed by the author's previous research, this paper examines design thinking methodologies into a brand analysis tool which allows key business decision-makers to plan the direction of a brand's strategic development.

KEYWORDS | DESIGN & BUSINESS INNOVATION, DESIGN THINKING, NEW RETAIL MODELS, EXPERIENCE DESIGN, CHINA RETAILING

1. Introduction

Traditionally, consumers regard the in-store environment of retailers as space which layout product or hanging on promotion materials to present "what they sell". From 2003, Apple store's provocative 'experience store' model dramatically transformed the way that a company should utilise the physical interaction with customers. The natural advantage that physical stores can compete with virtual retail environments is that they can create "full-sense" experiences (Norman, 2005) which can stimulate consumer's more in-depth responses and compelling brand associations. As one of the essential components of instore atmosphere, internal environments are attached with in-depth knowledge of the product and brand, contributing largely to consumer satisfaction (Mohan, Sivakumaran, & Sharma, 2012). The connection that a physical retail environment can create goes far beyond consumer satisfaction. Furthermore, real-life interactions dominate overall human wellbeing. Specifically, the interactions among human-human, human-social, and even human-culture that are carefully created by city-based retailers are not only can achieve the full-level of consumer satisfaction on consumption but also to the overall quality of everyday life.

The commercial decline of the city centre has forced businesses to reappraise retail trade activities; its planning seems behind the new economic era of demand (Léo & Philippe, 2002). Crawford argues in his paper 'A Brief History of Urban Form' "…*Cities have been consistently arranged around a centre hosting commercial and social activities*…" (2005). City high streets as 'systems' are directly associated with the life and death of the more extensive system of the so-called city (Dennis, Marsland, & Cockett, 2002; Hallsworth, 1995; Williams, 1996). Moreover, in competition between cities of creating their 'brands' (Coca-Stefaniak & Bagaeen, 2013), city high streets development links with secure investment and to attract and retain businesses which determines the economic success of a city (Hodgkinson, 2011). From a city planners' perspective, cities offer cultural, entertainment, healthy, social and more possibilities (Department of Communities and Local Government, 2013; Zhang, Zhu, & Ye, 2016). These should all be considered in the transition of city high street to shape future smart cities (Crawford, 2005; Fletcher, Greenhill, Griffiths, Holmes, & McLean, 2016). Regarding the specific debate about the function and the role that a store places in the city and community activities, Mary Portas, in her acclaimed review (Portas, 2011) offered a comprehensive summary. She argued, "*high streets are not just in commercial terms, but as dynamic, exciting and social places that give a sense of belonging and trust to a community, providing an important catalyst for both the investigation of and policy debate on, topics*."

How to involve social contexts into city-based retailing's sustainable business model innovation through design thinking is the key aim of this discussion. This paper questions the traditional way of product foci and brand story foci strategy and provides a full-spectrum interaction strategy could allow brands to meet the full level of latent customer needs.

2. The Evolution of City-based Retailing

2.1 Physical and social interactions

The role of a store environment and elements that can foster or sustain pleasant emotional reactions becomes strategically more important (Sherman, Mathur, & Smith, 1997). Nearly 40 years after Kotler (Kotler, 1973) noted the importance of the retail atmosphere for purchase decisions, marketing literature has affirmed the importance of a range of environmental and atmospheric variables. From the customer relationship point of view, as discussed earlier, if a brand wants to achieve full-sense of consumer experience (Norman, 2005), physical attachments are needed. The experience commonly associated with emotions. The way that our emotions' colour is strongly tied to environmental representations (Garling & Golledge, 1993; Golledge & Stimson, 1997). Furthermore, aesthetic preference represents part of the brand identity, which will automatically attract targeted audiences. Therefore, the data generated from the brand and consumer interactions in the physical space is way accurate than general online reviews. Secondly, research about retail business completed by Bell (Bell, 2014) shows that to understand consumer's activities in different types of locations (regions in the city and types of cities) will also support online business model evolution. In the same kind or regions or similar size of cities, consumers tend to behave with similar consumption patterns and preferences. This information is highly invaluable for a brand, which aims to expand the market or develop new product lines for both online and offline activities. This influence is pervasive, and sometimes counterintuitive, with implications for our lives in both worlds (both virtual and physical).

2.2 The changing status of retail strategy

Reviewing the relationship between online and offline retailing in the past decade, it has undergone three distinct phases. The first phase was Online VS Offline. It features the freshness of cross merchandise and the exaggerated convenience of online retailing. With lower start-up costs, less capital investment, and selling channels straight afforded physical retailers a heavy blow (Shackleton, 2016). While an online store can be quicker and simpler to set up than a retail business, though in terms of the allocated target market and building meaningful interactions with consumers, it is still far from satisfactory than physical retail spaces. To overcome this, the second phase was to move to Online to Offline (O2O). It is a business strategy that "draws potential customer from online channels to physical stores". The typical example of widely apply O2O is China (Pasquier, 2015), with the wide use of QR codes in local shops to make easy mobile payment and promotion coupons, branded and independent city shops achieved balanced benefits from the value of the internet.

As discussed earlier, customer journeys are increasingly complex due to multicomponent channels, online companies' disadvantages and limits were slowly magnified. Without 'touch-and-feel', brands will not be able to fulfil the full sense of shopping experience for

customers (Haims, 2017). Therefore, the third phase Online mixes Offline channels. In-store IoT (internet of things) technology and big data gives offline channels more opportunities to digitalise consumer behaviours and discover emergent business models. Overall, the image of bricks-and-mortar retailers in this research study is involved with technological tools and Omni-channel interactions; therefore, innovative business models and strategies are in urgent need of reappraisal.

Peter Drucker's definition in business model in 1994 (Jensen, 2013) was "assumptions about what a company gets paid for." Joan Magretta refined Drucker's definition and divided the meaning of business model into two parts. Part one associated with internal value proposition and capacity; part two is related to the external social and environmental context changes (Ovans, 2015). Especially to build a successful business in the Omni-channel retail era, establishing the core value proposition concerning the understanding of external context is the key to success.

2.3 Chinese 'New' Retailing: the new equilibrium

China is currently in the process of profound economic development, urbanisation acceleration and retailing evolution. The rapidly growing mobile internet market, emergent financial transaction technologies and new demographic segments afford Chinese city-based retailers both challenges and opportunities to develop new business models in achieving Omni-channel retailing and long-term survival (China International Digital Business Centre, 2017). With the support of the '13th Five-Year Plan' (2016-2020) for National Economic and Social Development, significant progress was made in transforming and upgrading the retail industry. City-based retailers are witnessing signs of recovery. China is widely recognised as one of the most competitive markets for city-based retailers. Rapid business evolution is now demanding retail enterprises to react proactively to develop innovative business models to remain competitive (Ho, Poh, Zhou, & Zisper, 2019). Traditional singular product or service-focused design strategies are no longer sufficient for city-based physical retailers to attract and retain existing consumers in the pursuit of sustained commercial success. As such, the authors are witnessing the emergence of a growing number of Chinese retail entrepreneurs leveraging the power of design and design thinking in the development of new hybrid retailing models. Through critical interrogation of the new retail landscape in China, this paper aims to discuss and reflect upon the evolution of retail design, proposing a hybrid retail model for the future development of sustainable city-based retail design activities.

3. Design Thinking for business innovation

Design has and is continuing to play an increasingly important role in delivering business value propositions, often in a variety of subtle ways. Firstly, the proposition contains elements that are highly tangible to the consumers, which are manifest in both tangible and

intangible forms. These may include built physical environments, digital applications, graphics and a wide array of supporting promotional material, physical devices and complementary packaging elements. The intangible proposition is equally as powerful but requires far more consideration in both development and delivery due to its subtle nature; these could be achieved through the offering of memorable services, clearly defined policies and processes that are so heavily informed by and through design. Taken in entirety, the holistic application of design addresses all attributes of a product or service offering it physically or virtually or both; what is essential though, this activity has to be intelligently and carefully orchestrated at both strategic and operational levels of implementation. In essence, it could be argued that design and design thinking is the manifestation of strategic intent making the intangible values of the organisation visible to a wide variety of both internal and external audiences (Turner, 2016).

It is very hard to have a singular definition of design thinking. Looking back to the evolution of design thinking, the first strand sees design thinking as a cognitive style (Cross, 2001); the second strand defines design thinking as a general theory of design which refer as 'human action in the realm of the artificial'; and the third sees design thinking as a resource for organisations (Kimbell, 2011, 2012). Tim Brown and Roger Martin, as a way to balance organisational tensions between exploration and exploitation (Abbing, 2010; Martin, 2009) or as a loosely-structured organisational process that stimulates innovation (Brown, 2009), design thinking that is gaining legitimacy among designers, organisations, and government bodies. Regarding the focus of this research within business contexts, theories from Martin and Brown toward business practice will be taking primary consideration.

It is commonly agreed (Cooper & Press, 1995; Hands, 2017; Turner, 2016) that the role, remit and responsibility of design and its overall management have considerably changed from an early stage to maturity and wider acceptance. As such, it is now considered a vital source of competitive advantage. Design thinking is increasingly gaining more attention within the organisation and that it is becoming increasingly strategic in its role as a mechanism to envision new futures for the company. Business leaders and key decision-makers drawn from traditional non-design backgrounds are exploring the numerous opportunities and challenges of this unlikely relationship with design. Brown (2008) argues that design thinking is "…*a discipline that uses the designer's sensibility and methods to match people's needs with what is technically feasible and what business strategy can convert into customer value and market opportunities*".

Furthermore, Liedtka (2010) actively encourages organisations to engage more proactively with design arguing "…*business strategy desperately needs design*..." With this flourishing symbiotic and mutually rewarding relationship in the ascendency, designers are now extolling the benefits of design to new and traditionally highly sceptical audiences, thus developing a 'design consciousness' within the organisation and establishing design as a core competence. In conjunction with this growing recognition from and by business leaders, design and designers are increasingly well placed to initiate, develop and support business

model development, NPD (New Product Development) opportunities and wider innovation activities. A core competence has to provide a significant contribution to customer-perceived value, and indeed design has played a leading and direct role in the 'value' offerings from organisations.

4. Research Methodology

The primary research approach taken by this research study, adopted a strongly qualitative methodology to gain an in-depth analysis of the city-based retail business model innovation. The study started with a comprehensive literature review of scholarly articles focusing upon contemporary retail evolution, design thinking, and business model innovation. The developing theoretical framework is shaped and adapted to gain a detailed understanding of city retailing dynamics, social interactions and the role of design in business model development to understand the symbiotic relationship between retailers, design and the local social context in which the retailer sits.

In addition, primary research methods and tools were drawn from established social science methodologies to obtain initial insights and observations from early findings. The author conducted an initial in-depth primary research in Tier 1 and 2 Chinese cities from 2017 to 2019. Early research activities involved visiting and observing numerous city retail outlets within a real-life context to gain an initial understanding of retail dynamics and consumer behaviour patterns. In-depth interviews with retail entrepreneurs, retail professionals and interior designers helped gain a deeper understanding of city retail model evolution and future retailing developments.

A radar chart has been designed for this research which upgraded from the author's previous developed design value framework inspired by Maslow's Hierarchy of Needs (Maslow, 1943, 1998). It enabled the author to identify and illustrate the relationship between core product (and services), design, brand value propositions, and social context engagement.

In order to reflect and incorporate representativeness of Chinese retail cases, the decision also took into account data from Combined China mainstream online consumer reviews such as brands' WeChat official account and Baidu, reports from international newsagents such as Tencent and Weibo. Three cases from field research were selected, WENHEYOU (catering and cultural brand), HUANYUE Art Space (art and aesthetic education institution), and 1200bookshop (24h bookshop). All three cases have its core value, albeit with different 'experiences' designed to represent their unique brand core value and to connect consumers through multiple dimensions. The hybrid functions well-orchestrated and crafted around the essence of their brand values directed towards their local communities and targeted user groups.

5. Case Studies

5.1 WENHEYOU

Brand core value: inheritance and disseminate Changsha city Culture.

WENHEYOU is a catering company, and cultural brand which located in the city in middle south China called Changsha. The founder started his business by selling local snack nine years ago and now became a cultural-driven brand and Changsha city landmark (WENHEYOU, 2018). Compare to traditional catering development model, WENHEYOU not only expanded in size and scale in the food-related category but most importantly, build a strong link with local culture and art. Different than most of the retailers try to design a high-end and modern style to fit with young group's aesthetic values, the brand takes nostalgia as their design strategy to build a warmth and closeness atmosphere with the unique local culture. Eat and visit at brand stores; customers can feel the core spirit of Changsha city, which is welcoming and enjoying life. In 2017, the company opened an art museum in the famous tourist place Changsha ancient Taiping Street to display the works related to the development of Changsha City and its local culture. Not long after, the brand opened a Stinky Tofu Museum in the same street to show tourists the history and making process of this unique local food.

In 2018, the brand presented its iconic architecture WENHEYOU Laochangsha Lobster Restaurant. It is a place located in a shopping centre with seven-floor high; the internal design replicated a typical Chinese community in the 1980s with various life scenes, such as barbershops, people's living room, and video game room etc. (WENHEYOU, 2019). In 2019, they upgraded the space and invited many local SMEs to join the space together became 'Super WENHEYOU Community'. It is a special place that could bring older generations memories of past times and refill the curiosity of young generations of the old city view. This project won reddot design award 'Best of the Best' 2019. The development of the brand is closely integrated with the local culture and the city's characteristics, the brand has become a window and representation of Changsha city image.



Figure 1. themes involved in WENHEYOU hybrid model. Pictures of 'Super WENHEYOU community' and brand logo.

5.2 HUANYUE Art Space

Brand core value: allowing everyone to become an artist of life.

HUANYUE Art Space is located in a place surround by living community and schools in Guangzhou city, China. Space's division is relatively simple. The first floor is a combination of a bookstore and a coffee bar; the second floor is an open workshop space for handicraft and art teaching. The brand argues that the demand for art and aesthetic education should not be limited by age and occupation. They wish to create links through art education and activities to allow people in communities embracing art and joyful life. Therefore, they designed three categories of brand' offerings (HUANYUE Art Space, 2019). Firstly, provide art and handicraft experience services for the surrounding residents such as children, older adults and housewives in store. These are the groups that are commonly ignored but could benefit from art activities.

Secondly, beyond the in-store space, the brand builds cooperation with various types of institutions to promote aesthetic education (HUANYUE Art Space, 2019). For example, the team visited regional libraries, middle schools, and kindergartens carried out art classes; organise pupils to explore their living regions. Thirdly, the brand also launches social welfare services and provide art activities to support NGOs and Red cross. For example, they designed art classes suit for the Deaf-Mute group, organised book sharing and donation activities. Leading by the brand core value, community bonding and social responsibility is

naturally integrated into their business model and brings the brand broader possibilities for future development.



Figure 2. themes involved in HUANYUE Art Space hybrid model. Pictures of HUANYUE Art Space store and art class for children.

5.3 1200bookshop

Brand core value: to light a city's deep night.

1200bookshop was a start-up project after the founder travelled returned from a 1200-km round-trip in Taiwan. It is located in Guangzhou city. This 24-hour independent bookstore's characteristics are closely related to the founder's own experience and value (1200bookshop, 2016a). First of all, the founder thinks the bookstore is not only about books, but it is also about space and human spirit. For numerous reasons, there are many people still awake after midnight. Some people cannot sleep, some people nowhere to go, and some travellers waiting for their train. Therefore, the brand aims to give these people a safe and warm place to spend the night. Second, backpacker experience allows the founder understood that some travellers might not be able to pay for the hotel. Other people nicely provided a sofa for him in the past made he wants to return the kindness to society. Thus, each bookstore always has a room for people in need to stay temporarily.

Third, from years of store operation, he noticed that many people come to the bookstore reading books with a long-term study aim. One of customer explained that his daily routine occupied with work and take care of family, he wishes to have a study room for reading and personal reflection. He sees the bookstore as his unique study room and a break to find inner peace (1200bookshop, 2016b). Hence, the design of space reserved a lot of quiet seats.

Fourth, after a young man shared his story of 82 days walks to the city, a Late-night Story Sharing event has been continually held over a hundred times. Added to that, every day, store staff pick up a short in-store customer story with a paragraph post in the bookstore's WeChat news account. More than 700 stories about ordinary people have been recorded and shared. Last but not least, deaf-mute people are welcomed to work in here, even though the bookstore is not a social enterprise, but incorporating public welfare into its brand strategy has brought them uniqueness and competitive advantages.



Figure 3. themes involved in 1200bookshop hybrid model. Pictures of a quiet space (during the night can transform to a bedroom for backpackers) in 1200bookshop and Late-night Story Sharing event.

6. Discussion

From the author's previously published research findings (see Figure 4) (Huang & Hands, 2018), it approves design could drive business innovation through different levels of human needs which based on Maslow's Hierarchy (Maslow, 1943).

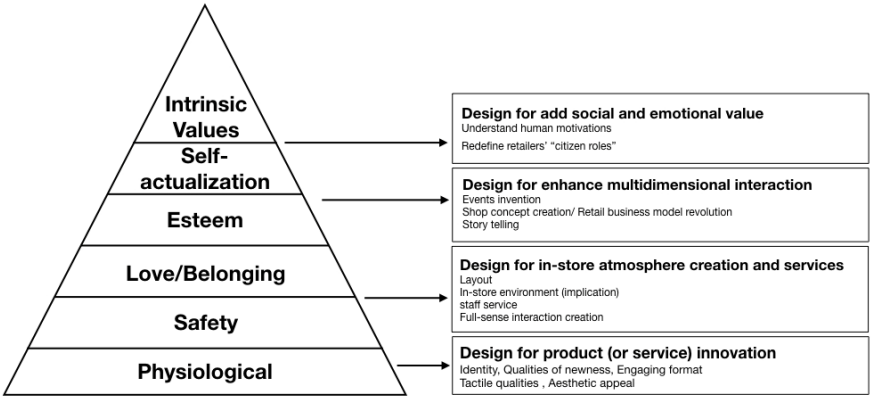

Figure 4. author developed design drive retail innovation categories fit with Maslow's Hierarchy from previously published research.

Based on the many scholarly' articles and primary case studies of selected Chinese retail brands, this paper enhanced that by strategically planning design, including but not limited to product design, service design, in-store atmosphere design, and business model design. Retailers can achieve what business management aimed to meet consumers' emotional and social needs; what marketing talked about to identify unique selling points; and what city planning emphasised to build stronger connected local communities. With innovative design thinking, city-centre based retailers can shift their focus on selling-and-buying competition with e-retailers to explore more possibilities by redefining "citizen roles". Design can build different channels to allow brick-and-mortar stores and consumers to communicate with each other. During its process, the business model was moulded and adapted to fit new contexts of consumers' city life. The reconfigured business landscape is on its way being rediscovered, and design will keep the equilibrium between the old and the new.

Similar viewpoint from a business development perspective, the Economic Pyramid which presented in the book 'The Experience Economy' highlights that companies can experience transformation from making goods, deliver services, stage experiences, ultimately, to guide transformations (Pine & Gilmore, 2011). 'If you charge for the demonstrated outcome the customer achieves, then and only then are you in the transformations business.' which rise the necessity of business shift their way of thinking and planning business.

The research used Maslow's Hierarchy (Maslow, 1943, 1998) as a foundation to analyse the route of business development. Order and hierarchy do not affect business strategy; the design of business strategies is more likely to consider cross hierarchy. Six categories can be seen individually and combine freely to present a brand's target and focus. Figure 6 showed categories placed with different positions in each brand that emphasises with distinctive percentage. The multiple services and products which the brand added over the years have

always encircled or enhanced the core value (see Figure 5). The weakness of categorising retail types and vertical business development thinking is it could limit the brand's possibility of developing higher offering and narrow the scope of ways to approach to innovation.

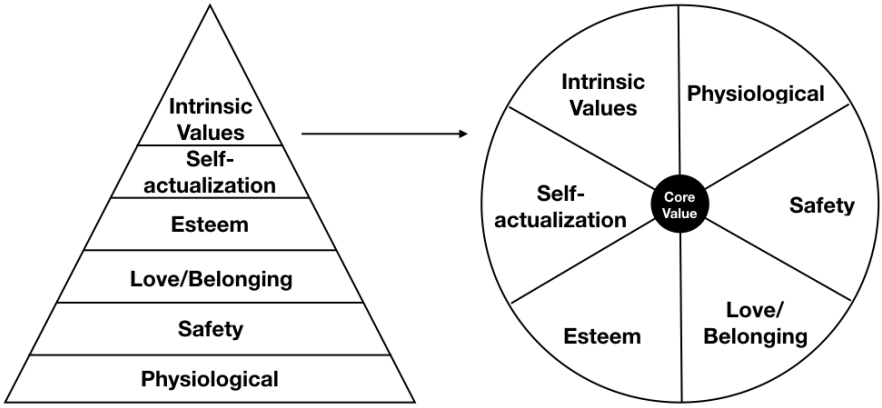

Figure 5. eliminate the hierarchy, transform the human needs into a design thinking tool for business opportunity innovation.

The Chinese-context-based case studies in this research paper provide a new perspective and development of the framework for business planning. It is evident that all three brands' offerings were mixed between different needs with clear emphasises (see Figure 6). 'Super WENHEYOU community' created an integrated experience which fulfilled customers' needs of eating local snacks and a sense of belonging with nostalgia. HUANYUE designed art activities for disabled group and communities that support both esteem and intrinsic values. 1200bookshop provide safety for backpackers and midnight sleepless people and create quiet space for people who wish to find inner fulfilments.

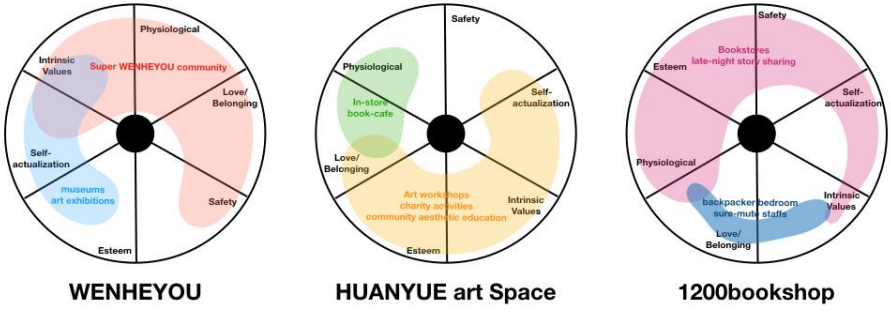

Figure 6. based on developed radar chart, they are clearly shown three brands' hybrid model covers different needs.

Furthermore, it is demonstrable that all three brands' core value is not about what they can sell, but closely related to social contexts and personal values, this could also offer insight of how to define a brand's core value and unique selling proposition.

7. Conclusions and further research opportunities

This discussion explored the realm of design thinking for business and in particular to business model innovation for city-based retailers. Through the selected three mix-category Chinese city-based retail brands cases; research demonstrated a hybrid retail model. Which allows the retail business strategy to evolve from a foci point (traditional advertising strategy) to storyline (brand storytelling strategy), and currently towards a full-spectrum Plane (brand core value and social context interactions). Furthermore, by illustrating the values of design as a subtle mechanism to explore new business opportunities and fulfil different levels of consumers' needs, this research contributes a 'radar chart' tool for retailers to discover and refine their retail design strategies. Therefore, to foster a long-term sustainable approach to their commercial business planning activities.

As this research study only extracts limited data from three years of design for business planning activities, initial findings may not be considered 'generalisable' to a broader sample of business contexts. However, the currently prototyped hybrid-model has been developed within an experimental scope for further refinement and subsequent testing. The authors acknowledge the current limitations of the model in its current developmental form. Further studies could focus on how to apply the developed design for business innovation tools into wider business contexts that allow them to use and adapt design thinking into their business innovation processes and planning activities.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Feeling Endem. How travel enhances applied-autonomy in spatial design.

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Abstract | Spatial design is a complex matter by nature. At various scales from cities to interiors, there is always a context with many preconditions that the designer has to take into account. In developing the ability to deal with the specific context from their own perspective, to act with an autonomous mind in an applied context, it plays a key role where designers themselves are situated. TRAVEL is an educational programme that enables future spatial designers, by means of travel, to discover their own preconceptions, to critically examine them, and to get to know their own position from the way they perceive their environment. Subsequently, the programme also enables them to use their own observations as personal special features in their designs. Through encounters, explorations and experiments in four successive phases, TRAVEL gives future designers curiosity, confidence and skills in gathering and interpreting information and developing personal design strategies from that.

KEYWORDS | SPATIAL DESIGN, TRAVELING, APPLIED-AUTONOMY, BUILT ENVIRONMENT, EXPLORATION

1. Introduction

Spatial design is a complex matter by nature. After all, at various scales from cities to interiors, there is always a context with many preconditions that the designer has to take into account. Ideally, the design of space is neither dominated by the preconditions of others nor by the autonomous perspective of a designer. Spatial design is *applied autonomy*. The virtuosity of the designer lies in the way how she/he manages to deal with these preconditions and how she/he sorts, interprets, places in a hierarchy and depicts preconditions. In developing the ability to deal with the specific context from their own perspective, to act with an autonomous mind in an applied context, it plays a key role where designers themselves are situated. Their backgrounds and opinions that emerge from that, the preconceptions that came out of it, determine to a large extent how they themselves see the world and act as a designer in that world accordingly.

TRAVEL is an educational programme that enables future spatial designers, by means of travel, to discover their own preconceptions, to critically examine them, and to get to know their own position from the way they perceive their environment. Subsequently, the programme also enables them to use their own observations as personal special features in their designs. The programme has four successive phases and starts with *ENDEM*, the albanian concept of *being happily lost*.

2. Traveling to observe trivialities

2.1 Search images enable navigation

In her book *On Looking, Eleven Walks with Expert Eyes*, New York psychologist Alexandra Horowitz observes her urban environment 11 times through the eyes of others. (Horowitz, 2013) Through her walks with a field biologist, an urban sociologist, a geologist, a typographer, a doctor, but also with a dog and her two-year-old son, she learns to see her urban environment from completely different perspectives than hers. Her fellow walkers all turn their eyes to other things; from a thirty thousand year old stone, a traffic light, a soup kitchen or a façade lettering, they all make their own connections and recognize their own systems. With the description of the walks, Horowitz shows our world as a *pluriverse*, an endless collection of small 'own' worlds. The various experts taught her to look at the city in a different way, adding various universes to her own universe. They gave her a bit of their expertise which now allows her to identify the genesis of some old stones, to catch aphid colonies in certain situations and to recognise the origin of some façade lettering. Horowitz shows that knowledge of a place is determined by the gaze of the person observing and the moment of observation. Horowitz calls the specific frameworks with which a person perceives the world around her or him and which in turn arise from her or his expertise of someone, *search images*.(Horowitz, 2013, p.124) Everyone needs a mechanism to choose from everything the world has to offer, those things she or he has to look for, or look at, and

what to ignore. "Thanks to the *search image* in your head, you're able to recognize a friend in the middle of the crowd getting off the train at Grand Central," says Horowitz. "It's the visual form of expectation that allows you to sense meaning in the chaos." The human brain also has to sort out information from the environment, because it is not able, it does not have the capacity, to give equal attention to all visual perceptions in the environment, including sound and smell.

2.2 Perception is determined by situatedness

Search images guide us through the jungle of the built environment. They filter out irrelevant observations so that our brain capacity does not have to succumb to the constant flow of information from our environment. A downside of this survival mechanism of the *search images* is that once they are successfully installed and the user can navigate reliably through the city, they do not quickly replenish or change. Your head does with impulses from the urban environment the same thing that Google does with your searches. Like Google, which interprets your preferences using an algorithm, your head thinks it knows what is relevant to you. Then your brain makes sure as much as possible that you only perceive the information that comes through that filter. The extraordinarily useful tools that our brain has developed to enable us to deal with complex spatial situations immediately ensure that our perceptions are filtered and therefore impoverished.

By filtering for relevant information, the ability to allow the impulses that are out there is limited. This makes our image of the world much more superficial and limited, we put it together especially for ourselves. Contrary to the *worldwideweb*, where the information assessed by the algorithm as irrelevant remains invisible to us, the information that our brains classify as irrelevant in the built environment and therefore do not allow us to perceive, remains visibly present in the built environment. We simply filter it out of our perception. We don't need a digital manual to conjure up this information, but an analogue instruction to see better what we don't perceive from automatism. The walks with experts provided Horowitz with such an instruction that gave her many new *search images*. The experiment made the urban environment more layered and richer for her and showed her how limited her view of her piece of city had been before. The knowledge gained from observations and the transfer of knowledge by experts never provides a reliable and universal 'complete' picture of the city. At the same time, it shows how endless the perspectives on the city are.

Horowitz book reveals that knowledge of a place is by definition determined by the moment of perception and the person who perceives it. Biologist, philosopher and feminist theorist Donna Haraway argues that objective knowledge by definition does not exist. (Haraway, 1988, Autumn). Knowledge is never objective and is always determined by the character of the observer. Knowledge can thus simply never be neutral, instead it is determined by the gender, race, cultural background, nationality, economic position and social status of the person formulating it. Haraway states that it is necessary to make the origin of the

knowledge clearly visible before you can assess its value. What is the background of the person who has gathered the knowledge and what are the points of view that this background has led to, how and where can you place the knowledge, i.e., where is it situated?

2.3 A catalogue of spatial awareness

Following Haraway's observation about the character of knowledge and the experiences of Horowitz, I argue that all observations are by definition situated: they are somewhere at some point in time and are made by someone, from a specific point of view. This concept of situatedness implies a relativization of the intended objectivity of spatial analysis, if at all. At the same time, however, it enhances the possibilities for personalisation for the world of spatial design. Spatial design is a creative process in which the designer applies his or her creative capacity to a spatial situation that is about to change. Spatial design is obviously not an autonomous process, but ideally it is neither entirely determined by the preconditions of others. Spatial design is *applied autonomy*. After all, there is always a context with spatial, social, legal, cultural, practical and financial preconditions that the designer has to take into account. The virtuosity of the designer, however, lies in the way how she/he manages to deal with these preconditions and how she/he sorts, interprets, places in a hierarchy and depicts preconditions. In order to do that successfully, spatial designers must first and foremost determine where they themselves are situated. Their backgrounds and opinions that emerge from that, determine to a large extent how they see the world.

How the future designers' perspective on the world is shaped by their backgrounds, is best discovered by constantly exploring the world that surrounds them. By travelling, and thus stepping outside their familiar situation, they confront themselves with other situations with which they are unfamiliar. This confrontation, followed by analysis and reflections, make these designers aware of how a specific space was created. According to the nineteenth century German architect Gottfried Semper, the creation of new spatial forms emerge by defintion out of the interaction between all the relevant *agents* or forces that dominate the spatial context. (Moravánszky, 2018, p.53) By travelling future designers can explore these *agents* and establish where these preconditions for the creation of the explored spaces differ from their own points of view. In this way they gain insight into the starting points, preferences, but also the automatisms and prejudices that determine their world view. TRAVEL enables designers to collect these insights in their own perspective and thus build up a catalogue of their own *search images*. This catalogue, this awareness of their own perspective on the world around them, is for spatial designers a crucial component of their own design position.

2.4 Collecting and interpreting evidence

Through TRAVEL future spatial designers practice observations as a tool to explore their *situatedness* and through that define their own design position. TRAVEL can start with an

extensive examination of the history and topicality of the context to be visited, but it can also start completely *knowledge-free*. The insights of the participants do not start from knowledge of a total overview, but are built up from the observations of fragments. In her conclusion, Horowitz describes this approach as follows:

> "In the nineteenth century, skilled anatomists insisted that they could recognize an animal and even reconstruct it on the basis of a single bone. But the 'animal that is the city' can be traced in the same way by means of small pieces of evidence. One aspect of perceiving all that is on a simple block of streets, is the realisation that everything that is visible has a history. At some point it ended up in the place where you found it, at some point it was put together, cut out or forged, and it has fulfilled a certain role or existed for a certain function... It is evidence." (Horowitz, 2013, conclusion)

By collecting and interpreting *evidence*, future designers build their personal catalogue with *search images.* They use this catalogue to be aware of their own perspective on the world around them and act as a designer in that world accordingly. TRAVEL does not aim to automate one's own actions so that they can avoid unwanted confrontations in the future. By observing and analysing their environment, designers are confronted with their own starting points and prejudices. They map out their own perspective and formulate their own design position in which confrontations do not have to be avoided, but rather can lead to brilliant particularisations. Horowitz ends her book with a quote from Sherlock Holmes: "You know my approach. It is based on the observation of trivialities". This observation of trivialities is the core of every enlightening TRAVEL.

3. The TRAVEL programme

3.1 Intuitive analysis of a spatial context

TRAVEL is a course that takes about 28 days spread over a period of 8 months. (Venhuizen, 2019) TRAVEL starts with ENDEM and ends with STOFFWECHSEL. ENDEM is the Albanian concept for *feeling happily lost* and invites participants to gather all sorts of impressions without actually knowing for what reason. In the next phase of TRAVEL, 好奇 or HÀOQÍ is the key emotion. HÀOQÍ, the Chinese word for *curious*, challenges participants to reflect on what they actually saw and to discover all kinds of fascinating observations that stimulate their curiosity. In the third phase participants limit their observations to the core idea framed in various PADIDEH, the Persian word for *phenomenon*. These PADIDEH will be confronted with designtasks through placing them on two sides of a matrix, thus creating a *field of change*. Finally participants explore the possibilities that are hidden within this field through combining seemingly irreconcilable elements, exploring the observations by merging them and thus applying these to their *metamorphism*, or STOFFWECHSEL as Semper framed this phenomenon in architecture.

The TRAVEL approach originated from my artistic practice, which is within the cultural dimension of the built environment. I develop proposals for spatial changes based on intuitive analysis of the context that is about to change. To this end, I developed a method that makes it possible for the results of that analysis to play a guiding role in the design of spatial proposals. With TRAVEL I made the method, which I implicitly applied in my own practice, also applicable to others. In practice it quickly became apparent that the participants needed much more than a mental introduction within a diverse programme of travel. Because of previous experiences participants had with excursions, which were generally more knowledge based and focused on specific visits of highlights, I determined that they needed clear instructions and a framework within which a broader intuitive spatial analysis could lead to results. This gave rise to the 4-stage approach introduced here, each phase with its own name and character. The identity of the phases, which is formed by the naming and the specific interpretation thereof, contributes to enticing the participants to question and immediately expand their palette of existing *search images*. With this, TRAVEL serves as the aforementioned analogue instruction needed to allow the exploration of the built environment to transcend the familiar perception.

3.2 TRAVEL: an exploration without preliminary research

The method of exploration I developed and applied shows great affinity with the way geographer JB Jackson approached the built environment. Jackson did not feel hindered by a lack of expertise in spatial planning, and relied entirely on his own observations and the knowledge that this gave him. He recognized the essential traces of man's survival strategies in the landscape and was able to test this knowledge with further literature study, expand it and place it within a broader framework of the culture of settlement. (Brinckerhoff Jackson, 1997, xxiv)

I argue that an exploration is best started without preliminary research. Each preparation provides guidance in answering the research question that has been opened up, thereby steering the observation in the direction of the data that has been mapped out in advance. An exploration that has been carefully prepared carries the risk that mainly the clues established in the preparation will subsequently be recognised and therefore the serendipitous clues will not be recognised. Scaling up your understanding of the context by determining meaningful details gives you the opportunity to see your own explanatory lines and structures instead of following those drawn up by others.

3.3 TRAVEL phase 1 - ENDEM

As you might expect, the TRAVEL consists first and foremost of a collection of travels. These travels can be short or long and far away or close to home, it doesn't matter. A number of principles are important when putting together and undergoing these travels. First of all: - *go there*. It sounds ridiculously superfluous but in practice it turns out not to be. Many designers find their inspiration and references from second-hand information. On the

internet and in magazines you can find beautiful photos and striking text descriptions of many inspiring places. It is tempting to believe and use them. That brings me to the second principle: - *only believe what you see for yourself*. This too sounds preposterous but turns out not to be either. The images of familiar places put in our heads by the internet and magazines are so strong that they can even survive a disappointing confrontation with reality. In the past, participants in TRAVEL sometimes appeared to be forgiving towards that disappointing reality and continued to cherish the second-hand image already present in their heads. But situations are - *as they are*. And also, or especially, from - *bad examples, there is a lot to learn*. Therefore, information about places only matters the moment you think it matters. When a participant notices something in an observed context, or feels a need for information, that information is quickly found by means of your smartphone. The last principle for ENDEM is: - *look in between*, that is to say, not only orientate on what you think is a highlight, but also study the front and back and everything in between. Travelling is a mental state and starts as soon as you leave your home and not only when you arrive at alleged highlights.

The design of the travels; the locations to be visited, the planned meetings, the modes of transport, the moments and places of stay, the *in-between*, etc, is a crucial part of the travel experience. The instruction participants receive is simple: photograph what you notice and load those photos onto your travel blog. However, the instruction turns out not to be as simple as it seems. Such openness frequently leads to uncertainty and also causes ingrained reactions. Participants generally start by taking *magazine photos* or *instagrammable images*. In addition, they sometimes try to see what they think I, as a course leader, want them to see. From the uncertainties came the name and design of this phase. Once, when I explained the intention to a group of international participants, who had been confused by the proposed openness, a participant from Albania came up with the word ENDEM, which in the Albanian language stands for travelling and being on the road, but above all has a meaning of *feeling happily lost*. In other words, a positive approach to the fact that you don't know what you're looking for. ENDEM turned out to have a a strong reassuring effect on the participants who were looking for a precise definition of the desired outcomes of the programme. Reassured that there was no such definition, they were free to observe and take photographs.

After about 15 days of travelling, I ask the participants to fill their blog with at least 100 photos. The selection they have to make is so broad that it can never contain only the beautiful architectural photos or the observations that were made strategically just to meet the conditions. I consciously ask the participants to take photos and not drawings because with the wide selection of photos comes much more information than the participant can direct. Moreover, although the photos are focused on a certain point, they generally contain a lot of additional information that could be lost with a focused drawing. As a result, participants take information with them that they didn't even know they had seen. This catch, and especially the bycatch, is an important topic of conversation during a first travel-talk that I conduct individually with the participants. Because of the uncertainty about the

course brings about, I prefer to have individual talks. In my experience individual talks can easier lead to understanding, trust and insight and tend to be less strategic than group talks. In these conversations participants are willing to see the prejudices with which they inevitably photograph, but they are also able to recognise other fascinations in their observations. New fascinations with which they become more aware of and can expand their catalogue of *search images*.

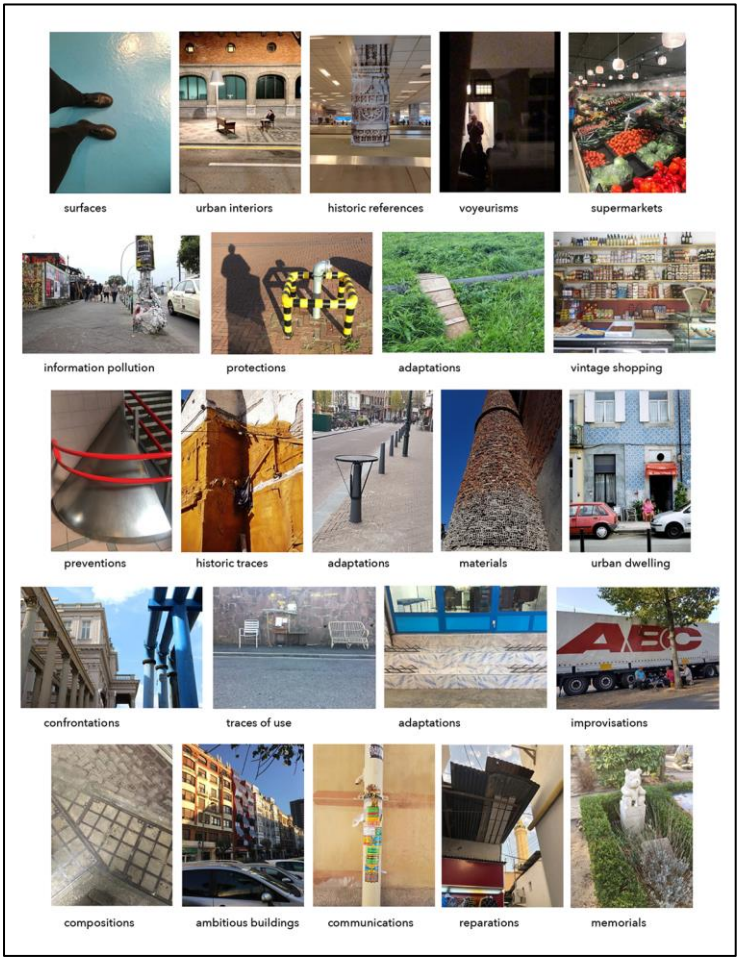

Figure 1. A small selection from the total collection of about 1500 photographs that resulted from the ENDEM phase of a TRAVEL course in 2018-2019 with 10 participants from 7 countries in Europe, Asia, and South America. These and also all other images in this text, are from participants Devina, Samantha, Shripal, Keyi, Mary, Sebastian and Ausra and were taken in Spain, Germany, the Netherlands, Portugal, India and Greece.

3.4 TRAVEL phase 2 - HÀOQÍ

The name of the second phase resulted from a long discussion with a Mandarin speaking participant. Our conversation kept going back and forth about the question of what to observe when there is no concrete design assignment. It may be a somewhat romantic idea, but I myself assume that spatial designers are always 'on', permanently searching their surroundings for interesting situations and their special histories. Not a paying client or an assignment but their curiosity is the most important client. With the Mandarin word for curious I convinced this participant of that. And the word remained connected to the second phase of the TRAVEL course.

好奇 or HÀOQÍ begins with an exploration of the self-composed travel blog. The instruction is simple: after traveling look back at what you have found. Try to distinguish what you think you saw, what you think you should have seen from what turned out that you actually saw. Let your intuition guide you through your documentation and see combinations, things that are fascinating, things you did not notice before, things that are out of the ordinary, or just especially common. I explore with them, allow myself to be carried away in the interpretations of the observations made by the participants, but also draw their attention to the wondrous situations that they may not immediately perceive. In doing so, I constantly ask the question: "what happened there, what is going on, how did it come about, what ambitions and strengths were at work there, whats your personal perspective on that?" I ask them to name the elements that could have caused the situations they observed, distinguish the decisions, ambitions, coincidences, accidents, designs, geographical contexts, cultural habits, political decisions, financial possibilities, social preferences, etc. etc. I let them speculatively fathom the origins of the observed situations and make sure they don't focus too much on the results they've observed. Participants go in search of this background information of the situations they find intriguing. They add this information as comments to their travel blogs.

As a fellow explorer, I pay special attention to the presence of prejudices and simple disqualifications in the descriptions that could be revealed by the use of words as • exiting • inspiring • amazing • disgusting • ugly • intense • impressive • surprising, etc. I encourage the participants that with these ratings, observation does not stop, but begins. Then the confrontation with one's own preconceptions begins and can be generated and supplemented with new *search images*.

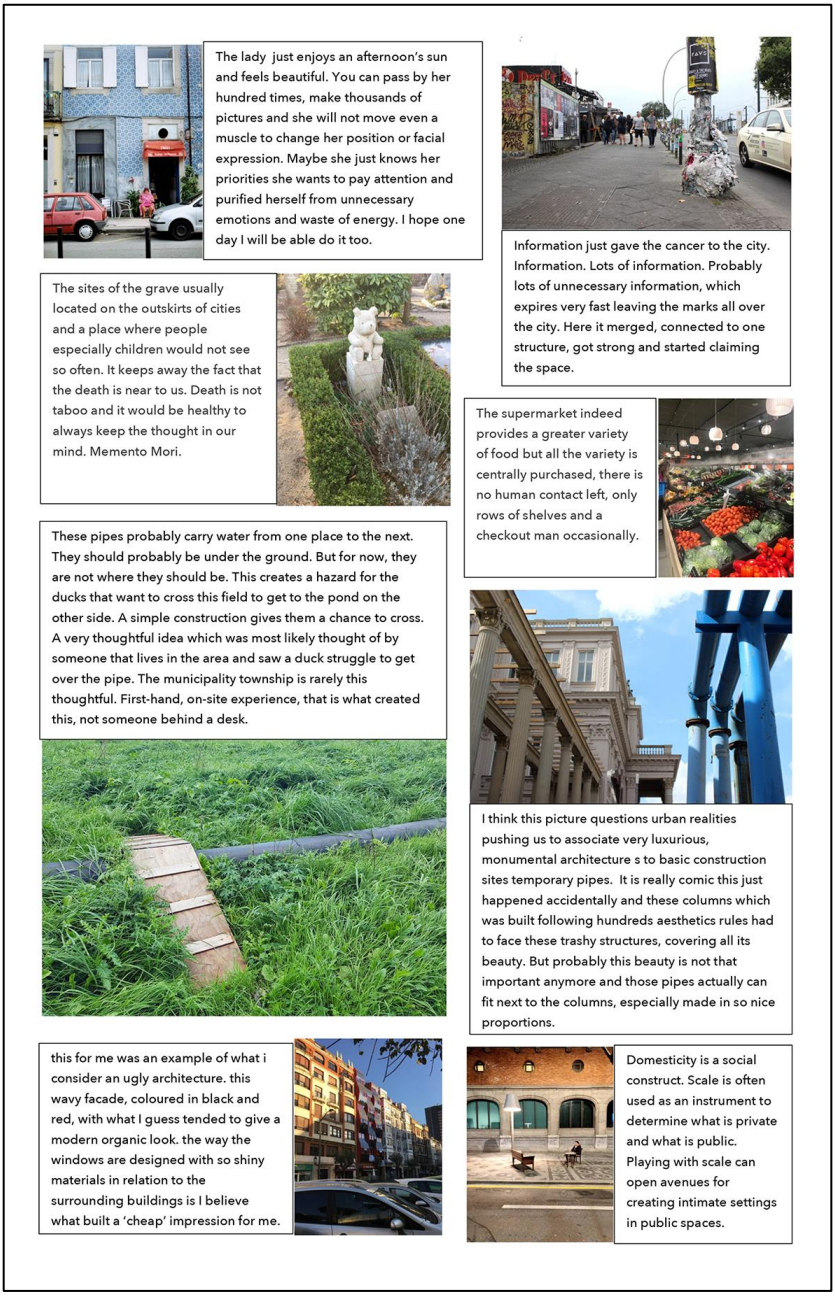

Figure 2. A selection of the previous selection with short reflections from participants added.

3.5 TRAVEL phase 3 - PADIDEH

Contrary to Brinckerhoff Jackson, the TRAVEL explorations do not aim at mapping out and interpreting the contexts that we visit as a final goal. Ultimately TRAVEL focusses on action and spatial design. What has emerged from phases 1 and 2 are speculative analyses of processes of spatial change based on personal interpretations of intuitively collected *evidence*. But understanding a spatial situation in your own way is not the same as being able to change it. To this end, the pieces of *evidence* gathered need to be transformed from 'passive' observations of situations, to 'active' instructions. In other words: in phase 3, we swap the perspective of *interested consumer of space* to that of *producer of spatial transformations*. When the 'activated' instructions are strategically positioned within a process of spatial transformation, they are able to add personal interpretations of the designers to the newly-built or refurbished built environment. They do this not by determining the form in which the future built environment should manifest itself, but by playing a guiding role as a determining precondition within a field of preconditions within which that future form arises.

This is how it works. From the large amount of pictures from the ENDEM phase, the participants in the HÀOQÍ phase have added their personal analyses to about 40 observed situations. The study continues with this selection of 40 observations. The participants identify similarities and striking differences. They combine the observations where possible to create groups. Subsequently, the observations are 'reformulated'; from the description of a situation a rule is drawn up that could cause similar qualities of the described situation in a different context. In the example of the almost sculptural accumulation of posters shown above, the participant chose to translate the form abstractly into 'visible layers of use'. The example of the staircase for ducks over the temporary drain in the field above was also dissociated from the context in which it was found. The participant has chosen to focus on the actual users of a space and to realise facilities that are explicitely recognisable for them. By separating the perception from the place in which it was found, by defining the core *phenomenon* behind the situation in a rule, this *phenomenon* can also become a quality for other situations. Although these rules are still based on the situations depicted, these examples are let go here. The examples fade away (literally applied here) and the words of the instruction, the *language of the rule* take over from here.

The name PADIDEH for this phase, like the previous names, comes from discussions with participants. Because the observations do not have an established appearance, they can consist of objects, space arrangement, but also colours, sounds, smells, soil conditions, climate, use of space or even laws or traditions, I called the rules distilled from these observations in the first place *phenomena*. In the Merriam-Webster online Dictionary, *phenomenon* is described as 'an observable fact or event', an open description for an observable event without the need to categorize it directly. *Phenomena* are a tool to frame a situation in a personal way and accompany a designer during the process from understanding to designing a spatial change. But it was precisely this openness that blocked

the participants who appeared to need a more detailed description of what they had to comply with. Because such a description would undeniably limit the openness, I adopted the word PADIDEH, the Farsi word for *phenomenon* that is also used as a maiden name, from a participant from Iran. The use of PADIDEH instead of *phenomenon* had the same effect as the word ENDEM, it invited participants to search for the rules behind their observations without wanting to know in advance exactly what the final outcome should be.

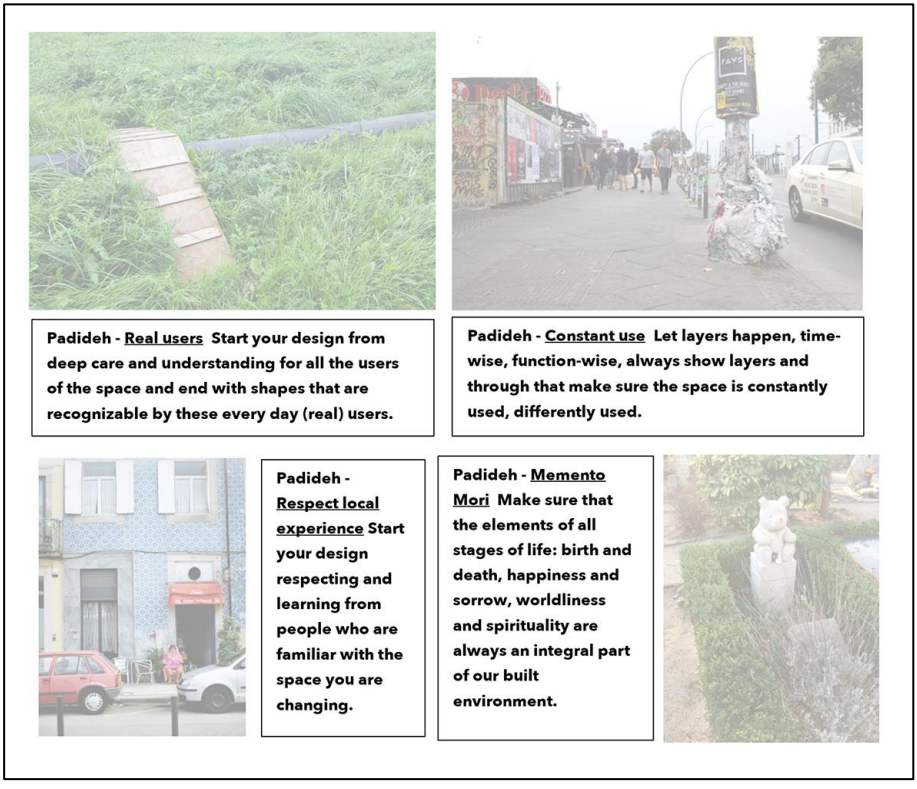

Figure 3. A selection of the previous selection turned into rules, to enable the observed phenomenon to become a quality for other situations. Examples fade away, words take over.

3.6 TRAVEL phase 4 - STOFFWECHSEL

From phase 3 at least 5 PADIDEH per participant arise which are applied to a design context in the fourth and final phase. I called this phase STOFFWECHSEL, a name that refers to the theories of the German architect Gottfried Semper. Semper adopted the concept of STOFFWECHSEL, or metabolism, from the natural sciences in the mid-nineteenth century to interpret his basic principles. (Moravánszky, 2018, p.163) STOFFWECHSEL is the collective name for all biochemical processes that take place in living organisms. It contains all processes in which raw materials from an environment are absorbed and converted in a body into substances relevant to that body. With the introduction of this term Semper stated his view that spatial design is a continuous reinterpretation of known forms in new contexts. According to Semper, cultural relevance arises in spatial design when a former dependence on materials no longer exists, but is 'thematized' by means of STOFFWECHSEL. This theming gives the objects the ability to remember and thus gives them a cultural significance that far exceeds their everyday usability. (Moravánszky, 2018, p.189) STOFFWECHSEL takes place within TRAVEL by confronting the collected PADIDEH in a matrix with design tasks that have no relationship to the locations in which the PADIDEH were found. With their application the PADIDEH function as deliberate limitations to the design. I argue that the most decisive for the form that the results of a spatial transformation process take are the limitations that the ambitions for that transformation have to deal with. It is precisely the limitations that give creative design processes an impulse. (Biskjaer&Halskov, 2014, p.57) In designing spatial changes, these limitations can be welcomed as *creative constraints*.

I apply a matrix because it enables a structured inventory of the components of an investigated situation and its form invites a thorough, systematic exploration of new possibilities. The application of a matrix is inspired by the theories of the *General Morphological Analysis* developed in 1967 by the Swiss astronomer Frits Zwicky. (Ritchie, 1998, revised 2013) Zwicky applied a three-dimensional matrix to systematically explore all confrontations between agents of a context in change. My matrix is much simpler than Zwicky's. My matrix is two-dimensional and contains on one side the formulated PADIDEH and on the other side (elements of) the design context. The fields between the entered parameters on the x and the y-axis are left empty. The matrix with its combinations of personal PADIDEH and design assignments that come together on its empty fields, is then the surface on which the possibilities for stacked transformations can be explored. In this way, the personal interpretations of the intuitively collected evidence, contained in language, are brought into relation to design assignments and explored in order to finally be materialized again, in a different form.

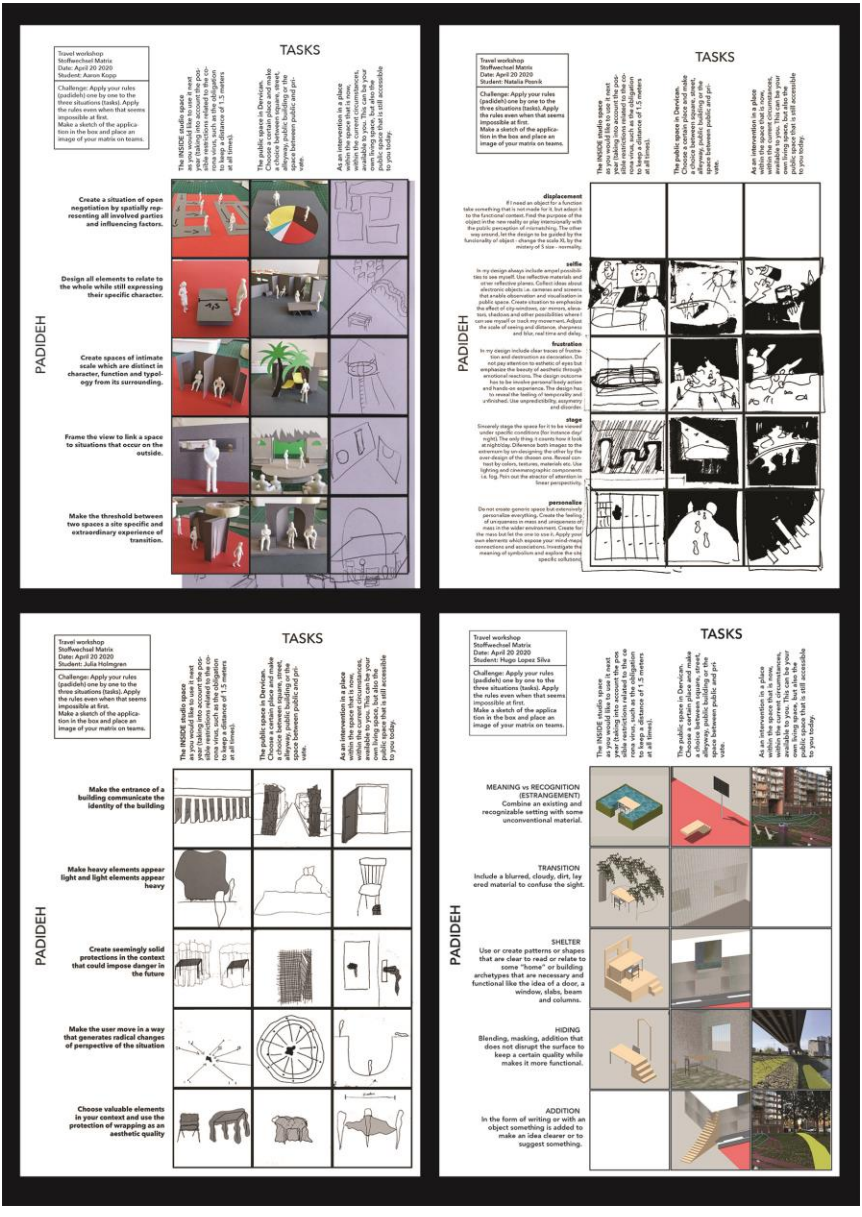

Figure 4. In the final STOFFWECHSEL workshop, the collected PADIDEH are confronted in a matrix with design tasks. In the image shown here four participants of a TRAVEL course in 2019-2020, Aaron Kopp, Natalia Posnik, Julia Holmgren and Hugo Lopez Silva, literally took the image of the matrix as a drawing board to explore the combinations.

The TRAVEL course ends with a matrix exercise in which all participants explore the PADIDEH formulated by them in relation to current design assignments for that context. The first sketches were commented on by the participants and selected, after which participants made models of the most promising results of the matrix exercise. As a final part the participants further developed proposals from other participants, which they found most appealing to the imagination. With this they confronted the original creators with a new layer of possibilities.

Because the TRAVEL program is an exercise, it ends here. The participants have gone from ENDEM to STOFFWECHSEL and will be able to apply the insights they have gained in their own way in their future as a spatial designer.

4. Conclusion

Search images succesfully guide us through the jungle of the built environment. They filter out irrelevant observations so that our brain capacity does not have to succumb to the constant flow of information from our environment. The extraordinarily useful tools that our brain has developed to enable us to deal with complex spatial situations immediately make our image of the world much more superficial and limited. We put it together especially for ourselves. In order to access the information that our brains classify as irrelevant in the built environment and therefore do not allow us to perceive, we need an analogue instruction to see better what we don't perceive automatically.

TRAVEL provides that instruction. Through encounters, explorations and experiments the programme enables future spatial designers, by means of travel, to discover their own preconceptions, to critically examine them, and to get to know their own position from the way they perceive their environment. By collecting and interpreting observations, future designers build their personal catalogue with *search images.* They use this catalogue to be aware of their own perspective on the world around them and act as a designer in that world with an autonomous mind in an applied context.

The prerequisite for being able to compile this catalogue of *search images* is the ability to explore the built environment with an open mind. This open mind does not necessarily appear to be present among future spatial designers. A designed programme of experience is necessary to invite them. By giving the various phases in the process of exploration and analysis of the built environment a name that appeals to the imagination, TRAVEL succeeds to remove the uncertainty in the confrontation with the unknown. Subsequently, the programme also enables them to use their own observations as personal special features in their designs. TRAVEL gives future designers confidence, curiosity and skills in gathering and interpreting information and developing personal design strategies from that.

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The examples in this text come from TRAVEL courses in 2018-2019 and 2019-2020 with 20 participants from 13 countries in Europe Asia and South America at the INSIDE, master interior architecture course of the Royal Acedmy of Art in The Hague. The programme lasted 8 months and included 28 travel days of which 2/3 were taken together and 1/3 individually. In addition, the programme consisted of 3 individual talks and 1 group workshop. The photos in fig. 1-2-3 are from participants Devina Amelia, Samantha Vosse, Shripal Shah, Keyi Xiang, Mary Farwy, Sebastian Koukkides and Ausra Cesnauskyte and were taken in Spain, Germany, the Netherlands, Portugal, India and Greece. The matrix images in fig. 4 are made by Aaron Kopp, Natalia Posnik, Julia Holmgren and Hugo Lopez Silva in a TRAVEL course in 2019-2020. (http://enterinside.nl/magazine-2/)

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Global Proximity: case studies of international and interdisciplinary collaboration between the USA, Italy, Guyana and Japan

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Abstract | Engagement with local communities and diverse traditions of making, support to off-campus academic initiatives, promotion of art and design's relevance within a global context, all must aim to a crucial goal: *the creation of proximity*. This idea of proximity within global learning is a concept that can assume multifaceted identities.
In this paper, we will specifically focus on three layers of cultural interaction in which different parameters contributed to ensuring a rich and mutual learning experience. Tokyo, Rome, and Guyana's rainforest are the contexts in which those experiences happened through the setting of international and collaborative art & design studios. At the foundation of each of those case studies, there is the idea of "reciprocity," between US students, foreign realities, and local partners. Fostering global proximity means aiming for a double beneficial effect: the most immediate, and tangible one, is clearly represented by the work and thinking produced during those workshops. However, the most meaningful, and yet hidden effect is reflected by how students will reframe, and expand their creative practices and inquire in the future. A truthful global engagement that broadens perspectives, decentres experiences and reframes assumptions will allow a new generation of art & design leaders.

KEYWORDS | GLOBAL PROXIMITY, INTERNATIONALIZATION, CULTURAL RECIPROCITY, DESIGN EDUCATION, STUDY ABROAD

1. Introduction

Design is a form of culture, well seeded, interpreted and constantly revamped by the specific society in which is rooted and embedded. Social, historical, political and economic dynamics of each society heavily influence the way design, and design culture is spread, developed, taught, expanded, and even controlled. The current global context, in its complexity, often pushes for cultural homogenization and the multitude of local design identities are developing toward new and unexpected paths. Moreover, the ways of sharing design knowledge, within and outside specific cultural contexts, are unpredictably shifting. “The more tradition is weakened, the more subjects must learn to design their own lives and shift from a prevalence of activities carried out in a traditional way to one in which choices are mainly of design” (Manzini, 2015). The decay of local heritage systems forces designers and design educators to make choices that are no longer informed by strong local design identities, but rather are based on cultural cross pollination.

In this paper, the concept of “proximity” is identified as a critical tool for expanding the idea of design cultures. Gertler (1995) defines proximity as a necessary condition for partners to engage in an exchange relationship of knowledge sharing, transfer and acquisition. Social proximity refers to the “closeness between partners in an interaction” (Buchan et al, 2006), which affirms that the inevitable gap existing between two partners, in our case design cultures, must be physically bridged through unequivocal messages, and proximity plays a crucial role in building trust between collaborators willing to share k Buchan knowledge. In the past decades, cultural proximity has grown in an effort to respond to global issues of cultural imperialism (Schiller, 1969) that are becoming more and more relevant for the contemporary academia, and that west-based higher education institution can’t ignore anymore or exclude from their teaching philosophy and values.

But how about design proximity? Where does it place itself within the act of sharing design knowledge between faraway cultures? The idea of design proximity within global learning is a concept that can assume multifaceted identities. Design proximity is meant to somehow interrupt that expected one-way flows of culture between western countries and the global South. When different design perspectives enter in proximity from different part of the planet, the consequent exchange of knowledge and experience can help the reciprocal design cultures to evolve, acknowledge themselves, foster cultural belonging, reinforce their peculiar identities, and avoid to be kept in stagnant, monolithic structures and cultural silos that might not able to evolve, and sometimes survive.

Design proximity assumes new and deeper nuances when paired with a pedagogy based on experiential learning. According to Kolb, experiential learning is "the process whereby knowledge is created through the transformation of experience. Knowledge results from the combinations of grasping and transforming the experience." However, applying experiential

learning to creative disciplines fronts the fact that "the process of making has a solitary component" (Sutton, 2013) and this isolation can distance people and defeat proximity. But as Sutton underlines, the process of making "is immensely helpful to engage with others in a feedback loop, a conversation about the work in which the maker shows, speaks see, listens, and is listened to, a gathering of makers, each taking turns to be on the spot, showing their work and sharing the ideas behind it. This is the forum for understanding what was made and why. It is the conversation known as critique". In design teaching and learning, the critique is the space where the work is shared, and questions are answered. This space of critique is necessary for true design reciprocity, and the space of critique is only possible through proximity which comes back as a crucial condition for design knowledge exchange. This proximity can be developed by art and design higher education and institutions in multiple ways: by engaging their students and scholars with local communities and diverse traditions of making, by supporting off-campus academic initiatives, by promoting art and design relevance within a global context through design research.

2. Three case studies: the USA with Italy, Guyana, and Japan

This paper is an empirical observation of the pedagogical process through which distant design cultures have used proximity as key for a fruitful exchange. Tokyo, Rome, and Guyana's rainforest are the contexts in which those experiences happened through the setting of international collaborative art & design courses. In the following paragraphs, those experiences will be analyzed and will inform on how proximity can enhance learning and teaching within multicultural pedagogical frameworks. The case studies will specifically focus on three layers of cultural interaction in which various parameters contributed to ensuring a rich and mutual learning experience: methodological, environmental and social proximity. At the foundation of each of those examples, there is the idea of "reciprocity," between US students, foreign realities, and local partners.

2.1 Methodological proximity

In 2016 and 2018, 13 undergraduate senior students from the Industrial Design department of Rhode Island School of Design (RISD) travelled with their professor to Tokyo, to engage in a 3-week intensive bike building workshop. The course was organized in collaboration with faculty and students of Tokyo College of Cycle Design (TDC), Japan's first college focusing on bicycle education and the Japanese tradition of bicycle building. The workshop was aimed at each of the RISD students to practice the traditional Japanese, brazed Chromoly steel, handmade bike building process via an apprenticeship approach to learning and end their program with a full build experimental bike frame. In Tokyo, proximity happened on a methodological level: through the conjunction of the precision -and rigidity of the Japanese traditional local craftsmanship and the looser creative practice of RISD's students. The immediate skill acquired by RISD's students was the ability to design and build a bicycle

custom fit to their body. But the more broadly transferable skill students learn through guided instruction by the Japanese team was the discipline and focus of a precision-oriented process of making. Vice versa, Japanese students and faculty were challenged towards more explorative approaches positively disrupting the local craft canons. The result was an expanded methodological experience in which both designers developed an inherent synergy between contemplative and creative powers, illustrated by the difference between Japanese and western design. Daily self-reflective practices led by both the American and Japanese faculty, such as meditation and the creation of a process journal based on principles of Insightful Ideation, helped all students to increase their receptivity to intuitive and strategic thinking and cultivate a heightened sensitivity to precision, a careful consideration to details, and the simple manifestation of beauty within efficiency.

As Maturana and Varela (1992) assert, often knowledge and cognition have relevant implications, in particular on a sociological and ethical level, and the reality can be built through the action of coexistence. Along with the workshop, a new pedagogy was created. As Maturana and Varela discuss that the world that we know -and so our ways of learning, too – is not pre-given but enacted, and the learner should focus on how our action relates to the world we create.

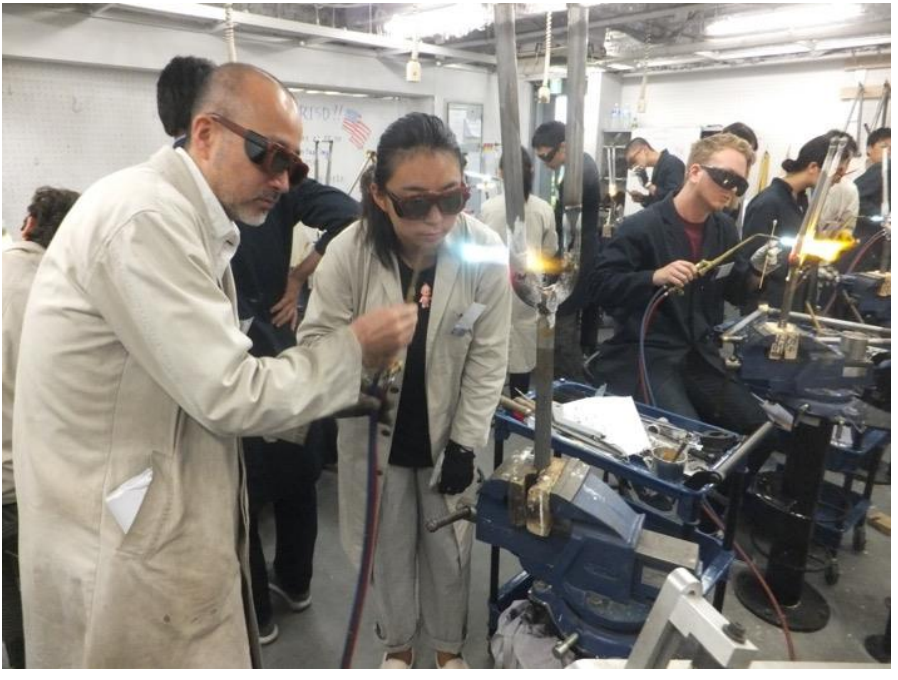

Figure 1. "Tokyo: bicycle design and making" course offered by RISD Global in summer 2016 and again 2018. A RISD student instructed by a TCD faculty. Photo courtesy by Khipra Nichols, RISD faculty teaching the course. Tokyo, summer 2018.

2.2 Social proximity

In 2017 and 2019, a group of 12 students from different art & design departments of Rhode Island School of Design (RISD) traveled with two faculty to Guyana for 4 weeks to explore the artistic, cultural, economic, and scientific role of biodiversity in today's society. Guyana, a biodiverse English speaking Caribbean nation, located along the northeastern coastline of South America functioned as a fertile ground to experience biodiversity and nature and wildlife conservation from multiple perspectives, from natural and social sciences to humanities, design and visual arts.

This course provided RISD students with the opportunity to engage with local designers and scientists, participate in conservation science field research and have rich cross-cultural interaction. Across the entire learning process, RISD students collaborated with local indigenous community members and stakeholders to focus on critical conservation challenges, exploring the problem in depth and collaborating to produce art and design projects aimed to inspire conservation action. Skills and new knowledge gained by the local communities included collecting and analyzing scientific data used to study and monitor wildlife populations; observing, sketching, and photographing wild animals, plants, and landscapes. RISD students were also expected to create an archive of photographs, notes, sketches, sound recordings, and videos that will be used by the Amerindian community for future inspiration.

Proximity in Guyana happened on a social level, when design and biodiversity became a platform for social exchange. In the rainforest, Amerindian communities, natural scientists and art & design students worked together towards the democratization of artistic expression. Drawing, illustration, and new media merged and became a common language used to diffuse biodiversity values within the local communities. A new pedagogy based on social justice, experiential learning and sustainability taught students and local stakeholders on how to improve conservation policies through art and design. The new curriculum can offer inspiration for all higher education institutions interested in new approaches towards biodiversity, wildlife protection, and just human-animal-environment relations in the context of Guyana.



Figure 2. "Guyana, Exploring Art & Science of Biodiversity" course offered in winter 2017 and 2019 by RISD Global. RISD Students and local biologists interacting with local environment. Photo courtesy by Lucy Spelman, RISD faculty teaching the course. Surama, Guyana, January 2019.

2.3 Environmental proximity

In the summer of 2017, as part of the Rhode Island School of Design (RISD) Global department's summer courses offering, students travelled to Rome for a four weeks class. The title of the course was "Sensing the City" and students were invited to observe and listen to the built environment and respond to it with interactive solutions. The class strongly promoted an interdisciplinary approach touching on various disciplines, from product design and physical computing to performances and video narratives.

In Rome, proximity happened on an environmental level. Through a deep connection and interaction with the city landscape and its embedded behavioral patterns, students were challenged to respond with digital technologies and robotics to the legacy and tradition of a millennial city. While forced towards a close physical relation with the space, Rome's hordes of tourists and labyrinthine structure, students learned and lived on their skin the cultural complexity of the Italian capital. In Spite of studying about Rome and its wonders, students "felt" it, "flaneuring" around, self-reflecting on their perceptions and identifying any multisensorial elements belonging to that specific context. The process of environmental proximity contributed to reduce as much as possible the distance between the individuals,

the students, and their environment, Rome, fostering an experiential learning based on empathy and responsiveness to the external surroundings. This proximity granted also a more genuine dialogue between a specific culture and who is willing to experience it in a limited timeframe; without trying to understand everything or fully blending with the local context, students expressed their impressions and feelings through their interactive installations.



Figure 3. "Rome, Sensing the City", course offered in summer 2017 by RISD Global. RISD RISD students creating wearable devices that interact with local environment. Photo courtesy by Paolo Cardini and Diane Derr, RISD and VCUQ faculty teaching the course. Rome, Italy, summer 2017.

3. Conclusions

Fostering global proximity means aiming to a double beneficial effect. The most immediate, and tangible one, is clearly represented by the work and thinking produced during those workshops. However, the most meaningful, and yet hidden effect is reflected by how everyone involved in the proximity experience will reframe, and expand their practice and inquires in the future: a truthful global engagement that broadens perspectives, decenter experiences and reframe assumptions will allow a new generation of art & design leaders.

Through the analysis of the case studies mentioned above, we recognize that the idea of design proximity works well either in contexts of diffuse design, that performed by

everybody (Manzini,2015) as we have observed in the Guyana course, as well as in the context of expert design performed by those who have been trained as designers, as in our Japan course. More than ever, higher education institutions have the responsibility to advocate for cross-cultural learning and educational exchange as a way to foster more responsible and sustainable ideas of the future. Design education within a global context must focus on sharing knowledge, practice, and expertise, with an open-minded perspective, through a multidisciplinary approach, and seeking meaningful reciprocity.

Design proximity can be seen as a pedagogical model to give students guidelines for a more conscious approach to the discipline. Moreover, a correct and careful application of the proximity principles illustrated in this paper can avoid reiterating problematic paradigms of cultural imperialism often present in western academia's study abroad and internationalization practices.

Finally, the idea of proximity is intrinsically connected with principles of coexistence, tolerance and empathy. Fostering proximity means to sustain a more inclusive dialogue and better understanding of the rich and messy kaleidoscope of cultures our planet is made of. Closing with a quote by Arturo Escobar, inviting people to leave in proximity will hopefully lead to that "world where many words fit".

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Acknowledgements: Our best acknowledgements go to the RISD faculty who taught the travel studios (in Japan, Khipra Nichols faculty at RISD Industrial Design. In Guyana, Lucy Spelman and Thomas Doran faculty at RISD Liberal Arts. In Rome Paolo Cardini, faculty at RISD Industrial Design and Diane Derr faculty and associate dean for research at VCU Qatar. A big thank you goes to Gwen Farrelly, Executive director at RISD Global, for her constant support.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Heritage and cultural accessibility: the role of design in the creation of an intercultural dialogue.

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Abstract | This contribution intends to present a reflection in the field of design for the enhancement of cultural heritage in terms of cultural accessibility, and the implications related to the reception and integration of communities and social groups nowadays excluded. Within this context, design skills can be made available as tools to generate mediation processes between these cultural multiplicities, encouraging actions to enhance diversity and activating a dialogue between people and cultures. Design can devise strategies, services and integrated communication systems to facilitate meeting and exchange between the heritage and the multicultural community that lives in a territory.
By mapping certain virtuous design actions (at different scales, such as graphic, product and strategic design), we aim to highlight new possible approaches in the design for the fruition of cultural heritage, according to which the design act presents itself as a "translation" of values and identities for new and existing communities that cohabit in a territory.

KEYWORDS | DESIGN, HERITAGE, ENHANCEMENT, INTERCULTURE, ACCESSIBILITY

1. Introduction

The current process of globalization does not only bring radical changes in economic and political models, but also determines a huge “human movement”, linked to wide-ranging migrations and important social changes.

Faced with these great events, it is necessary to be able to re-establish a sense of confrontation, exchange and encounter both on the political level and in the cultural debate. We are part of an increasingly multicultural society characterized by the interweaving of lives and histories, usually distant from one another, but prone to the same dynamics that shape the territory and the value of its heritage. Therefore, it becomes necessary to create communication channels able to give value to people’s experiences in relation to the territories they inhabit.

Human migration, as a paradigm of a global and multicultural world, is not a new phenomenon, but while diversity is now a structural reality, inclusion is necessarily a mindful action which requires conscious foundations. This social complexity was rarely faced with a reflection and planning that also involved the cultural sector. But why could it be so important to focus also on the cultural sector? The power of culture is the ability to create new and surprising meeting places: spaces which are open; that promote knowledge; that allow people to get to know the “others” and their humanity; that help to create connections and to construct a different image from the common visions often presented by politicians and by the media. It is possible to consider culture as a virtual space that “make visible and give voice to what often remains invisible or silent” (Vlachou, 2017, pg.8). It is necessary for all people to have access to the knowledge and tools that will allow them to reflect upon and understand the situation we are currently facing in order to develop programmes and actions that can address the concerns and needs of the current society, including those of the newcomers. It is not an act of “handout”: some newly arrived groups represent specific cultures that require to be recognised and to be supported in their efforts to adjust and rebuild their lives in the new society and culture – be it through language provision, educational opportunities, skills development, or access to arts and culture.

2. Research context

The skills of design can be made available as a tool to systematise this multiplicity, promoting an innovation respectful of diversity, comparison and encounter between people and cultures.

Within this scenario, cultural heritage obviously plays a fundamental role as vehicle of identity and potential tool for dialogue between cultures.

Cultural heritage, as an expression of belonging, is an interpreter of the lifestyles developed by a community and passed on from generation to generation, including customs, practices,

places, objects, artistic expressions and values. Cultural heritage is often expressed as either intangible or tangible. As part of human activity, cultural heritage produces tangible representations of the value systems, beliefs, traditions and lifestyles. Therefore, cultural heritage is a wide concept, and – according to the definition given by the Italian Decree-Law n° 42/2004 "Codice dei beni culturali e del paesaggio" (Code of cultural heritage and landscape) – it includes artistic, historical, architectural, archaeological, and ethno-anthropological assets, but also book, archival, museum, natural or human-transformed, and environmental landscape assets. Tangible cultural heritage can be distinguished in three main categories: built environment (that includes buildings, townscapes, archaeological remains), natural environment (rural landscapes, coasts and shorelines, agricultural heritage), artefacts (books and documents, objects, pictures). As said, heritage is not only manifested through tangible forms such as artefacts, buildings or landscapes but also through intangible forms. That includes, for instance, cuisine, clothing, forms of shelter, traditional skills and technologies, religious ceremonies, performing arts, storytelling. Today, we consider the tangible heritage inextricably bound up with the intangible heritage.

In Italy, cultural heritage represents a significant asset both in terms of quantity and economic potential: taking as a reference the UNESCO World Heritage List, in Italy there are 55 sites of cultural and naturalistic interest, to which one must add the numerous intangible assets, also recognized and protected. In the report "Io Sono Cultura 2019" (I am culture 2019), published by Symbola and Fondazione Unioncamere, the direct economic value of the Cultural and Creative Production System in Italy was also carefully analysed. In 2018, it was close to 96 billion euros, or 6.1% of GDP, with the employment of 1.55 million workers (Symbola, 2019, pg.42). Moreover, "culture and creativity have a multiplier effect on the rest of the economy: the entire cultural chain produces 265.4 billion euros, 16.9% of the national added value, with tourism as the primary beneficiary of this flywheel effect" (Symbola, 2019, pg.10).

Reading these data, it is clear how a good planning strategy applied to this sector of analysis could have important repercussions also at an economic and social level.

This contribution intends to present a PhD research path in the start-up phase, which aims to identify certain methodologies and intervention tools, typical of the design discipline, for the enhancement of cultural heritage as a medium of identity and intercultural dialogue.

Within this context, design skills can be made available as tools to generate mediation processes between the said cultural multiplicities, encouraging actions to enhance diversity and activating a dialogue between people and cultures. Design can devise strategies, services and integrated communication systems to facilitate encounter and exchange between the cultural heritage and the multicultural community that lives in a territory.

This would allow the promotion of cultural accessibility and participation of all – including the categories at risk of social exclusion – and improve the interaction between indigenous and new citizens – creating synergistic relationships of openness and confrontation. This is

possible through exploration and construction of methods, tools, skills and innovative practices that make the cultural heritage (both existing and "imported") accessible and available, also through the definition of languages and communication channels aimed at new audiences. Cultural accessibility is here understood as a dynamic and methodological process, not a design goal (Bodo, 2009).

An interesting repertoire of orientations and approaches developed by European museums in response to the multicultural society emerges from some studies carried out in recent years, some of which have been made available through online resources to draw upon for the identification of so-called "good practices": such as for example the "Patrimonio e Intercultura" website, promoted by the ISMU Foundation - Initiatives and Studies on Multi-ethnicity; the Research Project MeLa* - European Museums in an age of migrations; the Compendium of cultural policies and trends in Europe, promoted by the Council of Europe in collaboration with ERICarts.

3. The role of design

The discipline of design has multiple and changing facets. One of its strengths is that of being a hybrid field whose design process needs to bring together and deal with many different disciplines.

Furthermore, within a structurally increasingly multicultural society, the pluralism of cultures and ethnic groups determines an increasing variety of audiences. A community that interfaces with different heritages and is made up of numerous actors who constantly shape socio-cultural contexts. In this reality in tumult and mutation, we therefore identify in the intercultural dialogue that process of open and respectful exchange between people and organizations with different cultural backgrounds and world views, designed to promote cultural diversity itself and the development of intercultural skills.

The role of design in facilitating the relationship between people (old and new citizens) and heritage can be structured in many ways. For example, through the creation of pro-active spaces: places that do not have a defined function, but rather remain open to several appropriation practices and uses; or through the development of communication strategies and exhibition practices based on strengthening the involvement of the visitors and their physical and emotional interaction with museum spaces; or also through the elaboration of new strategies for widening and strengthening the collection and museum content and communicating the plurality of stories which the related objects represent and embody; or even by creating new perceptions of heritage, for example by addressing the need to introduce temporary exhibitions in museum spaces or to bring "the museum out of the museum", that is, to create design practices capable of bringing heritage out of places of pure conservation, where possible , thus making it a real shared asset.

4. Case Studies

Through a mapping activity of certain virtuous design actions (at different scale such as from graphic, product and strategic design), we wish to highlight new possible approaches in design for the fruition of cultural heritage, according to which the design act presents itself as a "translator" of values and identities for new and existing communities that cohabit a territory.

With the case studies that will be presented, we attempt to define a number of potential scenarios in order to design new forms of museums, exhibitions and design actions able to respond effectively to the challenges of the present age of cultural complexity and stratification.

Specifically, as said before, we will describe certain interesting examples taken from the world of communication, product, or even strategic design. Sometimes all these design fields can be interconnected and therefore the division will not be so drastic.

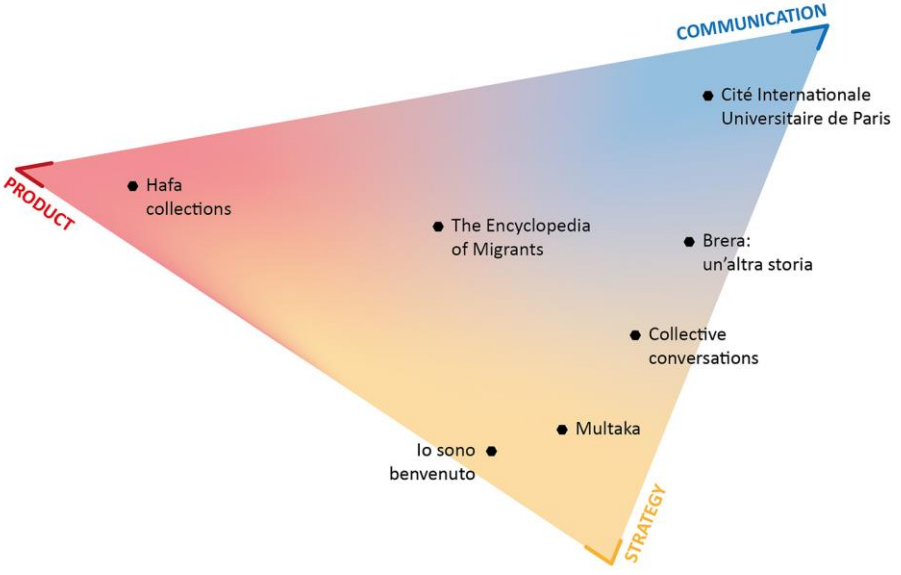

Figure 1. Case study analysis. How the different projects analysed are distributed in relation to the area of product, communication and strategic design (Credits: authors)

A first emblematic approach is represented by the wayfinding system designed by Ruedi Baur for the **Cité Internationale Universitaire** de Paris (2004); this is an example of how the interaction between visitor and signage system may be able to shape the perception of a space, also in terms of inclusion and cultural hospitality through the expressive languages

adopted by Baur with André Baldinger. In this case, in an intercultural scope, one of the main characteristics of the project is the font they designed: the Newut. As a matter of fact, the Newut font has the peculiarity that the height of the letter is the same for lowercase and capitals. This means that some letters can be replaced by non-Latin alphabet – such as Chinese, Greek, Arab, Hebrew, Cyrillic – characters whose shapes are similar to our own alphabet. A random variable percentage technique makes it possible to create texts that can be changed slightly by inserting foreign symbols, yet still be legible. By exploiting what is defined as the paradigm of the "orthographic priming" – according to which when a person reads, the position and shape of the letters are not strictly codified – it is possible to give the text a totally visual dimension that goes beyond its actual contents.

This project was bitterly criticised by those who believe it wrong to annex the symbols of other cultures "decontextualized" and deprived of their real meaning. But the fact remains that this solution creates a dynamic and chameleonic design in which the elements of visual identity, such as signage, seem ready to fit into a rapidly changing world. This wayfinding system not only fulfils its primary function – to indicate all the areas of the university campus – but leaves visual messages that are part of the university's complex, multiform and clearly multicultural identity.

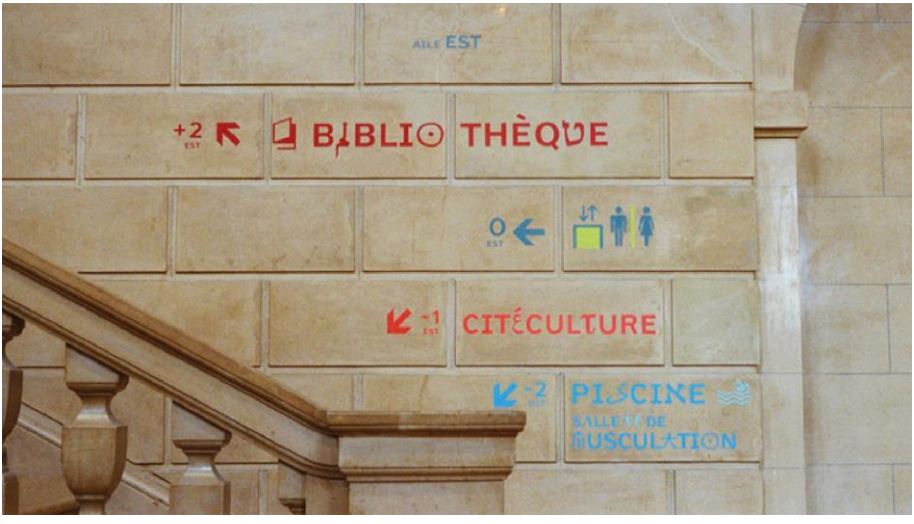

Figure 2. Cité Internationale Universitaire de Paris, 2004. Details of the orientation system in which is visible the application of the Newut font (Courtesy: Ruedi Baur)

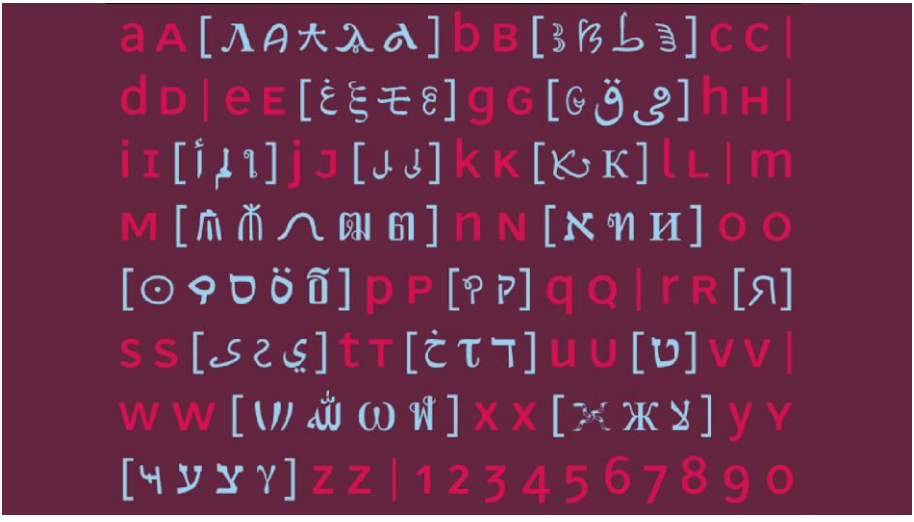

Figure 3. Cité Internationale Universitaire de Paris, 2004. The Newut font and the variations of the single letters (Courtesy: Ruedi Baur)

Moving on to more case studies linked to the world of the product, the **Hafa Collections** project (1998-2001), coordinated by the architect and designer Milli Paglieri, sees the Piedmont craftsmanship, supported by Turin designers and Moroccan craftsmen, reinterpreting the forms of Arab living, recovering typical processing techniques of Marrakesh.

The collections were born in Italy, but changed over time, during their production. The interaction with the artisans, along with their processes and advice, modified and enriched the initial projects. All the collections aim to tell a story, and the different items become pieces of a story that is enriched over time with new elements. In 1998 the "Hafa Collection" was created: 12 Italian and Moroccan designers and artists have been urged to rethink furniture and furnishings in collaboration with skilled Moroccan craftsmen. By proposing apparently lost rituals, ancient materials and traditional processes, the creators have been able to find answers to many needs of contemporary living: the terrace environment, the space around the ceremonial of tea with low seats and tables, the numerous water outlets, and ambient light, typical of the Moroccan house, constituted in the designers' interpretation experiences of enrichment and contamination between the objects and western culture. In 2001 the project was enriched with the "Hafa Hammam Collection": a collection by Milli Paglieri and Paola Navone, who tried to reproduce the atmosphere, the perfumes and the beauty rituals of the hammam (thermal complex similar to a Turkish bath) with a line of body and skin care products and a series of objects and accessories.

The meaning of Hafa is “end-point”: therefore, it describes a boundary to overcome thanks to a new approach to design and product. Evocative objects, full of references to the two cultures and immediately attractive. “Double” objects – simple and complex, spontaneous and cultivated because they are telling a population’s story and material culture, and another population’s design culture.



Figure 4. Hafa Collections project, 1998. Selected pieces of the Hafa Collection (Credits: Lorenzo Prando, Riccardo Rosso, Guido Drocco, Elie Mouyal)

Another interesting project, straddling the world of communication and product design, is the **Encyclopedia of Migrants**, that is an international project (2014-2017) supported by the Erasmus+ programme. It is based on a network of partners with different profiles (organizations, universities, museums, etc.) coming from France, Spain, Portugal and Gibraltar. The project was coordinated by the French organization “L’âge de la Tortue”, which works in the visual arts field. The initiative has had an artistic and experimental dimension designed with the aim to create an encyclopaedia both in printed and digital version, with approximately 400 testimonies directly made and written by migrants. The Encyclopaedia format was chosen in order to disseminate non-scientific knowledge, resulting from life experiences, with all the subjectivity that this involves. In this multi-volume, leather-bound book the care for layout and graphic design is visible and essential to the meaning of the project itself.

The main idea was to gather diverse accounts by migrants, which could be the source of a new knowledge, based upon the intimate and the individual. The most interesting aspect of this project is the idea that these life accounts are themselves interpreted as a heritage, to

be protected, remembered and spread, just as in the interpretation of Diderot and d'Alembert when they gave birth to the first Encyclopaedia.

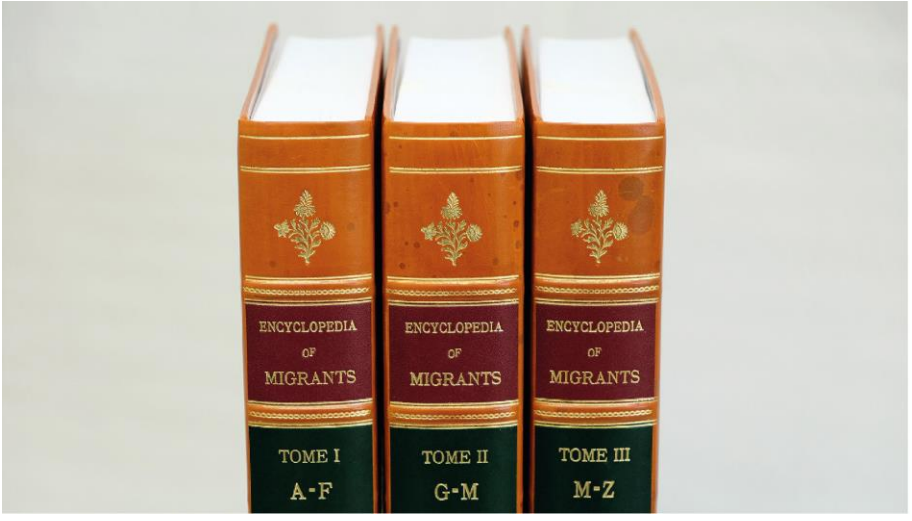

Figure 5. Encyclopedia of Migrants, 2014-2017. The three volumes that compose the encyclopaedia (Source: www.encyclopedie-des-migrants.eu – European cooperation project coordinated by L'âge de la tortue, at the initiative of the artist Paloma Fernández Sobrino)

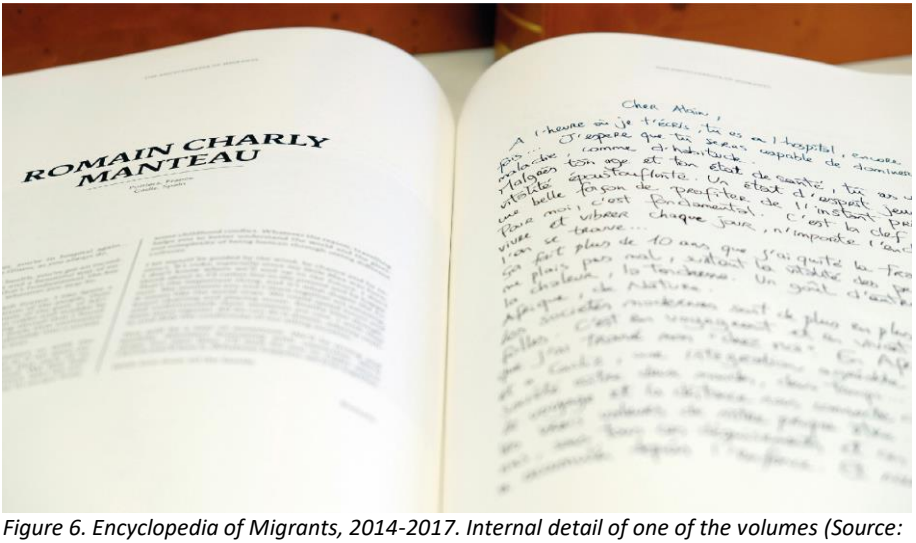

Figure 6. Encyclopedia of Migrants, 2014-2017. Internal detail of one of the volumes (Source: www.encyclopedie-des-migrants.eu – European cooperation project coordinated by L'âge de la tortue, at the initiative of the artist Paloma Fernández Sobrino)

The project **“Brera: un’altra storia. Percorsi interculturali nel museo”** (Brera: another history. Intercultural itineraries at the museum, 2014), held inside the exhibition spaces of the Pinacoteca di Brera (Milan), was an intercultural museum program cleverly narrated through video editing tools, in order to keep historical memory of this virtuous example.

This was an experimental project for the enhancement of the museum’s initiatives in an intercultural scope, and it was promoted by the Ministry for Cultural Heritage and Activities, General Directorate for the Enhancement of Cultural Heritage, and the Pinacoteca di Brera.

With the awareness that the museum is a treasure chest that contains a multiplicity of stories, the idea was born to bring out what works of art can tell each of us in a different and shared perspective. Thanks to the gaze of eight museum mediators from Bosnia, Brazil, Egypt, the Philippines, Italy, Peru, Senegal and Hungary, visitors to the Pinacoteca were guided to interpret the complexity and richness of the museum's works by discovering new meanings and unprecedented interpretations, until finding signs of contamination and reciprocal figurative influence.

The cultural and social relevance of the project lied in the promotion of different levels of accessibility: the development of a new familiarity between the Museum and “new citizens”, the promotion of regular visitors to new points of view on collections and, more in general, the construction of policies for access and participation aimed at an intercultural audience, not “segmented” on the basis of origin and nationality. Another strong point of this project is its narration through a video: this aspect of “historical memory” is often underestimated in the design of this kind of experience, however it turns out to be a fundamental element to give value to the project itself and to be able to take it as an example for the development of future actions, also structured on other realities.



Figure 7. Brera: un'altra storia. Percorsi interculturali nel museo, 2014. Selected moments of the guided tours (Credits: Erminia Sciacchitano)

This project may be linked with **Collective Conversations**: an audience development project of the Manchester Museum, active since 2004, which consists in filming the interactions of people with objects belonging to the collections of the Museum. Indeed, groups of participants use the museum's objects as a starting point for reflections, stories and narrations, often autobiographical; the videos of the "conversations", made by specially trained museum staff, are currently visible on the Manchester Museum YouTube channel (https://www.youtube.com/user/ManchesterMuseum/about) and from the direct links published on the museum website. These Collective Conversations started in 2004, following an acknowledgement that the Manchester Museum's collections had been relatively under-used by the surrounding communities and lacked important information regarding their history and community context. The project has gradually developed into a new operational model for the Museum to deal with issues of interpretation, documentation and display and to carry out a more inclusive work with diverse communities, by increasing physical, intellectual, emotional and sensory access and engagement through: involving a wide range of peoples in intercultural dialogue in a unique process of identification, interpretation and documentation of collections; piloting innovative inreach and outreach, recording and communication techniques; integrating the narratives into collaboratively-developed community exhibitions. In the Museum's own words, "Collective Conversations" is a way to establish the museum as a contact zone, creating a new way of working.



Figure 8. Collective Conversations, 2004. Frames taken from the YouTube videos (Courtesy of Manchester Museum, The University of Manchester)

On a larger scale and with a long-term strategy, we find certain projects developed by the Egyptian Museum of Turin – a reality that makes material culture a field of dialogue and constant promotion – among which **"Io sono benvenuto"** (I am welcome, 2017 - in progress), created with the aim of bringing foreign citizens closer to the museum heritage displayed in the museum and create an environment of inclusion and hospitality. This event is organized annually on the occasion of the "World Refugee Day" and involves an extraordinary opening of the Museum dedicated to the performance of numerous musical activities within the exhibition spaces. Access is free for all visitors, in exchange for a small welcome message to be placed on the Welcome Wall. This is a way for the museum to belong to everyone, as the director Christian Greco pointed out:

> "the museum becomes the place where all citizens, even those who have joined our community for a relatively short time, feel welcomed, learn about the immense heritage kept inside of our walls, and in doing so, they understand themselves and others better. This is the purpose of culture, to build bridges and break down barriers." (Christian Greco, 2017)



Figure 9. Io sono benvenuto, 2018. One of the concerts performed inside the exhibition spaces of the museum during the event (Credits: Museo Egizio, Torino)



Figure 10. Io sono benvenuto, 2018. The Welcome Wall (Credits: Museo Egizio, Torino)

Another strategic project is the **"Multaka: Museum as Meeting Point – Refugees as Guides in Berlin Museums"** (2016 - in progress), in which Syrian and Iraqi refugees were trained as museum guides so that they could provide guided museum tours for Arabic-speaking refugees in their native language. "Multaka" (Arabic for "meeting point") also aims to

facilitate the interchange of diverse cultural and historical experiences. The guided tours involve investigations on historical objects relevant to contemporary debates, in order to establish a connection between the past and the present. In the process, the guides incorporate the visitors into the process of observing and interpreting the objects. In this way, through the mutual dialogue and the consideration of their own history, the visitors become active participants.

Through addressing visitors in clear and simple language aimed at all age groups and using peer-to-peer communication, the "Multaka - Museum as Meeting Point" project attempt to facilitate refugee access to museums, and to help them find social and cultural points of connection, as well as increase their participation in the public sphere.

5. Conclusions

The case studies presented demonstrate the possibility to activate an engaging dialogue between people and cultural heritage, in which everyone is treated equally and everyone has the same opportunity to access culture.

Specifically, these projects were born to pursue different goals, such as the creation of new languages and communication methodologies; the production of new narrative visions and re-readings of the heritage in an intercultural key; or to strengthen the bond between migrants and local heritage.

Design is therefore configured as an essential tool in structuring these strategic actions for integration. As it is evident in most of the case studies, the role of design is expressed in its most concrete form, such as graphic or product design. However, through a necessarily multidisciplinary approach (in which design skills are combined with skills specific to the field of analysis), design expertise may be expressed not only in its most executive form, but can also emerge as an important coordination and systemisation tool of the design process in its overall vision. In certain case studies presented, such as the "Io sono Benvenuto" or the "Multaka" projects, the figure of the designer is not explicitly recognizable within the project path: however, it can be interesting to observe how the inclusion of this professional figure could bring improvements in terms of exploration of communicative languages (different and more plentiful than those currently developed) and in the creation of more effective tools for participation and interaction with the public, capable of being put into use even without questioning the spirit of the project itself, but rather strengthening it through the union of more than one point of view. Designers are professional figures that, in participatory projects, must be aware – on the one hand – of the goals of the institutional collaborators – and on the other hand – of the needs, interests, and expectations of visitors.

By moving away from traditional guided tours to dialogue-based forms of outreach, this intercultural approach can become a pivotal part of the educational methods employed by museums and cultural institutions. Rather than focusing on communicating specific content,

the emphasis is on facilitating a dialogue between visitors with their individual expectations and what is being presented in the museum.

Cooperation projects play an essential role in cultural accessibility, enabling people to participate in the everyday cultural life of a city or community.

In order to concretely explore the possibility that cultural heritage can represent a powerful vehicle for intercultural dialogue, it is necessary to start an articulated process, based upon a "contextual and correlated development of theory and practice, which provides solutions in interinstitutional partnership and continuity over time in the field of heritage education, in an intercultural scope" (Bodo, Cantù, Mascheroni, 2009, pg.14).

A few specific reflections can be made concerning the modality of public involvement. To enable people to participate in the everyday cultural life of a city or community, cooperation projects need to be developed. It can be essential to work with associations and organisations of people with different backgrounds in terms of regional roots, religious beliefs, political orientation and national, cultural and social interests, in order to re-examine and re-explore the current narration of cultural heritage.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Immigrant Cultural Acculturation- A study of Tibetan Clothing in India

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Abstract | The pursuit of preservation of cultural identity and search for an individual identity has led me to study various migrant cultures and their influence on design. The vibrant and spiritual Tibetan Buddhist migrants in India have always fascinated me. This research paper is an attempt to present a new perspective on the complex acculturation process of the Tibetans-in exile in India and its relationship to the clothing and visual culture. The data collected are narratives from the Tibetans that focus on variables like cultural differences, intercultural communication and intercultural relations that influence their experiences as well as a first hand observations of the life in Tibetan settlements in India. I aim to present the potential offered by Tibetan costumes as inspiration to be exploited creatively in a responsible way without offending anyone. This, I do, in a pursuit of positive cross-cultural adaptation between the two cultures.

KEYWORDS: ACCULTURATION, ASSIMILATION, APPROPRIATION, ADAPTATION, INSPIRATION.

1. Introduction

Myriad cultures form the warp and weft of the fabric of this world. The last century saw mass migration of people across geographical boundaries, owing to industrialization, globalization and political turmoil. These people took with them their cultures, costumes, traditions and folklore. The large flux of migrants around the world has sparked scholarly interest in acculturation, assimilation, appropriation, adoption and amalgamation.

The aim of this research paper is to understand the situation of the Tibetans in India, its correlation to Tibetan costume and culture in India (figure 1) and further, explore the potential of exploring elements from Tibetan clothing and visual culture to create something new and place it in a different context to make it contemporary.



Figure 1: A road trip through Ladakh, India showing Buddhist prayer flags against the barren landscape and Tibetan thangka paintings with visuals of deities. (Self-clicked images).

2.1 Cultural Exchange : Acculturation

Acculturation is a process through which a person or group from one culture comes to adopt the practices and values of another culture, while still retaining their own distinct culture. This process is most commonly discussed regarding a minority culture adopting elements of the majority culture, as is typically the case with immigrant groups that are culturally or ethnically distinct from the majority in the place to which they have immigrated. It can happen at both group and individual levels and can occur as a result of in-person contact or contact through art, literature or media. (Cole, 2019)

However, acculturation is a two-way process, so those within the majority culture often adopt elements of minority cultures with which they come into contact (Cole, 2019). This can include the uptake of certain styles of dress and hair, choice of food and music, etc. This research aims to explore this aspect of acculturation by focusing on clothing as an expression of culture.

Acculturation can take different forms and have different outcomes, depending on the strategy adopted by the people or group involved in the exchange of culture which in turn is determined by the extent to which the group believes it is important to maintain their original culture, and their willingness to establish and maintain relationships with the greater community and society whose culture differs from their own (Cole, 2019).

2.2 Cultural Exchange: Appropriation

Cultural exchange can either occur naturally through extended contact, or more quickly through cultural appropriation or cultural imperialism. Cultural appropriation is the adoption of some specific elements of one culture by members of a different cultural group. With the surge in population and growth of the fashion industry, there has been an increasing demand for innovative and individual fashion, from street markets to luxury brands. Exhausted by local influences, designers take inspiration from migrant cultures which they can exploit creatively. But unfortunately, the rich and vibrant Tibetan culture has escaped the fancy of designers in India and worldwide.

2.3 Cultural Exchange: Assimilation

Assimilation is the eventual outcome of the acculturation process, but the process can have other outcomes as well, including rejection, integration, marginalization and transmutation. Whether it is desirable for a given group to assimilate is often disputed by both members of the group and those of the dominant society (Cole, 2019).

Immigrant assimilation is a complex process in which immigrants not only fully integrate themselves into a new country but also lose aspects, perhaps even all of their heritage.

2.4 Cultural Exchange: Amalgamation

Amalgamation refers to a blending of cultures, rather than one group eliminating another (acculturation) or one group mixing itself into another (assimilation).

Today, many social scientists believe that integration, not assimilation, is the ideal model for incorporation of newcomers and minority groups into any given society. A person or group is encouraged to maintain their original culture while they are simultaneously encouraged to adopt necessary elements of the new culture.

3 Tibetans in India

Owing to the Tibetan uprising in 1959, about 1,50,000 Tibetan refugees, followed in the footsteps of His Holiness the Dalai Lama and fled to India. A second wave of Tibetan exodus took place in the 1980s due to increasing political repression. Even today, 3000-4500 Tibetans arrive in India every year in pursuit of cultural education and a peaceful life. All are given refuge in the little Himalayan town of McLeod Ganj- the seat of the Tibetan government-in-exile and home of His Holiness the Dalai Lama. Today, about 1,20,000 Tibetan refugees remain in India, spread across 35 settlements in Dharamsala, Karnataka, Odisha, Darjeeling and Sikkim. Besides, there are Tibetans located in scattered communities in various towns and cities of India (Thogmed, 2016).

Upon their arrival in India, the major priorities of His Holiness the Dalai Lama were the rehabilitation of Tibetan refugees, education of Tibetan children and preservation of Tibetan culture and identity. To realize these objectives, all Tibetan refugees were settled into a cohesive homogenous society and separate schools were set up for their children with their own curriculum. The Department of Religion and Culture was set up under the Central Tibetan Administration to preserve and promote Tibet's spiritual and cultural heritage (Paljor, 2017).

These people brought with them their culture, costume, cuisine and traditions. A walk through any of these settlements leaves you with rich visuals of Tibetan women in their chuba (long dress), pangden (striped apron), Buddhist monks in their chogo (red and yellow robes) and colorful prayer flags fluttering at every corner. The streets are lined with stores selling Tibetan jewelry and souvenirs and dotted with fabric stores and tailoring shops to cater to the needs of the community.

These people upon their arrival struggled to adapt to the dominant Indian culture, due to the vast cultural difference in religion, rituals, language, clothing and food habits. Their willingness to assimilate was low as they were introduced to India as asylum seekers rather than free willed migrants, leading to negative inter-cultural sensitivity and culture shock. This led to emotional expression and responses of hostility, anger, negativity, anxiety, frustration, isolation and regression. Combined with low economic standing, they preferred

to be clustered together, in large part due to a requirement to share resources in order to survive.

The Tibetan people's desire to assimilate is also disrupted by negative intercultural communication, institutional and interpersonal roadblocks that manifest from racism, xenophobia and ethnocentrism.

However, the second and third generation migrants engage more freely in the process of acculturation in order to reduce social friction. The new generation Tibetans develop better socio-cultural skills, move out of their settlement to attend school/ university in various parts of India, get jobs and try to blend in with the existing fabric of the society. But this is difficult as they are culturally and visually distinguishable from those culturally native to India. They are also afraid that of losing aspects or all of their heritage due to immigrant assimilation.

Most young Tibetans are educated in India and according to Mrs. Pema Gyalpo, younger sister of His Holiness the Dalai Lama, even though their cultural point of view is influenced by this environment, they are keen to preserve their identity (Hampton, 1985).



Figure 2: Tibetan prayer flags at Pemayangtse Monastery, Pelling, India, Enchey Monastery, Gangtok, India and Khelechopari Lake, Pelling, India.

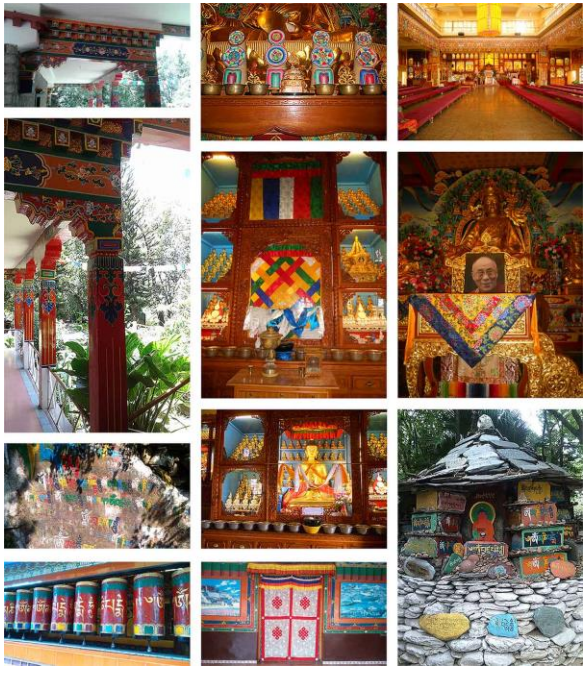

Figure 3: Tibetan religious symbols like prayer wheels, khata, butter sculptures, etc. at Karmapa Monastery, Norbulingka Institute and Tse Chokling Gompa in Mc Leod Ganj, India.

4 Tibetan and Indian Habits

Due to scarcity of water in the Tibetan plateau, Tibetans considered washing and bathing to be an unhealthy, harmful practice. As a result, many Tibetans would often be covered in a layer of greasy yak butter and dirt, their clothes caked in dirt and their hair matted. When they did wash, they rinse their face and hand in yak or goat milk. To protect their skin and beautify themselves, women applied a salve made of boiled curds. Some people went through their entire life without ever taking a bath. This made them the target of negative criticism by Indians who wash and bathe every day and led them to change their lifestyle. Most Tibetans have bright red cheeks- the consequence of high altitude, sun and winds. When they descended to the low altitudes, their skin became pale yellow. This further strengthened their dislike of life in India (Hays, 2008).

The most oft-cited problems for newly migrating Tibetans in India are the language barrier, their dislike of Indian food and the warm climate, which makes Tibetan clothing uncomfortable. Some also fear that their Tibetan culture is being diluted in India. (Thogmed, 2016)

5 Tibetans Emigrating Tibet Today

Within Tibet, Tibetans are losing their culture due to Chinese suppression. Significant cultural gaps exist between recent Tibetan emigrants and India born Tibetans. A prejudice of sorts against newcomers (post 1990s arrivals) exists in the Tibetan settlements (Martini, 2001). On the other hand, the Tibetan diaspora faces a threat of disintegration as many of the new generation exiles have started moving out from the existing Tibetan settlements and their urge to move to the west makes the situation worse. Moreover, Tibetans already settled in the west are in danger of assimilating into the western culture and lifestyle. Therefore, Tibetans fear that Tibetan identity will be wiped out completely and believe the only hope of keeping the culture alive is by those in exile. Hence, there is a resistance to assimilate into the Indian culture (Paljor, 2017).

6 Tourism in Tibetan Settlements in India

The past few years have seen a surge of tourists in these settlements, as a result of more awareness of different cultures, more disposable income and a desire to explore new places. Symbols of visual identification of these cultures- prayer flags, prayer wheels, thangkha paintings, singing bowls and cuisine like momo dumplings and thukpa soup- have made inroads into popular Indian culture.

However, there has been little or no cross-cultural adaptation of clothing cultures between the dominant Indian clothing styles and immigrant Tibetan clothing styles. Tibetan clothing is not available in markets outside their settlement. Even though the Tibetans disperse to the Indian plains for trading of woolen garments, their costume vocabulary remains untouched. Fashion and accessory designers have overlooked the rich inspiration offered by these beautiful wool and brocade clothing and silver and turquoise jewelry.

7 Tibetan Clothing

Tibet, though small in size, bears silent witness to their rich culture in the form of their attire and accessories. Unlike today's world of fashion, Tibetan attire and accessories, carry great significance to the culture and speaks volumes about their history, personal beliefs and the personality of the individuals wearing them. (Tsering, 2019) Tibetan costume showcases the beliefs of the Tibetan people. Old men love to wear clothes painted with suns and moons, which signify good fortune, happiness and longevity. The use of animal leather and the original colour of the wool shows the wearer's respect for nature. The costumes reflect the simple and pious attitude of the Tibetan people. (Meiling, 2018)

While influenced by neighboring cultures from China, India and Nepal, the Himalayan region's remoteness and inaccessibility have preserved distinct local influences and

stimulated the development of its distinct culture. Tibetan clothing is governed by the special environment and climatic conditions they live in, their animal husbandry and farming lifestyle, and lastly, by style and fashion. (Hays, 2008)

Tibetans are usually conservative in their clothes. They wear long-standing and unique Tibetan clothing together with vibrant coral, amber and other precious jewelry plus luxurious and beautiful gold and silver ornaments.

All in all, the clothing and accessories worn by the Tibetans speaks volumes about their love for expressing their culture and history through their art and clothing (Tsering, 2019). The Tibetans love of colour is evident in the way they decorate their clothes and homes (Hays, 2008).

The Tibetan traditional costume was added to the national intangible cultural heritage list in 2008. During the fourth China Tibet Tourism and Cultural Expo, held in Lhasa in 2018, models dressed in contemporary Tibetan clothing presented a potential opportunity to meld tradition with contemporary fashion. Li Mei, President of the Tibet Ethnic Dressing Culture Institute said, “the way people’s life has changed, so traditional costumes should also evolve to meet their new demands.” The institute which was inaugurated in 2018 September, aims to study the long history and culture behind the clothes, collect all existing patterns of Tibetan costume, invite experts to create innovative designs and help local apparel companies to grow (Meiling, 2018). Chemi Dolkar, an art and design teacher at Tibet University in Lhasa said, “People can learn more about Tibetan culture through this apparel. It is the most direct way” (Meiling, 2018).

Tibetan clothing is mainly categorized into the following, (Hays, 2008)

7.1 Women’s Clothing

The costume in adulthood rituals and that for unmarried females are quite different, which is a feature of Tibetan costume system. Usually, ceremonial clothes are much more gorgeous and solemn than ordinary clothes. Ordinary clothes worn by Tibetan females are long robes without sleeves, a silk/ cotton blouse underneath with woolen/ cotton pants and wide belt around the waist. Sometimes they wear jewelry symbolizing auspicious omen. In winter, they wear long overcoat that reaches over the knees or shawl made of yak skin, goat skin or sheep skin. Married women wear colorful striped aprons called pangden and slivers of white conch shells adorned with precious coral, silver and other forms of decoration in their hair. This is done to show the love and respect they have for their husbands. (19) Unmarried girls sometimes wear special costumes, implying the wealth of their family, so that wooers could estimate the dowry they would obtain. The illustrious women headdress, known as the bazhu/baguo, attracts the fancy of tourists.

7.2 Men's Clothing

Men's clothing: Tibetan men's clothing is categorized into Legui (working dress), Zhuigui (formal dress) and Zhagui (warrior dress).

Legui (working dress): It varies with the change of four seasons within the year. In spring and summer, men usually wear waist-level short shirt made of cotton or brocade laced with silk, and a long gown with round neck and wide sleeves. They put the long gown around their waist and tie the two sleeves overlapped on the back of the waist. The drooping parts of the long gown right reach the knees and form a pocket around the waist to carry portable items. The waistline, crotch and trouser legs are all very wide. Clothes in autumn and winter are all made of sheep and cow leather or man-made tufting. Long gowns are made of wool or sheep skin. They wear leather cap and Tibetan shoes with leather bottom and woolen upper.

Zhuigui (formal dress): It is the dress for grand festivals and ceremonies. The materials used in Zhuigui are quite expensive with exquisite workmanship. The upper Zhuigui is divided into inner and outer shirts. The inner shirt is usually made of silk in white, purple or light-yellow colors. It is a kind of Chinese-style jacket with buttons down the front and high collar, and the front of the garment and collar is laced with golden or silver. Some are also made of satin with different patterns and colors. The length of sleeves of the inner shirt reaches the wrist. The material for the outer shirt is brocade with patterns of Yuanshou, Miaolian and other flowers. The style of the outer shirt is same as the inner shirt, but without sleeves. The trousers are made of silk. The accessories for male include primarily Gawu(a silver box)and broadsword.

Zhagui (warrior dress): Fox-fur hat on head, Pulu laced with marten or woolen Chuba, long sword around the waist, the carrying of amulet, rifles and pistols enhance the beauty of masculinity of the handsome warriors.

7.3 Monk's Clothing

Monk clothing is simple and solemn. It is categorized into duiga (waistcoat), xiamute (monk skirt) and kasaya (patch worked wrap). In Tibetan costume culture, monk clothing is the most intact one that experienced the smallest change. When chanting sutras and praying, monks wear a huge piece of aubergine mantle Dagemu outside the Kasaya. Monk clothing varies in texture, colour and style according to the ranks and seniority. Ordinary monks could only wear duiga made of red pulu or wool. The ones wearing duiga and Kasaya made of yellow silk and satins are Living Buddha or eminent monks.

A Khata is a traditional ceremonial scarf given in Tibet. It symbolizes goodwill, auspiciousness and compassion. It is usually made of silk and is generally white in colour to symbolize the pure heart of the giver (Zingka, 2019).

7.4 Accessories

When it comes to accessories, the Tibetan folk pay keen interest in the way they project their rich culture in the form of art, clothing and accessories. Tibetans wear ornaments made of gold and silver as well as jewelry made of amber, agate, jadeite, pearl and ivory. Women wear earrings, necklaces, bracelets and finger rings. Men sometimes carry swords and wear earrings and bracelets. It is common to see women wear head ornaments made of silver, coral, turquoise, semi-precious stones and animal bones (Hays, 2008).

Tibetan crafting techniques like encasing, inlaying and wire drawing are used to decorate both, jewelry and religious objects like prayer wheels, barrels to hold rice for offering, sea snail shaped ritual horns, etc. The designs are derived from religious beliefs and convey special meaning. Most silver jewelry are carved with the six-syllable mantra, Om Mani Padme Hum, which is believed to have the ability to eliminate disease, prolong life and increase wealth. Pendants in the shape of Vajra (a ritual instrument for subduing demons) and amulets in silver or bronze with small boxes inlaid with pearls or precious stones containing clay images of Buddha, Tibetan pills, Buddhist paintings or photo of His Holiness the Dalai Lama are popular. Many handicraft and jewelry pieces' feature dzi beads which are regarded as given by God (Hays, 2008).

Except for the lamas and for certain laymen who shave their heads, Tibetans wear their hair either long or in a braid (Migot, 1955).

8 Beauty Pageant

Miss Tibet beauty pageant have been staged in Dharamsala. The Communist Chinese government objected to this pageant because it was seen as a sign of defiance to Chinese rule and an expression of the Tibetan desire for independence. Buddhist leaders opposed it because it apes western culture and mocks Buddhist philosophy. In December 2007, Miss Tibet withdrew from Miss Tourism beauty pageant in Malaysia, after pressure from China to participate as Ms. Tibet-China. (Hays, 2008)

9 Tibetan Clothing and Culture as Design Inspiration

Designers worldwide have overlooked this vast treasure of inspiration for creating contemporary, innovative designs. But this changed when below crisscrossed arcs of scaffold-hung prayer flags and against a backdrop with visuals of Nepal, Tibet and Bhutan, Etro presented their Fall Winter 2017-18 collection which celebrated the beauty of our sadly often mistreated Earth by acknowledging the power of diversity, transposing its main patterns to fashion. The eclectic and variegated pieces had mandala motifs matched with big colour blocked designs and juxtaposed with psychedelic patterns. The garments exuded a multi-cultural appeal (Leitch, 2017). (Figure 4)

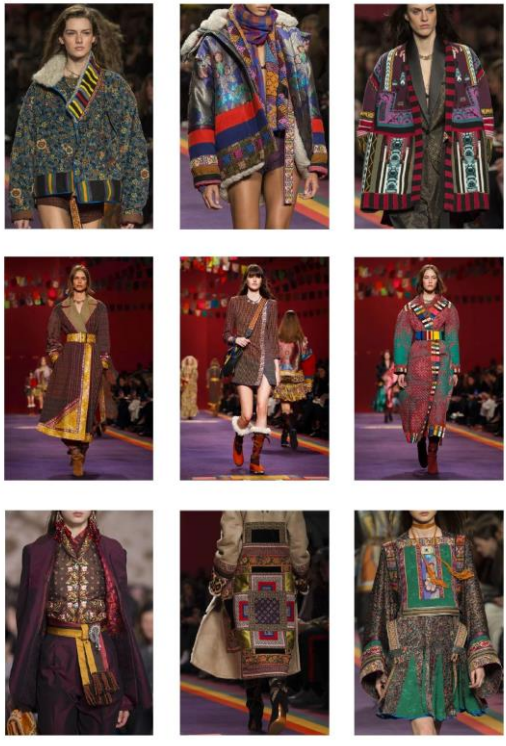

Figure 4: Etro's Fall Winter 2017-18 Collection.

10 Tibetan Clothing and Culture in Movies

Hollywood movies like Seven Years in Tibet (figure 5), Himalaya (figure 6) and Samsara have narratives set in Tibet and took the audience on breath taking and mesmerizing journeys

through the untouched landscape, people and culture of Tibet, giving a glimpse of all the hidden treasures this country and culture has to offer. Bollywood movie Paap (figure8), narrated the story of the struggle of a woman to join a Tibetan Buddhist nunnery. The vibrant colors of the monk's costume and prayer flags against the barren mountain is a visual treat.

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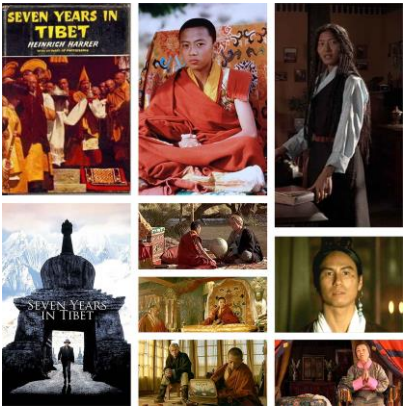

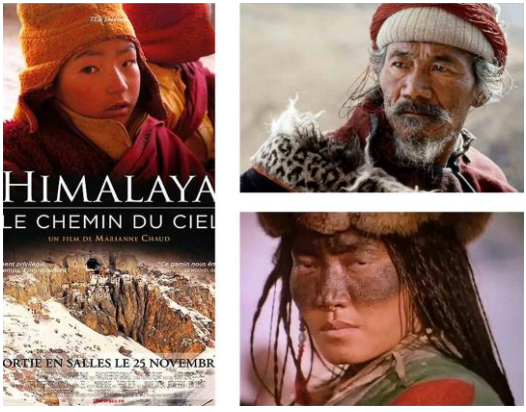

Figure 5: Seven Years in Tibet. *Figure 6: Himalaya*

11 Tibetan Clothing and Culture as Inspiration for my Design Projects

11.1 Project 1

My first project with Tibetan inspiration was as a Fashion Design student in 2005, where I used the visual imagery, elements like bell sleeves, metal buttons, enameled buttons and brocade fabrics to create a womenswear outfit (figure 9). The process strengthened my interest in this unexplored world and led to textual and visual research into the Tibetan culture and their struggles.

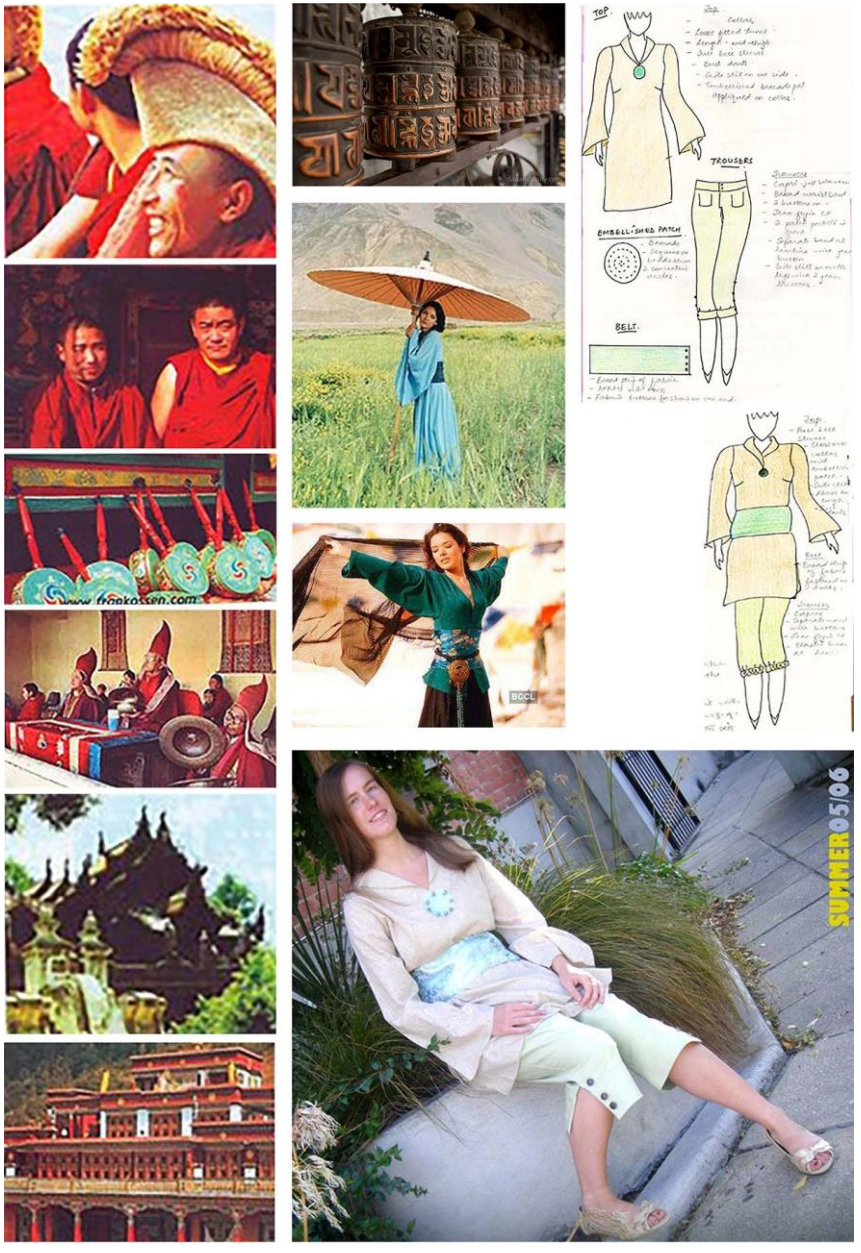

Figure 9: Inspiration pictures, sketch and final garment design. (Self-clicked images)

11.2 Project 2

The next project was my graduation collection titled, 'In Search of Harmony', drawing inspiration from the landscape of Ladakh, the prayer flags and the lotus flower- a symbol of compassion in Tibetan Buddhism. Made in khadi silk, naturally dyed with tea leaves and accessorized with necklaces and belts of hemp strings in colors of the prayer flags. As the tea dyed fabric fades away over time, it reminds one of the prayer flags that fade away in the wind, as the wind carries the prayers in all directions. The lotus petals inspired the vibrant pendants and brooches (figure 10).



Figure 10: My collection, In Search of Harmony. (Self-clicked images).

12 Tibetan Clothing & Culture as Design Inspiration for Design Graduates

I collected visuals from the personal albums of Tibetan friends in India and in November 2019, I conducted a mini project by sharing some visuals of Tibetan clothing among a group of fresh graduates of Fashion Design in India, to be used as inspiration for creating contemporary garment designs. The results are mostly visual, not conceptual and show the potential offered by Tibetan clothing to be translated into contemporary garments with a national and global appeal. Tibetan traditional costume with its bright colors, robe like design and use of striped fabric is given a modern, fashionable look. The graduates have used the striped pangden fabric in unconventional ways and used styles like cross over fronts. Combining elements like cross collar, raglan sleeve and colorful patterns with jeans and nipped in waist silhouettes appeal to style savvy customers while still preserving the key cultural elements (figures 12, 13, 14, 15).



Figure 12: Sketches developed by Sakshi Jain.



Figure 13: Sketches by Smriti Johar.



Figure 14: Sketches by Kajal Patra.

13 Conclusion

Tibetan refugee community in exile in India is considered as one of the most successful refugee communities in the world. They have managed to rebuild their lives in a completely alien environment achieving almost total economic self-reliance. Tibetan Administration in exile has succeeded in rehabilitating the refugees in a cohesive society creating an environment where Tibetans have been able to preserve their age long rich cultural heritage and identity. But the emigration, the uprooting has contributed to disruption of identities, low self-esteem and resistance to assimilation.

This research paper is an attempt to present a new perspective on the complex acculturation process of the Tibetans-in exile in India and its relationship to the clothing and visual culture. Design connects people and culture while bridging cultural gap. I hope to present the potential offered by Tibetan costumes as inspiration to be exploited creatively in a responsible way without offending anyone, with an awareness of crossing cross-cultural boundaries. This, I do, in a pursuit of positive cross-cultural adaptation between the two cultures by blurring the dividing lines.

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About the Author

Anahita Suri is a fashion educator, designer and researcher, with an interest in Identity and cultures through clothing and visual symbols across the globe.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Making in Proximity: Design Policies for collaborative making cultures

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Abstract | The contribution reflects on how the proximity between the actors of originally bottom-up Making Culture and public administrations can stimulate a virtuous urban Culture of Making, that is economically sustainable and well distributed in the city. The article starts with an overview of the "economy of Making" today on a global and European scale, focusing then on the Italian context. In particular, making issues in the regional context was investigated with a general mapping and a series of interviews, highlighting misalignments between the makers' initial objectives and the everyday reality of making. As a potential response, the contribution presents the partial findings of a European project that intervenes at the level of local policies to support the activities of design and distributed manufacturing manufacturing and proposes a format and toolkit that analyzes the ecosystem of makerspaces in a city / region, to then formulate operational proposals to support for innovative activities with an economic and social impact.

KEYWORDS | COLLABORATION, FAB LAB, POLICY, INNOVATION, WORKSHOP

1. Introduction

Building on a project currently underway within the Interreg Europe program, this contribution reflects on possible ways to improve activities in makerspaces, the virtuous places of doing where citizens connect to productive resources and to other citizens with the same. willingness to create tangible projects - be they single objects or products destined for the market.

As extensive literature demonstrates (e. Anderson, 2012 and Gershenfeld, 2005), makerspaces have the potential to bring industrial processes back into urban areas and into the hands of citizens by making them independent of mass production. These spaces offer specialized equipment and skills, so as to allow the performance of innovative activities to a transversal audience, making them able to respond to the problems of their immediate habitat - potentially with design solutions of various usefulness and worldwide diffusion thanks to the online community of makers.

The Research project object of this article starts from the observation of a problem related to the management of makerspaces, which rarely reach the theorized potential. Today, after the "pioneer" phase of the maker movement, self-organization, enthusiasm and in many cases, voluntarism are giving way to the growing need to establish economically sustainable models, drawing the attention of both the scientific community and policy makers. In fact, the project focuses on policies intended both as internal policies necessary to guarantee effective functioning, and as external policies to be implemented at the level of local or regional administrations.

2. Economy of Making

The evolution of Hackerspaces, from places of diffusion of a technological culture to Makerspaces as potential places of widespread production in the territory (Menichinelli, 2016) has brought traditionally informal DIY spaces (in all their forms such as repair cafes, fablabs to name a few formats) at the center of a new debate on the resilient city.

Most of the scientific literature is concordant with recognizing in Making Practices, intended as the combination of digital fabrication technology and open design, a revolutionary potential to define more resilient models of development. Such potential was welcomed as a response to the 2009 financial crisis, and has been theorized in models of diffuse capitalism, such as the *third industrial revolution*, and *social innovation*. Such "revolutionary" models have been progressively substituted by re-mediation practices as in the case of industry 4.0 or redirected toward less open practices as urban living labs.

Significant example is Barcelona (Spain) model of productive city, that in response to youth unemployment exceed 50%, and the traditional idea of the city as a place of consumption "products-in thrash-out" prosed a paradigm shift based digital manufacturing of the "data-in

data-out" type, (Gershenfeld, Gershenfeld, Cutcher – Gershenfeld, 2017). Such a top-down model based on a new infrastructure of Living Labs as places of open innovation boosted by private-public partnerships, is balanced by Fab Lab, hacker spaces and makerspaces as bottom-up workshops of social innovation. Barcelona experiment is represented by Barcelona Laboratori initiative developed by the city council to encourage innovation through public and private collaboration between the arts, science, and technology; (Capdevila, Zarlenga 2015) with specific claim “For the first time, peer to peer relations between City council and citizens is the main principle that is helping to Barcelona Laboratori to involve users […]” (Barcelona Laboratori, 2012)

This model of "self-sufficiency 4.0" promoted in the plan for the Barcelona Smart city in 2014, although it was superseded by subsequent city administrations, had two fundamental effects. On the one hand, the institutional recognition of digital manufacturing laboratories as places of culture is comparable to libraries in terms of representative role and type of use. The distribution of makerspaces (ateneu digital) in each district was, in fact, included ten years later in the current plan of "Barcelona Ciudad Digital" [1], integrating the informal network of self-managed spaces of bottom-up type into a new top-down cultural infrastructure (Capdevila, 2014)

From 2016 to 2018, it is possible to recognize a shift of the European perspective over the maker movement, from the civic role of commitment and engagement to a local economic booster role.

According to the Science for Policy JRC, stable policy and practical solutions to address new work challenges are more marginal in politics than in media coverage (Rosa, Guimarães Pereira, and Ferretti 2018). Regardless of the attention on EU and national levels, maker economies are relevant mainly on the metropolitan, urban and community scale, ranging from open innovation in manufacturing (as in North Italy example) to the innovation as cultural challenge (as in southern Europe cultural heritage applications).

Local and regional Public Administrations (PA) assume the role of fostering Maker economies with specific policies and programs to consolidate existing bottom-up communities or to seed them creating top-down public living labs of entire networks, thus elevating a new infrastructure model demonstrated in Barcelona to a European level. Among these there are notable examples: the French Fab lab network, the Italian MakER network of bottom-up labs in the Emilia Romagna region (Cattabriga, 2020) or the Fab Lab Lazio network of laboratories.

Meanwhile a closer analysis of the most relevant digital platforms highlights the current state of difficulty facing makerspaces. Between 2005 and 2018 there was a trend that saw the global number of fablabs doubling every year and a half (Gershenfeld, Gershenfeld, Cutcher – Gershenfeld, 2017), while 2020 data shows a contraction in the absolute number of laboratories: 1027 active fablabs in 2020 (fablab.io [2], October 2020) compared to 1120 fablabs in 2017 (Fasoli,Tassinari, 2017) and only 991 active Hackerspaces in 2020

(Hackerspaces [3], October 2020) compared to 1331 active Hackerspaces in 2017 (Niaros, Kostakis, Drechsler, 2017). This crisis is confirmed by a report from the Joint Research Center (JRC) which, circumscribing the European context, highlights a reduction in the trend of increasing the number of Hackerspace and fablabs since 2015 (Rosa et al., 2017).

3. Making issues in the regional context

To understand the recent phenomenon of maker spaces' decreasing numbers, we have developed a field investigation on the territory of Lazio region. The study was developed on 2 steps:

- Static snapshot: obtain an overview of the "maker culture" in Lazio, showing number, localization, openness and specialization of fab labs, maker and hacker spaces, through their digital presence and activity.
- Dynamic image: in order to evaluate the evolution of each maker community, in relation with their local environment, human and skills capital and proximity relation ability, we have developed a data triangulation based on institutional documentation, web platform presences and interviews.

3.1 THE MAKER SPHERE SNAPSHOT

The first analysis has found 53 maker labs, in which has been recognized: 21 Public laboratories with open users (Pub-O), 3 Public laboratories with referenced users (Pub-R) and 23 Private laboratories with referenced users (Priv-R).

In order to obtain homogenous data, a survey campaign has been developed involving all entities by means of e-mail and phone call to complete missing data. This first level of investigation recognized six categories of investigation in the context of Making that they explored respectively; the technological system, the range of services, the inclusion or relationship with a specific business network, the level of openness and sharing of projects, the company setting in relation to customers and the type of involvement in the projects developed within of its own structure (Figure 1).

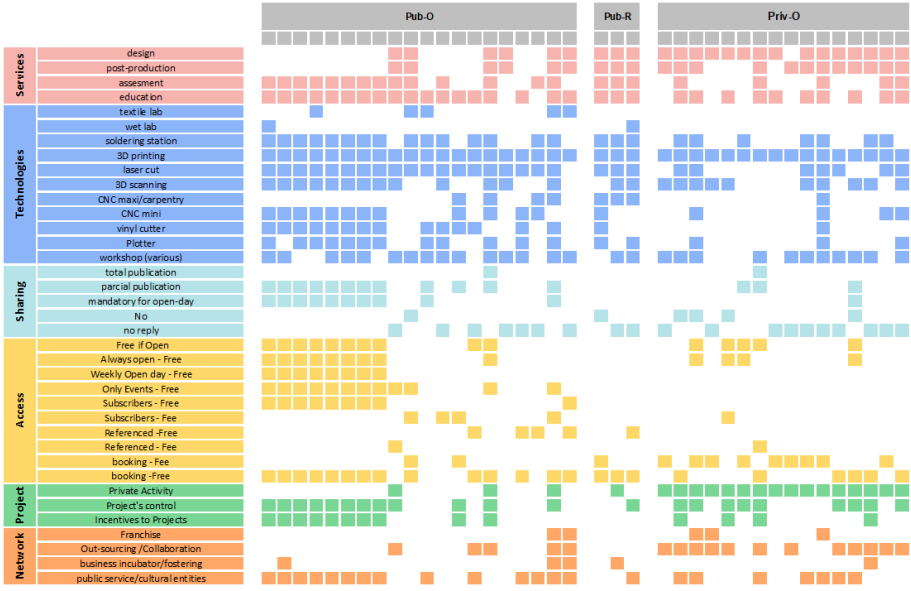

Figure 1. The table above shows the preliminary information retrieved from the internet and the feedback given to the specific questions made via phone calls by the laboratories which have been divided by their assets in three main columns (Pub-O, Pub-R and Priv-O). Coloured dots represent all positive answers given to the questions reported on the left side bar.

3.2 Maker COMMUNITY evolution

In order to evaluate social value and proximity impact of Lazio Maker Community, have been developed a interview campaign, to key person selected for their representativeness and relevant in cover special observation roles over maker realities in their environment.

The preliminary interviews have identified several realities with the most complete profile and in extremely heterogeneous relationship with each other. Among these, initiatives such as *FIRAS*, as an innovative startup that proposes itself as a real factory for the production of totally digitally produced components, and *Gulp 3D*, a small private business in close contact with the local community, have been investigated the most; the manufacturer of 3D printing materials *MakeAShape* as an activity between public and private as it is affiliated with the FabLab of Frosinone, followed by the association *FabLab Lazio*, whose coordinator and technical manager propose themselves as representatives of the entire network Regional FabLab, and the *Fondazione Mondo Digitale initiative*, for their open relationship and verticalized approach on digital manufacturing education. Those interviews were structured according to anthropological investigation methods, characterized by low structured

questions (the discourse flowing fluently through questions), long duration (always more than 45 min) and holistic evaluation (including non-explicit commented context).

Through an informal chat, the topics of which were prepared directly by the interviewees, the questions posed verticalized on the theme of the identity and role of the maker within the city (how it identifies as a service or service provider), and the contact o support of PAs (whether they are supported or not) and of project management when approaching a different clientele.

These interviews highlighted 3 main problematic areas:

- a widespread misalignment between digital and physical identities: community activity and face to face design development do not correspond to Open-Source design and sharing practices. In commercial relationships, many clients of the makers come from other regions, rather than from the same territory, even if initially they have established their lab after a local market study;
- regardless of the physical territory, there is a robust community characterised by strong, interdependent personal and professional relationships that do not correspond to a synergic vision of a new production/distribution model. In fact, digital craft is not considered as a relevant alternative for mass production among the interviewed labs;
- the FabLabs founded by public institutions are shifting their cultural objective: from spreading digital culture and open innovation to economy booster and project incubator, with an increased focus on intellectual property.

In order to pursue a resilient development model, new governance models are therefore necessary, capable of protecting makerspaces as places of physical materialization of the sharing and co-design practices of a consolidated digital community, in which sharing of technological tools and practices are concentrated. Incubators of new generations of urban entrepreneurs are active "for" and "with" the local community in order to collaboratively achieve common goals that are useful for society (Smith, 2016). In this scenario, the Urban Manufacturing (UM) project was born, funded by the Interreg Europe program, proposing a method to connect administrations and the maker world.

4. Urban Manufacturing Policy Toolkit

The goal of the UM project is to make both the shared creative space and the project and the adjoining innovative potential increasingly accessible and usable, overcoming those physical and social barriers that divide those who supply from those who use certain processes (Seravalli, 2014). To do this, it is necessary to consider in an increasingly precise and strategic way the needs of the local community to ensure better involvement and concreteness of the proposed solutions. To be truly effective, social innovation policies must

directly involve society, directly confronting the needs of citizens, so that the design and production activities can be identified as truly open and collaborative (Fleischmann, 2016).

UM through its network of 8 Universities, makerspaces and regional administrations, develops a format capable of guaranteeing public administrations a picture as clear as possible of the potential of the Maker economy, facilitating an entrepreneurship able to face the new ways of living and work in urban settings at the political level.

The format proposed by the UM project is structured in two phases. The first Investigation defines the necessary foundations to facilitate the work of makerspaces through three guided workshops: Policy Clinic, Makerspace's Ecosystem and Makerspace Design. In the second Evaluation phase, the results are reviewed in 5 sessions by another member of the partnership acting as external auditor, drawing on the skills and experience accumulated by the UM network.

Investigation Step 1: Policy Clinic

Framed as a thematic seminar, the first step strategically sets the initiatives that foster innovation, using best practices in their urban centers. The Policy Clinic suggests a limited time window, which allows different stakeholders and the Public Administration in different local contexts to approach under a specific agreed thematic topic. In this first step it is necessary to frame the actions undertaken by other neighboring and non-neighboring makerspaces (at least 3), in order to collect useful information according to pre-established templates. This allows you to work around 3 specific issues such as the type of challenge to be faced, the particularities of the case studies (makerspaces) visited, and the type of action one would like to undertake.

Investigation Step 2: Makerspace's Ecosystem

Therefore, assuming the inclusion of a project that looks to its audience, 4 fundamental phases follow in the development of the ecosystem:

Identification (emerging): by sharing different types of information, we identify the presence of measures to support the skills encountered, the presence of Makers in the local community, useful infrastructures and meeting events.

Growing: given the pre-existing situation, the survey shifts its lens to the Administration and its degree of openness to new technologies, to develop a vision of an "innovative city".

Support (sustaining): the quality of the infrastructure is questioned, what process the value chain follows within the city network and which other makerspaces collaborate on the initiative.

Exceeding: through the enabling technologies and the network thus developed, the new industrial policies of the city are developed together with the ecosystem of makerspaces together with the contribution of policy makers, defining thematic areas for making in the city.

Based on the involvement of the Administrations, the steps assume more or less relevance within the process, at the cost of considerable care in controlling the results and possible repetitions of the process.

Investigation Step 3: Makerspace Design

Through a template, the logistics of the available spaces are organized via a small group of space managers that guides the activity through 3 steps together with a member of the Administration, who will then be able to better understand the nature of the activities carried out and any support needs:

Empathy (empathise): participants identify with randomly generated profiles taking into account: social aspect, starting skills, availability and object of interest.

Definition: needs are defined on the basis of the following parameters: Accessibility, Atmosphere, Collaboration, Community, Creativity, Instrumentation, Experience, Innovation, Space.

Setting (create): based on the needs explored, the participants hypothesize the ideal organization for the space, as well as the most desired equipment.

Evaluation

The last phase involves one or more external figures from the 8 European cities that are partners of the UM project, who are able to contribute with experiences similar to those addressed. This confrontation phase is structured over two days. In the first, divided into two sessions of 2 hours each, external guests analyze the reports formalized during the previous steps and discuss useful information.

The second day the new policies are discussed, examining and refining in terms of feasibility the immediately following steps useful for their implementation. In order to address this work, in this 2-hour session at least three policy proposals are formalized which can then respond to the needs of the average user in a subsequent session, taking into account their perspective on the policy, the points of contact with the latter and the effects that the new policy will have on his experience.

In the last session, the roles of the participants are defined by appointing the coordinator, the approval process, the timing, and the origin of the funds (or budget allocated) that will support the project.

5. Establishment of new awareness of local production potential

As part of the UM project, which is still ongoing, only some of the activities (such as the Policy Clinic) have been completed by each partner at the present time. The Lazio Region,

the only Italian partner of the project, has identified problems regarding the commercialization of ideas: although the basic infrastructure has already been established and funding programs exist, so far, the transfer to the market has not been satisfactory. In response, the Policy Clinic workshop identified some possible strategies, for example facilitating the productive exchange of knowledge through “challenge workshops”; establish ways of sharing data and local issues, as input to work in makerspaces; differentiate innovation initiatives according to the gap between more and less urbanized areas; making the access of small businesses to regional makerspaces more fruitful through planning aid.

This last objective, particularly relevant for our discipline, refers to the ability to create a coherent and meaningful strategic vision (Design Driven Innovation, as described by (Verganti, 2009) for the company, in addition of course to the ability to improve quality of products and services already existing or designed by other figures. To put this policy into practice, a program of "Design Angels" has been established, i.e. young designers and researchers who will help a series of small and micro enterprises to achieve product innovations and process at makerspaces The activity, scheduled for 2020, has been re-planned considering the health emergency.

In addition to a static mapping, the Research intended to initiate continuous monitoring of regional makerspaces, in order to be able to measure the impact of the policies implemented and to be able to establish new programs according to the needs expressed. The collection activity involves different types of spaces including FabLabs, Hackerspaces, Makerspaces, Coworking, but also company workshops, entrepreneurs and small artisans - dedicated to a more referenced audience. To understand who the users are, other questions investigate the degree of openness or audience selection and control, design assistance services, inclination to co-design, and consulting services.

After an initial analysis of the completed questionnaires, a second level of Research of a sociological type, investigated some issues through unstructured interviews. Various initiatives are facing a period of readjustment of their business models, reassigning machinery, however present and potentially active, to different uses and services. The picture obtained of maker entrepreneurship confirms the state of crisis already found in the study of global FabLab and hackerspace communities, highlighting a substantial parallelism between the fate of makerspaces as cultural places and digital manufacturing laboratories as professional spaces.

6. Conclusion

Although the European Urban Manufacturing project (basis of this article) is still in a work in progress state, the activities carried out have already led to some interesting observations. First of all, the extreme heterogeneity of makerspaces is evident both among the members of the partnership and within the examined regional territory; in fact, the workshops held suggest an equally heterogeneous variety of policy interventions. A recurring element is the

need to better connect technical knowledge - virtually spread by the global Makers community - to design knowledge, a field of Design, which will be introduced as a catalyst in a series of small and micro enterprises through a new regional program specifically established.

However, there is a further front inherent in makerspaces as places for the diffusion of technological culture, which overcoming the logic of DIY and referring to co-design models goes beyond mere production. Design education, which in this context becomes transversal and transgenerational, indirectly assumes the role of training more aware citizens, connected both to the creative resources and to the problems of the territory, transforming them from consumers to proactive agents able to propose new solutions.

Notes

[1]https://ajuntament.barcelona.cat/digital/ca/apoderament-digital/educacio-i-capacitacio-digital/ateneus-de-fabricacio

[2]https://www.fablabs.io/

[3]https://wiki.hackerspaces.org/List_of_ALL_Hacker_Spaces, ottobre 2020

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Author contribution statement:

The article is a product of a concerted effort. L.M. and L.D. performed the interviews and analysis, while V.M. supervised the project. All authors contributed to the writing, with responsibilities as follows: Section 1 V.M., Section 2 L.M., Section 3 L.M. and L.D., Section 4 L.D., Section 5 and 6 all authors.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Making practice as narrator of changing social worlds-Textiles and the Scottish Borders, in the 21st century, but based firmly on the past?

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Abstract | The paper explores a variety of actors in the historic and contemporary textiles industry of the Scottish Borders with a specific focus on the region's collective understanding of place. It uses ethnographic, material culture based and archival probes into past and present textiles practices from education to industry and archive. It does soin order to explore current and past manufacturing activity in Scottish Borders textiles not just as economics or object based,and in its respective significance for the life worlds of makers past and present. In a dialogical construction of heritage narratives in the Scottish Borders, the paper provides some evidence on the nexus of heritage and innovation with some insights for other design actors keen tocompete globally from a local position.

KEYWORDS| HERITAGE, INNOVATION, PLACE, LIFE-WORLDS, CRAFT

1. Tradition and geography

1.1. Textiles in the Scottish Borders

Textiles traditions in the Scottish Borders have left indelible footprints on the built environment and the archival collections of the area, and textiles occupy much affectionate space in the region's collective understanding of place. A strong perceived link between the Scottish Borders' geography, community and industry feature prominently in the marketing copy of many local textile businesses and the tourism agencies, with rather nostalgic notions of a manufacturing heritage linked to a unique place, exceptional traditional skills and a niche economy dominating narratives; as is often the case where heritage is used as a selling point, the historic and contemporary realities of textiles in the Borders present as rather complex and at times contested (Varutti, 2015, p1038), however. This paper reports on ethnographic, material culturebased and archival probes into historic and contemporary reality of textiles making in the Scottish Borders. It does so against the backdrop of the region's continued relative success in the cloth related design industry, and in awareness of a strong and at times nostalgic attitude towards its fabric manufacturing heritage. The focus of research is on exploring current and past manufacturing activity in Scottish Borders textiles not just as economics or object based, but in its respective significance for the life worlds of makers past and present.

1.2. Heritage as practices that design a future

This papers' research looks at justone area and discipline but seeks to provideinsightsintoopportunities and challenges for a wider field ofdesigner-makers, micro-entrepreneurs and international corporations. It hopes to contribute to our understanding of how inciting heritage for design or manufacturing may be convincingly linked to a specificarea of praxis,in what one might term a culture of geographical proximity,and how this might position local businesses trying to weather the challenges of a global design industry.

The paper thus considers Heritage as a construct of the past as well as present and imagined futures (Smith, 2006), and it is interested in shining a light on how successful innovation might come to an industry that is known to project its tradition, and that tradition's link to a particular geographical place. In doing so the paper aligns with Rodney Harrison's view that

> "'heritage' has at times very little to do with the past but actually involves practices which are fundamentally concerned with assembling and designing the *future"* (Harrison, 2015, p35);

And by considering voices, documents and projects from across education, industry and the broader archive of historic expression, the research shares in the 'new heritage' paradigm proclaimed by Cornelius Holtorf (2013). The research further believes in Harrison's ontological politics of heritage, where "dialogue of heterogenous human and non-human

actors" becomes a form of "futurology" (2015, p35); a discipline, this paper posits, that most good design will be wise to associate with.

2. Some perspectives on education, place and labour in the Scottish textiles industry

2.1 Textile Education in the Scottish Borders

In its various incarnations, the School of Textiles and Design of Heriot-Watt University has played a central role in the textiles industry of the Scottish Borders over almost a century and a half. It was opened with strong industry backing as the Galashiels Combined Technical School in 1883/9 to serve as "the main important institution in the training of recruits for the industry" (Pattison in Silverman, 1946/ reprinted 2013, p129), but has since grown into a highly regarded provider of design education well beyond local manufacturers' needs. In adaptation to an internationally changing industry the institution added clothing manufacture and knit disciplines to its core around the time of its name change to the Scottish College of Textiles in 1968, majorly expanded its research portfolio into technical textiles, heritage studies and sustainable design since 2000, and more recently broadened its curriculum into interior design as well as digital manufacture and more (HWU 2020).

In the current climate of textile related design and production, barely a two-digit number of graduates find employment locally or start-up lasting businesses in the region, when in 1938 a large proportion of some 8000 thousand Borders weave industry workers had enjoyed day release training at the college at some stage of their working lives (Pattison in Silverman, 1946/ reprinted 2013, p101). Yet, the School of Textiles and Design has steadfastly resisted a physical move away from its semi-rural location, and while local economics and political pressures played a role in this, much of the narrative surrounding the loyalty to the physical location in Galashiels continues to be its position at the heart of the Scottish textile industry. The School's website to this day starts with its history as one of the oldest textiles teaching schools in the world (is it indeed the second oldest, pipped by a few months by Philadelphia, USA) (HWU 2020), when history is not de facto all that central to its current remit, reach or curriculum.

2.2 Perceptions of the Scottish Borders as a heritage place for the Textile Industry

A parallel emphasis on attachment to place can be witnessed in the Scottish Borders Textile industry itself. Its origins lay in a domestic handicraft industry that flourished into a woollen manufacturing centre thanks to a "plentiful supply of soft water" for scouring and finishing wool, and a good supply of labour, fed by tradition and training in the industry. (Pattison in

Silverman, 1946/ reprinted 2013, p 111-2) While by as early as the 1930s only a small percentage of wool fibres were still produced locally, the ample, soft waters of the River Tweed and its tributaries have retained a special status in the manufacture not just of wool, but increasingly the luxury fibre of cashmere (Johnstons, October 2019).

A skilled workforce, however, has more recently become a cause for concern to such a degree that Government action plans have been drawn up (Skills Development Scotland, 2019) and significant private (Textiles Scotland, 2019) and public (Hawick News 2015) resources have been diverted into rural skills development for the textiles industry in a bid to stem the gradual death of skills as the trained workforce ages. Not all initiatives have so far proved successful in terms of attracting long term recruits from the local community, despite significant unemployment in the region (Arnaud, 2019).

The Scottish Borders have in that sense become a place of some concern as business need to balance their attachment to real (water) and imagined (skilled labour) heritage narratives that connect textiles to the Scottish Borders as location.

2.3 Perception of uniqueness in the Scottish Borders Textile Industry

Rare craft skills and the limited edition or luxury production that almost inevitably follows are very key marketing currency in a fashion industry that increasingly bases quality on provenance, but the extent to which actual practices relate to such heritage varies markedly:

In the *Our Story* section of their website, the famous textile company Johnstons of Elgin declare pride in their

> "rich Scottish heritage" as "all stages of our manufacturing processes continue to take place in our own mills, deep in rural Scotland", with "many members of those communities becom[ing] our employees. (…) Providing high-quality jobs in our local areas is part of our mission. Over one hundred of our team members have been with us for over twenty years" (Johnstons, August 2019).

In a post titled 'Modern Heritage' the company interviews Company Chairman (sic) Jenny Urquhart and intern Sophie George who are both female heirs to the family business founded in 1779 (Johnstons, December 2019). Heritage for them first relates to values rather than practices as they mention support for the local community by providing meaningful employment, in an interesting inclusion of Scotland into a scenario more commonly associated with crafts of the Global South (Greru and Kalkreuter, 2017, p156). Modern heritage, the heirs of Johnstons continue in their marketing blog, also means continuing a philosophy of craft paired with innovation that started with novel fibre processing some 200 years ago, more recently introduced whole garment technology and currently considers co-bots to assist humans in the involved quality control process of such luxury products (Johnstons, December 2019).

While the actual effects of such automised production deserve closer scrutiny in a separate study, the company can claim some such adherence to values as it remains the biggest employerand provider of apprenticeships in the Scottish textile industry.

In contrast, Stephen Rendle, whose Lovat Mill in the Scottish Borders town of Hawick produces woven cloth for Chanel and Ralph Lauren, Paul Smith and Dries van Noten, points out that his company

> "keep things deliberately small here – just 220,000 metres of fabric a year with 21 people weaving 24 hours a day – to make sure that we create something really special"(Doig 2017).

In doing so, some production realities more often associated with the industrial revolution persist in the Mill, with less relevance to the expectations of a modern workforce, perhaps: Weaver Andrew Walton gives creed to Harrison's assembly of heritage in dialogue by various actors when we learn that he

> "recently switched from night to day shifts so that he could train a young apprentice in the craft" (Doing 2017), but posits at the same time that "the best thing about coming to work each day is knowing you're doing something to keep this industry alive. It's part of our heritage" (Doing 2017).

The practice of keeping looms running overnight is used as a practical way around the limited production narrative for provenance conscious fashion that is at the same time surprisingly cloth hungry as luxury label have become more accessible: a special cloth is produced in large scale quantities, by just 21 weavers, by maximising limited production facilities working day and night.But at the same time, in order to remedy a projected future lack of trained workforce (Arnaud, 2019) and to satisfy expectations of that modern workforce as well as contemporary training laws, the heritage practice of working day and night is in part suspended here in order to retain industries for the future.

2.4 Textile Labour in the Scottish Borders-life worlds through the artistic lens on archive material

Changing work patterns have been at the heart of the Scottish Borders Textiles industry's success before, and it is of interest how a darker side of the industrialisation of the woollen cloth industry in the Scottish Borders has been explored by artist Joe Magee during a residency in the Heriot-Watt University School of Textile and Design's Textiles archive in Galashiels in 2011. His research into archival artefacts and documents, and with reference to E.P. Thompson's seminal paper on *Time, Work-Discipline and Industrial Capitalism* (1967), was published under the title "SLEEP NOW, AND AWAKE IN HELL" in 2012. His series of silk screen prints and accompanying text traces Jean Pattison's society of 'domestic handicrafts' (in Silverman, 1946/ reprinted 2013, p111) and sheep farms in the Scottish Borders as they are transformed by mighty, water-powered mills and their capitalist demands. It is an

erawhen ‘clock-time’ became an instrument of control as it was “replacing earlier, collective perceptions of time flowing from the shared wisdom of human societies” (Magee in Harley 2012). The artist focuses on Thompson’s link between puritanism and industrial convenience, and a degree of equating looms that never rest with economic success rather than capitalist exploitation, persists in some heritage narratives of Scottish Borders Cloth as seen in the Lovat Mill quotes above. A life-world that is far removed from contemporary ideals continues to play a part in some heritage narratives seeking to ensure the very survival of the industry here.

2.4 Notes on production practices in the Scottish Borders industries from archived newspaper clippings

Concerns about the life-worlds of workers are not a new feature in this heritage industry: At the time of the worldwide recession of the 1930s staff at the Scottish Woollen Technical College in Galashiels pasted clippings from local and national newspapers in large leather-bound volumes that are still kept in Heriot-Watt University’s archives. The meticulous collection demonstrates a keen awareness of the transformational changes that were sweeping an industry just a decade after prosperous times for Tweed fabrics had seen their institution recognised as a National College in 1922. Representative of the many commentators bemoaning a decline in business is one who writes that looms now only work “30-34 hours a week” as “few repeat orders for the spring season of 1935 are being received” (Peeblesshire News, 28.12.1934). Some 10 months earlier, the same newspaper had reported on a public lecture by the College’s own Emeritus-Principal that was headlined ‘Some Plain Speaking’. In the article, Dr Oliver blamed a “Slavish Adherence to Tradition” for a lack of competitiveness, as weavers who used to service two looms when their mill was in the blanket trade now is responsible for just one dobby loom producing fabrics for clothing, with much time lost just watching mechanised production take its course. Aware of the danger of seeming unsympathetic to advancements in workers’ rights, he adds that “’Made in Scotland’ is not an empty commercial formula”, but that time gained through technological advances and change in business must be filled with productive work in tough economic conditions (Peeblesshire News, 05.02.1934). To Oliver, adherence to tradition is not a goal in itself as he lists some very real dangers of valuing it over progress and adaptation; and changes in life-worlds have very real consequences for an industry.

In the same volume of 90 year old news clippings, many interesting perspectives on adherence to design related traditions have also been gathered:

3. Some perspectives on local heritage and global style in the Scottish Borders textiles industry

3.1 Design and the Scottish Borders textiles industries in historic newspaper clippings

The Border Standard newspaper ran a full-page article on the Scottish Woollen Trade in March 1934 to present 'Findings of the Scottish Committee of the Council for Art and Industry' (Border Standard, 24.03.1934). 'Designers [are] urged to visit fashion centres' in the subtitle of a piece that makes a series of recommendations based on a large scale consultation exercise amongst 'representative' local mills, some London Industry and Design Specialists and the Scottish Woollen Technical College; it makes very interesting reading to the present day with regards to how it sees the balance of heritage and innovation in the Scottish Borders industry, and why:

The report seeks to counteract "an unconscious tendency to obsession by the limitations of the machine" and recommends that technical training should always go hand in hand with design and colour education. Sir Steven Bisland confirms in his report that a strong link to place and proximity exists in the industry of the 1930, as 130 small scale firms make up the Scottish Woollen Industry, often run "on a craft basis, in which successive generations of the same family had been connected, both as masters and men". On the question of design, the report noted an advantage in location "where the designer was in contact with the beauties of Nature, and could get his inspiration from them", but recognised that the depression-affected export trade now was in need of new ideas.

The same report was reprinted in several local and national newspapers throughout 1934, as publishers pressed upon its textiles 'born and bred' readership that a slowness to produce 'novelties' was to be counteracted by

> "designers (…) mov[ing] about more at fashionable resorts, at restaurants, and race courses", as "the industry was failing to benefit by the opportunities which existed for the development of the human side of the industry" (Peeblesshire News, 24.09.1934).

In an address to the annual dinner of the Edinburgh Borderers' Union in February 1935, another local industry insider,Thow Munro, put this apparent reluctance to look beyond the industry's heritage less delicately when he quipped:

> "Had the Border manufacturers been progressive and up to date? Within the confines of their own knowledge they had. From the point of view of producing beautiful goods suitable for every market in the world at an economic rate nobody had been better than they. But from the long view, and the realisation of present day conditions, they had not done well. They had failed to observe the great change that had taken place in the very clothing trade in this country and in every other country" (Edinburgh Evening Dispatch, 9.02.1935).

Munro here portrays the community of textile manufacturers in the Scottish Borders as rather insular and blinkered as they mistake their proud and tested traditions for a heritage that is fit in terms of Harrison's 'futurology'.

While these historic critiques refer to the dangers that ready-made clothing, shifting centres of fashion and increasing protectionism posed to cloth manufacturers of the1930s, if they stayed too closely wedded to their traditions of make and location, such perils are never far away from 21st century businesses either as they charter their course through heritage and innovation:

3.2 Design collaborations in some Scottish textiles industries of the early 21st century, seen through the Scottish Book

The last part of this paper will briefly consider some contemporary design collaborations with local textiles industry, showcased in the aforementioned *The Scottish Book*. A limited edition of 1000 of this publication was printed in 2012 to

> "celebrate the expert, the industry and the project, to showcase the work of inter-disciplinary teams, individuals and the cross pollination of knowledge and expertise from across education and industry in Scotland." (Harley 2012)

Even before opening the book one is struck by its heritage exterior, as, in the words of a photographer who contributed to it,

> "each copy is individually hand-aged with carbon paper, creating the idea of a lost record, rediscovered in some forgotten underground store." (Brown n.d.)

The publication was supported by Heriot-Watt University, South of Scotland Business Solutions, The Scottish Funding Council and the European Regional Development Fund as its foreword declares that

> "the demand and opportunity to maintain a global position of a traditionally based industry underpins the contemporary psyche of the Scottish Borders" (Harley, 2012).

The book reports on a large number of projects that met with mixed fortunes as far as longevity is concerned, and amongst the casualties of the requirement to show economic viability once public funding ends one ironically finds the STA(r) Multimedia Archive. It was conceived to provide access to the heritage of Scottish Textiles and help promotion of innovation that sought to provide knowledge-rich archives of textile design artefacts to provide a cohesive, usable and flexible access point to heritage and innovation (Harley 2012). The STA(r) archive was a project of the now dormant Scottish Academy of Fashion (HWU, 2011), and how the book reported on the same Academy's collaboration with Scottish stalwart Mackintosh will conclude the exploration of changing making practices in the Scottish textiles industry:
Students from Edinburgh College of Art and Heriot-Watt University were asked to 'collaboratively research' the 'Scottish heritage brand Mackintosh to realise new approaches

to design'. 'Expertise and skills' of the brand were tracked in the company archive and soon highlighted its 'industry standard hand-made manufacturing process', before students produced toiles that sought to innovate silhouette while the manufacturing remained traditionaland executed by the traditionally trained staff at the factory. The innovation here then consists of a separation of heritage rich industry production know how from the outward looking fashion sense of a younger generation of designers. These designers might be seen as unencumbered by too practical a knowledge of the Mackintosh tradition, and hence less vulnerable to the 'unconscious tendency to obsession by the limitations of the machine' that Sir Steven Bisland and the Scottish Committee of the Council for Art and Industry recommended some 80 years prior, as reported in the local press, as above (Border Standard, 24.03.1934). The Mackintosh brand has established itself in its own words as a

> "luxury name that combines updated technology with traditional techniques, heritage and craftsmanship, and seeks designer collaborations that highlight the collaborating designer's focus on "authenticity" and "unique savoir-faire" (Mackintosh 2018).

In marketing a more recent collection as Jil Sander+ crafted by Mackintosh, this casual separation of innovative design inspiration and heritage craft of making is even moreexplicit (Mackintosh 2020).

4. Heritage as curator of an industry's future

This paper has proposed some perspectives on the historic and contemporary reality of textiles making in the Scottish Borders through ethnographic, material culture based and archival case studies. In doing so it was able to link the region's continued relative success in the cloth related design industry to an understanding of heritage that is constructed from the past as well as present and imagined futures (Smith, 2006).
Ithighlighted instances where such heritage had less to do with an actualpast based on location or traditionof skills, but instead involved practices which were fundamentally concerned with assembling and designing a viable *future* (Harrison, 2015, p35). The wide scope of the case studies from across education, industry and archive allowed the research to align with Holtorf's 'new heritage' paradigm (2013) and tested Harrison's ontological politics of heritage for current textile businesses and their employees in the Scottish Borders, where dialogue between employees and technology, human and non-human actors becomes a form of "futurology" (2015, p35).
It is this nexus of heritage and innovation that most good design will be keen to explore further and associate itself with in a bid to compete globally from a local position.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Multiple narratives for multiple visions: engaging citizens in building future scenarios for their city through participatory design and storytelling

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Abstract | The paper presents a context-based and cross-disciplinary research, reflecting on how a participatory design (PD)-driven approach, embedded with narrative structures, could stimulate citizens' ability to envision plural understandings of their own city. The project is focused on the city of Ivrea, recently named for its industrial past in the UNESCO World Heritage List as "Ivrea, industrial city of the 20th century", influenced mainly by Olivetti's transformative action. The applied methodology demonstrates how the hybridization of PD processes with storytelling can trigger civic engagement and resilience within local communities, aimed at overcoming latent conflicts related to their past through PD-led activities. The co-creation of a common narrative dimension, shifting between real and fictional worlds and intended as an exploratory process, could engage citizens in envisioning future scenarios for their city, triggering their capability of analyzing and reframing past(s) and present(s) towards possible futures.

KEYWORDS | PARTICIPATORY DESIGN, STORYTELLING, COUNTER-NARRATIVE, PERFORMING ARTS

1. Introduction

The approach and findings presented in this paper are based on the research project "Tango-Down Athena – Theatre and Design as hacking means of the contemporary urban myth" (TDA), run by the Polimi DESIS Lab of the Politecnico di Milano University, in collaboration with CRAFT - Centro Ricerca Arte e Formazione Teatro, a theatre research and training centre, and endorsed by Cité du design research centre (France), Tongji University (China), and supported by "Compagnia di San Paolo" foundation. TDA is a cross-disciplinary project that explores, by means of storytelling, the idea of "myth" in relation to urban spaces. Through design-led envisioning processes, the project aims to explore the influence a myth can have on the transformation of contemporary cities, its imaginary and its identities, through the development of a counter-narrative (Fuad-Luke, 2013) that is able to activate new meanings for the local communities and to offer a balanced articulation of their own past(s) towards future scenarios. The paper presents the first two phases1 of the project, focusing on how the use of narrative methods triggered awareness and broadened envisioning capabilities within a wider and ongoing process of transformation.

1.1 Contextual condition

The TDA area of intervention is Ivrea, a city in north-west Italy. The context was selected in 2018 following the registration of Ivrea in the UNESCO World Heritage List as "Industrial city of the 20th century" for its industrial past, and influenced mainly by Olivetti's transformative action. Thanks to the economic, social and cultural policy of Camillo and Adriano Olivetti in the middle of the last century, the city underwent a successful development model. The industrial area of Ivrea, developed between 1930 and 1960 according to Adriano Olivetti's vision, proposed an alternative model to the 20th-century national and international experimentations of urban industrial areas, of the *company town* and industrial systems developed in large urban agglomerations. The area includes buildings for production, offices and study centres, but also for social purposes such as residential units, public services, and summer colonies, as well as centres for training and various cultural, sporting and recreational activities. Therefore, the company's development affected the whole urban pattern, becoming a laboratory for spatial, cultural and social projects and ideas. For more than thirty years, Adriano Olivetti tried to apply and redirect the urban conceptions that were being explored in the national and international debate and entrusted to the most significant Italian architects of that period. His death in 1960 marked a break in the city's

[1] The project is divided into four phases: 1) "Scientific assets" (from January to April 2019), a research phase on the definition of the relationship between urban myth and the urban model, analysed through scientific literature, some emblematic cases, and with a focus on the city of Ivrea; 2) "Co-design activities, community activation, urban installations" (from April to October 2019), a co-creation phase, involving local informal groups and associations; 3) "Theatre production" (from October 2019 to June 2020), the writing phase of a plot linked to the urban activation resources; involvement of design students for the spatial definition and realisation of the set; production and replicability, as well as in other contexts; 4) "Dissemination and communication" (from July 2019 to June 2020).

history, ending a period of commitment of the factory towards its own territory. The change in the factory's leadership led to a consequent change in its vision, which led in its turn to the slow but inevitable interruption of the former activities and the final fragmentation of its architectural heritage.

1.2 First mapping

The overall legacy of the city and its golden age was considered to be an f oundation on which to build up a project concerning the notion of the urban myth and its potential for cities today. During the first phase of the project, the research team had to approach a relatively unknown context by getting in touch with places and communities and collecting data about Ivrea's past and present using desk and ethnographic research. While framing the context with representatives of local organisations and informal groups of citizens[2], a far more diversified background emerged than expected, one that was filled with conflicting opinions and visions.

This phase highlighted the early interpretation of the context as the sum of *overlapping geographies*, linked to the city's different souls and identities and connected to the city's heritage and memories. The concept of *overlapping geographies*, introduced by the authors, has been conceptually devised to mean elements of territorial diversity that have changed over time. These different portions of the city are mainly the results of a series of cultural and historical changes which occurred according to the city's development over the centuries. The configuration of the territory and the presence of the Dora Baltea river generated a geographical distinction between the northern part of the city - the old town - and the southern - the modern town. The first is characterised by a medieval urban pattern, which once a year becomes the scene of the nationally recognised carnival. The southern part developed during the twentieth century thanks to the presence of industries (primarily Olivetti and, later, Montefibre[3]). The main purpose of the UNESCO candidacy was to stimulate a relaunch of this area and, therefore, of the entire city, towards a functional regeneration that would boost Ivrea as an innovative technological and cultural pivotal point, as it used to be in the last century. However, the concept of *overlapping geographies* not only refers to the physical meaning of *geography*, but to a broader one, including social, cultural and human identities. In trying to allow local citizens to gain a deeper understanding of their identities and visions, a general sense of immobility and hopelessness emerged that connected the majority of people in the Ivrea community. This is mainly due to the myth of the Olivetti family as creator of a golden age that has now been lost, and has devided the citizens' perceptions of this heritage. If, on the one hand, this legacy is constantly re-proposed by communities as a unique and irreplaceable period in history, on the other hand,

[2] Relationships were established by first getting in touch with the experts who have been in charge of writing the candidacy report. This first step then led the authors to get in touch with people from cultural and administrative institutions in Ivrea.
[3] Montedison Fibre, funded in 1972 and, for years, one of the largest Italian companies for the chemical sector.

it is somehow uncomfortable for those who are trying to move towards a future of possibilities that are disconnected from Olivetti's past. Throughout the years these different visions have generated latent conflicts and difficulties in mutual recognition, which is of course crucial for defining a common direction for the future of the city.

This extremely rich set of differences stimulated critical thinking about how historical, cultural and social changes, if not metabolised, can produce frictions within communities. How is it possible to boost communities' resilience towards proactive actions? How can PD approaches, tools and methods help to stimulate people's capacity to act?

2. Objectives

The cross-disciplinary process of the project required the understanding of participatory activities to be opened up in terms of key methodological approach, thus researching how a PD co-creative process can trigger awareness within local communities. For the design discipline, this means to be able to cross borders in order to design systems, strategies, and experiences rather than objects, visuals, or spaces (Muratovski, 2015).

The project investigated diverse levels of engagement to tackle the contextual complexity, made up of controversies and opposed perspectives, conducting within this given situated context a social conversation towards a non-solutionism(-based) (Manzini, 2016) process. This required an in-depth understanding of the role of PD-based activities, not for creating an alternative future but for envisioning one while shaping a better present. In fact, PD and Design for Social Innovation (DSI) practices are not only necessarily meant to empower communities towards efficient, durable, scalable and replicable solutions, but also towards questioning/re-framing the public realm, possibly triggering the participation of citizens and other local stakeholders such as associations, administrators and policy-makers in the democratic debate concerning the public realm. This could only be done by not pursuing all-encompassing and definite solutions but by diving into the contextual complexity, which allowed the difficulty to create a common voice to emerge, when there is no sense of a shared community or a mutual knowledge to be recognised and undertaken. This voice is needed in order to support the proliferation of *"*a more favorable environment for the birth and development of a multiplicity of other projects, even though they do not contribute directly and immediately to the solution of a specific problem*"*(Manzini, 2016, p. 57). In this sense, design activities, including visions, *"*can increase the probability that new solutions will emerge and can help them develop in greater synergy*"* (Manzini, 2016, p. 57).

The whole process aimed at nurturing the ability of citizens to envision and gain awareness of what is possible in terms of inner human resources. The essential matter of the design-led part of project was how to connect people's *"*active [and] agential role in changing the process of construction of social realities*"* (Kemmis & McTaggart, 2005, p. 573) towards a series of activities specifically designed for the reactivation of local communities.

3. Methodology

The Polimi DESIS Lab adopts a strategic and systemic approach to design and investigates the way design can support and trigger social innovation, combining creativity and visioning with the capability of engaging in co-design processes with a community-centred-design approach, particularly focused on the development of prototyping artefacts for the service and spatial design in urban contexts and towards the development of solutions for social innovation. Design artefacts, in the larger sense and beyond tangibility, are complex systems affected by – and affecting – a relational network of processes, interactions, bodies, things and ideas constantly in flux, where lives, societies and history unfold, in a world which is constantly becoming (Fox & Alldred, 2015).

TDA is a project that lays its foundations in direct contact with the communities of citizens and their context of belonging. By means of the practices borrowed from PD, an attempt was made to articulate a participatory path to highlight the potential citizens have as an active community able to act for their own well-being. Although the first phase of exploration of the territory brought to the surface the presence of a enthusiastic and diversified structure of identities, the inability to converge this pluralism into something truly proactive was also encountered. The research team aimed to trigger *agonism* (Arendt, 2013; Mouffe, 2000, 2007) within public spaces, that is the capacity of human plurality to establish a public sphere fuelled by a political and democratic dialogue to be then translated into concrete actions. In trying to articulate this proactive debate, it was decided to use storytelling and narratives as a tool with a transformative power to generate processes of change (Tassinari et al., 2017), and to funnel a shared vision of a hypothetical fictional world that overlaps the real one. This means reinterpreting what is familiar (real) through a process of abstraction (through the lenses of the fictional) to, then, return the uncovered meanings and understandings of their own resources into a new familiarity (Kemmis & McTaggart, 2005).

To stimulate an active debate on extremely sensitive issues for the community of citizens is a process that nevertheless requires a significant level of abstraction from the context. Letting people discuss their unfamiliarity with divergent issues is an extremely delicate practice. Starting from the structuring of a process of increasing awareness – which is typical of PD approaches – the project explored a correlation between places and temporality within PD, hence the added component of narratology. According to Jung (2014), narrative, as one of the ancient forms of communication, has its own way of delivering concepts and information, using archetypes as developed elements of the collective unconscious. The effectiveness of the use of stories as a practice for understanding, by means of PD, dormant needs and future scenarios, is to be found in its being a mental framework for the cognitive organisation of human experience (Bruner, 1991; Plowman, 1996). Furthermore, using storytelling and narratives as a tool for exploring and encoding the context has the exceptional ability to trigger a process of abstraction: people > characters / actions > events / places > scenes. This process of abstraction emerged as a challenging area of reflection for

the PD field due to its ability to bring democracy, agonism and politics to an enhanced and fictionalised surface where communities can feel comfortable in discussing present issues and future visions, and avoiding the fact of feeling too attached to reality. Transferring physical places and personalities to a fictional level of action is a way to support, by means of stories, the participants' imaginative ability towards a broader design capacity, since "stories offer examples on how we can face and manage conflicts in everyday life and generate processes of change" (Tassinari et al., 2017: S3491). This transfer of elements between real and fictional worlds has also emerged as a useful strategy in other disciplinary fields. An example is what is defined as narrative embedding (Lane & Maxfield, 2005), largely employed in the marketing field, where the use of narrative and its peculiarities is applied in place of the collection of data and analysis in orienting individual actors towards the future.

The development of a parallel and fictional narrative world leads the researcher to perform the role of the narrator, carrying out a work of construction of the imaginary in which s/he tries to direct a process of awareness (through the production of knowledge) by a community of people. In order to trace all these elements, the research team provided participatory tools borrowed from game, service, and spatial design as well as narratology, philosophy and sociology disciplines. The whole activity was conceived mainly as a co-generated game and used devices such as cards and props to stimulate the envisioning capacity of the participants. All the elements were specifically designed to help the co-narration develop among the citizens, and provided a solid basis to trace all the insights and information useful for the research purposes.

4. Project

Starting with the objective and methodologies described above, the activity specifically designed for Phase 2 of the project focused mainly on:

- the creation of a community map of the city based on objective deductions and subjective memories/experiences related to local communities;
- the use of storytelling as a design discipline's co-generation tool to funnel visions (in terms of stories) set in a hypothetical fictional world that can be later brought back to the real one to enhance citizens' resilience;
- the definition of a toolbox made of characters, places, events and narrations as a basis from which to develop an immersive performative act (Phase 3 of the project).

The activity was conducted with four groups of citizens from Ivrea and the surrounding areas, as well as members of associations and informal groups, and experts in the cultural sector. The groups were also heterogeneous through the presence of participants of different ages, thus allowing for a more diversified interpretation of the territorial context. The activities were carried out in the spaces of the railway station managed by the Zac! Zone

Attive di Cittadinanza, a well-established cooperative that collaborates with citizens through social and economic approaches together with conviviality and solidarity.

The co-design (or better *co-narration*) activity was set in order to guide participants between real and fictional worlds, through the deconstruction of narrative in its fundamental elements: characters, actions, places. The co-creation session of narration with local citizens was divided into two distinct activities carried out in sequence:

- Activity 1 "Building a common narrative world": creation of a shared – both physical and conceptual – vision of Ivrea starting from the narration of subjective and objective memories of the participants.
- Activity 2: "What if... - Living the fictional world": development of a possible future scenario within a fictional context, where participants are abstracted into another level in terms of temporal and spatial dimensions through storytelling elements. The process of abstraction is triggered by the introduction of a disequilibrium element (hacking) that generates an imbalance. The story, created by the interviewees, uses the narrative world of Activity 1.

The two activities led to the creation of a story-making toolbox made up of characters, places, events and narrations. The toolbox, delivered to the partners of the TDA project, will be used as a starting element for writing the interactive performance (currently under development).

4.1 Activity 1 - "Building a common narrative world"

The first part of the activity was designed to stimulate a greater awareness of place through different interpretative levels that are able to give back a community (and objective) map of the city of Ivrea. Starting from some recognisable elements, the group was asked to define a map through a joint discussion on the physical and mental perception of the places in Ivrea. In addition to defining spaces (*thematic areas*, *borders* and *special places*), questions were asked to identify characters and events that were particularly related to the memories and stories of the participants.

The development of the first activity was requested by the research group which set itself up as a narrator by defining a series of steps:

1. **Introduction (blank map)** - Participants were provided with a print depicting the stylised map of Ivrea showing only the river (the Dora Baltea) and the railway axis.
2. **Thematic areas** - Subsequently, with the use of stickers, the group was asked to provide further specifications about the location of places and thematic areas they considered fundamental to the recognizability of the city.
3. **Borders** - The identification of areas and places allowed the circumscription of Ivrea within a confined space. The shape of the city changed throughout the

activities conducted with different groups of people, as a result of the conception of the individual participants.

4. **Special places -** Individual participants were asked to identify two places each that were related to particularly important past memories and experiences.
5. **Characters -** As the final step of Activity 1, participants were asked to identify some noteworthy characters related to local people (real and imaginary) who could be matched to a series of archetypes.

4.2 Activity 2 - “What if... - Living the fictional world”

The second part of the activity aimed at creating a story in a hypothetical fictional world in which the city of Ivrea has faced a significant event that has shaken its sense of balance. Starting from the map co-created in the previous phase, the participants were called to imagine an alternative world to be used as a setting for the definition of a self-contained narrative arc composed of a set of characters, tools, places, unexpected events and actions. The activity was aimed at stimulating group awareness as to how to recover from a destabilising situation through proactive actions that would enhance the communities' resilience.

If in Activity 1 the participants were asked to take an approach more linked to their personal experiences and behaviours, in Activity 2 they were encouraged more to imagine solutions within a process of teamwork. Furthermore, the personification of a fictional character limited the participants' possibilities of action to specific characteristics and skills, adding a further level of difficulty in creating the story. Activity 2 was conceived as a role-playing game; all the events and the progression of the story were recorded on cards to create a complete story, from the first chapter to the epilogue.

Activity 2 was completed over several steps:

1. **Traces from the fictional world** - Participants were provided with three different boxes containing different prompts (1 photograph, 1 object and 1 newspaper article) from the city of Ivrea set in a parallel world. They were then asked to trace the fictional world through the description of social, historical and environmental characteristics linked to previous hints. The different prompts are connected to hypothetical future changes in terms of climate, social, cultural evolution.
2. **Alteration event** - The participants were presented with a short narrative of a change (identified through a natural disaster caused by non-human agents) which led to a change in the city of Ivrea. Here resilience is required and is closely related to the ability to “bounce forward” and “move on” after a disaster (Manyena et al., 2011; Manyena, 2006), conceived as changes related to floods, the energy crisis, desertification due to global warming, or depopulation.
3. **Creation of the heroic community** - Subsequently, participants were asked to draw character cards (some new and others generated in the first part of the

activity) connected to specific archetypes. All the characters together defined a heroic community, i.e. a team that had to act together to overcome the situation. Participants, associated with a specific character, had to act consistently with the skills of their game avatar to proceed in the story.

4. **The game** - The game consists in building a Hero's Journey (Campbell & Moyers, 2011; Vogler, 2007) in which the community of characters is brought to face the change at places pointed out in the first part of the activity (special places). To move forward in the game, participants have to roll the dice and then draw a card from two different decks: the first contains *tools* to be used, the second contains *unexpected events* that change the course of the game.
5. **The narrative arc** - Even if the story was generated collectively each character was chosen to be the protagonist of a particular step of the game. In each step, the protagonist had to create a story chapter considering the characteristics of the fictional world created, the skills of the character card, and the tools found along the path. The group of participants had to outline a self-contained story structured in ten chapters, trying to combine characters, actions, tools and places.



Figure 1. Graphics of the tools used in the activity. The blank map served as the board on which to play the game.



Figure 2. The development of a story's chapter by participants and other prompts used to create the fictional world. The picture was taken at Zac!'s spaces in Ivrea, on the 25th of October 2019 during the co-design session with citizens.

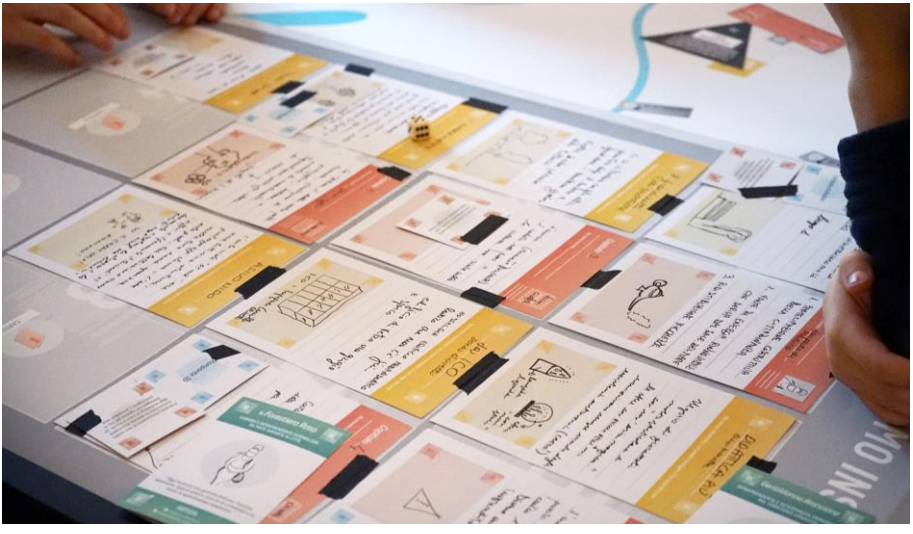

Figure 3. "Special places" and "Chapter" cards are matched to define the progression of the story. Each card had a blank space where to sketch a quick visualization of spaces and actions. The picture was taken at Zac!'s spaces in Ivrea, on the 25th of October 2019 during the co-design session with citizens.

5. Results

Both the contextual conditions and the expected outcomes were somewhat challenging and therefore interesting to explore. First, the project location was atypical for the Polimi DESIS Lab: the research team had only a previous indirect knowledge of the context and its inner dynamics. This meant that the risk of a superficial commitment was high during the ethnographic exploration and in providing networks and activities, and also because of the short duration of the project. In this specific case, the character of the expected design outcome – a potential social change powered by the co-creation of alternative narratives – and the consequent lack of traditional tangible outcomes of the project's goal challenged the research group, raising questions both about the effective agency of the project's design innovation and the difficulties connected with such an open-ended, ephemeral outcome.

A central challenge for PD today is to embrace a cultural and humanistic re-balance, able to question not only viable solutions, collaborative knowledge construction and systemic change, but also the human action of inhabiting. This challenge means actively exploring alternative ways to tackle the context-based design process, where the interaction between people and the environment is a primary issue, intertwined with an attention towards temporality which is not only about reflecting in terms of short-/long-term effects and impacts, but rather moving from a linear and univocal interpretation of the temporal dimension, to a resilient and open-ended way of expressing different visions and voices, which are more related to the human (and non-human) dimensions.

Working with a community of citizens rooted firmly in the history of the city provided a double level of interpretation. On the one hand, it helped to cement our understandings of the territory, while on the other, it allowed us to test a series of approaches related to the theme of resilience. The idea of splitting the activity into two parts helped the participants experience a conceptual and emotional swing through the initial development of a sense of control, and the subsequent annihilation of the same with the consequent need for reconstruction. Activity 1 helped the formation of the teams take place in a relaxed atmosphere through personal emotional experiences, while the story making-focused Activity 2 unsettled this apparent sense of control, stimulating the same teams to act towards a possible solution. The participants were themselves associated with the experiences of their game avatars, even if on a purely fictional level. The activity allowed the research group to effectively test, even on a limited sample, the capacity for resilience of urban communities and their attitude in dealing with situations of potential uncertainty. At the end of the activity the participants were agreeably impressed by the challenge as they were initially unaware of the second part. Even if tested on a purely fictional level, most of them expressed a sense of satisfaction in understanding the number of actions individual citizens can undertake in a team. In their opinion, the activity also served to help them empathise more with their own territorial and social context, which was all-too often criticised. The objectives of the work have been effectively verified, triggering different

points of view in the community about the role they, as citizens, can play in improving their condition.

All the elements traced through the activities will now build the foundations of the interactive performance to be staged by CRAFT association. It will be interesting to observe how a PD co-creative process, its methodologies and approach, as well as the deconstruction of narrations, will then be reinterpreted by the peculiar language of the theatre, where the individual plot-spectator relationship owns, potentially, endless interpretations.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

New Technological Space for Tourists. Design as a Trigger of Experience, Osmotic-Membrane Interface, Know-How Provider and Social Engager

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Abstract | Milano is considered the liveliest and creative metropolitan area in Italy. It is now involved in four current tourism migratory fluxes toward the city, and it is opened to welcome a wide range of new Metropolis actors: professional, professional travellers and tourist practices. Their needs are *accessibility*, *adaptability*, and *inclusion*. Are there any aids that can promote their experience and increase the link with the living spaces, usually taken for granted? Nowadays symmetrically, mobile technology and location-based services are an excellent novel opportunity for cities and their cultural institutions to reach a wider audience. In this essay we introduce a project designed to welcome tourists and citizens in an environment where analog and digital technology meet creating a multi-sensory experience. The final purpose, providing different stages of the process, is to demonstrate how Design can be a *Trigger of experience*, *Osmotic-membrane Interface*, *Know-how* provider and *Social engager.*

KEYWORDS | SPATIAL DESIGN, INTERACTION DESIGN, TOURISM, CULTURAL COMMONS, USER EXPERIENCE

1. Who are the actors of the new metropolis?

*"*Cities are complex systems, with emerging qualities which cannot be reduced to static understandings or representations*"* (Lupi, 2013, p. 1). Talking about cities, from their planning to their living, means activating fields of dialogue with more and more connotations. It means taking into account not only the urban morphology and architecture, but even vibrant and ever-changing networks of human flows. In this sense, the *Urban fact*, as defined by Aldo Rossi at the end of seventies, becomes matter of the man and, nowadays, it is rapidly changing (Bollati, 2014). It is being intensively reshaped by unexpected dynamics:

> "on the one hand, the rise and growth of the digital economy has deeply modified the relationship between the urban fabric and its resident community, overcoming the conventional hierarchy based on manufacturing priorities; on the other hand, contemporary society appears to be discovering new labor conditions and ways of making things, crafting new synergies and connections" (Trimarchi, 2019, p. 1).

Today, cities compete for liveliness and quality of life (Morea, 2019); (Hall, 1998); (Richards & Palmer, 2007). In this regard, in 2018, during the first Domusforum, *The Future of Cities* was discussed, emphasizing the cities' complexity in terms of architecture, economy, social sciences and citizens' emotions. The proposed analysis based on a survey commissioned by *Domus* and executed by Nielsen, gathering and measuring of consumer data, showed Milano as the liveliest and creative metropolitan area in Italy, with high quality of urban life and urban atmosphere. Thanks to its smooth, permeable, versatile and flexible urban backbone, Milano is able to encourage new flows of ideas, contents and experiences reciprocally fertilizing (Bollati & Collina, 2020). It is able to be adaptive, to make space inclusive and to make time managed, becoming more and more appealing. It's no wonder that today is involved in four current tourism migratory fluxes toward the city and it is opened to welcome a wide range of new Metropolis actors: *newcomer, traveler*, *globe trotters*, o *city* user (Domus, 2017). Therefore, it aims to be attractive for workers, residents and tourists *"*to effectively respond to the complex need for an eloquent representation of the self*"* (Benincasa, Neri, & Trimarchi, 2019, p.10).

2. Tourism: an evolving concept

The concept of tourism can be defined from various points of view, one is connected to person who travels to a country other than that in which s/he has his/her usual residence but outside his/her usual environment for a period not exceeding one year, and whose main purpose of visit is other than the exercise of an activity remunerated from with the country visited. This definition shows tourist's activity as a search for something different in comparison to the usual practice, and it is also unavoidably linked to the territory and temporally defined. Therefore, tourism is about traveling to reside in places outside a usual environment for short periods of time, however the purposes for tourists can be various. Not only pastime but it is motivated by reasons of health, leisure and even business, it

represents one of the major business of Cities and Countries, contributing to their image (Tornatora & Amaro, 2019). It allows to experience and to know new, varied and different realities.

Tourism has deep historical roots and a long history. It assumed economic connotations since the end of the XIX century and a mass dimension in the sixties (Bellini & Pasquinelli, 2017), often meaning a reduction of the knowledge to a simple information. As mass tourism, it has been described as *hit and go*, where the local identities vanish due to the process of globalization. A merchandized tourism able to transport large numbers of people in a relative short time span to distant parts of the planet, but not able to ensure the right quality level of knowledge experience.

Just in more recent times new tourism paradigms have emerged, more attentive and sensitive to environmental sustainability, cultural and socio-economic conditions of places of destination. We are witnessing the increasing interest of tourists in heterogeneous contexts, which successfully combine the tourist practice, creativity, subjectivity, the spontaneity of places and non-traditional sectors such as food, craftsmanship, sport, subcultures, music, art, productive and rural industries (Richards, 2011). A new desire to see, even thanks to the new technologies, pose new questions about the sense of places and visit, mixing more and more real or imaginary knowledge of a destination; tangible and intangible experience. A city, in this process, becomes a 'places of the mind' and its visit is not just a roster of places and cities, structured by tourist guides which impose things to see into the places and cities – buildings, artworks, environmental – forgetting about many others. It is a personal and shimmering collage of tips, information and suggestions offered by different sources such as book guides, websites, blog, friends, locals and other tourists experiences. The role of the tourist changed, having the opportunity to an active protagonist and planner of his/her own itinerary. The idea of personalization and the possibility to feel part of a place become components worthy of consideration when designing experiences.

3. How can technologies support our urban visit experience?

Technological advances and digital transformation are deeply influencing our lives, impacting our habits and uses, as well as on how we perceive our surroundings (Castells, 2000). Since they simplify our everyday life and our tasks, we are used and often even addicted to a technology that provides answers to our needs, while creating them (McLuhan, 1964). Expanding this point, we can say that we witnessed a change of role: technology quickly shifted from being oriented to problem-solving to satisfying or raising needs (Hassenzahl & Tractinsky, 2006). Embracing a user-centered perspective, technological changes made the access to information diffused and smooth, broadly reframing our literacies (Jenkins, 2006).

Mobile technology and location-based services are an excellent novel opportunity for cities and their cultural institutions to reach a wider audience (Proctor, 2011) and to enhance

traditional cultural consumption. Technology, whether one likes it or not, is becoming ever-present in our everyday life and they are gradually causing changes in daily habits. It multiplies the possibilities of reading, interpreting and participating the cultural asset. Technology offers new urban narratives (Trocchianesi, 2018). This seems particularly true in the context of tourism, where digital has more and more become strong support of the tourist experience.

According to Gartner (2010), in last years people have been accessed the internet mainly through mobile technology since *"*today's tourists are now a large percent digital native, born and bred in virtual worlds*"* image (Clay & Ruth, 2019, p.144). The location-aware systems are able to provide additional information, give directions, and customize the offer, delivering therefore an individualized content, and thus enhancing the tourist's experience according to his/her personal and particular interests. Mobile devices are changing the way people enter in contact with the city knowledge, its habits, and culture. These technologies enable turists to connect with others, search data, and create personal and shareable contents (Gammon, 2008; Burch, 2008).

> "The capability to add social engagement is a chance to involve communities with a different active approach in generating cultural contents. Digital resources are a great opportunity to connect anytime and anywhere allowing online interaction; multiple tasks could be performed quickly and easily allowing a deeper understanding of a subject, works of art, and cultural heritage in general" (Ceconello, 2012, p. 1)

Therefore, the tourism success of a city *"*will depend solely on their abilities to communicate their real as well as their virtual offerings properly to the public*"* (Clay & Ruth, 2019, p.144) and the current situation opens up space for change and innovation. The city's information conveyed through the web has greater impact to tourists' choices. Technological and mobile devices support tourists-visitors at all stages of the journey: organization, arrival, planning of activities and return home, as regards the demand, needs or wishes. Social networks allowed a direct and easy access to useful information for the visit. Moreover, as mentioned above and according to some studies, travelers tend to rely more on information received by other tourists rather than those supplied by tour operators; since direct experiences are considered as a guarantee of neutrality and truthfulness of judgment and not conditioned by particular interest (Spasiano, 2016). Tourism therefore produces and unearths new social rituals to which it is possible to adhere and belong (Cipolletti, 2014).

4. A multimedia living room for newcomers, travellers and city users

Design today faces complex problems and situations. It has a holistic approach (Buchanan, 1992), and therefore, more and more seemingly separate areas of intervention are overlapping and intersecting. Design is changing from a single craft-oriented discipline into

one that is more robust and multidisciplinary, connected with social environments, products, services, systems and brands (Friedman, 2002; Muratovski, 2010). Disciplines such as the design of spaces and services often require interactions in the various stages of the project. Service Design, which always combines the design of tangible and intangible aspects (Meroni & Sangiorgi, 2011), in a hyper-connected, digital and ephemeral world like ours, needs more and more tangible, secure, stable, and physical aspects.

In this essay we introduce a spatial and service project, the YesMilano Tourism Space, designed to welcome tourists and citizens in an environment where analog and digital technology meet creating a multi-sensory experience.

The project's proposal has been started from a scientific agreement between the Chamber of commerce of Milan, Monza Brianza Lodi and Politecnico di Milano, Design Department. The project's aim was to work with a shared approach between these two public institutions and dealing with the need of the Chamber of commerce to design an innovative experiencing space, giving a prospective of an engaging place for tourists arriving in the City of Milan. The space, that opened in December 2018, is an emblematic and strategic project not only for the Chamber of commerce but also for the city of Milan. It's located in a historical building in the city center, Palazzo Giureconsulti in Piazza dei Mercanti, and due to the importance of the building, its architectonical and cultural heritage, several figures have been involved during the research process such as the Superintendence of Cultural Heritage of Milano, that supervised and validated the project.

Which are the needs in a City we don't know anything about yet? Which services do we make use? Are there any aids that can promote our experience and increase the link with the living spaces, usually taken for granted? Every one of us has been a newcomer, tourist o more in general traveler in life. These are the questions which guided the action research process (Muratovski, 2010) and designers into the realization of the space.

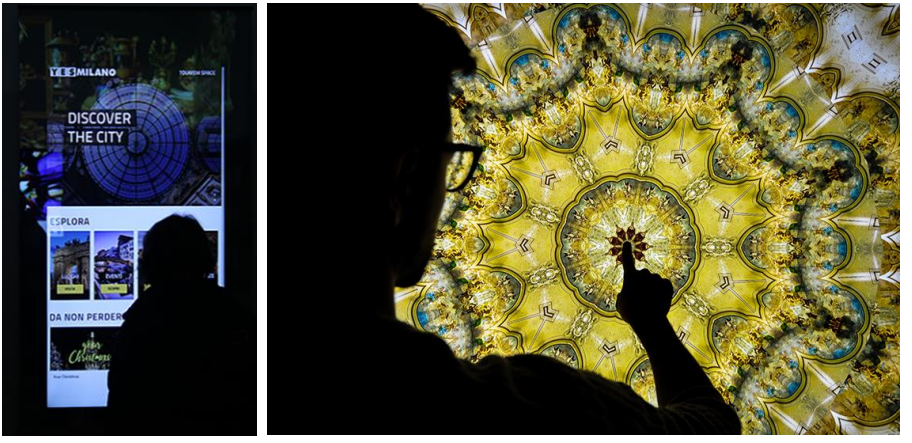

Figure 1-2. Two touch-screen mirrors guide and a big interactive monitor, like a hanging picture, welcomes the visitor with colorful and changing patterns.

Enabling narratives through new technologies stratification is a "model which involves the citizen, the tourist and the city user in an immersive experience; it asks for their active participation and aesthetic, cultural and playful involvement" including "screen-facades that became multimedia metaphors of explicit (visible on/in buildings) and implicit (as augmented reality by tag, app, QR code and so on) narratives". (Trocchianesi, 2018, p.140)

The space, as result of a multidisciplinary approach, is configured with a high dualism between analogic and digital: two touch-screen mirrors guide to the discovery of a hothouse filled with ideas for tourists in the city (fig. 1), they reflect the richness of the environment, expanding it and playing with the filtering lights from the large glass surfaces, when activated by human presence, they turn into display surfaces and reveal dedicated visual stories; a big interactive monitor, like a hanging picture, welcomes the tourist with colorful and changing patterns (fig. 2). Starting from the images of the city and its surroundings, the tourist is called to recreate new visual configurations and chromatic blends. By selecting a tourist route and / or photograph of interest, it is able to transfigure it while maintaining the starting polychrome DNA. The combinations are infinite and can be turned into a gift as a souvenir of the experiences to be sent by email.

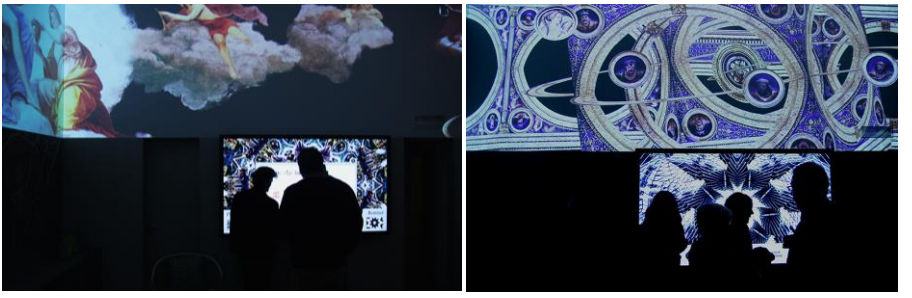

Figure 3-4. Images of the space during the night: magic lantern changing the projections on the inner walls.

In the evening, once the space is closed, the YesMilano Tourism Space turns into a multimedia magic lantern (fig. 3-4) changing the projections on the inner walls as well, just touching the skin of a window from outside (fig. 5-6), projections created ad hoc permeate the ceiling and walls, showing through the large glass surfaces. They invite the passer-by to interact with the transparent skin of the historic building. With a touch the contents can change, offering the possibility of sensorial immersion in a new dimension of knowledge and experience. In this sense, the accessibility which denotes that these spaces are open to all, should be understood as permeability, being able to "enter a space" without hesitation and effort. (Poot et al., 2015).

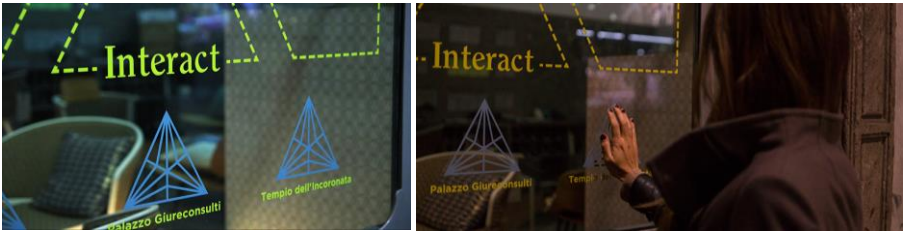

Figure 5-6: Interactive outside skin windows.

A stylized map of the City suggests itineraries to follow and is flexible and passable to analogue interaction. The tourist can in turn propose itineraries for visiting the city, through the playful and analogical use of colored threads.

YesMilano Tourism Space turns into the living room of today's tourist and citizen, a warm environment, with a strong visual character, equipped with tapestries, custom-made wooden furniture and design objects (Bollati & Collina, 2020). The domestic atmosphere welcomes the tourist and invites him to digital and non-digital interaction. Some other partners took part in the project like publishers, furniture brands and cultural institutions present in the city.



Figure 7-8: General overview of the YesMilano Tourism Space.

5. Design as a trigger of experience

> "The great struggle of travelers used to be to know the facts of the countries they travelled through. Nowadays, our phones have made factual knowledge ubiquitous and unhelpfully overwhelming. What we need isn't ever more facts, but experiences that are curated in accordance with our own inner needs" (De Botton, 2013, cited by Cipolletti, 2014, p.93).

The purpose, providing different stages of the project process, is to demonstrate how Design can be a *Trigger of experience*, *Osmotic-membrane Interface*, *Know-how* provider and *Social engager*; how Digital has become strong support of the tourist experience, activating fields of dialogue with more and more heterogeneous connotations? The project yearns, starting from existing processes, forms and case studies, a systematization in innovative models, feeding theoretical reflections with an empirical experience.

Some of the most recent technological transformations are inherently linked to the way in which communication advanced and evolved through time. Communication is nowadays more and more diffused, constant and global than ever before, and it happens between people, people and objects, but also among objects themselves (Evans, 2011; Evans, 2012).

Moreover, it is featured by the overlap and commixture of what we were used to consider polarities: the boundaries between tangible and intangible, hardware and software, private and public are indeed blurring (Loukides & Bruner, 2014). Users are the starting point of Design, and Human Centered Design in particular. The analysis of their habits, gestures, rituals, needs, and aspirations plays a key role in the design process, since it allows designers to conceive modern solutions and proposals that combine digital and physical aspects in an aesthetic context. Contemporaneity sees a designer who can manipulate novel sensitive objects that become active subjects according to the way in which their behaviors are engineered and programmed within a digital and physical design schedule. Knowing how to manage sequences of contents, being sensitive towards graphic trends, their communicative effects, the behaviors they suggest and how the different objects on stage interact and dialogue as part of a complex system, requires designing contemporary artefacts and systems assembling a multiplicity of fragments in order to obtain a unitary set of meaning.

The programmatic function of this practice invokes a user-centered approach capable of precisely imagining the experience of fruition. In fact, it is relevant to note that at the center of the process of designing interactivity there is interaction rather than interface (Montefusco, 1992).

Inside *Yes Milano Tourism Space*, the technological equipment is not displayed, but its effects are felt. The technological presence, in terms of device machines, is reduced, increasing the "sensitivity of the environment". The space is not complicated with technology. The technical components are not highlighted. The emphasis is, instead, on the technological consequence and interaction results. The analyzed project is based on the use of "natural interfaces", interactive systems which react "without the use of technological intermediaries but through traditional methods of communication" (Cirifino et al., 2011). This fact is also supported by the growing attention that is drawn on researching the user and his/her practices (Kuniavsky, 2003), natural behaviors and needs, when developing complex spontaneous systems.

Moreover, the project follows the direction of an aesthetic that includes variation and dynamicity, as well as on contents that imply stratification and the possibility of reconfiguring themselves over time (Manovich, 2011). The space is therefore designed in narrative way. It allows not only an informative experience but even an evocative one. Each tourist is able to recombine the provided contents and information in a completely personal way. The result is different touchpoints with which the tourist can relate at different levels and at different times, when experiencing the city.

Between accelerations and interruptions, the ongoing digital evolution is reshaping users' habits (Turkle, 2011), deeply affecting design processes. Designing contemporary systems means indeed dealing with a technology that surrounds us, being almost omnipresent and increasingly pervasive (Kuniavski, 2010), but also human. Looking at being enabling and accessible, technology is aimed at making contemporary services increasingly smart, using sensors (embedded technology), network connectivity, and the power of data computing (Anderson, 2012) for improving users' daily life. Considering how electronics and information technology can be enabling, pervasive and accessible, as designers we are more and more inclined, but also encouraged, to imagine smarter and hybrid experiences that are articulated between physical and digital dimensions (Ishii et al., 2015; Krishna, 2015), consequently influencing users' behaviors and habits. Especially the trend of embedding technology triggered the desire to experiment and design UX experiences where the distance between the user and technology as "the artifact" is reduced and made inherently seamless.

6. Conclusions

In this essay, Design enhances technology, assists in making it accessible and increases the value of learning and emotional experience. Design involves also human dimensions,

sometimes ephemeral. Thanks to the use of *natural user interfaces* (Cirifino et al., 2011), it can combine *Technology* (tools) with *Art* (language) and *Territory* (substance); novelty and familiarity (Bianchi, 2014) as well as new and traditional forms of communication, the emotion of surprise and the importance of feeling comfortable. A final output of the project is also to be able to reflect starting from a specific context, an abstraction of replicable approaches able to face several fields of interest.

If tourism is to be considered a system of relations between people and places, between people themselves as socializing subjects in contexts where the tourist practice is possible, and between the individual, their experiences and desires, then the specific organization of a site may be responsible for producing and suggesting the separation or involvement of the interrelating elements. The study of these relations makes it possible to understand the articulation and consistency of a tourism space, in regard to the quality and roothold of spaces with respect to the existing fabric, with significant effects on the rhythm of cohesion and upheaval of places, in contexts of day-to-day life.

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Acknowledgements: Visitor Space Credits—Yes Milano Tourism Space
Project Camera di Commercio di Milano, Monza Brianza e Lodi
Supported by Comune di Milano e YESMILANO
Designed by Politecnico di Milano
In collaboration with La Triennale di Milano
Curator Luisa Collina | Politecnico di Milano
Project coordination and executive production Ilaria Bollati, Claudia Mastrantoni | Politecnico di Milano
with Samuele Baruzzi | Politecnico di Milano
Visual identity and graphic design Umberto Tolino | Politecnico di Milano
with Agnese Bartolucci, Riccardo Fuccelli, Eleonora Rossetti, Marco Valli | Politecnico di Milano
Exhibit design Ilaria Bollati, Claudia Mastrantoni | Politecnico di Milano
Michela Fenoli | EXPLORA S.C.p.A
Multimedia project CamerAnebbia, StreamColors and Politecnico di Milano
Special thanks to Ethimo

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Placemaking through Creative Practice: Enabling Change and Empowering Future Change-makers

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Abstract | Toronto, Canada experiences both the benefits and challenges that come with rapid urban growth. Challenges include increased racial and economic inequities; lack of affordable housing; loss of community space in redevelopment, and marginalization of citizen voices across planning processes. There is a zeitgeist of Toronto as an emerging world class city based on economic, cultural, and environmental qualities, yet it struggles to ensure inclusion, access, and social justice for all its citizens. Design Manifesto 2020 (DM2020) explores community-driven placemaking across the metropolitan area as it gathers stories of lived-experience in creating spaces and places. How can we learn from successful local initiatives to foster creative solutions elsewhere and further, how can we impart the process of community engagement as an ethical tenet of design praxis and pedagogy? This paper takes a mid-project look at the narrative inquiry process of storytelling and its potential for greater inclusive community-based placemaking.

KEYWORDS | COMMUNITY PLACEMAKING, NARRATIVE INQUIRY,
INCLUSIVE DESIGN, DESIGN ACTIVISM, DESIGN PEDAGOGY

1. Introduction

> "As both an overarching idea and hands-on approach for improving a neighborhood …placemaking inspires people to collectively reimagine public spaces as the heart of every community" (Project for Public Space, 2020).

Placemaking is a collaborative and powerful tool for community-building. It can be driven top-down by politicians seeking broad development goals, or bottom-up with grassroot activism in fostering ad hoc solutions. At the core is the value-added concept of employing a community's strengths and aspirations to reflect its unique identity in shaping the public realm (Stewart, 2018). The US-based non-profit Project for Public Space (PPS) implements placemaking by animating the public sphere, positing that systemic neglect of places leading to marginalization of neighbourhoods demands *systemic change* through locally driven transformations (Project for Public Spaces, 2020).

In Toronto, neighbourhoods are experiencing the negative aspects of large-scale urbanization. Indigenous, Black, Youth, LGBTQ2S, Newcomers and other strong communities want a greater say in planning their communal spaces. Historically left out of mainstream planning discourse, the communities have also been systemically ignored by sectors developing and influencing city building processes. The result is a list of exclusions including forgotten densities, lack of affordability among other lived realities (Pitter, 2020). Toronto Foundation's Fallout Report (2020) on COVID-19 states the virus creates an even greater risk with challenges in respect to health services, food security, employment and stable housing (Ayer, 2020. p.9). Robust placemaking policies and plans based on community need, immediate and longer-term, will need greater 'resilience' for existing and new challenges to come.



Figure 1. View of Toronto from western edge of Greater Toronto Area and Lake Ontario. Image highlights the city shoreline, the renown CN Tower and built-up downtown core with offices and condominium towers.

Toronto (figure 1) is awakening to its role in decolonization, and reconciliation with Indigenous communities amid a national call for nation-to-nation dialogue.

The city is learning Indigenous principles of placemaking among many other first nations' cultural and creative practices. Urban Indigenous youth are emerging place makers engaging ancestral knowledge for 'connection to place' (Hood, 2017). It is a poignant moment to understand how connection to a place has meaning for communities seeking equitable opportunities to participate in growth. Design Manifesto (DM2020) considered this opportunity in developing its research project for capturing how Toronto's six historical boroughs are faring with community-based placemaking and with a view of sharing the collected placemaking stories back to the city. The two-year research project was launched in January 2019 as part of the annual Toronto DesignTO event with a public forum at OCAD University. After the city amalgamated in 1998 to become a single municipality of Metropolitan Toronto, there remain six geographic regions based on the prior boroughs of Toronto, East York, York, Scarborough, North York and Etobicoke (Toronto.ca). The initial framework for listening to citizen stories for the design of community space was based on these geo-political boundaries but has since shifted to a framework for learning about the critical economic and social boundaries that actually influence or impede community placemaking. Over the last decade, three distinct economic boundaries (figure 2) as reported by Hulchanski (2007) have now emerged, and these have a profound effect on community placemaking success.

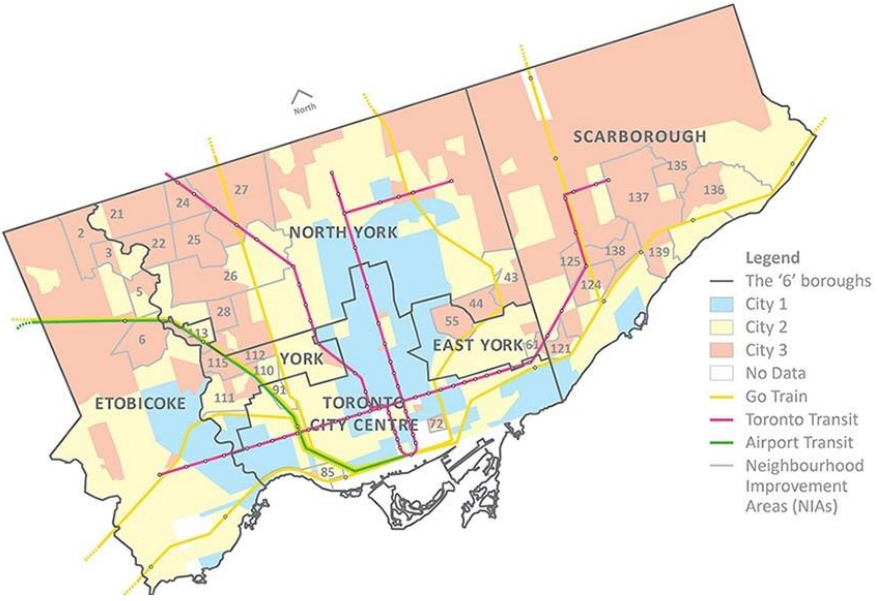

Figure 2. Map of Toronto showing six former municipal boroughs, three emerging economic cities, and an ineffectual transit system which isolates much of Toronto's population from the city centre.

City #1 has the wealthiest neighbourhoods (Toronto, Downtown) and City #3 comprises west (Etobicoke), east (Scarborough), and north (North York) regions supporting the fastest growing number of newcomers with 50% of overall city population. These larger areas include a car-oriented middle-class, less efficient public transit, and densification of older neighbourhoods. City #2 surrounds the downtown (includes York, Mid-Town, and East York) where the once middle class and upwardly mobile is now splitting into either City #1, or #3. As a result, Toronto, while more diverse, has also become more economically divided (Hulchanski, 2007, p.2). Expensive high-rise developments engulf central and mid-Toronto neighbourhoods. These have been isolating older social housing communities and the research has heard from residents concerned for falling behind the urbanization curve. The new realities of Covid-19 pandemic and other challenges yet to come highlight that community-based placemaking matters, if only to confirm community identity and reinforce 'connection to place'.

2. A framework of inclusive storytelling

DM2020 is collecting personal stories in order to respectfully capture citizens' account of their own lived realities in placemaking. This data collection method of narrative inquiry leads to disccourse analysis (Gray, 2018). Stories of local placemaking actions are positioned in the research as *case-stories*. Participant storytelling also contributes to a broader discussion about community-building that generates collaborative responses to issues of the day. In forums and workshops both in person and online, case-stories, and the co-created outcomes of community events become the 'research findings'. The qualitative data collection will ideally evolve a set of community informed planning tools for placemaking applications, and for design pedagogy and practice. In its second year, DM2020 continues to apply the narrative inquiry method and has welcomed over 100 citizens to date with seniors, students, art practitioners, community animators, and design activists sharing their experiences with placemaking across Toronto (figure 3).

The project also aims to understand participatory action research (PAR) and participatory design in utilizing storytelling as a generator for social change discourse. Participatory processes are not new, they have been the key approaches for design of technology, products, services and space. However, lessons learned from the collaborative approach with stakeholders or 'end-users' seem to be lagging in design industry practices, particularly in real estate development according to communities contributing to the research. They continue to ask why local voices are not registering in the final design of spaces that affect their daily lives?



Figure 3. DM2020 Forum-East Scarborough Storefront. Community shares ideas and goals for placemaking with written and drawn ideas, sharing of stories, and group discussions.



Figure 4. Danforth Village Laneway Project. Changing an alley of neglected garages into canvases for mural artists. Photo courtesy of Bruce Reeve (2018).

Community placemaking in Toronto as elsewhere can result in ad hoc interventions for the empty niches in the urban fabric, or forgotten parks and thoroughfares. These are sometimes born out of frustration when neighbourhoods are neglected by authorities in managing public space. The solutions raise new questions for research:

1. What ad hoc solutions get city support?
2. What actions disrupt planning processes and lead to shifts in practice?
3. Do community projects need both public-private partnerships to be sustainable?
4. How do local projects foster greater equity in serving communities affected by systemic exclusion?
5. Is beautification a necessary first step in addressing neglected urban space (figure 4)?

Once analysed, case-stories gathered may help to answer these questions, and potentially guide creative actions across other urban contexts.

Participants invited to DM2020 events require two conditions: space (analogue and/or digital) for story sharing as 'expert witnesses' to their day-to-day experience (Lupton, 2017. p.32). Second, an audience willing to respectfully listen. Engaged interaction is not always assured and each forum results in various storytelling dynamics. Respectful listening empowers those sharing the stories with an understanding that shared knowledge will matter in making change happen and in better ways. Arendt's seminal work The Human Condition identified that we are both affected by and effecting the world we create (Arendt, 1998). Identifying how the public realm can be more functional, accessible, liberating-communities strengthen connection to place equally as they establish their place in it. Shared experience stands as collective expertise for how to get things done and critically, for what should not be done again. Developers, governments and designers need to commit to leveraging community lived experience in shifting *'design for'* to *'design with'* people.

3. Participation in placemaking

The model of participation, well-established as civic engagement, gained both political and social traction with civil rights movements and civic activism in the mid-last century (Schneekloth & Shibley, 1995) but shifted towards the more practical approach for citizen engagement in planning new, or redeveloping older neighbourhoods in the 1990's:

> "…one that no longer viewed participation as 'citizen power.' The purposes of participation have been more modestly defined for information exchange, resolving conflicts, and to supplement the design/planning [processes]" (Sanoff, 2017, pp 9–10).

Participatory design, positioned as front-end activity in planning, requires community contribution and power sharing for effective decision-making. To achieve sustainable and long-lasting outcomes community action at front end of development, during

implementation, and inportantly, at post-occupancy stages are needed. In this way, lived-experience can be validated as critical design knowledge. Community redevelopment rarely gets design feedback except through a maintenance complaints process.

Two decades into the 21st century, the participatory process is seemingly shifting from advocacy back to activism. In the North American context, it now responds to even greater racial injustices and economic disparities, with global pandemics and climate change posing further challenges. However, community voices will no longer be 'silent' (Cole, 2020). As large urban centres like Toronto brace for new urban growth, the resulting disruption will further marginalize established neighbourhoods excluded from planning decisions. Diverse, insightful Toronto voices like Desmond Cole, author and activist, and Jay Pitter, award-winning urban planner and place maker are affecting social and material change through participatory placemaking. Pitter is spearheading city-building projects for greater equitable public spaces in what she terms as 'healing fraught sites' (Pitter, 2020).

Genuine participation occurs when communities are "empowered to control both the agenda and the action" (Sanoff, 2017, p.8).

The Arts have a unique role in shaping public space, in ways that few disciplines can. DM2020 has revealed this to be particularly true for youth artists trying to make a difference by animating neighbourhoods that speak to their identity. Artmaking commands placemaking platforms including building facades, community centres, streetscapes, and digital space (Luger & Ren, 2017). A graduate in community development shared their story of trying to make a difference by bridging the gap between youth and powerful institutions. Taking jobs at various agencies including Parks and Recreation, the storyteller came to understand that major organizations were 'hostile' to urban youth—viewing them as potential 'problems' to be avoided, and discouraging their access to public space. It was clear that change was harder to achieve from *inside* the establishment where the storyteller felt their individual power systemically dismantled. As a result, the storyteller now opens up their home for creative gatherings with music, poetry readings…thereby making a welcoming space for youth to connect around the arts without fear of stigmatization and judgement. The arts drive both a discourse about the larger public realm, and equally foster moments of intimate placemaking where communities would not otherwise have a venue for creative expression. Case-stories gathered show meaningful placemaking happens by people desiring places that hold their creative dreams. This is a key distinction from placemaking driven by large entities, or top down by politicians with self-serving notions of planning legacies.

Grassroots placemaking can occur in both expected and unexpected ways. In 1995 Toronto got its first outdoor public bake oven and more have sprung up across public commons, offering ways for neighbourhood celebration. A guest place maker at the inaugural DM2020 event lives in one of Toronto's 31 Neighbourhood Improvement Areas (figure 2). Disappointed in the neglected state of their local park (a space lacking in minimal garbage collection), they began the task of improving the neighbourhood with a welcoming place for

residents to gather. The need was not for another ‘bake oven’, but for a Tandoori Oven, as this better reflected the cultural make-up of the community. In revitalizing the park so too was the community revitalized, and surrounding neighbourhood treated to a diverse perspective on food. The park has become a hub for community markets, another of this place maker’s many accomplishments.

Asking who holds city power and how it might be shared is a good way to start a community development conversation and avoid, what Dave Meslin terms ‘intentional or designed exclusion’. Meslin, a self-proclaimed ‘professional rabble-rouser’ actively involved in challenging Toronto’s politics, joined the project launch as a guest panellist (figure 5). He characterizes the city’s planning invitations to the public as an example of designed exclusion. In his Ted Talk “The Antidote to Apathy” he speaks to how cities ‘discourage engagement’, using a typical City Hall Notice of Zoning Application as an example. Ads placed in local newspapers invite the public to information sessions about new building developments. The dense text on the half-page ads is ‘impossible to read’ and all pertinent information on how to attend meetings is buried at the bottom in small font or typeface. This, says Meslin, is an example of intentional participatory exclusion (Meslin, 2010).



Figure 5. DM2020 launch at DesignTO 2019. Panellists left to right: community activist, Dave Meslin; Chair, Thorncliffe Park Women’s Committee, Sabina Ali; Toronto City Councillor and panel lead, Kristyn Wong-Tam; Public art critic, Spacing Magazine, Sarah Ratzlaff; Manager, Centre for Connected Communities, Ajeev Bhatia. Photo: research Team.

Neighbourhoods are keenly aware of their political capital in the approvals process. Planning proposals have been thwarted because of concerns raised by residents. The reimagined aim of the participatory design process is to put community and resident voices on par with centres of control in decision-making and to avoid potential confrontation in advance of approvals processes. “This must be done very early on in the process in order to contribute and lead the preliminary development design ideas” (Ratti, 2015, p.17).

For Indigenous urban communities there remains as architect Calvin Brook’s states ‘… so little in the fabric of the city that acknowledges them” (Hood, 2017, p 48). New placemaking councils, local visioning exercises, and reinforcement of indigenous identity across the city of Toronto are being planned with the aim to respect indigenous knowledge in the development of spaces for gathering, storysharing, and cultural exchange (Hood, 2017, p.49). Community leadership in urban design is a means to accomplish buy-in for social change as new developments and revitalization become fully realized, but it must be given both respect and power to be effective.

There are success stories for projects undertaken with community engagement across Toronto that counter the many developments lacking in critical community-based placemaking needed for sustaining ‘connection to place’. A well-documented example is Toronto’s St. Lawrence Neighbourhood—a tri-level government partnership under what was then new housing policies of 1970’s that remains a model for engaged participatory design (Sewell & Jacobs, 1993). Recent revitalization projects for older social housing complexes are working with a mixed income solution and added social value in the form of new cultural and recreational facilities. This aims to bring greater diversity of land use and people together for stronger economic viability and increased standard of living. Regent Park (2009–present) redevelopment (figures 6–8) is such a case, however, the outcomes of these development models are not fully known (Moos et al, 2018). Given that communities were already highly mixed, revitalization projects may result in less diversity by reducing affordability; displacing long-time residents and newcomers, or by making gentrification attractive to upwardly mobile dwellers in ways that further exclude prior communities.



Figures 6, 7, 8. Regent Park, Toronto's renown 69-acre public housing project, isolated the neighbourhood from main streets. Above shows a collection of images for regent Park-an apartment tower being torn down during revitalization, a public art installation, and the replacement mixed-use facility along Dundas Street East. Photo courtesy of Bruce Reeve.

4. Role of the creative practitioner: A work in progress

Citizens aim to make change happen without formal processes but can run afoul of planning authorities. The planner-designer, historically delegated to facilitate community engagement, present their projects in methods that will foster approvals and expedite implementation. Bearing the mantle of best-educated in theory and practice, they interpret people's needs and manage their expectations (Sanoff, 2017). Vital in making formal placemaking happen, they are also groomed for this leadership (Ratti & Claudel, 2015). Le Corbusier's 'urbanisme' expressed in la ville contemporaine of 1922 was a colonial planning vision for eradication of 'urban blight' with 'systemic development' to improve a citizen's quality and standard of living, all aimed to house the masses of future urbanites (Guiton, 1981). The ultimate orchestration of such a creative vision would fall upon the conductor—the architect. The designer's 'creative vision' on behalf of the community remains strong to this day (Ratti & Claudel, 2015). A discussion should be formed around how designers shift from interpreter of communities needs to facilitator of inclusive design processes that aligns both development and community goals. DM2020 research partner Bryan C. Lee Jr, co-founder and design principal at Colloqate, a design justice firm based in New Orleans, USA fosters inclusive design of places to ensure racial, social, and cultural justice. Colloqate state that "For every injustice there is an architecture built [to] sustain and perpetuate it" (Colloqate, n.d.). Bryan inspires young design professionals to collaborate with social change makers in community orchestrated solutions for mitigating systemic exclusion.

> "Injustice and inequity manifest relative to their respective contexts. We are attempting to grow the Design Justice field through organizing students, academic theory, and community collaboration." –Bryan C. Lee, AIA (Colloqate, 2020).

Colloqate is shifting the designer's role from 'conductor' to community collaborator in driving planning and design of urban space.

In respect of the art, the City of Toronto's Planning division implemented a 'Percent for Public Art Program' in 1985, which secures one percent of gross construction costs for any new development towards public art. These guidelines ensure the program is applied in a consistent and informed manner citywide while controlling where and how it is manifested (Toronto, 2010, p.13). In this context, the arts practitioner can become an interpreter of planning aspirations, managing community expectations, while the community remains an 'end-user' rather than a co-creator. When the arts partner with endowed agencies to become "cross-sectoral intergovernmental partnerships for placemaking" (Zitcer, 2018, p.2), the impetus becomes how to attract visitors and investors rather than support grassroots placemaking through art practice (Eisinger, 2000, p. 322).

Across Toronto, from City # 1 to City # 3 there is an exponential rise in mixed-use tower development with the welcomed percentage of programmed art, but in what had been smaller scale, community-focused neighbourhoods (Nasser, 2019). Determining who is included and excluded from decision-making processes is an ethical act: "Those involved select and exclude aims and boundaries for any project; privilege ways of working at the expense of alternative methods" (Schneekloth & Shibley, 1995, p.13).

An outcome of exclusion in decision-making is not only the loss of creative alternative ideas, but disempowerment for those left out. Gentrification, positioned for economic and cultural revitalization and implemented under the guise of eradicating 'urban blight', assumes that where and how people live should be measured against economics and investment in urban growth. The planner, designer and artist remain the creative interpreters for development, caught between client/owner, builder, authorities, and the 'end-user' (Ratti & Claudel, 2015). The process still begs the question, for whom does all this benefit?

5. The young are alright: Empowering new voices

> "Forgive no error you recognize. It will repeat itself, increase, and afterwards our pupils will not forgive in us what we forgave" (Yevtushenko, 1952).

As DM2020 continues into 2021 it becomes clear that younger voices for placemaking are determined to not only be heard, but to effect change. The project is learning how co-creating places with young place makers are vital for their survival. Interventions that humanize and animate forgotten urban areas buffer planned revitalization that sanitize and designs away spontaneous acts of placemaking. Case-stories identify how to make things happen at the margins of an expanding city. An example of a grassroot intervention for and

by youth is “Behind the Line”, founded by Artist Amir Akbari. The organization works with local businesses and community groups to develop creative programs and art projects that engage youth in challenging perceptions, raising awareness, and beautifying communities left behind as new development surrounds their neighbourhoods. Street art fosters spontaneous dialogue with passers-by, allowing nascent artists to share their work and stories, strengthening a community’s connection to place by the act of making art (figure 9).



Figure 9. Mural art by Behind the Line, a grassroots Toronto organization working with building owners to engage youth in creative practice and community-building.

The collected case-stories are growing in volume-informing opportunities for pedagogy at the post-secondary level. Social justice practitioners including Jay Wall of Rally Rally (Toronto) and Bryan C. Lee Jr of Colloqate (New Orleans), support the project’s push for NextGen practitioners to be more ethically and socially responsible when working on projects that aim to support communities. At a recent DM2020 design activism workshop (figures 11 to 14) facilitated by Colloqate, youth were asked to identify issues that emerge from shared knowledge in order to generate solutions to address the lack of empowerment in city planning. Access to, and quality of public space; weak intergenerational programming; and minimal resources to support education, and foster creative endeavours were the key issues identified. A recurring theme was the lack of respect displayed by those with privilege who control city finances, and social and recreational programs that impact youth.



Figures 11, 12,13, 14. Creative Practice as Protest Workshop (CPP). Clockwise from top: Founder, Black Futures Now Toronto, Adwoa Afful speaks about her work with anti-oppressive placemaking practices; Sticky Note exercise to help get to know one another; Brainstorming placemaking ideas; Founder, Rally Rally, Jay Wall share posters he and a participant created to raise awareness about pedestrian and cycling deaths in Toronto. Photos by: Nick Sagar, 2020.

6. Conclusions

DM2020 set out to engage, listen to, and learn from diverse citizens across the six regions of Toronto, and as the project progresses, it is listening more intently to NextGen voices and the social and economic issues that diminish their neighbourhoods. An online discussion is being organized due to safe distancing measures that will pair DM2020 with a youth mentorship group from north west Toronto. The event will seek to learn how this community has fared during the pandemic and explore their placemaking efforts for community-building and economic stability. Engaging youth in narrative inquiry as part of both formal and informal learning is how DM2020 welcomes and respects youth

perspectives. Their lived experience is a catalyst for raising social awareness and fostering inclusive placemaking solutions for communities where they live, work, and play.

During tremendous urban growth, city governments are under pressure to implement expedient solutions. The collaborative placemaking model requires patience—a potential enemy of bottom-line outcomes. Diverse community voices, including voices of the very young, however challenging to hear for those of privilege and power, are important to inform, guide, and build upon, as 'lessons learned' that should not be repeated. Places also take time to develop and evaluate. The measure of success for a place should be gaged for equity and inclusion, including the humanistic qualities it supports and the respect it offers communities. To achieve this, it is necessary to have confidence in citizens' capacity to conceptualize the design of places that reflect their collective need and creative dreams. Jane Jacobs, long time Toronto resident, acclaimed author and renown urbanist famously stated in her 1950's Fortune article "There is no logic that can be superimposed on the city; people make it, and it is to them, not buildings, that we must fit our plans" (Fortune Classic, 2011).

Outcomes of DM2020 intend to highlight the 'lessons learned' from many case-stories gathered for transforming forgotten neighbourhood spaces into vibrant expressions of community identity. The creative artefacts of the work are yet to be fully realized, but the design of a shared-knowledge community planning toolkit, a checklist, or a roster of local-based solutions for inclusive placemaking are all under consideration.

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Acknowledgements: The authors wish to acknowledge funding by Social Sciences and Humanities Council, Canada under the Partnership Engage Grant (2019). Expression of thanks goes out to research partners Colloqate Design, USA, and Graduate Research Assistant, Lena Phillips, MSc. A final thanks is in order for the tremendous input and insight of the diverse local communities across the City of Toronto that agreed to participate in this design research.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Proximity as space of opportunity: connecting people, productions and territories

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Abstract | The paper presents the work of the Advanced Design Research Unit (ADU), currently involved in the experimentation of new services and products, able to face territorial issues coupling a proximity approach with a global perspective, contributing locally to the achievement of SDGs of EU Agenda 2030. This approach applied to the research and educational fields allow designing new solutions for local/global challenges (new flows of people, light reindustrialization, urban voids emergency, resources' scarcity) in more imaginative, inclusive and sustainable ways. ADU learning and research structure is based on a quadruple helix approach to connect R&I, enterprises, PAs and communities. The synergies between design education and the productive environment of the Emilia-Romagna Region is strengthened by the launch of the new Research Center for Interaction with Cultural and Creative Industries, to define research lines and open design perspectives oriented to guide the dynamics of a responsible and cross-sectorial society.

KEYWORDS | PROXIMITY APPROACH, PRODUCTION&TERRITORIES, RELATIONAL SPACES, SDGS, FRAGILITY FACTORS

1. Introduction and General Framework

The controversial relationship between design and cities is receiving great attention at an international level. This is due to external factors related to an interdisciplinary debate, but also to internal factors that deal with the design discipline itself.

In the recent past, the concepts of city and territory have profoundly changed. The idea of uniformity and identity in urban transformations has been superseded by a wider debate that involves many disciplinary fields, stakeholders, actors. The concepts of knowledge cities (Carrillo, 2004), intelligent cities (Komninos, 2002), innovative cities (Simmie, 2001), creative cities (Florida, 2003; Landry, 2000), and media cities (Mould, 2014) have been adopted to some extent as strategic visions for urban development. This happened in the same moment in which urban policies assumes a new perspective on knowledge-intensive industries, incorporating creative and cultural industries concept, which emerged as a promising growth sector with a strong urban orientation (Mould, 2014) and a tangible relation with the experience and transformative society.

On the other side, as previously mentioned, the design discipline itself has started to look at the urban dimension with different eyes, no longer only regarding its final form but the ways and processes through which cities and territories are intentionally transformed continuously. Earlier signs of this discourse date back to the 1960s, with great repercussion on the disciplinary debate. The writer and activist Jane Jacobs, in her seminal book *The Death and Life of Great American Cities* (Jacobs, 1961) wonders about the intellectualistic perspective of urban planning, leaning towards a more concrete vision of the city strictly connected with its inhabitants. Almost in the same period, the British architectural critic Reyner Banham (1971) described Los Angeles through the idea of “four ecologies”, associating the urban development of the Californian city to a living organism. This debate is strictly related to the emergence of a new vision of the design project, that, in the same years, started becoming critical, relativizing the blind faith towards progress and the un-limited growth that dominated the design disciplines before and immediately after the Second World War. The performative experiments of the 1960s and 1970s professionals in urban and non-urban areas (i.e. Riccardo Dalisi for the Traino district in Napoli, Giancarlo De Carlo with the Team X on participative planning, Renzo Piano’s living labs in Otranto, to quote just a few examples of Italian architects and designers), demonstrate the emerging need to look at cities and territories through a mature awareness of the relationship between citizens, people, and environment.

These approaches come back in the recent debate (Busbea, 2019), while, at the same time, the top-down approach of “urban mysticism” (Celaschi *et al.*, 2018), that characterized the urban scale in the 1990s, has been gradually replaced by the care for the city as a living organism that needs constant vitality. This form of attention could be achievable through a widespread and capillary, temporary and convertible, design, which recalls continuous and small-scale mutations rather than radical change (Reale *et al.*, 2016).

The designers' action in the contemporary city subtends, indeed, various concepts, such as sustainable, participatory, co-designed, reusable, collective, replicable and scalable, technologically enabled; they refer to process that encompasses what is transient and temporary, recall participatory and small-scale activities, introduce a "light" dimension supported by new technologies. Designers know how to propose a strategy of transformation that is both gentle, effective and base on "continuity". Strong, sporadic projects have been replaced by regular, low-key projects, which are transient but visible, sustainable and shared.

Among these plural factors there is one that is closer to the concept of proximity (Boschma, 2005; Hansen, 2015): portions of cities including peripheral and/or historical areas are increasingly assimilated to open labs where experiment strategies of social and economic regeneration at urban scale activate processes that can involve both the institutional structure and economic actors, but also empower communities, paving the way for innovative models of action and funding. Urban and peri-urban dimensions are assumed in many European cities (i.e. Barcelona, Bologna, Lisbon, Brussels) as experimental fields, where to highlight and compare different forms of relations and co-production.

The paper focus on the proximity approach carried out in the research and education fields of action of the Advanced Design Research Unit (ADU) and assumed as a combination of time, space/place and cross-media practices in order to promote co-design solutions to tackle territorial and global challenges (Hasche *et al.*, 2019).

The main characteristic of this approach is to act in a capillary way through micro-interventions linked to the territory. This allows:

1. the institutions, to enter in contact with the factuality of disadvantages within the city meshes and to look at citizens in their life context;
2. the academic researchers, to directly collect qualitative data and focus on specific communities' issues and real needs;
3. the citizens, to develop a strong political engagement and active participation to the local public sphere.

As conceived by the Pact of Amsterdam (2016), the quadruple helix approach can address the increasingly complex challenges in urban areas, enhancing proactive collaboration between Urban Authorities, local communities, civil society, businesses and knowledge institutions to move environmental, economic, social and cultural progress. One of the key issues is to consider the territory as a whole, to improve the connection between urban and peri-urban areas, with the purpose of preserving and providing a spatial and infrastructural continuity, increasing mutual relations between human being, spaces, and productions (resources, flows, services) which brings together the interactions of both the natural and cultural landscape structures and infrastructures. Promoting equity, social cohesion, and active citizenship and enhancing creativity and innovation, including entrepreneurship, at all levels of public realm implies the adoption of a systemic approach, considering not only the

different dimensions of urban issues (economic, social, environmental), but also taking into account all possible connections among different actors and systems, according to the 2017 European Commission Circular Economy Action Plan.

Territories are analyzed on the basis of their inclination and capacity to support new uses, densities and modes of interaction, multifunctionality and multiculturality, formal and informal expressions of public life, protecting their recognizability, and their consolidated heritage while generating new ones. This new heritage is assumed as the result of an open innovation process (Montanari & Mizzau, 2016) activated through co-design and co-realization initiatives, and represents the best result of the "talents" with which the various actors (public sector, world of research, formal and informal communities, local and supra-local entrepreneurial fabric) contribute to the transformations of urban contexts and share them through experimentation, useful to express the real potential of spaces, overcoming the temporary nature of change and generating permanent transformations of entire portions of the city (Gianfrate *et al.*, 2018).

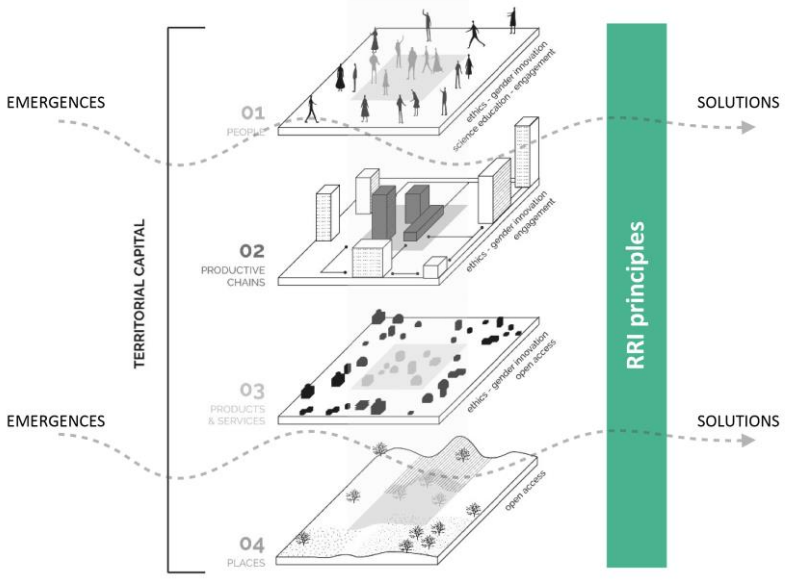

Fig. 1 Co-design methodology, Advanced Design Unit (ADU), Department of Architecture, University of Bologna.

2. Citizens as creative/creativity's agents

In the contemporary realm citizens are considered more and more actors of the change and not just witness of the continuous transformation, thanks to creative experimentations and also to the unlimited access of social networks and data, using the web to create, assemble and disseminate sensitive, personal and geographic information provided voluntarily by all of us (Goodchild, 2007).

How much do the creative processes conducted by citizens modify the city and our local networks? On a global scale, at the beginning of the 2000s the role of activator of change was projected on the free-lance creative subject – falsely generalized under the name of the "creative class". In fact, this "class" was constituted by divided individuals– divided by their (precarious) living condition, in the (temporary) spaces in which they moved, and by the (reduced) times in which the city is experienced (Florida, 2003). Today, however, the ability to interact, plan and guide change has expanded to the whole community, addressed to citizen science. This phenomenon can be read with divergent lenses: on the one hand, it can be a declaration of the extreme trust achieved in the planning skills of the communities, through their participation in co-designed processes; on the other, it can be a denunciation of the inability of the political class, administrators, urban planners, sociologists, anthropologists to have an integrated, anticipated and systemic long-term vision about the transformations of cities, which therefore gradually leaves shares of responsibility and space for citizens to make the city by living the city (De Klerk, 2018). In both cases, the issues of governance and the centrality of citizen science respond to an ever-increasing need to redefine the identity of the city-community which, subject to its continuous transformation, loses the sense of belonging to itself, and to confine the depersonalization and alienation drifts that globalization has generated. The concepts of subsidiarity and proximity communities can partly give an answer when asked whether the city is a physical place or an idea that needs to be continually reshaped (Sudjic, 2016).

In Italy, a constitutional review law in 2001 introduced the principle of horizontal subsidiarity into the Constitution, favoring "the autonomous initiative of citizens, individuals and associates, for the performance of activities of general interest, based on the principle of subsidiarity" (Italian constitution, law n. 118, last paragraph). The new regulation recognizes that citizens are able to act independently in the general interest and provides that institutions must support their efforts in this regard in their specific territories.

Considering citizens as prosumers of the territory, their creative productions can be assumed as drivers for new rhythms and connections in urban life. This concept opens more fruitful options for creatives, makers and users (De Klerk, 2018) and define a new conception of creativity, artistic, cultural and technical production (Bianchetti, 2014; Bishop, 2012). Thus, the territorial identity and the site-specificity of creative processes could be enhanced also due to the opportunity to activate, trace and consolidate relationships with local productive and commercial networks (Evers, 2014).

The participation of mixed groups even in unconventional and disruptive forms (Goodchild, 2007; Bergevoet & Van Tuijl, 2016) can play a role in the reconfiguration of the urban order. Kevin Lynch (1964) describes these reconfigurations as new social forms and solutions which, if properly valued and supported, can contribute to the creation of innovative systems connected to the networks of local activities, stimulating projects from micro to macro-scale in an integrated and complementary way (Haydn & Temel, 2006).

The Advanced Design Research Unit of the University of Bologna is currently involved in the design and experimentation of new services and products, able to face territorial issues coupling the proposed proximity approach with a global perspective, contributing locally to the achievement of grand challenges (i.e. SDGs of EU Agenda 2030, RRI principles, etc.).

3. How to combine higher education institutions people, production and territories: the work of the Advanced Design Unit

Since its birth in the academic year 2013/2014, the Advanced Design Research Unit (ADU), through the Industrial Product Design and the Advanced Products and Services Design Bachelor and Master degree courses, feeds a circular network, designing a learning structure and process based on a quadruple helix approach able to connect research, enterprises, public entities and communities. The experiential learning and the development of an entrepreneurial mindset incentive the synergies between design education and the production environment of the Emilia-Romagna Region.

The exchange of design practices and tools within production systems has allowed companies and institutions to deal with research in order to anticipate new models and processes, but also future business scenarios with a direct impact on the social-economic environment. The rich network of relationships and the relational spaces (virtual and real) have the same importance of the products realized and led the construction of a dynamic observatory of local businesses, in order to open research scenarios, training and application of innovation models guided by design (Celaschi, 2016). On one hand, this observatory monitors the exponential growth of companies affiliated to the University, on the other hand it is a database for students' internships to enhance the connection with the territory and the capacity to face local challenges with a global vision.

The synergy between this economic system and the Design cultures' program of the University of Bologna has therefore become, in addition to a peculiar characteristic of the territory, an emerging opportunity to enhance design for proximity (Vai, 2017) in terms of:

- learning activity and internships in line with the most emerging innovative trends at local and regional level;
- consultancy and special projects connected to the specific needs at local level;

- linked initiatives to strengthen the third mission of the University;
- knowledge exchange among formal and informal institutions;

value co-creation thanks to the capitalization of collective intelligence and creativity expressed by citizens in specific or cross-sectorial networks, also in connection with the Regional Clusters Structure (www.retealtatecnologia.it/clust-er).

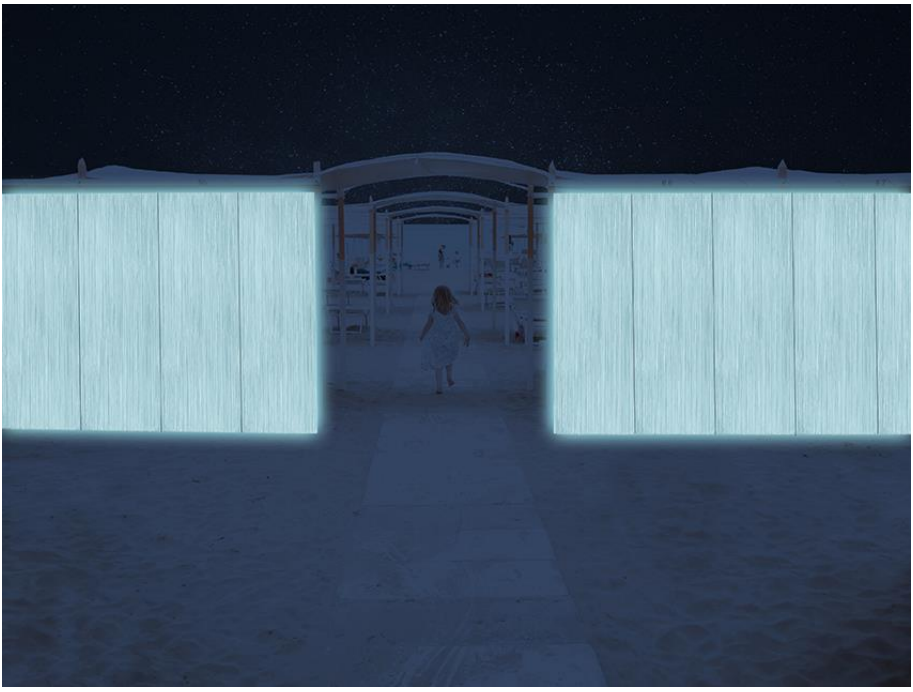

Fig. 2 Almare-night (night at the sea) is one of the scenarios and area of application of ceramic slabs with luminescent properties as outcome of the advanced design workshop with Target Group (rendering Advanced Design Unit).

Referring to the previously mentioned actions, the direct and constant relation with the real-life setting promoted inside the courses is part of the proximity approach, addressed to develop, among students, the ability to explore and mediate the different aspects of the territories of intervention. The goal is learning how to provide design responses applied to specific cases, understanding how to use methods and tools for competitor analysis, and conceptualizing product-service design systems, facing year by year higher level of complexity. At the master's level, the model for designing relationship with the actors and stakeholders of the local social, economic and cultural system is managed in a more structured way, with the creation of specific paths and through forms of convention for teaching both in class and inside companies. The results of these continuous collaborations

led to "special projects" in which the relationship between university and territory is managed thanks to the involvement of the Advanced Design Research team. The Workshop with Target Group on new scenarios and areas of application of ceramic slabs with luminescent properties, or the collaborations with Hera to transit their corporate academy to a wider learning network, constitute just few of practical cases.



Fig. 3 Almare-day (day at the sea) is one of the scenarios and area of application of ceramic slabs with luminescent properties as outcome of the advanced design workshop with Target Group (rendering Advanced Design Unit).

A further level of collaboration concerns the dissemination and promotion of the relationship between universities and stakeholders to enlarged communities through the organization of thematic workshops and events. The workshop's model adopted at the beginning of each academic year is based on real challenges presented by local companies or local entities, short term to elaborate concepts-ideas-solutions in informal space outside the academic classrooms, to strengthen the students' sense of entrepreneurship and sense of belonging to Bologna and its University. These initiatives create opportunities for growth through real synergies and collaborations. The workshops' topics deal with the innovation of products, services and processes, digital humanities, interaction and, of course, advanced design. For example, at the beginning of the past Academic Year and in occasion of Bologna

Design Week, Via Zamboni became a living experimental lab within Le Cinque Piazze's project, a co-design and self-construction workshop aiming to care for the university area, temporarily redesigning the public space, curated with and by the Fondazione Innovazione Urbana, the Department of Architecture of the University of Bologna, the Fondazione Rusconi, in cooperation with the Municipality of Bologna, as part of the activities envisaged in the ROCK project (Regeneration and Optimization of Cultural heritage in creative and Knowledge cities H2020-SC5-2016-2017 GA 730280) won by the Department of Architecture.



Fig. 4 Piazza Rossini Green. Unexpected grass square in the historical center of Bologna (Ph. Margherita Caprilli).

Another instrument of contamination and cross-fertilization between the Advanced Design Research Unit, the community of the Design Courses and the cultural and productive context is the Bologna Design Week, directly managed by the research team. It is the opportunity to spread the students' projects in design talks and installations in the city in order to narrate the relationship between design, territory and manufacturing, to inform the communities of citizens and non-professionals about the last innovation and creativity productions and to open contaminations between different disciplinary areas. As an annual event Bologna Design Week transforms the city for one week into a "theatre of wonder", experimenting the creativity of designers in site-specific, immersive and participatory projects at the urban scale.

These activities on field are supported also by Regional Authorities, triggering by the direct involvement of different actors, companies, and collaborative groups at the proximity scale, within a more complex and capillary system of elements, creating a network with existing infrastructures.

Following this objective and investigating a wider concept of proximity which implies a transdisciplinary approach, a new academic center named C.R.I.C.C. – Research Center for Interaction with Cultural and Creative Industries has been established in November 2019, as an evolution of an internal movement, born in 2017 called Thematic Action Group CCI, promoted by the Advanced Design Unit, which saw the participation of over 70 teachers and researchers from different departments and produced a first census of the training and research program offer in the field of CCI. The new Research Center for Interaction with Cultural and Creative Industries inherits this census and intends to be a relational space with a co-productive perspective and focus its activity on the triangle between CCIs: the use and diffusion of digital and enabling technologies, the ability to create new businesses and jobs, the aim to improve cultural and social development of the territory.



Fig. 5 An urban forest in Santo Stefano square was created on the occasion of Bologna Design Week 2018 as a temporary installation dedicated to the reflection of contemporary ecology by Mario Cucinella Architects (Ph. Federica Conti for BDW).

The aim is to explore how applied research can strengthen regional cultural and creative enterprises, in the fields of technologies for music, entertainment and audiovisual production, digital communication design, fashion staging, semantic web research, anticipation and future sciences applied to business, digital humanities, regeneration and

urban reactivation, the design of services, the contamination between contemporary arts and the production of industrially replicable value, the digital applications of culture.

4. Future research branches and conclusions

To face the multiple challenges of complex contemporary phenomena and to contribute locally to the achievement of SDGs of EU Agenda 2030 it is crucial, as previously described, to create new mediation systems and cooperative platforms between local institutions, research centers and citizen science.

As previously presented, the concept of Advanced Design defines a research and training approach that fits into a specific field characterized by the crisis of the relational system between knowledge production centers (universities, scientists and research centers), companies (goods and services), and citizens. This mutual incomprehension has progressively deteriorated the mediation structures, insufficient to keep together mutual perspectives and shared visions of future potentials. In a scenario characterized by inclusiveness, openness, responsible forms of innovation, enabling technologies and the search for sustainable solutions, these mediators appear not able to renew their objectives and facilitate the exploration of opportunities. On the contrary, this mediating area is full of opportunities: it is becoming the territory in which recover bi-univocal relationships between the involved actors in order to share the processes of ideation, creation, realization of the desirable, possible and shareable future. This is the objective of the first phase of exploration of the Advanced Design Unit: educational and research paths for product and service design have been consolidated and have accelerated the activation of multi-level relationships between companies, people and universities' courses.

The launch of the new Research Center for Interaction with Cultural and Creative Industries open to a new phase in which the Universities' role is addressed to a knowledge building more and more oriented to guide the dynamics of a responsible and cross-sectorial society, put in action research lines and design perspectives, overpassing the borders of specific circuits.

The C.R.I.C.C. will offer the opportunity to combine the approaches of advanced design culture(s) (Celi & Morrison, 2017) with the use of enabling technologies and data acquisition, allowing to create bonds between people, production and territories, following an open and continuously updated methodology that works at the proximity scale with a global perspective. As member and founder of C.R.I.C.C., the Advanced Design Unit will deepen, structuring and codifying its proximity approach further fields of investigation:

- Fragility factors and their impact on the context under consideration, and integration with SDGs and Research and Responsible Innovation Indicators;
- Availability and interpretation of sensitive data (big-data) and design of their social sharing. Working on the interoperability to facilitate the communication

among people and machines it is possible to create new services or update existing ones to improve the quality of life and people's autonomy;
- Co-design and involvement of stakeholders and citizens in data analysis through forms of crowd mapping and crowdsourcing;
- Implementation of adaptive governance systems (Folke et al., 2005; Goodchild, 2007) that exploit the potential of the widespread network of subjects (citizens as sensors) to support central decision-making processes.

Cities and territories become design spaces: they can be interpreted as a creative potential for the community of designers, end users and actors with different skills, enabling them together with small/medium-sized enterprises to a new approach to enhance knowledge and awareness of the regional entrepreneurship and its production processes.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Radius 100 model – Working multi-disciplinary theories, methodologies and design practice: An approach to social design beyond academia

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Abstract | Radius 100 is a social design action seminar co-framing the "right to the city" with the moto "beyond academia". The seminar aims at developing projects through focusing on the diverse experience of urban users in site-specific setting of 100 meter. A concept model discoursing multidisciplinary theories and methodologies and design practices is introduced as a platform for enveloping people & place with design-based projects. Four (4) core pillars guideline the model: (1) theory (2) methodology (3) design charrettes based on cross- disciplinary methods (4) applied tools. Divergent thinking and open inquiry are the fundamental values of the mode action enabling open-ended processes in building up projects for urban social sustainability. The project`s conclusion after its implementation in the past two academic years is that adopting the Radius 100 model as a design project skillset aspires to construct dialoguing research, social design methods and communities as a platform for social sustainable innovative projects

KEYWORDS | SOCIAL DESIGN, OPEN INQUIRY, DIVERGENT THINKING, MULTI-DISCIPLINARY APPROACH, URBAN COMMUNITIES

1. Introduction to Radius 100 model's skillsets and toolkit

Radius 100 is a social design action seminar focusing on developing social design interventions through landscaping the diverse experience of urban users' site-specific settings defined by a radius of 100 metres. Social design focuses on applying design processes in identified opportunities within the social terrain so as to encourage relationships between people, communities and institutions.

By co-working with a wide range of stakeholders invested in social sustainability such as: academic researchers, design students, urban policymakers, local communities and urban cooperatives that drive sustainable design and art interventions as local activism a new form of co-knowledging design academia and beyond academia. In other words, working out an academic knowledge & design-based model of multi-disciplinary theories and methodologies can lead to new design practices for creating social design proposals (and their feasibility) for urban site- specific. The methodological model developed in this project offers therefore a new discourse for enacting communities 'right to the city'.

Divergent thinking and open inquiry are the fundamental values of Radius 100 model in building up multi-disciplinary knowledge, skillsets and toolkits. Four (4) pillars were developed in the concept model: (1) theory-core aspects in diverse urban themes, (2) methodology-mixed research & exploration methods, (3) design charrettes based on cross- disciplinary methods and (4) applied tools.

This lecture paper introduces the Radius 100 concept model by elaborating on each pillar`s value creation to an open social design practice by presenting a concept visualisation that analyses the different processes of the student's projects that were conducted from 2017-2019. The varied components enabled the formation of open-ended processes and encouraged student's creation of new and innovative social design experimentation.

Looking at the transition that occurred in the projects from model to social design as a viable design practice in situ assured the value of framing academic knowledge side by side student`s diverse, and at times negating, toolkits while also highlighting an opportunity for game-changing in social design projects.

From 2017-2019, the seminar's model facilitated knowledge platforms and social design projects in urban social sustainability. A two (2) stage pilot was carried out: (1) 2017-2018 and (2) 2018-2019 (28 weeks in each academic year, a total of 56 weeks). The piloting of the model entailed an ongoing divergent and open process of implementing the step-stages of the model. The study process produced various proposals and products based on co- working and co-knowleging with art/design cooperatives and community members and through feedback meetups with municipal personnel. This many-layered development processes defined the components in the landscaping of the concept model.

The first stage in piloting the model's framework was carried out in 2017-2018 envisioned within the Radius 100 concept of an art exploration residency in Jerusalem's Mahane Israel

neighbourhood developed by the artist and urban activist Noa Arad-Yairi and her partner Yuval Yairi from artists' and designers' cooperative `HaMiffal`.

Co-working and co-knowledging with the cooperative community of 'HaMiffal' and community members of Mahane Israel neighbourhood allowed for the development of eight

(8) projects by the students. The projects researched various socio-typology aspects in situ, which were translated into research in urban sustainability and social design proposals. Focusing on the people-place-design trialogue offered a knowledge toolkit that is also applicable to the ongoing urban activism (actual and potential) of the involved community. The themes that were explored touched on soundscape, walkability, urban community gardens and different aspects of the site's gentrification.

The conclusions of the first year's pilot prompted in 2018-19 a wider engagement with the artists' and designers' cooperative 'Muslala', creative industries and with additional agencies empathic to the question of a 'sense of place'. Five (5) projects were developed as a proposal for social design intervention in specific urban landscapes by communities and art/design urban cooperatives. The projects focused on the implementation of psycho- geographical street structures for senses experiencing urban space enacting urban visualisation installations by gamification and frames for community-based socio- meetups. In addition to the above projects, one (1) particular project adopted the Dérive method as self-documentary by focusing on the antagonistic life experience in the urban space of Jerusalem for those who are defined by a political agenda as marginal groups. This candid exposé added a knowledge tool of the 'invisible communities' to the capacity- building of 'Muslala's' urban work.

The project's conclusion after its implementation in the last two academic years is that adopting the Radius 100 model as a design project skillset paves the way for a viable toolkit that aspires to offer sustainable innovative projects and products in and beyond academia through dialoguing, co-working and building capacities for and with the creative class and creative agencies in social entrepreneurship in urbanism.

2. Concept Model

2.1 Theory

Theory is defined in the model as a methodological tool that structures research & exploration as a value drive for socio-cultural awareness and understanding when designing urban social design proposals. It is our academic conviction that adopting diverse bodies of knowledge adds a layer to exploring, gathering and analysing findings as comprehensive step-stages in applying Radius 100 model.

The co-framing of theory and design allows for dialoguing multi-disciplinary research knowledge with design intuition, inspiration and creativity. The 'usability' of theory as a key component aims to build up and validate the concept development stage of the urban social design proposals.

Theory as a component offers a cluster of theories such as urban theory, environmental psychology, field and senses-based theories,1 material data and global and local case studies. Theory is guided by the core vision of Lefevbre's 'the right to the city', which presents a 'call to action' in reclaiming the urban life of the city as a social space where people uphold their responsibility, involvement and intervention as city citizens in the process of re-shaping urbanisation. The notion of the 'right to the city' echoes in latter theories in the demand for social justice and confronting spatial inequalities regarding marginal groups side-by-side and with the demand for a dignified access to urban life as basic but often negated human rights manifest.

Debord and Lynch adopt this meta-urban idea when articulating, at times manifesting, their theoretical and methodological claims of 'Dérive' and 'imageability' as tools for re-shaping and analysing urban socio-typological spaces. The theory of the 'Dérive' offers a method for urban exploration focused on spatial and socio-spatial relations as a strategic tool embodying the political thought of the 'right to the city'. At the core of this method is a form of drift-walking2 in an urban environment in which one or more participants let their usual objectives, engagements and daily tasks go for a defined period and plunge themselves into a behavioural disorientation of their habitual axes so as to be drawn by unplanned social encounters, sensual-spatial attractions and varied ambiences of the terrain.

Debord emphasises that this method is not 'mere exoticism' but instead offers a critical analysis of the city. As a central method of the situationist's movement, 'Dérive' is perceived as a metapraxis of psycho-geographically3 'collage' mapping through a process of creative re-imagining the socio-typology of the city; i.e., countering and disrupting the standard typological representations of space so as to reveal fractures that signify an imagined proposal's possibilities of what in latter theories would be defined as promoting bottom-up suggested interventions.

Another aspect of capturing a new notion in re-reading the socio-typology of the city is Kevin Lynch's 'imageability'. Imageability refigures, through a perceptual form of the urban physical environment, urban users' mental maps of the city as a visual articulation of behavioural

[1] Such as analysing (a) the phonic identity of the city through sound-maps and designing soundscape for social designed spaces: 'The soundscape technique uses a variety of investigation techniques, taxonomy, and measurement methods, sound-walks, questionnaires, interviews and recordings' (Schafer, 1977) and (b) walkability as a multi- defined urban action regarding the various fields of physical environment, sustainability, accessibility, health and safety urban expressions and social & social justice concerns (Pak, Verbeke 2013).

[2] Debord defines the praxis he suggests as 'rapid passage', while the translation favours the concept of 'drift' as articulating the core idea (Debord, 1956).

[3] The effect of environments upon emotions and behaviour not as a recording or tracing but as an active intervention.

geography and considers main urban elements such as paths, nodes, edges, landmarks and districts.

William Whyte's study of pedestrian behaviour as a city's socio-dynamics further adds a methodological frame for observing and analysing individual engagements and community/social interactions and their dynamics in public spaces such as corporate plazas, urban streets, parks and other open spaces.

The main issues proposed by these core theories are contextualised locally by focusing on Israeli site-specific theories, such as Fenster's work on the question, 'Whose city is this?' (Fenster, 2012) debating bottom-up knowledge offering a viable component for city policymakers; Churchman's emphasis on the importance of the democratic aspects of the public sphere as an aspect of social justice concerning urbanism (Churchman, 2002); Hatuka's work on looking at the city as an experimental territory when exploring the 'sense of place' as a an immanent part of self/group social construction of loci habitus (Hatuka, 2013) and Yacobi on uncovering space memory and dispossessed groups and communities (Yacobi, 2011).

These baseline theories support the model's agenda of social design as a sustainable intervention for encouraging city's citizens' involvement in the various aspects of city life as an integral aspect of creating their sense of place.

2.2 Methodology

The methodology component focuses on integrating field research, creative thinking & design inquiry as methodological steps in formulating social design and design as a praxis for advancing 'proximity culture' in situ when exploring people and places in Radius 100 site specific.

Four (4) main methodological steps are frame worked:

- Site-specific analysis by applying Lynch's Imageability and situationist's 'Dérive' drift walking.
- Mapping possible social design/design action interventions by applying field thick description, documentation and visual &/or sound materials.
- Working through experimental frames based on the reflexive and reflective evaluation of research and practice-based findings.
- Pitching social design/design implementation proposals to professional stakeholders, site-specific communities and artists and designers in urban cooperatives that drive sustainable design and art interventions.



Figure 1. *Radius 100 Site exploration, Asaf Weinberg, Yaara Farber & Alina Ixanova. Department of Industrial design, Department of Architecture, 2019-2020*



Figure 2. Shahed (Witness), Yusuf Rajbi. Department of Ceramics and Glass Design. 2017-20

2.3 Cross-Disciplinary Design charrettes

Adopting cross-disciplinary methods as a leading concept for design charrettes triangulates theory, methodology and applied tools with: (1) participatory research approach that emphasises bottom-up knowledge based on qualitative dialogues with creative class (urban activists), social and municipal entrepreneurships and local communities; (2) combined knowledge platforms via cloud for and by students that encourages knowledge crossing by sharing textual, visual and material concepts; (3) cross-disciplinary teams that offer various skillsets such as co-knowledge design toolkits, mutual team learning and innovative social design toolkits.

2.4 Applied Toolkits

The fourth component refers to applied toolkits, a component that combines the seminar's theory-based field tools with students' design-based skillsets formed in their affiliated departments. This component adds an additional frame to the cross-disciplinary design charrettes component.

Two (2) sets of applied toolkits are formed:

1. Visual/audio representation tools: photo/audio database, a cluster of design tools and different forms of spatial mappings. These diverse tools offer a frame for creative inspirational ideas and images in prototype modelling.
2. Concept visualisation tools: team-based toolkit (seminar toolkit & team members' departmental skillset) articulating projects prototype proposals.



Figure 3.Initial sketch for community based event proposal, Asaf Weinberg, Yaara Farber &Alina Ixanova. Department of Industrial design, Department of Architecture, 2019-2020



Figure 4. Conceptual model of "Radius 100: Research, Design and Community" seminar developed by authors

Table 1. Open inquiry and divergent thinking based projects

Theme	Selected project	Methodology
Sense of place: Artistic material representation of counter-historical narratives of the dispossessed Added value: . Developing a unique innovative design technical brief. . Emphasising artistic materiality workshops as an aspect of proximity culture[4]	Shahed (Witness), Yusuf Rajbi, Department of Ceramics and Glass Design 2017-2018 As a ceramic artist, Rajbi had a special interest in the material research of the historical (6th century) Muslim cemetery of Mamila. He pinpointed the 'Shahed', a small sculptural object placed on Muslim tombs as a witness to the oneness of God, as his material and artistic exploration. In the context of the specific site inquiry, the 'Shahed' embodies also a complex socio-political statement because of its narrative connection to HaMiffal's Palestinian history. Rajbi developed a unique innovative design technical brief that placed the Shahed as a standing sculpture that carries the counter-site narratives of past and present of Palestinians and Israelis. As an artist, however, he allows the technical brief to stand by itself as an artistic process. Rajbi's product was added to HaMiffal's self-identity and was developed into a community-based workshop held at HaMiffal's house.	
Sense of place: Socio-spatial site exploration Added value: . Proximity culture: In situ spatial and socio-spatial relationships . Experiencing the social use of tangible space & place	Walkability, Sharona Kremer, Yotam Oron & Yaron Marcovitz, Department of Architecture 2017-2018 The project explored the theme of 'Walkability' through self-documentary-mapping of the daily routine in the neighbourhood's spatial typology. The self-focus mapping unfolded the nature of the relationship that has been developed personally, interpersonally and publicly. The findings through the implementation of visual methodology portray the self-experience of the personal and social use of tangible space	

[4] Author's note: This project presents a thematic challenge since by emphasising the materiality brief as a leading theme in the process of community-based social design, the politics of counter-historical and identity narratives were put aside by the artist.

Sense of place: Soundscape, the sound of negating socio-spatial identity Added value: . Sound maps as a spatial-political analysis tool . Analysing phonic identity in situ	Soundmaps: Vacant 'Spirit of place', Ismael Faroun & Nagham Copty, Department of Architecture 2017-2018 Ismael and Narram analysed the 'spirit of place' in Mahane Israel' neighbourhood by narrating soundscape in different locations. Their theme aspired to unfold and emphasise the strong negation existing between the concept of a vibrant socio-spatial urban typology and the non-voice that envelops the specific site space. This knowledgeable description offered another layer to the activist's campaign against gentrification processes.	
Community-based social design: Added value: . From online to offline. Offering an additional platform for fostering and cultivating community proximity relations	Real Life Encounters Facebook: The Material Museum of Storytelling Objects, Dor Gershovitz, Adi Lax Aviezer & Tali Saquin Department of Architecture, Department of Industrial Design 2018-2019 The 'Nachloaot' community fashioned intensive personal and communal ties based on the digital platform of Facebook. An intrinsic social interaction was an ongoing cycle of object exchange. In the spirit of human sustainability, the project proposed an additional physical social platform for the engaged community by moving from virtual encounters to face-to-face meetings and by sharing personal narratives of objects through an architectural form of a museum-like ephemeral space in the actual living space of the neighbourhood.	
Psycho-geographic structures in urban place I Added value: . Engaging city citizens in experiencing a sense of place through the use of senses	Space of Silence: A Psycho-Geographic street scene, Eden Paz, Rasha Abu-Amir & Gregory Kern, Department of Architecture, Department of Industrial Design 2018-2019 The project introduced a psycho-geographical object that triangulates vision-scape with soundscape and offers a momentarily 'haven of silence', i.e., an open-closed structure that invites urban users to pause and disconnect from the noisy and hectic surroundings of the street. The inclusive object introduces through its liminal space an experience of a blur of sight and sound that creates a diversified new outlook on urban space.	

Psycho-geographic structures in urban place II Added value: Urban gamification	Interactive Installation in Urban Space, Shira Kaufman & Nadia Adler, Department of Photography, Department of Industrial Design 2018-2019 Nadia and Shira's project focused on the social life of urbanism. Using the urban street as a platform, the project proposed an interactive installation based on 'moving films' that portray visual sequences of Israeli urbanism and nature habitat. The installation necessitates the participation of the urban user as the moving films screen comes to life only through cycling. The aim of the project's apparatus is to encourage urban citizens to reclaim urban space as their own front yard by 'staying in' and not just passing through.	
Gentrification processes: Property-based, site-specific 'right to the city' Added value: In-depth case study analysis of David Harvey's theory on gentrification processes of accumulation by dispossession	'Accumulation by Dispossession': The use and abuse of community members' ignorance, Merav Dahari, Department of Architecture 2017-2018 Meirav`s project on 'accumulation by dispossession' explored the different layers of the current gentrification process in the site, identified the stakeholders and uncovered the links between economical profit, legislation and the use and abuse of community members' ignorance in this matter. The project heightens the future prospects of the community's negotiations on its identity and day-to-day urban life and constructs a knowledge tool for community members in their struggle against ongoing gentrification processes.	

The project development of each student or group of students reflects the nonlinear process evolving according to core themes presented by student's site-specific project. Each project reflects a selected cluster of relevant toolkits applying the diverse bodies of knowledge (theory and practice) that discourse with their themes.

The projects vary in their themes and offer in-depth, site-specific case study analyses of an urban macro theory by concentrating on a theoretical baseline and applying a personal selection of methodological processes and different toolkits. The concept visualisation identifies the different stages applied in the process of each project.

All projects were presented to their potential urban stakeholders.

3. Reflective summary

The added value of the model work-process discussed in this lecture paper can be summed up by seven (7) main points:

- Applying open inquiry and divergent thought and methods for social design by integrating diverse, multi-disciplinary theories and methodologies, participatory research, design exploration and design practice. Discoursing academic-based knowledge with students' design practice skillsets and toolkits 'pushed' students outside of their natural comfort zone and offered a new knowledge skillset for design.
- Creating innovative and/or new social design proposals by implementing multidisciplinary frames through the challenge of balancing all four parts of the model in the workflow.
- Encouraging and developing diversity through cross-disciplinary student work teams and team-based co-learning, and by developing co-knowledge in students carrying diverse and at times negating toolkits.
- Inspiring curiosity and passion for an additional knowledge-crossing framework for design (in our case, social design) implementation.
- Dialoguing urban cooperatives, activists and stakeholders and local communities with design academia for social design entrepreneurship.
- Emphasising bridging academia (the hub of creative class) with creative agencies by investing design strategies in a knowledge skillsets and toolkits.[5]
- An unplanned value of the seminar was the identification of the effect of 'human resource'. The makeup of the student's team was instrumental for the content of the seminar, as it allowed sharing each student unique design brief and evolving beyond their personal perspective.

Looking at the different volume of the projects produced in the now three (3) years of the seminar reflects a varied range of themes. In the first year (2017-18), most of the projects were research-driven, analytical and focused on site exploration concerning urban sustainability issues, as the majority of the students were affiliated with the architectural department. Other projects in this year reflected a personal aptitude for art activism. In the second year (2018-19), the proposed projects focused on social intervention in urban and community spaces through objects, street structures and redesigning personal and/or local space. These proposals, though designed for a specific space, were not site-bound and could stand as a design brief for a social design intervention in other locations. In this current year (2019-20), projects are oriented at (1) community art-based objects for psycho-geographical

[5] In the specific case of Radius 100, the knowledge skillsets and toolkit were applicable to the urban activism of the communities and the art/design urban cooperatives.

sustainability action, (2) a performance event promoting community's proximity culture, (3) producing design products for community's sense of space place and (4) uncovering site specific `s historical narratives as part of an in-depth sense of place.

The variety of the projects themes in each year posed a challenge in working with stakeholders and urban communities that were diverse and different in each project. Connecting with stakeholders is significant to the seminar, and also poses a challenge in terms of connecting relevant stakeholders to each project, and their involvement in the process. The common ground that encompassed all the projects was the definition of a site-specific urban space and co-working with activists and artists who engage in various ways of community action and know the city and its residents in depth.

The motto 'beyond academia' stands, therefore, at the core of the Radius 100 methodological model. The concept model and it`s components were constructed through a reflexive and reflective process with the defined stakeholders to a pilot engaged in the implementation prototype and dissemination processes of urban social design.

The 2017-18 projects were exhibited at 'HaMiffal', an historical Arab house in the site specific of the seminar that carries the complex identity of the neighbourhood and currently functions as a centre for art and art performance ventures promoted by groups of artists, activists and students of design. The research and the exhibition were carried out with the active involvement of 'HaMiffal' activists and community representatives. In 2018-19, the action seminar concluded in an exhibition at Muslala centre (a place for social activists and artists working in Jerusalem urban communities) and held a unique pitching presentation in front of various urban stakeholders (municipality and community). This current year is yet to be planned.

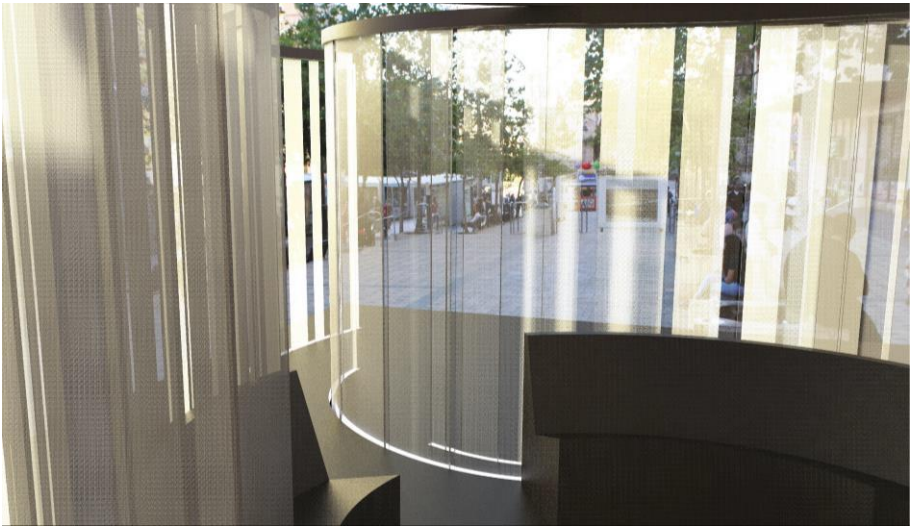

Figure 5. Space of Silence: A Psycho-Geographic street scene, Eden Paz, Rasha Abu-Amir & Gregory Kern, Department of Architecture, Department of Industrial Design. 2018-2019



Figure 6. The urban Garden, Mayar Kulgasy & nave Knafo. Department of Architecture. 2018-2019

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Acknowledgments: Radius 100 was conceived and constructed by Dr. Yona Weitz as a partner and fellow researcher and was co-developed with Architect Sharon Koniak with the support of the Erasmus+ program of the EU "CLEVER" project (Creative Leadership & Entrepreneurship – Visionary Education Roadmap (2014-2019).

To our EU friends with appreciation and gratitude for their professional support and for an inspirational dialogue: Sigrŭn Birgisdottir and Tinna Gunnarsdóttir (IUA), Eva Leemet, Ragnar Siil, (Creative Estonia and EBS) and Marge Täks (EBS) to Donna Close (Brighton University).

To our Supporters in Bezalel: To Prof. Ori Bartal (Head of Visual and Material Culture Department), Tamar Arman (Of the Dean of student's office project for investing in innovative social design projects) & Shelly Hershko (Student Dean), Safi Hefetz (Head of Industrial Design Department), Erez Gavish (Head of Visual Communication Department) and to Dr Yoav Freidman (Head of Research & Innovation Authority) for his candid support.

Special thanks and gratitude to our Graphic design advisor Stas Krylov

To artists & urban activists: Noa Arad Yairi ("HaMiffal") and Matan Israeli ("Muslala") and finally to our colleagues in Bezalel and Clever

Many special thanks for our students on our joint venture.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Rethinking User Experience of Parking Garage. Exploring Innovative Suicide Prevention Strategies Through Motivational Design

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Abstract | Suicide rates on university campuses are increasing. University parking garages, in particular, have become "hotspots" for these tragic events. In response to death-by-jumping attempts at these locations, authorities have installed preventative measures at the edge of higher levels of parking garages (structural barriers, help hotline signage, etc.). Although these coercive interventions generally are seen as effective in preventing suicide, collectively, they do not improve the quality of the user experience or provision necessary support, once potential jumpers return to a typical mindset. The shortsightedness of these approaches contrasts with design's capacity to contribute to the development of environment geared toward people holistic well-being. In this context, a successful approach needs to go beyond suicide prevention and instead pursue a culture of care. This new approach, moving away from a coercive solution, may positively affect well-being perceptions of *all parking garage users*. Through a student-led workshop, we explored potential motivational designs (by creating somatic interactions, emotional reactions, and social engagement) to initiate a critical discussion on our current approach to context sensitive intervention.

KEYWORDS | DISRUPTIVE INNOVATION, CULTURE OF CARE, SUICIDE PREVENTION, MOTIVATIONAL APPROACH, CRITICAL THINKING

1. Introduction

Since 2000, there have been 58 documented suicides on the campus of The Ohio State University (OSU) in Columbus, Ohio (Zachariah, 2018). In 2017, there were six suicide attempts by jumping from the campus's parking garages. Those incidents prompted the University to investigate parking garage security and led to more serious reflection on students' mental wellness. In March 2018, University President Michael V. Drake commissioned the OSU Mental Health and Suicide Task Force. Since then, decision makers have restricted access to the rooftops, added barriers to prevent further falls, increased the presence of security foot patrols and campus police, and placed permanent signs in the stairwells of all multi-level parking garages featuring the University's counseling hotline number. In design terms, the University's actions are considered coercive (or direct) strategies to enforce certain modes of use, or to limit unwanted behaviors.



Figure 1. The Ohio Union garage with suicide fencing on top level and hotline signage

The University's actions are commendable and understandable. No one could argue against measures that may prevent student deaths. However, these interventions do not directly address the first recommendation of the Mental Health and Suicide Task Force, which was for the University to embrace a "culture of care." In this culture of care, suicide prevention would seek to address underlying issues from a community perspective—encouraging students, faculty, and staff to reach out to one another. Advocates of this type of person-centered community approach, such as Ulrich Beck (1992), would argue that chain-link fencing, police presence, and prominent signage are counter to a culture of care. To designers, such interventions may also be considered reductive within the scope of environmental design improvement that is possible to address a problem of this nature.

In response to these University measures, five undergraduate design students approached faculty members of the newly established OSU DESIS Lab, wanting to contribute their talent and creativity. These students believed that they could mobilize around the originality of their person-centered view on life matters and their capacity to facilitate collaboration and dialogue beyond traditional disciplinary boundaries to foster innovative and disruptive ideas for suicide prevention. Building on contemporary experiments in suicide prevention, the authors engaged in a Research-Through-Project (Findeli, Brouiller, & Martin, 2008) to examine an approach of place-making wherein experience design and motivational design strategies (Thaler & Sunstein, 2009) would address the parking garage situation and help establish the culture of care sought by the students. To examine the extent of design's role in suicide prevention, the authors set out to explore how parking garages could be redesigned to reflect how environments can positively affect mental wellness. Although our approach is focused on indirect and subtle changes, it represents disruptive and critical perspectives on the actions suggested in the guidelines of the United States National Strategy for Suicide Prevention (Office of the Surgeon General, 2012). Those national standards can be considered efficient in many ways; however, the underlying evidence-based approach yields only incremental changes. Fixation on a proven-only approach, by definition, leads to a broad dismissal of alternatives and serves as a barrier to innovative thinking. As Mishara (2003) points out: because mental health and suicide are multidimensional and complex social problems, prevention demands innovative thinking and solutions.

In this paper the authors present and discuss a typology of indirect strategies induced from student-designed prototypes. Tasked with the challenge of developing novel motivational design strategies, we question current suicide prevention approaches. This paper reflects on how a design research endeavor may help change perspectives on complex social matters.

2. Background. The need for innovative thinking in suicide prevention

In the United States, more than 47,000 people died by suicide in 2017 (Center for Disease Control and Prevention, 2019). Deaths by suicide in the U.S. rose by 30% between 1999 and 2016 (Hedegaard, Curtin, & Warner, 2018). This makes suicide the second leading cause of death for people aged 15 to 29 (CDC, 2019). Further, college is a stressful environment which puts university students at greater risk. A report from the National Alliance on Mental Illness (2012) found that 64% of students who do not complete their college education do so because of mental health reasons. Another study by The Ohio State University Suicide Prevention Program (2015) found that 59% of students felt helpless. Sadly, many studies connect these (and other) mental health issues to suicide.

Although suicide is preventable, prevention must be considered a never-ending endeavor. No single factor causes suicide, nor does a single factor contribute to mental illness leading

to suicidal ideation and self-harm. Among the methods of suicide (hanging, drowning, etc.), suicide by jumping makes up a relatively low percentage of the reported deaths. However, the choice of method seems to depend largely on access and availability. In an interview with ABC News, Adam Kaplin, Assistant Professor of Psychiatry at Johns Hopkins Medical Institute, commented that "when people don't have access to firearms and get it into their heads that they don't think pills are going to work, they think there is something about the finality of [jumping] and think 'If I just do this it will be over'" (Friedman, 2008). This observation seems particularly relevant for young adults. A longitudinal study carried out over 12 years in Norway revealed that 30% of those who committed suicide by jumping were between 15 and 24 years old (Sæheim et al., 2017). For university students, an unpopulated parking garage provides isolation, access, and availability.

Traditional suicide-by-jumping prevention efforts focus primarily on limiting access. Locations install structural interventions (barriers, safety nets, etc.) at the edge of higher levels to prevent access, and most studies support the effectiveness of these structural interventions, despite the notion that suicide-minded people simply will go somewhere else. For instance, O'Carroll, Silverman, and Berman (1994) found that the addition of a suicide-prevention fence at the Duke Ellington Bridge in Washington D.C. did not increase the number of jumpers at the nearby Taft Bridge. While one study by Sinyor and Levitt (2010) found that, although suicide rates at Bloor Street Viaduct decreased after barriers were installed, overall suicide rates in Toronto stayed the same; this study appears to be an outlier. A meta-analysis of the effectiveness of structural interventions (Pirkis et al., 2013) found that following the interventions, there was an 86% reduction in suicides by jumping per year at the sites and a 44% increase at nearby sites. This study also concluded that there was a net 28% reduction in all suicides by jumping per year in the study city. With this evidence, many city authorities rely solely on the effectiveness of structural interventions.

This access-focused approach is also common on university campuses. Cornell University posted security guards and installed fences and netting around university-owned bridges where six students died by suicide during the 2009–2010 academic year. New York University installed plexiglass barriers inside their library after two suicides in 2003 and installed floor-to-ceiling metal barriers after another suicide in 2009.

In design terms, these types of structural interventions are considered coercive (or direct) solutions—these designs force wanted behaviors or deny unwanted behaviors. Although this approach succeeds in meeting its targeted purpose, in implementing these barriers, most authorities do not seek broader success, defined through the lens of all parking garage visitors. From large help-seeking signage to tall black metal fencing, it is clear to all that these apparatuses are installed to prevent suicides by jumping. The bluntness of the installations shows that priority was not given to the broader visual or aesthetic qualities found through experience design. One notable example seeking to avoid this visual stigma is at the Golden Gate Bridge in San Francisco, California, where work recently started on a three-year project to install horizontal netting below the deck of the bridge. Although novel

in design, this solution comes with a cost that has risen from an already high $75 million to more than $200 million. Regardless of their visual appearance, structural interventions deter motivation to navigate to the location for suicide, as well as the impulse to attempt suicide at the location.

A few innovators have conducted experiments in search of alternative ways to address suicide. For instance, the South Korean Mapo Bridge, a notorious suicide spot in Seoul, was redesigned in 2012 with sensors and positive messages along the railing that light up as pedestrians walk past (see figure 2). This approach garnered mixed reviews, with some social work experts calling the idea naïve (Chung, 2012). However, epidemiological evidence demonstrates that the frequency of suicides at that location has dropped while on-bridge rescues have dramatically risen from 15 rescues in 2012 to 93 in 2013 since its redesign (Lee, Lee, & Park, 2016). Designers and city officials adopted a similar approach for the redesign of a six-mile stretch known as “suicide black spot” along the River Foyle, which runs through the city of Derry-Londonderry in Northern Ireland. *Our Future Foyle* is an ongoing project at The Helen Hamlyn Centre for Design, which partnered with Public Health Agency Northern Ireland to explore how design can be used to uplift an area associated with poor emotional well-being and encourage residents to help make the banks, river, and bridges a lively and lived-in place (Myerson, 2016) (see figure 2).



Figure 2. Seoul Mapo Bridge/Bank of River Foyle

Universities have also tried to implement indirect motivational solutions. John Hopkins University concealed the grades of first-semester, first-year students from graduate admissions and future employers on transcripts to reduce stress and anxiety for students. At Yale University, the readmission policy was changed in 2015 by the Yale College Withdrawal and Readmission Review Committee to make it easier for students to leave for medical or mental health reasons and then return to the University. However, the use of such motivational strategies by universities has only been found outside specific suicide hotspot locations, like parking garages.

3. Thinking about suicide prevention in a cultural of care

We may never have a clear answer to the complex question of why university students choose to commit suicide at parking garages. However, we can acknowledge that, from a design perspective, parking garages are notoriously neglected. They often are hostile, dark environments, that do not obviously demonstrate care for the well-being of their users. Garages are an embodiment what anthropologist Marc Augé (2008) calls non-place—places with no existential meaning. The experience of finding oneself in a parking garage is rarely memorable. Garages are spaces designed to serve a narrow function. The issue with such approaches to environmental design is that they negate humanity and the experience of finding oneself in that place. When in the garage, a person is reduced to a simple, rationalized, theoretical view. In such a context, a person has no anthropological "thickness," no personality that may qualify a person's experience while in the garage.

In contrast, a culture of care commands that all human experience be considered as valuable and worthy, even experience in a so-called non-place. From this perspective, the use of the parking garage is no longer a commodified task but a genuinely impactful part of someone's daily routine. Here, designers' interventions can shift away from coercive strategies toward motivational approaches. Design has the capacity to motivate the adoption of healthy, safe, preferred behaviors.

Motivation, as opposed to coercion, is a soft approach, in the sense that design interventions are not enforcing behaviors. For instance, Thaler and Sunstein (2009) show that high school students' eating habits can be nudged towards healthier options simply by rearranging how the food is presented by the cafeteria. Their experiment demonstrated that placing healthy foods at the front of the display was enough to steer students' choices away from the junk food placed in the back. Although often simple and subtle in form, motivational measures can have real impact. In the parking garage context, the realizations of the interdisciplinary design firm Integral Ruedi Baur Paris & Zurich are worth mentioning (see Figure 3). Integral is regularly commissioned to address spatial orientation issues in parking garages. Through playfulness or ludology, they show that design can address people's emotional state and reduce anxiety (Baur, Braunstein, & Intégral, 2001) through desirable visual engagement. Such interventions mitigate the fear and discomfort associated with feeling lost.

Drawing from suicide prevention interventions in Korea and Northern Ireland and Integral's work in parking garages, our goal is to explore similar motivationally focused solutions that may transform the aesthetic experience of Ohio State's parking garage to support suicide prevention more broadly for the University community.



Figure 3: Examples of Integral Ruedi Baur interventions in parking lots.
Source: http://www.labo-irb.eu/projet/index/id/15/image/5/lang/fr

Methodology

To explore and rethink the user's lived experience in the parking garages, a three-week design sprint workshop with second-year students from the Industrial Design major within the Department of Design at The Ohio State University was organized. The immediate goal of this activity was to create an initial range of novel motivational strategies. Sixteen students were divided into 8 teams and were asked to develop disruptive ideas using C-K theory (Hatchuel, 2003) as their methodological framework. The proposals they were asked to develop had to align with the idea of a culture of care. The ambition of this disruptive innovation sprint was modest. The goal was not to define realistic or implementable ideas but to allow the research team access to ideas from which it would become possible to reflect on the qualities of the prevention strategies generated from an approach focused on experience design and motivational solutions.

Students were asked to research existing strategies that address suicide-by-jumping problems. Each student started by finding two strategies, one motivational and one coercive. This exercise introduced the complexity of the topic, while allowing the students to open their minds to the scope of innovative solutions possible. This activity also allowed students to better understand the distinction between motivational and coercive approaches, which is not always clearly defined. In the second part of the sprint, students were paired in teams and repeated the process to arrive at what they believed to be a disruptive idea. Again, they were asked to generate one idea adopting the motivational approach and one adopting the coercive approach.

Results of the design sprint were examined using inductive categorical analysis to distinguish their core properties (Paillé & Muchielli, 2016). As suggested by Paillé & Muchielli, this method allows solutions to be classified in types according to shared properties. Given the focus of our research, the analysis focused on the motivational interventions, as they are the ones geared towards the activation of the culture of care expressed by the university administration.

The analysis identified three strategies: Beautification, Activation, and Transformation of Use. To further examine the extent of those intervention strategies and the nature of their impact, a follow-up group of five undergraduate students summarized the key principles of these strategies and further developed visualizations to represent each type.

To gain input on the value of each type of intervention as a suicide-prevention strategy, a focus group with three topic experts was organized. The focus group was composed of a Clinical Psychologist, a Suicide Hotline Administrator, and Students Resource Monitor. The goal of this focus group was to challenge and receive feedback on the intervention typology before we moved our exploration forward. The panel of experts was asked to openly react to the students' concepts and share their professional opinions on the potential value and limits of each type of intervention. Their responses were later analyzed to precise the intervention categories and translate them into a typological model.

A typology of indirect strategies

Analysis of the design sprint activity and the focus group discussion led us to classify the various interventions proposed by the students into three different typological strategies: Beautification, Activation, and Transformation of Use. While there are some shared properties, each of these strategies presented specific perspectives on ways to activate a culture of care through place-making (Oldenburg, 1999). Moreover, each of these strategies demonstrates an ability to affect user experiences. Such experiences are threefold: somatic interaction, emotional reaction, and social engagement. Somatic interactions engage the user's physical senses (vision, touch, etc.). Emotional reactions engage the user's emotional expressions (joy, delight, self-worth, etc.). Social engagements foster connections to the community (exchange, cooperation, etc.).

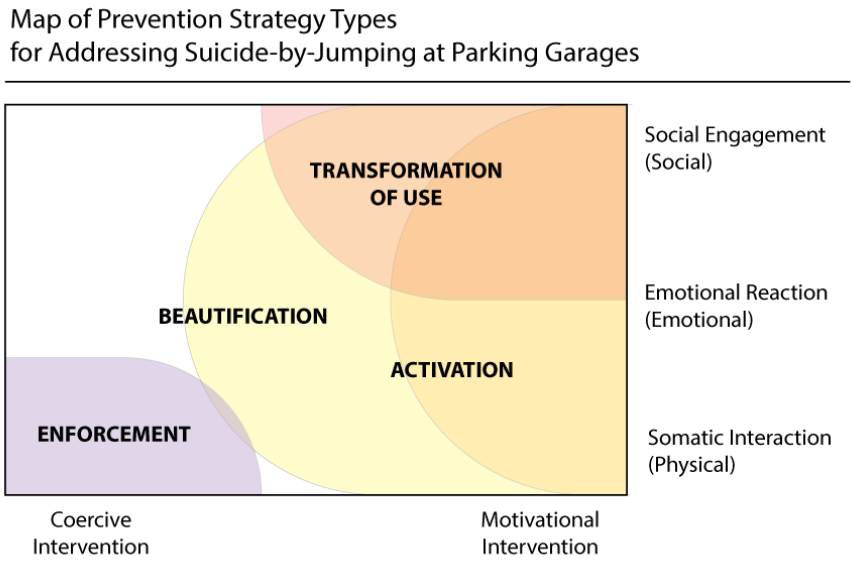

Figure 3. Conceptual map of motivational prevention strategies

Beautification

Beautification looks to address the neglected status of a typical garage—a status which inspires impressions of darkness, dirt, and depression. This strategy's primary aim is to seek significant improvement of the formal aesthetic quality of the physical space. Intervention examples would include applying color or graphics to the walls or floors, improving the lighting, adding an organic quality such as plants, installing or improving the seating, etc.

The Beautification strategy is the least engaging of the three since it relies primarily on passive emotional responses of garage visitors. This strategy also may overlap social engagement (the content of the wall graphics) or a somatic interaction (an interactive seating arrangement). However, this strategy seeks favorable responses from parking garage visitors that would be accumulated over time. Each time a user enters the garage space, they build a memory of it as a positive place. Due to the passive nature of this strategy, it may be considered a neutral intervention, nor solely relying on coercive or motivational interventions.

When presented with this strategy, the topic expert panel responded positively to the approach. One of them noted, "I like the softening [of a conceptual rendering], so it's not so stark and prison-like." Also, supporting that little interventions do help, adding that "anything to distract from their focus" will have a positive impact. Another noted that "30% of people don't actually want to talk to anyone." Added discussions reinforced that you

cannot tell people what to do, but it is important to say that you are not alone, saying "distract, then connect."



Figure 4. Example of student Beautification ideas (Pictured: Exterior of the parking garage covered in greenery to create a visually interesting wrap over the safety fencing on the upper levels)

Activation

Activation looks to address the individual user's internal experience, by focusing on users' feelings of disconnectedness and being "stuck in one's head." This strategy's primary aim is to be responsive to individuals in the garage. While activation can foster each type of engagement, the purpose is to create an emotional experience. Examples include a participatory installation that may use light and/or kinetic-based sound elements that respond to the individual's movement. While common elements (light, color, etc.) exist between the first two strategies, the key difference between Beatification and Activation is that now the materials are used within the space to acknowledge or respond to their presence/interaction. In doing so, it is *for* the person.

The Activation strategy's focus is to change the behavior of the individual by creating an alternative activity (if even for a brief time). The aim is to increase the time spent in the intervention so that individuals may have time to return to a neutral mental state.

A topic expert panelist responded to this strategy by agreeing that "I think something interactive is good." Another furthered, "the brain is connected to the body. It is all one." and "It's definitely a distraction … anything out of the ordinary." As the discussion progressed, the experts agreed that noise is a particularly good approach to helping people feel like they are not alone. Seeing that the conceptual solutions could reinforce a "web of connectedness" might help accomplish something that they do in therapy sessions, which is to get people to think about their future.

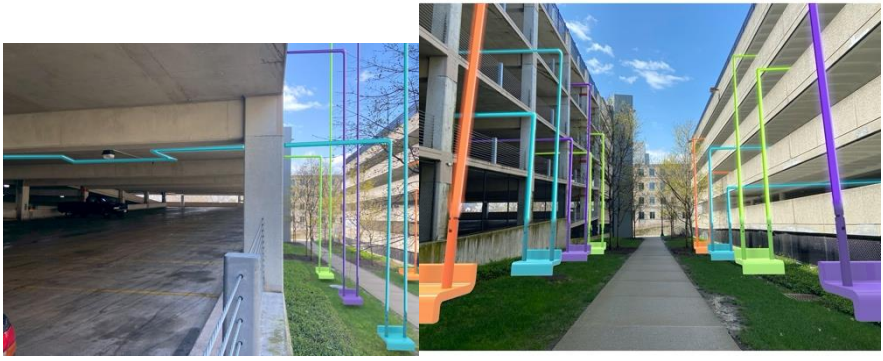

Figure 5. Examples of student Activation ideas (Pictured: Garage with brightly colored swings suspended from higher levels, to create an individual activity to prompt self-reflection)

Transformation of Use

Transformation of Use looks to address the shared (or group) experience by addressing feelings of isolation and loneliness. This strategy includes solutions that interact with others, are inclusive and public. Examples can vary from constructing a greenhouse on the top level to hosting food truck parties or creating 24-hour study spaces.

Regarding suicide prevention, this strategy is the most direct. It generates interactions with others, so that users are re-focused towards an entirely new (and possibly unexpected) social activity. How the space is transformed is not as important as why it is transformed. The use needs to support opportunity for social participation or interaction. Several types of interventions can include a wide collection of interactions: cooperation (i.e., food trucks), direct exchanges (i.e., study spaces), accommodations (i.e., stargazing lessons), and even moments for light-hearted competition (i.e., playgrounds). By using the Transformation of Use strategy, the garage becomes a place for direct human connection as well as general visual activity, which may circumvent a suicide-inclined individual seeking isolation. Topic experts saw concepts from this strategy as providing "another beneficial barrier." "Having things to do is cool, and playgrounds are a great way to activate a space—play is a really important thing for nostalgia." However, they did raise some questions about the types of concepts they were shown. Given that "high lethal [suicide prevention help] calls are during

the day, but they get more calls at night," the experts were interested to know how this space could be populated and at what times to ensure that someone is there to help.



Figure 6. Example of student Transformation ideas (Pictured: Top level of a parking garage with food trucks, sun screening, video boards and various seating configurations to create a social retreat from typical campus life)

A Critical Approach to Public Health Matters through Design

In a recent paper reflecting on the rise of social design, Alain Findeli (2017) suggested that the rise of designers' concern for the quality of people's experience of the artificial world has provoked a cultural shift in design practice. He suggests that with social design, the focus is on how people interact with their material and social environment. By considering the experience as important, designers are in a position to more holistically address and fulfill people's needs and desires. Through experience design, or design for experience to be more precise, products are no longer end in themselves, but are merely parts of an ecosystem of touchpoints embodying services that looked to fulfill people's needs or desires. The *people* these spaces serve are the ends in themselves. Incidentally, the quality of design projects depends on their fitness to users' capacities, values, and biography; users' understanding

becomes a crucial part of the design process (Proulx, Gauthier & Hamarat, 2020). This facilitates moving away from coercive-centric interventions (although coercion may remain relevant in certain situations).

Developing motivational preventive measures is a complex process that calls for the acknowledgment of diverse issues and forces. It is now widely recognized that context—the sociocultural reality in which people live—is a significant health determinant. Coincidentally, socio-cultural fitness must be considered important in the development of successful health and wellness strategies. Fitness is defined by how easily people can connect, appropriate, and understand the various touchpoints within which measures are at some point encapsulated. The development of socio-culturally fitted measures requires those involved in their design to account for the idiosyncrasies of social realities. Accounting for localized realities allows a more holistic approach to problematizing interactions between people and health measures. In other words, context awareness can emphasize quality or aesthetics of the user experience as a matter of concern, launching innovative ways to think about how to motivate people to adopt healthy behaviors.

One source of inspiration for this problem's motivation strategy can come from understanding what fosters participation in public places. Through a series of collaborative design workshops with older adults, a recently completed study (Fromme, 2018) sought to identify key characteristics that motivate individuals to participate in public places. The resulting Age-friendly Framework for Public Places identifies four key design qualities that motivate participation: Approachability, Intuitiveness, Equitability, and Value. These qualities can be viewed as desirable characteristics that may be used to counter the coercive effects of structural installations. Additionally, Cox et al. (2013) identify approaches to prevent suicide-by-jumping impulsive behavior by (a) restricting access through physical barriers, (b) encouraging help-seeking, (c) increasing the likelihood of intervention by a third party, and (d) encouraging responsible media reporting. Intervention by a third party generally is interpreted as a police or security presence. However, by broadening these approaches to their intent, one can imagine their application to the various intervention strategies named in this study, such as using the top level of a garage for food trucks (and the people that come with them) to address impulsive behavior.

Conclusion

Upon completion of this research, one of the student researchers contributed this reflection:

"From a student perspective, this project offered an opportunity to explore how design can make a meaningful contribution to complex and wicked problems. Specifically, the outcome of our research taught me the importance of designing for intention and joy in the every day. I learned that the world we inhabit is meant to be thoughtful, caring, and intentional and the design of the built world should reflect that."

This project sought to explore new strategies to address a pressing issue on the campus of The Ohio State University. We are trying to examine how to leverage design as a critical voice to suggest potential ways to activate a culture of care. Interestingly, we came to acknowledge that disruptive ideas can be those that no one will notice. By changing the prism through which the problem is being examined, we make ways for critical perspectives. Obviously, this research must be regarded as explorative. No claims can be made about the potential empirical impact of any of these motivational strategies for suicide prevention. But this type of work could be later initiated by refining the prototypes to a form that would allow comparing the difference between expected and observed somatic, emotional, and social behaviors.

Drawing on recent experiences that mobilized design to address social problems, our practical proposition is to engage designers to envision the design of a world less prone to suicide. From a scholarly perspective, we sought to contribute to the question of how design can have an agency in wellness and suicide prevention. In other words, we sought to provide evidence of the type of conceptual thinking that may arises from engaging designers in the development of measures contributing to the establishment of culture of care. The resulting student-designed prototypes provide an array of novel peer-directed motivational designs that validate this approach and contribute to this important discussion.

This project is connected to a larger discussion about the roles of evidence-based practice (EBP) and the design approach. It is necessary to acknowledge that EBP offers important validation; however, for time-sensitive topics such as suicide prevention, the implementation of this approach is relatively slow and provides incremental change. In contrast, the design process can supply forward-looking strategies that often are considered innovative by noticeably closing the gap between “the known” and “the needed.” This mindset of design thinking needs to be applied to broader conversations, such as the one addressed in this paper, where proven strategies are sometimes inadequate. More urgently, in addressing complex problems such as suicide prevention, both strategies need to work in tandem. This study shows how expanding from of the traditional strategy of coercive interventions to several types of strategies that include motivational interventions (applied to somatic, emotional, and social experiences) means that both approaches can share responsibility for the common goal: establishing a culture of care in addressing future suicides by jumping.

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Acknowledgements: We would like to thank The Ohio State University, College of Arts & Sciences, Global Arts and Humanities Discovery team for financing this project. We are also grateful to Associate Professor Susan Melsop for her contribution as co-teacher of the Collaborative Studio in which part of this research was conducted, as well as for all students enrolled in the studio.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Sign of the artisan city

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Abstract | In 2017 the City of Florence started to sketch out the application for UNESCO Creative City for the Craftsmanship, opening in 2019. The application was not selected by the Italian National Commission UNESCO.
However, the challenge made it possible to put at the center the physical city and citizens.
Contrary to what we thought in the past, the digitization of cities has increasingly turned out to be a not entirely democratic tool because it is often out of the control of its inhabitants. With the advent of the digital dimension, cities are constantly "measured" with different parameters to enter the rankings capable of expressing their qualities (technological equipment, quality of life...). Even this long path, in different aspects, began with a competitive spirit, gradually revealing elements of an extremely complex structure that led those who followed the candidacy to cross real data with the internal and external perception of the city. Often they did not correspond to the numbers of the smart city.
The project involved a large number of stakeholders who related in different ways than usual, managing to define the elements on which the projects were developed.
The experience, although not having had the desired result, was nevertheless able to highlight how consolidated but not clearly perceived values can be made to re-emerge and help design a new development model.

KEYWORDS | CRAFTSMANSHIP, IDENTITY, CREATIVITY, CITY, PARTECIPATION

1. Introduction

The expression creative city was first used by David Yencken in 1988 in the historic Australian literary magazine Meanjin, a name derived from aboriginal words. Yencken, professor of architecture and planning at the University of Melbourne, supports the importance for a city of not only being efficient and fair, but also promoting places for creativity and exciting experiences.
The theme is then taken up by Charles Landry, as regards economics by John Howkins, and by Richard Florida who elaborates the concept of creative class. With these studies we begin to consider creative activities, not restricted only to cultural artistic activities but more generally to who economize with their own ideas. If it is the people who make the difference, in a Human center vision, the city, understood in its most generic definition, must be able to encourage creative activities through suitable places and initiatives.
UNESCO in 2004, opens the calls for applications for creative cities by classifying them in seven categories: Music, Literature, Craft and Folk Art, Design, Media Arts, Gastronomy and Cinema.
Creativity is therefore associated with artistic activities with a space for technologies (albeit not primary) and no reference to science, referring to the fact that creative activities are traditionally connected with an artistic and technological innovation closely related to the concept of culture.
If on the one hand, therefore, the concept is circumscribed, on the other hand it is placed side by side with a model of sustainable development ensuring that there is no overlap with the cities that are world heritage sites; for these indeed, the purpose is «the protection and the transmission of future cultural and natural heritage» (https://en.unesco.org) while the network of creative cities promotes cooperation between cities «that have identified the creativity as a strategic element for sustainable urban development» (https://en.unesco.org). It is not therefore, a recognition of the goodness of local creativity but of how it is capable of triggering actions among at a sustainable development that can be connected, even if only in part, with the starting creative sector.
A way, therefore, of conceiving creativity and the cultural industry in a strategic sense, not only as a competence, and know-how.

2. The vision of the creative city

The research group headed by the Design Laboratory for Sustainability of the University of Florence, as a first action, tried to decline the theme of the creative city on the reality of Florence and, subsequently, identify which planning the path for the candidacy could have to contain.
The three T's identified by Florida - talent, technology, tolerance - turned out to be attractive and adapted to the urban reality we were working on, but the whole theoretical vision did not seem to help the path; in particular, it made us reflect the insistence on the concept of class. In short, we didn’t want in any way to favor the transformation of creativity into merchandise and therefore Benjamin Barber's words sounded like a warning.
However, if it is the ruling class that chooses a place, uses it, consumes it, transforms its image according to its own needs, the disputing sense of the operation could have been

precisely that of bringing out the people and their works which, despite being important for the city are not class and are not dominant.

According to Benjamin Barber, however, «culture is 'built by consumption' as much as by production. Consequently, through the 'creativity of consumption', the homogenization of the dominant culture can be colonized and re-transformed into cultural peculiarities» (Barber p. 382).
How to do so that the creative culture is original, identity, not dominated by the culture of consumption.
Barber writes:

> "In fact, the restoration of a condition of healthy pluralism, where human values are manifold and the material consumption is only one in a cornucopia of human behavior, will require a social therapy that cures the civic schizophrenia that defines us, a civic therapy that restore the balance between private and public by giving our public civic Selves a renewed sovereignty over our private consumer Selves and placing the destiny of citizens before that of the markets. This implies a return of capitalism to its primary function as a productive and efficient system that addresses real economic needs not on the basis of supply (push) but demand (pull), and the restoration of democratic public life as a supreme system regulator of our worlds of life, of which the market is only one among many" (Barber 2007, p. 378).

By choosing to submit the application for Florence as a creative city for crafts and popular arts, the municipality intended, more or less implicitly, to attribute to the artisan reality the possibility of triggering virtuous projects with regard to sustainability in its forms - social, environmental cultural - and therefore to be able to re-propose an urban model where artisan production is a founding element, where creativity is a value and not a privilege, a tool to create better conditions for citizens and from a social point of view, environmental-cultural and economic.
But why is Florence a creative city? There are many different answers and not all of them can be expressed with the same clarity and determination. Among these certainly the fact that craftsmanship represents the meeting of different knowledge and disciplines, continuously contaminating itself with art, architecture, theater, literature[1].
Florence is a traditionally artisan city that founded this heritage starting from the Guilds of Arts and Crafts, on which the social and productive structure has settled, which, with their abolition of 1770, saw its powers transferred to the Chamber of Commerce, Arts and Manufactures (Gandi 1971). Today to the traditional processes are flanked the fab labs of the new makers, the new forms of social entrepreneurship that often combine traditional processes with tools for communication and digital manufacturing. The large and complex network of artisan businesses with a predominantly traditional approach operates on

[1] We can think of the artisan workshops project of the choreographer Virgilio Sieni

different knowledge, techniques and materials that materialize in the various production sectors: leather, wood, precious metals, ceramics, weaving, hard stones, flakes and gilding, all having an important role in restoration techniques (Tofanari 2015).
Once identified the reasons that allowed to positively evaluate the presentation of the candidacy, it was necessary to answer what are the objectives to pursue through the candidacy, why is Florence applying? Among the main purposes there is to bring out and share what exists in the field of artisan creativity through a path that involves the major stakeholders of this sector: from artisans, from trade associations, to schools passing through administrations, event organizers, and foundations.

3. The reality-Florence

Florence has worked hard in recent years to increase its reputation as a contemporary city, managing to address some of the most pressing issues of medium and large cities. At the same time to enhance its historical-artistic identity more and more current.
Since 1982, the historic center within the walls has been registered in the World Heritage Site, one of the most prestigious and historically consolidated UNESCO awards.
It is among the cities with the longest life expectancy and good health and social care services (https://www. Osservatoriosullasalute.it/ Osservasalute/rapporto- Osservasalute-2016). It is firmly at the top of the European Union ranking as Cultural and creative cities in 2019 for medium-sized centers (https://publications.jrc.ec.europa.eu/repository/bitstream/JRC117336/citiesmonitor_2019.pdf)
It is the second smart city in Italy according to ICity Rank 2019 (https://www.ingenio-web.it/25527-le-prime-10-smart-city-di-italia-secondo-icity-rank-2019)
The Time magazine puts it in first place for the most loved city in Europe.
It is the fifth green city in the Legambiete ranking for 2020 (https://www.legambiente.it/wp-content/uploads/2020/11/Ecosistema-Urbano-2020.pdf).
The complexity of the indicators of each of these categories is really high and the administrators know that each of these brings national and international visibility.
From a census carried out on the basis of the candidacy, it was possible to verify that there is a high concentration of shops and artisan workshops inside and outside the historic city and that these must face important problems in relation to the economic stability of companies. But these problems, for most of them, are not solved by becoming self-promoters through new communication channels, not by becoming masters for largely foreign apprentices. There is therefore a resistance to transformation, a perpetuation of traditions not only in the manufacturing processes but also in the mentality that changes very slowly: even in the meetings the artisans have affirmed the attachment to their work as a discipline of doing and the reluctance to want to transform themselves in communicators or masters. This almost hidden artisan practice, certainly not exhibited, had to emerge out of respect for the artisan mentality, and in some way flank the reality of Florence, a place of the Renaissance as it is told in an effective, albeit simplified, way in *The geography of genius* (Weiner 2017). How then to express the artisan identity of the real city?

At the time of the candidacy, Carrara, Fabriano were the only other Italian creative cities for the Craft and folk art sector. Definitely smaller cities and with simpler identities where it is

easy to combine the name of the city with one, and only one type of processing. In other areas we had Rome, Milan, Turin and Bologna which for many characteristics could be comparable to Florence. There is no doubt, however, that UNESCO's policy in recent years was to reward small towns to enhance their excellence within an international network and make them more recognizable and visible.
What visibility was Florence looking for? or rather what visibility did it need? If indeed Sheki or Baguito City they can express their artisan identity even with just an image but they are not known globally, for Florence the exact opposite was true.



Figure 1. Tourists in Piazza San Giovanni

Furthermore, precisely in comparison with the rankings compiled by the various bodies and institutions, this recognition was able to express a more real and permanent character: how little does it take for a city to rise or fall within the livability ranking? how many extremely serious but unpredictable facts can shift positions? and again: can the work of an administration and the commitment of its population really be evaluated as such volatile parameters?
And how much does entry into these rankings depend on the management of data that is outsourced? and for this: how great is the desire not to give up power in exchange for necessary and strategic services?
It is also in this sense that the candidacy was carried out to affirm historical skills and realities but at the same time capable of great innovative potential with an authentic and non-transferable location.

Craftsmanship as a strategy to regain sovereignty over the place between the modernity of a technological matrix and a past of great importance.

4. The concept of Territorial Identity

The competition of a territory is increasingly played on two different levels but decidedly complementary: the global and the local one. The first allows companies a strategy extended to the world scenario in the search for services, suppliers as well as markets; the second commits companies to find in the local context those elements that allow them not to "homologate" their business with those carried out in other parts of the world, taking root in the territory and assuming an identity that cannot be replicated.
The two strategic dimensions are absolutely and necessarily complementary, so much from having favored the creation of the term "glocalism" (Senn, 2007)
The rapid progress of globalization has resulted in strong competition in every country, every city and every region that find themselves "fighting" to win their own share of consumers, tourists, investors, students, entrepreneurs, sporting and cultural events international media, and for the attention and respect of the international media, other governments and people of other countries (Anholt, 2006). The need to cultivate the roots in one's own territory of belonging has once again emerged strongly: tourism has favored communication investments in the micro-territorial dimension and has produced, with the creation of sporting, musical events, festivals, etc. who in this context are encouraged to review their communication strategies to try to go beyond the dynamics of internal community services, towards a narrative that favors the promotion of new attractions.
In the commercial field, the 'good name' of the brand is a precious asset for producers, an asset that allows the company to compete and win with the other millions of almost identical products on the market. Applying brand concepts to land management means understanding that each location needs to manage its own internal identity and external reputation. Every place on Earth has its own reputation, just like companies and products, which can be simple, articulate, predominantly positive or predominantly negative, and this reputation influences how people perceive a country, how they behave and they react with respect to what this produces: German engineering, French elegance, Japanese miniaturization, Italian style, Swedish design and Swiss precision are all values that are transferred to the products arriving from those countries even if the guaranteed qualities since made in are nowadays purely symbolic.



Figure 2. leather craftsman at work

Simon Anholt, an expert in places and perception, argues in Places: Identity, Image and Reputation, that public opinion very often tends to be superficial and therefore to work by cliché, by stereotypes. The image that others perceive is often quickly transformed into what is defined as "reputation". And reputation is about identity and values. It is therefore necessary to start behaving and acting in order to be able to influence the way in which one is perceived, as Socrate argued stating that «The best way to earn a better reputation is to strive to be what you want to appear»

On the basis of Aaker (2001) and Aaker and Joachimsthaler (2000), place brands have been defined as representations of place identity, building a favorable internal (public, private and civil society stakeholders) and external (tourists, investors, traders, migrants) image ', leading to brand equity; that is, brand satisfaction and loyalty; name awareness; perceived quality; and other favorable brand associations (that is, positive image and reputation) attached to a name or symbol representing a country, city or region (Govers and Go, 2009, p. 17)

Places are definitely very complex “objects”. Often the mistake is made of treating the city or region as a product since environments develop in places that allow products to be brought to international markets, to market tourism products, investment opportunities, cultural offers, job opportunities and offers of international study programs. But places are also spaces where people live, where they move, where they educate their children, enjoy their work and free time and think that the awareness and reputation of all this can be influenced by the use of a logo perhaps it is a bit simplistic.

Does all this mean that logos and slogans and identities are completely useless? No, of course. Logos and slogans play an important role in supporting a territory which, by proudly referring to its origin, will increase awareness and its communicative strength. However, if it is not only the symbol that builds reputation, it is certainly the symbol that can become an icon for an existing reputation built scrupulously over time and it is the identity of a territory that is able to create added value for global competitiveness by helping to activate a virtuous cycle of development.

This ideal path, thus, has been followed for the preparation of the application, trying to build an authentic reputation by working in full respect of our own identity and not by

building from scratch something that has nothing to do with our own nature, but remodeling the purpose that it has, on the basis of a better and more positive perspective[2].
The complex richness of the artisan culture and the lack of a solid reputation emerged from the major weaknesses: "Florence was able to apply for all categories". This sentence is pronounced by one of the stakeholders who took part in the participatory path, reinforces what has been previously expressed: a complexity that goes far beyond the artisan sector, a perception not decidedly oriented towards craftsmanship (Anholt 2007). The sentence reveals what, following the failure, can be called an optimism and an overconfidence that has made the status quo judge significantly positive so as not to have given importance to the need for changes to achieve the goal and not to I have had goads pointing to this (Thaler 4014).

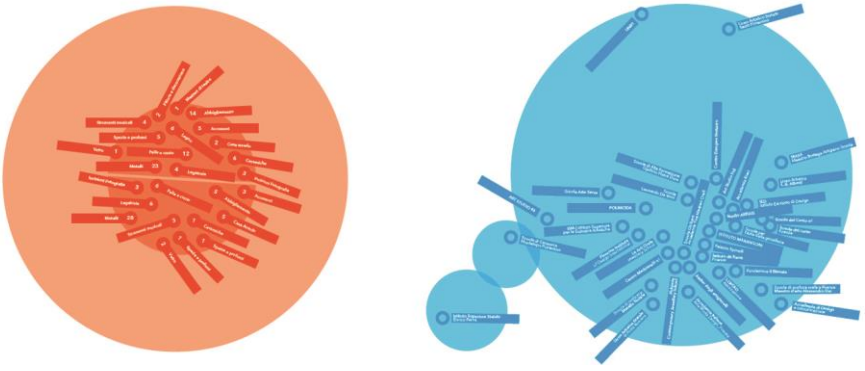


Figure 3. Density of artisans and creative schools in the city

5. Perception and Partecipation

There are various 'image formation agents' (Gartner, 1993) that influence the way people understand the world. The most important agents that form perceptions in people's minds are, of course, their own experiences (also called organic agents), followed by word of mouth about the experiences of colleagues, friends, relatives or otherwise connected contacts (called social agents).
We must never forget those who live in the places and their active role in the territorial management process: a good brand strategy should be built on the basis of the sense of belonging and shared objectives, factors that generate a link that is difficult to reproduce or imitate.

[2] It is worth mentioning the thesis of Eliana Dedda, Logo place. Territorial brand and procedural evolution in the visual translation of complex identities, Master's thesis of the Polytechnic of Milan, School of Communication Design, year 2013-2014, supervisor Francesco Ermanno Guida.

The entities and institutions that work on crafts in Florence are many; just as there are fairs at national and international level. An articulated and complex fabric both from an institutional and product point of view. An artisan area was not chosen but artisan knowledge as a whole. If Carrara is a city of marble, if Fabriano is a city of paper, Florence is the city of goldsmiths, leather, straw, carvers and gilders, stone, ceramics, and fashion and the choice could not fall on a sector only by virtue of the calculation of the higher turnover.
Therefore, choosing to nominate Florence not for an artisan sector but for all the artisans as a whole, was a choice that certainly didn't facilitate communication with the evaluators but, precisely by virtue of the authenticity of the message sought, it appeared essential.
Distinguishing what was and wasn't perceived, what is the reality, occupied the first part of the time of the path; the second part concerned the definition of the vision and the mission of all the work.
Re-starting from the net, knowing and sharing the existing was the first important goal.
The role of the stakeholders is to be considered fundamental in all participatory processes. Following the classification proposed by Rossella Sobrero, the stakeholders were placed in a map that was able to summarize those involved in craft activities with different roles (Sobrero 2018).
Operational stakeholders are identified with the craftsmen; institutional ones with representatives of administrations, the key stakeholders represented by trade associations, organizers of events dedicated for the part of the training chain, the foundations, and with marginal stakeholders part of the training chain not included among the key stakeholders[3].
At least the 'operational' and the 'keys' have been seen to belong to the community of interest and purpose (Manzini 2018).
The key stakeholders have filled a form to collect information about their skills, the inclusion of their structures in national and international projects, the initiatives they promoted and in which they took part, the suitable spaces they had for activities to be played.
Just from the reading of the documents and from some meetings with the artisans, a composite panorama emerged, consisting of small companies able to make important sales, which, above all, acted as custodians of a material culture of inestimable value, understandable only through the immersion in the environments and hardly returnable through simplified narrations. From what was considered a first census, the strategic role of creativity emerged.
"Knowledge and culture are nodes of networks that feed a new tertiary social composition on the territories, widespread in the productive activities in the craft sector, involving the high education present on the area" (Bonomi 2014 p. 36).
One of the peculiarities of Florence, that has been highlighted, is that of having on its territory a very high number of schools dedicated to creative training (only 40 universities are American). Design students from the University of Florence, ISIA, Academy of Fine Arts and IED were involved in the final stage of preparing the application to give shape to the project proposals.

[3] Rossella Sobrero divides the stakeholders into four groups: marginal, institutional, key, operational. Although the text refers to business contexts, however, the division between the stakeholders seemed to be able to be transferred to the reality described.

6. Project for the candidacy

Joining the network of creative cities has no economic recognition, and membership in the network is subject to periodic checks which could also lead to the exit of members. It is an important commitment that involves the implementation of three local projects and three aimed at the international network. If the former mainly expressed, they were the first to express the wishes of the world of craftsmanship which saw a great opportunity to carry out even ambitious projects, with the second it was the whole city that put itself on the line that it shared with the other members of the international network what original contributions Florence could offer.
Among the requests of the call was to develop the application through a participatory process. The number of stakeholders involved was different, however it would be incorrect to say that a bottom up formula was applied: it was a formula that brought together some elements not only with interests but also with great planning but it was not a path that it started from the bottom and this is partly due to the structure of the UNESCO demand.
The candidacy, in fact, which must be presented by the mayor, was followed by the Councilor for productive activities who instructed the Department of Architecture of the University of Florence to structure it. Another point of reference was the Municipality Office dedicated to UNESCO World Heritage Site.

About 100 people representing administrations, trade associations, associations, artisan businesses, hubs and makers. The method adopted in these two meetings is inspired by Open Space Technology (OST - Open Space Technique), a tool that, thanks to an atmosphere of informal relationships and a solid structure of the works, maximizes the active contribution of the people who participate. Eight topics for discussion were discussed during the days[4] from which the traces of the six projects emerged to which the students of the creative schools, as mentioned, gave shape.

[4] - The places of craftsmanship
What are the most significant places of Florentine craftsmanship? What are the places that, although less visible or known, have a potential to express?
- The actors to be involved
Which actors or categories of actors could it be strategic to involve in local and international actions?
What strategies to adopt for the involvement of the actors?
- Telling the past, acting on the present,
design the future
How to foster a narrative that intertwines the past, present and future of craftsmanship in Florence?
How to relate the future with the artisan tradition of Florence? What are the most interesting strategies and cases?
- Relationships between different practices and knowledge
How has interdisciplinarity been and can it be an added value for Florence?
How can this added value emerge? What are the most interesting experiences?
- Awareness of the value of heritage
cultural artisan and popular art
How to create greater awareness in Florentines of the value of cultural heritage linked to crafts and popular art? What are the most interesting strategies?
How to communicate this value also to those who do not belong to the local community?
- Feeling part of a city of craftsmanship

The decision to conclude the course with the contribution of the students was chosen for two reasons: the first was to represent the Italian and foreign students who are part of the urban community of the city and who characterize it, the second was to have a feedback with the young generation on the work done and possibly be able to change direction.
Just as the artisans focused on the local dimension, the students gave international breath to the proposals by reiterating that citizenship is not by birth and that, at least in ambitions, it is a concept that has at least extended to Europe.

The six project themes that were proposed to the commission were the following:

- Mapping - Census and digital mapping of all the realities related to the world of craftsmanship in the metropolitan area - creative ecosystem.
The result had to be that of creating a digital and "physical" map of the artisan ecosystem. The map is continuously updatable and digitally updated and where every stakeholder involved can add documents and information to contribute to the construction of a shared narrative of the metropolitan city. The goal has been pursued and today there is an active network where artisans of the old and new professions can voluntarily register and have a space available.

- Strengths of networking - bring out the creative ecosystem and event creation capable of representing it.
Although Florence has been home to an international craft exhibition for more than eighty years, it was considered by many stakeholders that it is a formula that is no longer capable of satisfying the visibility and attention sought by artisans on its own. The proposals went from the Fuori Mostra to a physical place where to exhibit in conjunction with the city's attraction events. This was the hypothesis that prevailed and the creation of a pole that also achieves the objective of the second point is the path that the administration is following.

- Safeguarding Inheritance and building the future - the construction of a digital and material archive to collect all the corporate assets and put them in part for free consultation. This project, which from a physical point of view was linked to the previous one, among the three, was the most demanding for two reasons where the first was of an economic nature for the preparation for physical archive locations, the second, even more important that he saw the artisans willing to share not only with the competitor but with the world part of their identifying elements and in many ways unique.

How to foster a closer relationship between craftsmanship and population? What are the most effective tools and strategies to spread the identity of the artisan city among the population?
How can craftsmanship be a vehicle for promoting new lifestyles, which make it closer to people's daily lives?
- Tradition and innovation in production
What elements related to innovation can be strategic in the elaboration of local and international actions?
How can the preservation and respect for the tradition of production processes be reconciled with technological innovation?

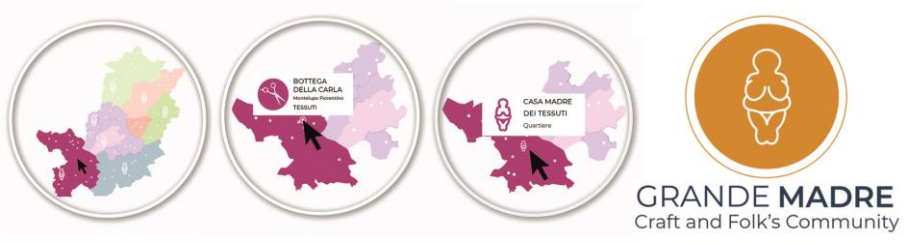
On international projects, the start was to highlight the many relationships that bind Florence to international networks of municipalities, from twinning to the most recent networks.

- Competitive Identity and Know How Alliance - starting from the competitive identity, the objective was the overlapping and integration of the UNESCO creative cities network with the existing networks to which the city of Florence adheres: twin cities linked by friendship pacts, the network of UNESCO World Heritage sites, the Unity in diversity network. The materialization of these bonds was given by objects that were built passing from one city to another until it was completed.

- “Creativity" in-residence - Combination and exchange between artisan enterprises of the network I unite with the aim of innovating and contaminating the different shop models. The Erasmus of craftsmen has been defined where the Erasmus model recognizes the ability to unite and increase the ability to understand others. Here too, on the model of residences for artists, dedicated in particular to performers, the administration is equipping spaces for artisans.

- Sustainability contest - Creation of a competition between the schools of the creative cities on crafts as a model of sustainability that generates a digital exhibition and a traveling exhibition between the participating cities. The competition is a way to promote a production model but also a socio-cultural and environmental one.

Projects therefore feasible so much so that the city, even though it has not entered the network, is implementing them; differently ambitious projects but above all projects that have tried to respond to the needs and desires of those who study, produce and work in the creative field of craftsmanship.



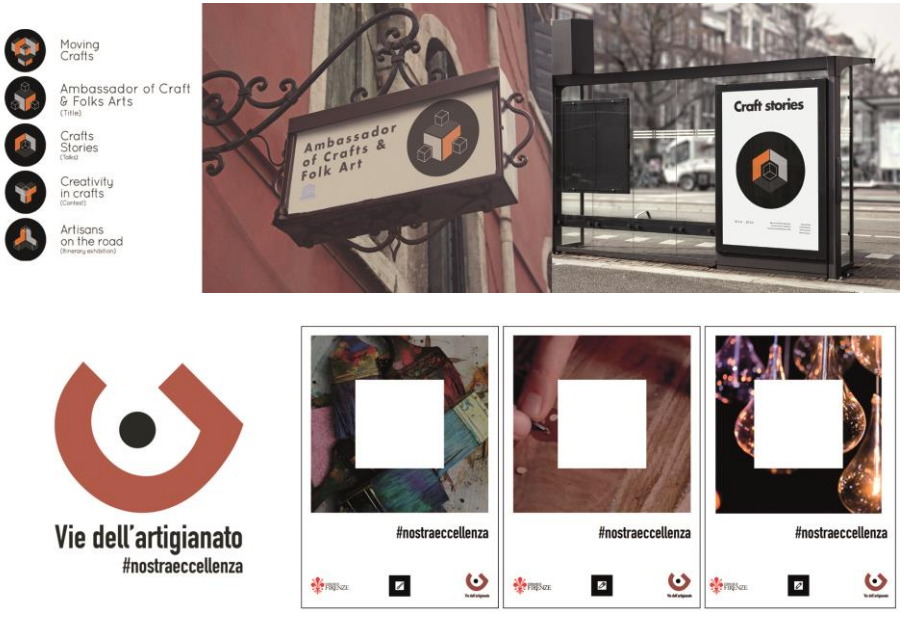


Figure 4. Some concepts of the creative students of the final workshop

5. Conclusion

The candidacy for creative city cannot be said to have been a useless experience in the first place because the city is working in the right direction.

But we must reiterate that perhaps the deepest reason that allowed it was the search for an identity that was independent of both the assessments of technological networks and the reputation of a Renaissance city and, consequently, a city with a significantly linked economy. to tourism.

Logos and slogans can help raise public awareness, but identity is not just something to put in the corner of the advertising page or on business cards: only if local businesses, cultural organizations, tourism businesses and individuals, they will constantly engage in referring to the territory with pride, raise awareness, and can impact reputation.

From here and from the desire to tell not only the material but also and above all the immaterial, virtual storytelling paths will develop that will find fertile ground in digital applications that combine storytelling and information, tradition and technology.

So, strategy and substance first, then the rest.

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The text was conceived together by the two authors. However, Eleonora Trivellin is attributed the first seven paragraphs of paragraph 3 paragraphs 1,2, and 6. Susanna Cerri is attributed the last six paragraphs of paragraph 3 paragraphs 4, 5 and 7

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Social networks as enablers of design cultures: An analysis of multiplex relationships among members of a creative hub

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Abstract | Triggered by the strategic use of filming locations for city branding, and with a specific focus on Istanbul, this research investigates the role of movies on shaping the image and perception of cities. It aims to consider how a city is depicted in different movies/genres and discuss how such representations affect the traditional image previously constructed through the cultural heritage and the built environment. Through the analysis of twenty-one international movies that were produced between 2000-2020, and were selected out of 3586 movies, the comparison of fictional layers with the traditional tourist attractions of the city were carried out. This research approaches Istanbul's urban visual culture and its many meanings, through Lynch's aspirations for imageability, visibility and legibility in the design and perception of urban environments. The findings underline the influence of the film industry on city's branding processes and perceptions through representations and imaginary layers.

KEYWORDS: SOCIAL NETWORKS, INTERACTIONS, DESIGN HUBS, CREATIVE COMMUNITIES, INNOVATION

1. Introduction

Design cultures are defined as the emergent patterns during design activities that encompass vision and values, enable conversations and eventually shape the future of our existence (Manzini, 2016). Despite acknowledging the expansive discourse on the meaning of design cultures, Manzini (2016) underlines the lack of cultural dimensions within the debate on design that relate to environmental, economic, and social issues, and point out the serious limitations that prevent design cultures from being agents of change. To strengthen the change agency potential of design cultures, their essence needs to be examined from these perspectives. In this study, we explore the social interactions that enable designerly ways of thinking and operating, by taking a co-creation hub as a qualitative case.

One of the defining features of design cultures can be considered to be creative interactions it gives rise to and is shaped by. Creative thinking is a prerequisite of design-based practices (Perry-Smith & Shalley, 2003; Brown, 2008). Although creativity is often considered to be an individual merit, scholars argue against this Platonic view that suggests that creativity is a personal characteristic one is born with, rather suggesting it is an outcome of the interactions between the actors of a system (Albrecht & Ropp, 1984; Nemiro, 2002). It is defined as "the creation of a valuable, useful new products, services, ideas, procedures, or processes by individuals working together in a complex social system" (Woodman et al. 1993, p. 2). Indeed, the quality interactions can have a fundamental effect on creative output- For example, in his comprehensive study on the creative peaks of 41 artists from 19th and 20th centuries, Accominotti (2009) discovered that creativity occurred regardless of age, background or education level of the painters but was tied to their involvement in various art movements, which required them to come into interaction with other artists. The art movements that in a way functioned as communities, where ideas were openly discussed and challenged, facilitated the necessary interactions that trigger creativity of the artists.

However, human relationships are complex as there can be interactions in multiple natures occurring between two individuals. Each of these relationship natures form a different network within the same community. (Monge & Contractor, 2003). This refers to the multiplexity of networks, which is the multitude of relationship forms contained in a tie between two members (Cardillo et al., 2013). This means, for example, two people can design a product together and be friends at the same time. The extent of their interactions influence their creative output and, consequently, the narrative of the community they belong to. Social network analysis is a useful tool to investigate such layered social structures that are a result of these complex, multi-layered relationships (Knoke & Yang, 2008). Performing a multiplex analysis of networks provides a holistic interpretation of the impact different relationships have on each other.

The importance of providing possibilities for maximization of interactions is a widely acknowledged aspect of triggering creativity that forms the core of design-based interventions (Csikszentmihalyi, 1997). In professional environments such serendipitous interactions often need to be facilitated to form the necessary dynamics to maximize the potential. This is, in essence, what many innovation hubs aim to do – support creative connection across individuals and groups. Despite the unpredictability or serendipitous interactions, networks are affected by certain routines that are practiced within the community, as well as the operating mechanisms behind the community. Therefore, studying the networks through mapping multiplex interactions among the actors in a creative community helps understanding the favorable conditions and limitations towards the formation of a fruitful ecosystem, and aims to investigate how social interactions in creative communities enable rich design cultures.

2. Methods

The social network analysis presented in this paper derives from a dataset of structured interviews with 35 members of an interdisciplinary co-creation hub that consists of designers, researchers, educators, project managers and technical staff. This community of the Co-creation Hub (pseudonym) were asked questions regarding their collaborations and connections with the remaining members of the community from creative and informal perspectives. The nature of social relationships is defined through their content. Relationships that carry the potential to lead towards a creation of newness in form of knowledge or artifacts fall in the category of creative relationships. Informal relationships on the other hand are defined as kinship, friendship, sharing leisure time and having commonalities besides the professional work environment (Kratzer et al., 2005).

2.1 Research Context

The interdisciplinary Co-creation Hub that is subject to the network analysis presented in this paper is located within a public research university in Finland. Founded over a decade ago, the internationally acknowledged hub accommodates interdisciplinary project courses with challenges brought by industry partners, fostering collaboration across disciplines and between students, industry and academics. Throughout the years, based on research and experience, the premises of a re-purposed research lab building have evolved in a way to maximize interaction, hands-on experimentation, collaboration and research. In addition to a variety of prototyping opportunities, the building also offers flexible work spaces. The hub operates in a self- sustaining fashion, where members of the community share the responsibilities to keep the premises functioning.
The community comprises three broadly defined, interdependent categories of involvement. Teaching staff, who are also responsible for scientific output, technical staff, who are responsible for operating the prototyping facilities and organizational staff, who are

responsible for project management, communications and relationships with the other hubs in the network. Apart from these three employee groups, the hub also hosts community members who are not employees, but are involved in ongoing projects. This paper looks at the employees and guests and considers them as 'regulars' of the community. There are also students, visiting teachers and entrepreneurs who benefit from the facilities, but they are not taken into account in this paper, as they do not have a continuous relationship with the rest of the hub.

2.2 Data Collection

The collection of data consisted of structured interviews with 35 (n=55) members of the community, where sampling was focused on equal representation of each category of employment (teaching, technical, organizational), age group, gender and the years of involvement in the hub.
The interviews were conducted individually, and lasted from 28 to 95 minutes. The participants have received the identical set of questions, as well as a brief before the interviews, as none of them had prior knowledge about Social Network Analysis (SNA).
The interviews started with a set of introductory questions that focus on the role and the experience of the participant within the community. Later, the interviewees have been asked to identify the people they collaborate on a creative nature, as well as the people they have informal contacts with, having a list of people in the community in front of them. The participants were given examples of relationships that might fall under each category for inspiration. Additionally, the participants rated each relationship they reported on a scale of 1-5 considering its average frequency, duration and depth. And last but not least, the participants were asked to provide an example of a low-ranked (rated 1-2) and a high-ranked relationship (rated 4-5) for both relationship natures.
The reliability of participants' ratings was analyzed through comparing how different sides of dyads had rated the relationship. This suggested consensus among the strength of the relationships. The answers were anonymized and transferred to Gephi software to create network maps in order to analyze community dynamics.

2.3 Data analysis

Social Network Analysis (SNA) is most frequently applied within the field of organizational management for seeking answers to various problems such as improving collaboration, finding influencers, leadership development, performance enhancement and integration of units (Borgatti & Foster, 2003). Despite being a mathematical analysis of relationships, SNA commonly provides visual material (network maps) that represents these relationships. However, 'reading' these maps and interpreting the meaning behind emergent patterns that describe how networks behave does not always require statistical approaches. When combined with the thematic analysis of the interviews (Bansal & Corley, 2011), the maps have the potential to provide in-depth insides that statistics cannot explain (Scott, 2012).

Therefore, in this study, we made use of a combination of analysis techniques in order to paint a complete picture.
The relationships and their ratings collected with the interviews were transformed into maps with the standard tools and plug-ins available in the open-source software Gephi for representing and analyzing networks. In our study, we utilized the measures of degree, density, centrality and modularity. In addition to utilizing a variety of measures, we have also utilized two different force-directed layout algorithms that are available within Gephi software, Fruchterman Reingold and Force Atlas specifically, in order to achieve meaningful visualizations.
The interdependency of creative and informal relationships among community members that form the base of the design culture within the community were analyzed using the network maps from three lenses of proximity - generational, disciplinary and physical proximity between community members. These three lenses of proximity derive from the interviews, where the participants underlined the importance of time, interests and contact repeatedly when talking about the drive behind their interactions regarding both creative and informal relationships.

3. Social Networks as Enablers of Design Cultures

Design cultures benefit from rich interactions that trigger creativity and enable knowledge sharing. We examine the characteristics and dynamics of creative and informal networks within the Co-creation Hub community to examine how these types of networks are shaped and interact in creative communities.

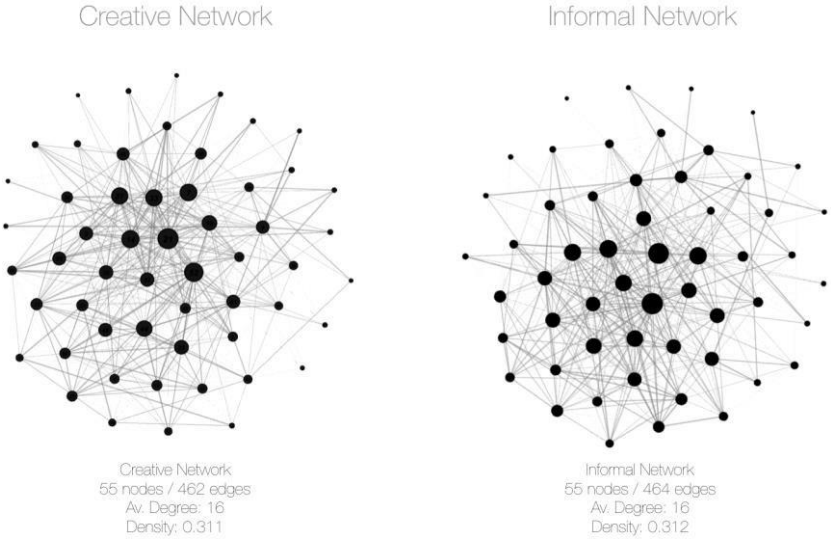

Figure 1. Creative and informal networks

First, it is important to describe dimensions of each network in order to set the context. The community consists of 55 regulars (who are represented as circular nodes in the graphs), who regularly visit the premises. All of them are actively engaged in the network, as there are no disconnected nodes in either of the networks. The average degree in both networks is 16, which means that the nodes are connected to 16 other nodes on average (29%). The highest degree is 42 in both networks, and the lowest is 1 in informal network, and 2 in creative network. In Figure 1 and in all the other images presented in the paper, the node sizes are defined by their degree (how many edges, or lines, are connected to them). Between the 55 nodes, there are 462 edges defined in the creative network, and 464 in the informal network, which makes the network densities comparable. Density refers to the ratio of the established connections to all possible connections in a network. In both networks this value remains around 0.310, which points out plenty of opportunities for collaboration and unrealized potential within the networks.

3.1 Generational proximity

Generations in this design community will be the first aspect to be looked at as a proximity parameter. Creative communities consist of members that have different levels of experience, and the hub is no exception to this. The actors in this network can be divided into three generational categories. Group 1 consists of people up to the age of 25, who are either researchers or working at the hub part-time during their studies (18.18%). The second and the largest group is those between 26-40 years old, representing more than half of all the nodes (54.55%). This group is highly diverse in terms of background and position. The third group are 40+ year old experienced staff, who are mainly involved in teaching (27.27%).

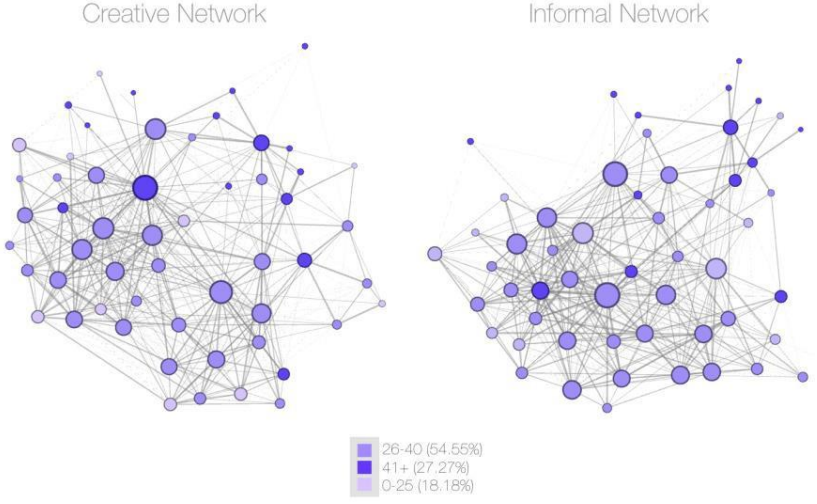

Figure 2. Age distribution in the creative and informal networks

The two maps in Figure 2 show the distribution of age groups and how they are linked to each other. The node sizes identify the degree of the nodes, whereas the color identifies the age-group. It is possible to see that (especially in the informal network) there is a generational gap between the members of the community. Nodes of similar age occupy the central area, while older and younger generations remain on the periphery. When talking about the older generations, who in this case have more experience, a peripheral role is not necessarily a negative aspect. This peripheral role enables an experimentation culture, where trials and errors are permitted, without the presence of highly central nodes who are powerful and highly experienced. When it comes to younger generations, the situation is different. Younger generations do not occupy a central role in the maps and they remain in the periphery in both networks, which can limit being an active part of the community. The richness of intergenerational knowledge exchange can be meaningful for design cultures, as generational values and awareness inform design decisions (Gamliel & Gabay, 2014). Actors that hold a central role should purposefully engage younger generations into creative and informal circles. One interviewee mentioned: “I believe in apprenticeships. I see X as a younger version of me in a way, I try to pass on every bit of my knowledge.”
Another aspect in relation to time is the years of involvement in the hub. Figure 3 shows the distribution of experience through the colors of nodes. The hub has a strong core group of people who have been a part of the community since their studies. The maps show that the majority of the nodes have been involved in the hub for longer than eight years, with some being highly central in the networks. Especially in the creative network, the lighter nodes remain on the periphery. One interviewee explained: “I have been here for a very long time. You could say that I grew up here. Of course, relationships change, but it is very hard to forget long lasting bonds, I feel somehow responsible towards them, as if we are on a mission together.”

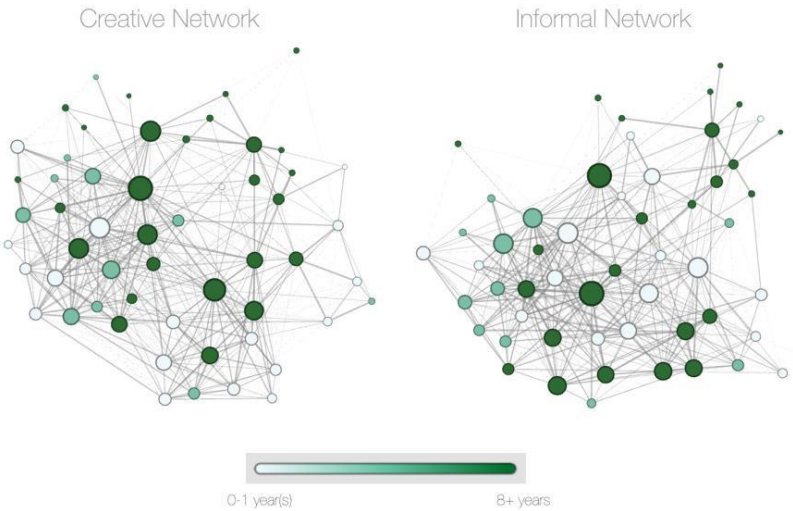

Figure 3. Years of involvement within the creative and informal networks

3.2 Disciplinary proximity

The hub defines itself as an interdisciplinary co-creation hub. Between the 55 regular members of the community, it is currently possible to identify four disciplinary backgrounds, which are engineering, business and management, arts and design. In the hub's context, engineering (industrial design, mechanical, electronical) is the dominant group with more than half of the community being engineers. Looking at Figure 4, the majority of the central nodes of both networks consist of a multidisciplinary group, although in the informal network similar disciplines are clustered more together. In both networks designers, artists, and those from business and management backgrounds occupy the center of the graphs with high degree nodes. Additionally, in both networks, it is possible to see that the engineers (red nodes) tend to stick together on the periphery. However, engineering knowledge plays a crucial role in technological innovations since it enables execution of tangible outcomes.

The artists on the other hand, are the best embedded group within the community. They enable diversity in the creative network by collaborating with multiple disciplinary groups. Additionally, artists are central to the friendship network, which points out high level of trust and sharing on a personal level. One interviewee stated:

“Everybody knows something else here. That is what I like about this place. And people are full of surprises. Together we make more than the sum of our capabilities. I am sure if I come up with, I don’t know, a crazy new idea, I am sure I can find enthusiastic people to join me right away. We can rely on the community.”

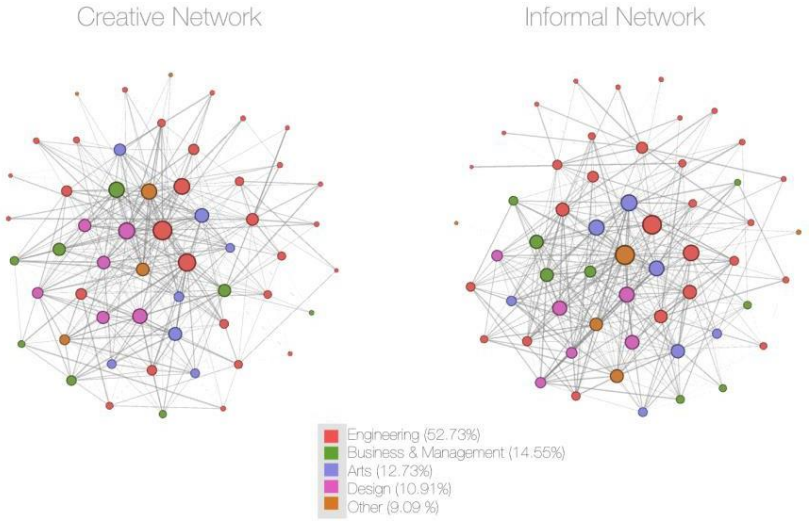

Figure 4. Disciplines within the creative and informal networks

Figure 4 also shows us the lack of collaboration between certain disciplinary groups in both networks. For instance, designers do not collaborate with engineers in the creative network except for a few central nodes in the middle. A common pattern is also visible in the informal network, as designers do not communicate directly with the large group of engineers that are on the periphery. Therefore, it is possible to say that the design culture of the hub would benefit a lot from channeling the unrealised potential. Artists of the community can function as the gatekeepers between these disconnected groups if their potential is operationalized.

3.3 Physical proximity

A final type of proximity at play in the hub is the physical proximity, or in other words the spatial layout that enables certain groups to be in contact. Although the building is especially developed in a way that brings disconnected actors together under informal circumstances, such as having open spaces for eating, meeting or relaxing, during the majority of the day the employees sit at a certain workspace. It could be argued that those who work in close proximity are more likely to engage into creative relationships, while remote work with regular meetings could also be enough to facilitate the necessary team dynamics.

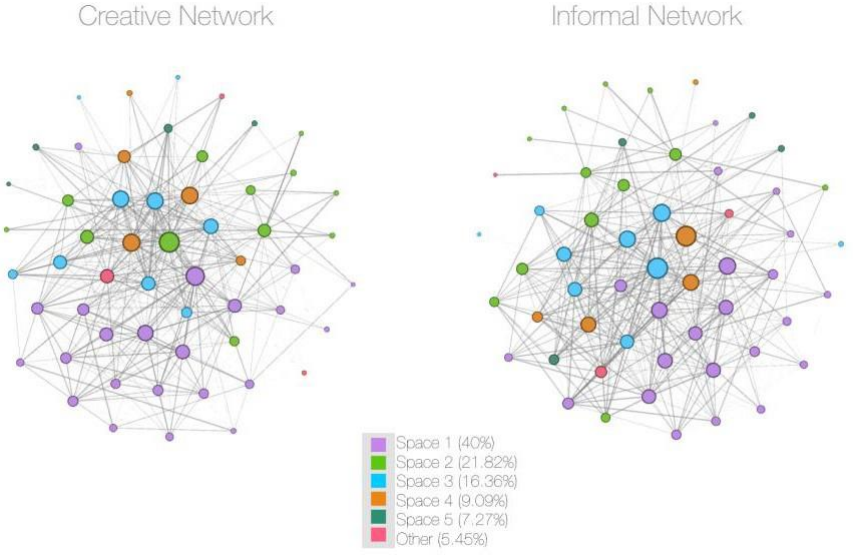

Figure 5. Spatial distribution of the creative and informal networks

Figure 5 shows the distribution of nodes to workspaces. Each color represents spaces that employees use as workspace. The common spaces for eating, meeting and mingling are not taken into consideration. In this case, considering that the offices are designated to certain teams that work together on projects, it makes sense that people who share the same

spaces are clustered together in the creative network. However, the threshold is kept very low and there is plenty of flexibility in terms of work spaces. One interviewee remarked:

“Although our tasks are very different, we are good friends with X, and sometimes I just grab my laptop and go sit in their office for half a day. It helps me to gain new perspectives.”

What is interesting is that we see an even stronger clustering pattern on the informal network that suggests stronger friendships between the people who share the same workspace. Indeed, the situation in the hub points out the importance of daily encounters for getting acquaintance that also enables idea sharing and collaboration. This dynamic has potential to lead towards a mini-silo effect, where people are hesitant to step into each other’s designated work areas (Bevc et al., 2015). In fact, one of the interviewees stated:

“Group X sits somewhere else in the building behind closed doors, I feel uncomfortable barging in and asking what they are working on.”

The community in the hub is investing a lot of effort into disabling silo structures, but adopting rituals that bring the entire community together on a regular basis and keep them up to date on what is going on within other projects. Weekly community breakfast hosted by different project groups, bi-weekly staff meetings, regular research presentations, as well as the active use of common spaces are examples to such routines (Bjorklund et al., 2017).

4. Discussion and implications

Studies on social networks that investigate the dynamics of creative and informal relationships are often based on case-studies on organizational level (Borgatti, & Foster. 2003). A majority of these results point out the parallel development of creative and informal networks, as people commonly prefer to commit to creative collaborations with people that they have positive feelings for. In fact, already in 1973 Granovetter argued that close friendships are the best for innovation, since they provide ideal grounds for communication that consist of trust, values and matching objectives. However, the literature also suggests that close friendships can be a threat to creative relationships (Kratzer et al., 2006). The reason behind this is two folds. First of all, creative collaborations that have an impact require the community to be open to external information to be able to think outside of the box. In close-knit communities, it can be difficult to penetrate the friendship bubble, where foundations of creative collaborations are built on. It is important to enable the constant flow of new knowledge and skills into the community and facilitate the growth of creative potential. Secondly, strong friendships within creative communities can potentially hinder critical thinking, which is an important element for design cultures.
Obtaining a critical mindset and being able to give constructive feedback on each other’s progress is a crucial element of progress (Kratzer et al., 2006). Therefore, design cultures must steadily question their openness towards external knowledge. Creating a community with diversity in age, experience and discipline can be a starting point.

In this paper, the underlying dynamics of creative and informal networks among the staff of a close-knit creative hub was explored, in order to see how these two different networks deriving from two different natures of relationships operate within the same group of individuals and lead to a rich culture that facilitates design, innovation and entrepreneurship. In the case of the creative networks of the Co-creation Hub, the majority of collaborations are initiated by more experienced actors, and they operate as a bridge between different groups of less experienced actors. This highly important role of gatekeeping is risky in terms of network resilience, as any change in the position of such individuals could have catastrophic results for the network and damage the flow of information between the rest of the actors (Celik, 2018). The co-creative design culture in this community relies heavily on agile ways of working, where responsibilities are easily shared and member's trust in each other's skills is very high. Therefore, it is important that the gatekeeping role should be mitigated by delegating connections to less experienced members, in order to create and maintain a healthy centrality balance in the network.

On the other hand, hubs often aim to create connections across diverse groups. In the current study, some clustering could be seen amongst the majority, whether in terms of age, tenure, discipline or primary working space. However, connections across all groups were frequent, and minority tenures and disciplines in particular had rich connections in both the creative and informal networks. Interactions amongst diverse groups can help to create novel perspectives through combination, with for example, generational norms and values having a high influence on the way we interpret the world around us (Del Conte & Celik, 2015). Design cultures that facilitate such diversity will benefit from the richness of different perspectives that arise from the knowledge exchange between different groups.

By providing a close look into the network structure of the Co-creation Hub, this study bring together two fields that are rarely studied in combination, social networks and design cultures, but also contributes to the field of design research from a methodological perspective by providing a mixed method approach where qualitative data gathered through interviews is used to interpret the quantitative data gathered through the social network analysis and provide multilayered results that shed light on both actor-level and system-level dynamics.

To conclude, we have observed that creative and informal relationships evolve in an interdependent manner in design cultures. Generational proximity is more important in informal networks, possibly because being in the similar phase of life brings more commonalities. We saw that in the creative network, older actors remain in the periphery and leave the stage to younger members only to intervene if necessary. However, we found tenure to be a better informant of generational proximity than age, as tenure refers to the openness of the design culture for new and less experienced members. Disciplinary proximity has shown slightly more relevance in forming informal relationships than creative relationship. There could be two speculations on this dynamic: either the need for

multidisciplinary collaboration in the creative collaborations exceeds the informal interests of members; or informal relationship have a longer history that date back to study times and hence they are stronger than relatively newer creative relationships. The study confirms that physical proximity does play a role in the development of both creative and informal relationships. Additionally, the study highlights rituals and mindsets that are adopted by the community members to enhance creative collaborations through abundant informal connections. Multiplex bonds between actors seem to eliminate the risks towards network operations by creating a safety net and therefore encouraging experimentation, which could be an inspiration to other design cultures that have similar goals.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Subversive Design. Designer Agency Through Acts of Insurgence

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Abstract | Designers working within Small-Medium businesses are habitually positioned to be cogs in the capitalist machine, working only to produce a visual output. This paper explores giving designer agency within these types of organization through the notion of *Subversive Design*; investigating how designers can influence the trajectory of businesses through the act of subversion. By examining instances of subversive acts within a consumer hard goods business, and the methods and results of those act; breaking down how incremental design decisions transpired as a way of subversion. Through the creation of agency of designers to establish and drive design-led projects, we are able to investigate the direct impact of designers work within an organization. This subversive method embedded within design process permits designers to employ methodologies such as Transition Design, System Change, and Design for Resilience into their professional practice.

KEYWORDS | SUBVERSIVE DESIGN, BUSINESS OF DESIGN, DESIGNER AGENCY, DESIGN FOR CHANGE

1. Introduction

In-house designers, in particular, those working for small to medium-sized businesses in North America, are often categorized exclusively as production designers. These roles are created by CEOs or Directors who may not have a background or cognizance in design practice, and as such, perceive the positions from a conventional viewpoint where the role of *design and the designer is understood as that of visual output*. As a result of this, designers are often not given the opportunity, space, or agency to advance and disrupt businesses via much needed creative solutions, interventions or products. Through a descriptive analysis of design-driven projects situated within a small-medium enterprise (SME), this paper reveals how incremental design decisions transpired and acted as key sites of subversion. These subversive acts impacted not only the business but also the role of the designers within this SME — referred to as *MARIC* to maintain anonymity for the organization. These acts are considered as methods that designers may use opportunistically to push forward toward positive and needed system change. With the controlled scope of focusing on MARIC as a case study, the research acts as a preliminary definition and contextual groundwork for *Subversive Design*.

Focusing on means of affording agency to lower-level employees within SMEs, this paper explores the formation of *Subversive Design* — investigating how designers can influence the trajectory of a project through deliberate and enterprising acts of subversion. This exploration of subversion within design builds off the work being done within the approaches of Transition Design, Persuasive Design, and Critical Design which will be discussed throughout. *Subversive Design* exists in parallel to these methods, while concurrently working within the method's established contexts to aid in the production of applied research.

The evolution of contemporary business models and operations has accommodated the adoption of design methodologies into executive suites across the globe. This shift has provided a spotlight on design education's approach to design thinking and its role in business (Cassim, 2013). The transformation, while predominantly to the advantage of the expansion of the design community through job creation and industry exposure, has been rudimentary - its impact focusing more on start-up businesses and institutions with extensive capital resources. The integration of design into the conventional process of business decision making is often limited to large, well-funded organizations and presented to executive and director level employees to embrace the design as a valid business methodology (Muratovski, 2015). This paper focuses on the context of small to medium enterprises (SMEs) that represented more than 50% of Canada's gross domestic product (GDP) (Government of Canada, 2019) and 44% of the GDP in the United States (Government of the United States, 2019). Design Capitalism, which links economics and design in the grounding of future creative economies (Murphy, 2015) acts as a foreground for this research. It is building from this framework, and by applying the methodology of *transition design,* we begin to investigate whether "design-led societal transition" (Irwin, 2015), can be

used to reconceptualize lifestyles and systems to encourage economic growth through socio-political change utilizing concealed acts of positive insurgence.

A case study grounded on MARIC serves to illustrate and consider opportunities that arise when a small team of designers and non-designers are tasked to build on a company's existing product portfolio. The preliminary research presented centres around the daily operations of this business, it's social and cultural restrictions. By giving agency to designers at all levels within MARIC and affording them means to create and drive design-led projects, we investigate the direct impact of designers work within an organization. This triggering of designer agency was approached as Research through Design (RtD) as articulated by Cristiano Storni, "In RtD, design is not what you look at but rather what you need to extend the ability to investigate and acquire new knowledge" (2015, p.74) Though the integration of RtD into contemporary business practices, aiming to establish a foundation of creative agency within the organization.

2. Subversion as a Construct

2.1 Archetypes of Subversion

In order to recontextualize subversion and apply it to design practice, we must look at the traditional definition of subversion. Subversion can be defined as "the overturning or abolition of an established or existing practice, belief, rule, etc., or of a set of these; the transformation of a state of things; an instance of this." ("Subversion, n.," n.d.). From this definition, subversion can be understood as the intentional overthrowing of large established systems. In actuality, subversion also exists in the small moments of life; a public transit commuter jumping the faregate of a subway or a cashier placing only a portion of produce on the scale to lower the price for an underprivileged family. When observing the instances subversion exists in the everyday, we begin to decipher that subversion is often a nuanced act. Subversion provides a way of navigating the world that permits a subtle insurgence against power. Understood as a method in which individuals navigate any given system or situation, the dimensions of subversion and how it operates become more apparent. As a means of deconstructing the term for applied usage within design, I have identified three subversive archetypes tied to subversive acts. These three types subversion are an initial classification, additional forms or variances to these may be identified with further research.

1. **Overt Subversion**

   Overt Subversion is a type of subversion that is most easily identified by the general public. These acts of subversion are instances in which an individual or group consciously and evidently subverts an established practice or system. This could occur in small instances such as a citizen blatantly ignoring a city parking by-

law, dumping garbage in a “no dumping” zone, or protesting governmental legislation. In the contemporary context we see this played out as strained political relationships in the United States triggering significant acts of overt subversions, be it through Donald Trump’s brash disregard for historical political standards (Zurcher, 2020); or Nancy Pelosi’s statement-making tearing of the President’s State of the Union (Kellman & Mascaro, 2020).

2. **Inadvertent Subversion**

   An act of Inadvertent Subversion is one that is not easily identifiable without in-depth analysis. These are instances where the subverter is unaware of the subversion and its associated consequences; this could occur when an individual operates within their daily lives without realizing the implications of the smallest actions. For example, before rampant news coverage over the political views of its CEO, A patron to the fast-food restaurant Chick-Fil-A may be unaware of the political ties the ownership has to anti-LGBTQ groups, and by visiting these restaurants, the individual inadvertently supports the marginalization of a group of people. (Weber, 2013)

3. **Covert Subversion**

   Covert subversions are ones that deliberately contravene established rules or systems in an attempt to overturn or advert the existing structures. This particular method of subversion is one that designers often actively invoke/use as a means to prompt and move their work forward. Not to be confused Persuasive Design that encourages behaviour/user change through the utilization of a design (Fogg, 2009), Covert Subversion occurs within the *process* of design and not through the use of the designed object. The implications of the design existing within the world may have repercussions that progress the original subversive ideals – but it is not markedly the interaction between the design and the individual that generates the change – *it is creation and existence of the design that cultivates change*.

2.2 Power Relations

Irrespective of archetype or context, subversion exists within structures of power and the attempted insurgency of that power. There is nothing to be subverted without the presence of an element of power — this can social, economic, political, religious, or structural power. Within these power relations, we can demarcate between two contrasting groups that I will refer to as *Ascendant Power* and *Subservient Force*. Each relationship includes the Subverter — the agent that is doing the subverting, and the Subvertee – agent that is a being subverted. The Ascendant power is the group or system that holds the dominant power; this can be represented as governments, economic structures, or social norms. The Subservient Force is more exclusively a group of people, often marginalized, that is impacted by the

Ascendant Power. Referring back to the Oxford English Dictionary's definition of subversion, it is the Subservient Force is that which subverts the Ascendant Power; this is can be characterized as an overturn of power of political leaders. Within this dichotomy of power, the system, group, or individual that exists within/as the Subservient Power is relegated in some form — their power has been taken away or agency over their power was never afforded. This practice of the subservient subverting the dominant is the most common understanding of subversion due to the conventional definition (fig 1).

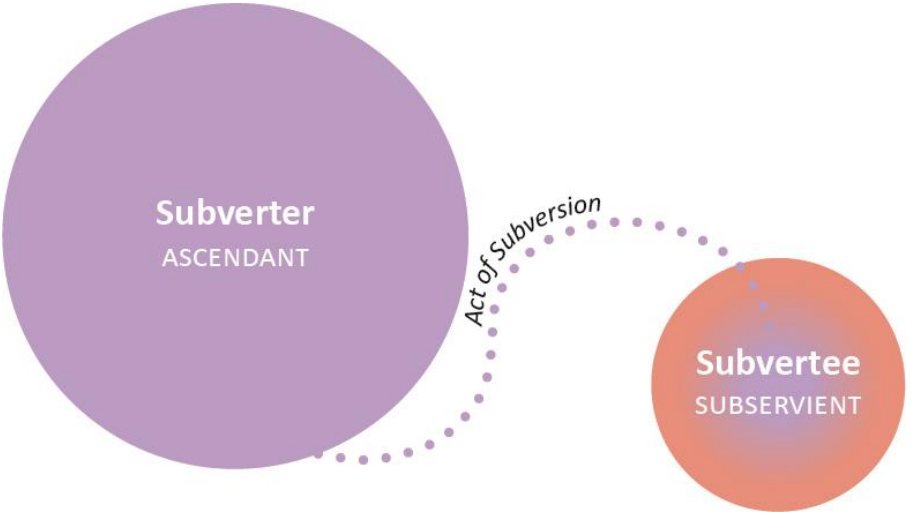

Figure 1. Flow of Subversion; Subservient Power infiltrating Ascendant Power

When reviewing the ways Acts of Subversion occur, there is a consideration that the process is bilateral. In some instances, the Ascendant Power acts as the subverter (fig 2). These occurrences are quotidian; represented and concealed through, namely, governmental policies and structures. A prime example of Ascendant Power acting as the subverter is the nature in which the Chinese government polices its citizens use of the internet, subverting the public's free speech and access to information through digital censorship (Zittrain & Edelman, 2003). Many occurrences of subversion by Ascendant Power are not perceived as subversions as a result of common acknowledgment of power structures (governments), as a means to rule

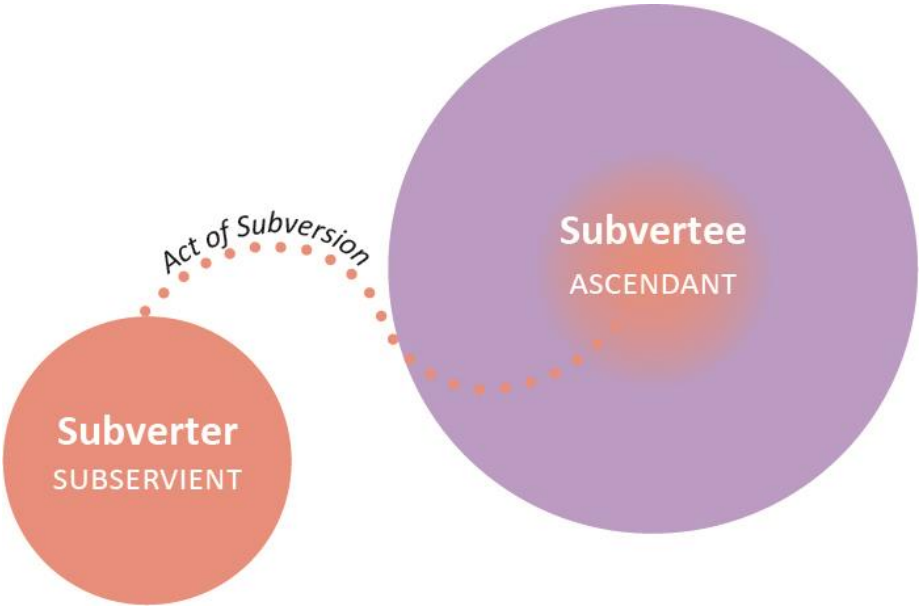

Figure 2. Flow of Subversion; Ascendant Power infiltrating Subservient Power

These two power relations are important considerations when implementing subversion into design practice. It is important to note that these power relations are not simple connections and do not always operate as dichotomies and have been expressed above as a preliminary effort of defining power structures within subversion. Understanding how individuals/groups subvert existing structures informs processes that the designer can utilize when defining the scope of their project. The knowledge of how existing structures subvert, or are subverted, can assist to elevate designer's comprehension of the scope of their work, identifying opportunities for subversive integrations.

3. Acts of Subversion: A Case Study

The below Case Study takes place from 2017-2020 during my tenure at MARIC. All projects were led by me in collaboration with creatives both in house and externally.

3.1 State of the Business

MARIC is rooted in decades of operations as an importer and distributor company – sourcing consumer products from overseas and bringing them to market in North America. The

company's primary focus for the mass amount of its history has been through independent retailers and large box stores. Recently, in the last decade, the company stumbled into the online marketplace and became a first adopter on one of the world's top eCommerce marketplaces. Through the happenstance success of eCommerce sales, the company witnessed rapid fiscal growth. This growth, however, did not translate to a reimagining of its product offering through design, development, or marketing. In the history of the company, there has been no initiative to position itself as a design-driven organization, despite consumer products being the sole revenue driver for the organization.

An extensive cultural and operational shift has occurred within the organization since the end of 2016, with the ownership acknowledging the shifting retail and e-commerce landscape. New executives were brought in to bolster this change, which occurred in a turbulent manner. During 2017-2018 the company witnessed a turnover of 80% of its office workers. The focus of the organization became about streamlining operations and leveraging warehousing and sourcing capabilities, as this is what brought the company success in the past. As a result, MARIC saw continued staff turnover, a reduced customer base, and a downward sales trajectory. Through the years of discomfort the product and design teams urged the executive leadership to invest in its design and product teams in order to deliver economic growth for the business, understanding that product design can increase not only the company sales but can translate as a reduction in costs as well (Guo, 2010). Unfortunately, the pleas were not often met optimistically, and as a result, the design leadership turned to considerate and heedful covert acts of subversion in an attempt to progress the company forward while maintaining their values as a designer. While not always the case, there are instances where MARIC does invest in elements of design and product. Three examples of *Acts of Subversion* represented as Design-led initiatives that occurred at MARIC within the last two years will be discussed below. Established to support and embolden designer agency through *Subversive Design*, these initiatives investigate how subversive acts within contemporary business practices and nomenclature might influence the objectives and outcomes of interconnected industries while simultaneously informing the creation of resilient systems (Manzini, 2013). These acts are incremental activates that either partially or wholly embody passive insurgency through their process of creation.

3.2 Act of Subversion I: Applied Design Project (APD)

The primary activity in this case study of MARIC was the development and execution of an applied design project that brought together a local Design Academy and MARIC. This was presented to MARIC administrators as an opportunity for the company to explore new ways of acquiring new products. Traditionally, as a trading company, MARIC only sourced products overseas – offering no design 'value' to the local marketplace. This APD was a low-risk venture in which the organization could explore the processes and outputs of designing a product 'from scratch.' Low risk in this scenario is defined as (1) not requiring a considerable investment for new employee hires or product sampling, (2) not distracting the existing product and design team from their everyday objectives. Upon the sign off of the

collaboration, the APD formed as a five-month program established to design a new range of products that MARIC could manufacture overseas and sell to the Canadian market.

Participants:

- 2 Industrial Design Undergraduate Students (2nd + 3rd Year)
- 1 Communication Design Undergraduate Student (3rd Year)
- 1 Graduate Researcher (Design Manager at MARIC)

Each participant in the collaboration had a specific objective that they hoped to get out of the project. The list outlines the objectives of each participant and ranks them as a *subversive stratum* (fig 3).

> *Researcher Objective*: (1) Explore how design can influence business operations and objectives. (2) Examine the potential for producing the designed product in Canada.
>
> *Company Objective*: Acquire a new range of 'designed in Canada' products to sell and market.
>
> *Student Objective*: Design a new range of shelving, or shelving adjacent products suited for small space living

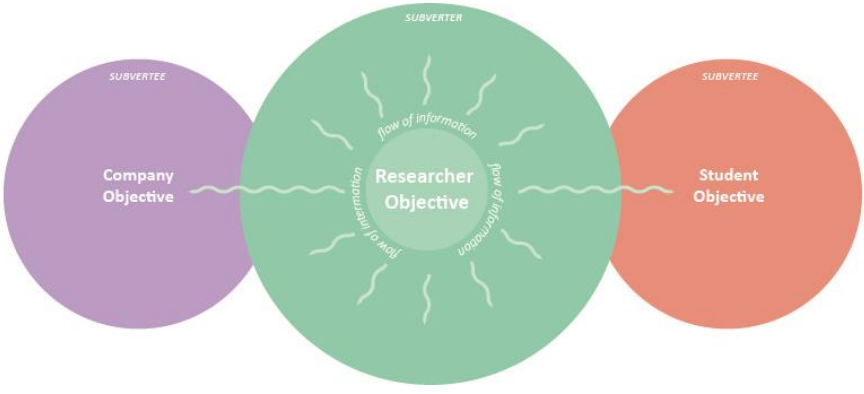

Figure 3. Subversive Stratum. Driving goals through design briefs.

Throughout the process of the project, members of the MARIC team attended critiques at the academy in tandem with Design faculty and independent industry designers. Established by the graduate researcher these critiques were situated to (1) provide direct feedback from industry and academy to the undergraduate students on the development of their design concepts, while (2) subversively assimilating an element of the design process into the genesis of MARIC's company culture. In the end, a product concept was presented that won admiration from MARIC's design team, sales team, CEO, and board of directors. The praise was so high that it was determined, for the first time in the company's history, that an

exploration of local manufacturing was to be explored. While the viability of manufacturing the product in Canada dithered, it's impact on the company's thought process surrounding the notion of localized production was shifted permanently. Swiftly, the product developers, sales managers, and even the CEO were including goals of local production in their everyday work conversations.

3.3 Act of Subversion II: New Product Development

In mid-2019, a meeting took place between design leadership and the CEO. The team discussed the company's forward trajectory and how they might capitalize on the business in the future. The design leadership recommended the company put a significant emphasis on the design and development of new products, instead of the sourcing and modification of factory products that they believed was the wiser and more secure route in the interim. At the close of the meeting, the leaders agreed to work on the modifications of an existing product line (new colourway and finishing). With the knowledge of the lengthy design and development timeline, the design leadership withheld a significant piece of information - they would also be tasking the small design team with an assignment to design bespoke products as a side project.

Back on the Design floor, the company's three designers were presented with the subversive act of designing a new line of products for the company. They were not informed of the previous conversation with the CEO but were advised to work on the project only when free time was available for them to allow them to work on it. In the three months that followed, it became apparent that everyday projects that occupied most of their time could be completed in a faster manner, maintaining a high quality of work while providing the space for the designers to pursue the new bespoke design project. At the end of the three months, in addition to the colourway and finishing work, the design team provided the company with a new catalogue of custom designs that would be presented to new and existing customers.

3.4 Act of Subversion II: New Business Partnerships + Local Production

A by-product of the work done during Act of Subversion I, a comprehensive analysis of local production facilities occurred, to determine the feasibility of local production for the select range of product. As a result, a new relationship with an injection moulding facility was formed. This manufacturer produces utilitarian products such as flooring and packaging tubes for a cosmetics company but also operates with a value of sustainability; turning waste stream materials into new products and reducing transportation and carbon emissions. The discovery of this facility and subsequent introductory relationship led to many fruitful conversations within MARIC, ultimately resulting in the development of a nascent design project - a new range of eco-plastic products, produced using waste from local curb side recycling. To date, this new venture has not been discussed with anyone outside of MARIC's product team. If successful, this partnership would define a new groundwork for MARIC to begin production in Canada.

3.5 Results

The projects and acts outlined throughout this paper are projects based on reflexive intuition by the design leader, trusting that in their experience as designers, managers, and researchers will attribute to a positive impact for MARIC. The tangible implications of these Design Subversions are only beginning to come to light; however, it is possible that these interventions act as instigators, or directly influenced the trajectory of the company. In the months following each of these acts of subversion the company has seen a dramatic shift in its outlook and business objectives including but not limited to:

- A large investment to attend an international design trade show and research trip to Europe
- Expansion of the product and design team twofold
- Awarding of “category captain” by a key retailer, affording full control of the retailer’s product section
- Securing a face-to-face design meeting with one of the largest global retail chains, redefining a once failing business relationship with immediate sales increases.
- Launching a new company mission which includes a call out to “engage with Canadian designers + artists through the continued development of originally designed product”
- Establishing short term and long-term company goals:

    1. Develop professional opportunities for Canadian artists and designers, supporting local communities and institutions.
    2. Produce products in socially and environmentally responsible ways and stimulate regional economic growth where possible by meeting the following targets:
    3. 90% recyclable packaging materials
    4. 50% of products made of sustainable materials
    5. 100% of suppliers to meet socially and environmentally responsible standards by 2024
    6. Investigate domestic production and assess the feasibility of a pilot program

4. Subversion as Design Practice

Design historically and primarily operates in systems of capitalism (Margolin, 1989), with designers working in house, as contractors, at an agency, working for for-profit organizations. The clients in these situations indicate their objectives, and it is the designer’s role to manifest an idea to suit the objectives. The design interventions illustrated above are subversive. Subversive design operates within these capitalist design systems and encourages the designer to continue to meet the project brief while lacing in acts for positive change. The designer must operate on high ethical grounds — this is a critical

component to the notion of subversive design, taking influence from transition design and its principles as described by Terry Irwin:

> "Transition Designers learn to see and solve for wicked problems and view a single design or solution as a single step in a longer transition toward a future-based vision. Transition solutions might have intentionally short lifespans where obsolescence is a given because it is a step toward a longer-term goal." (2015)

Subversive Design employs the future-base vision of Transition Design and applies its motives for solving these wicked-problems by introducing subversive elements into the design process. *Subversive Design's* anarchist-like approach encompasses working in components of systemic issues into a design brief without the avert awareness of the client. The intent is not to change the project by producing an outcome that is in direct opposition to the client's needs but to infiltrate elements of the design process/product that will act as small levers in a more extensive system. This method allows for design to continue to operate within the capitalist models while moving forward towards a more resilient economy. Within daily constraints of business operations, we are given permission - by ourselves - to act as design researchers in the field. As soon as a designer begin to insert particulars into their brief that are not widely known, they have given themselves permission to discover – finds ways to shift and open up new opportunities and – arguably – give a site for new knowledge to be revealed and shared.

> "New knowledge gained in the frame of redirective practice can also bring greater authority to the application of one's practice, this not least because of the support gained from other voices speaking similar messages, and other practitioners delivering projects informed by the same imperatives." (Fry, 2008, p55)

The pursuit and development of new knowledge through *Subversive Design* can encourage the integration of design methodologies utilized in formal design education; encouraging the undertaking of wicked problems (Horst & Webber, 1973) within the industry. Methods of subversion permit the designer to bring their experience and knowledge from the lab *(academy)* into the field *(industry),* an occurrence that could bring much discomfort for new designers. As presented in the foreword to *Design Research Through Practice,* Ideo's managing director Jane Fulton Suri describes the importance of confronting global problems in industry:

> "Design research plays an important role in illuminating and tackling many complex problems facing the world today. It encourages and enables social change and challenges assumptions and beliefs about how we live, work, and consume. It raises questions that prompt us to consider other possibilities." (Koskinen, 2011).

By assimilating Design Research into industry and businesses that are not privy to this type of knowledge creation, the scale of real-world impact for designers grows exponentially. In a report analysing the creative economy identified that 30% of respondents worked for an employer that did not have design as a core service (Association of Registered Graphic Designers, 2017). Organizations without design as a core service are the most susceptible to

the subversive integration of Design Research into their practices – constructing a condition for designers to augment the scale of their impact of their own fruition. This integration of Design Research within the applied context of working in industry allows for designers to work within critical spaces; consenting for the exploration speculative and prevocational (Dunne, 2006) work while maintaining integrity of a desire design outcome.

5. Conclusion

The research presented through the subversive acts at MARIC are rooted in business, and the results are reflected primarily through sales statistics or leads. These examples however illustrate a preliminary byproduct of designers taking agency over the context of work through means of betterment. This case study review only touches the surface on what subversion can accomplish when recontectualized and applied to design within SMEs; the abundant potential to transform subversion as a method within the design process is encouraging. Designers have the potential to impact their work by their own means, despite being constricted to the operations of a capitalist society; this impact can translate as influence beyond the scope of only their project.

In a world that suffers from ongoing natural disasters, novel viruses, social inequalities, and catastrophic environmental concerns – designers are posed to be in a position enact change. There is no singular solution or approach that will grapple with all of the problems in the world; however, a myriad of incremental and subversive movements that can be made through varying processes and disciplines in an attempt to progress forward. Designers often feel as though the work they do either directly contributes to these issues and that they have no agency to change any of the situations they find themselves or their work situated in. *Subversive Design* is an opportunity for designers to take agency of their work and ensure it is moving in a direction that fuels future generations.

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Acknowledgements: The author would like to acknowledge that this research took place on the unceded territory of the Coast Salish peoples–Sḵwx̱wú7mesh (Squamish), Stó:lō and Sḥíl̓wətaʔ/Selilwitulh (Tsleil-Waututh) and xʷməθkʷəy̓əm (Musqueam) Nations.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The City of Care

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Abstract | Three quarters of the European population is concentrated in cities, with urbanization continuing to grow at high speed. In contemporary cities, living is more and more based on "mobile lives". Young people live a significant evolutionary dynamic phase characterized by increasing both experiences opportunities and uncertainties. Starting from the design of interiors, a reflection on the development of the urban context is needed to understand, encompass and balance the ongoing social transformations and the lifestyle evolution. The overlapping, contamination and fertilization between different architectural typologies and functional solutions as well as new using ways allows the development of a new system called hybrid spaces. The paper investigates the emerging topic of care, highlights its potential relevance for the future generations and outlines the contribution that design, with a specific focus on the interior design approach, can offer to post-industrial society[1].

KEYWORDS | URBAN WELLBEING, INTERIOR DESIGN, HYBRID SPACES, RESILIENT CITY

[1] The paper is the result of a project titled *City of Care. Wellbeing for a new human dimension in future Urban Environments*, which is ongoing under the responsibility of the Authors.

1. Introduction

Cities concentrate three quarters of the European population, with urbanization continuing to grow at high speed. A United Nations report predicts that in 2050 more than 70% of the world's population will live in urbanized contexts[2]. This will be accompanied by the highest level of migration due to climatic causes[3] and to the perverse effects of globalisation and profit-driven economic policies based on inequality at the expense of cultural identities and people's needs.

Health and wellbeing are critically influenced by the natural and built environment as well as by social relationships. In urban contexts, environmental changes, like air and water pollution together with transportation problems, are decreasing social cohesion and rising stress, also affecting physical and mental health. Studies on the long-term effects of growth in an urban environment show an increase in psychological disorders such as anxiety, panic, boredom, sleep disturbances. If health is assumed not merely as the absence of disease or infirmity but as a state of complete physical, mental and social happiness[4], we understand how the individuals and communities' life quality plays a key role in promoting and maintaining health status[5].

As European cities are growing, they are progressively acting and introducing policies to become more sustainable and liveable, adapting to climate change, investing in a range of smart and innovative solutions, higher energy efficiency and stronger social cohesion and inclusion. In Canada, USA as well as in Asia and Africa similar initiatives are ongoing[6]. Starting from the design of interiors, that plays a fundamental role in the creation of spaces where people live, work, relate with others, all these issues call for a reflection on the development of the urban context able to understand, encompass and balance the ongoing social transformations and the evolution of the lifestyle. In a wide perspective, beyond the concept of smart cities, an idea could be supported promoting the notion of a resilient city, more accessible and inclusive for all people[7].

[2] UN. (2018). World Urbanization Prospects. Retrieved 11 May 2019, from United Nations News website: https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html
[3] UNHCR. (2019). Retrieved 11 May 2019, from The UN Refugee Agency website: www.unhcr.org/en-au/figures-at-a-glance.html
[4] Declaration of Alma-Ata, EU 1978
[5] United Nations Sustainability Goals 11.
[6] SC1-BHC-29-2020
[7] https://www.ispionline.it/it/pubblicazione/beyond-smart-city-sustainable-city-22054

2. The city scenarios

In contemporary society, the ongoing digital revolution, the evolution of human relationships and the ease of mobility, coupled with a general decrease in travel costs, have deeply changed social practices associated with the persistence of individuals in the same place for long periods. Living is more and more based on momentary conditions related to new lifestyles dictated by working and personal activities, that often determine “mobile lives” (Elliott & Urry, 2010). We are living a “disruptive mutation” (Baricco, 2018), that is a total subversion of the use patterns of spaces and services capable of altering all the "solid" and archetypal conceptions that we had established. For these reasons, the diffusion of co-living and co-working experiences have increasingly exploited new sustainable practices combined with a progressive blurring of the boundary between the worksphere, the space for hospitality and living, a nomadic style finding its stage in the city. These social modifications impose a reflection on the new development of the urban context able to support the ongoing lifestyle evolution. As demonstrated by a research carried out in the Design Department at Politecnico di Milano, these social developments impose a definition of a new hybrid system of space-services characterized by the overlapping, contamination and fertilization between different architectural typologies and functional solutions as well as new using ways (Scullica & Elgani, 2019).

Focusing on the individual and community wellbeing as one of the most crucial purposes of architecture and interior design, it is particularly interesting bringing up indications from a psychological point of view, which seems to highlight the need to take account of an ecological dimension as a convenient approach to an individual’s discomfort. According to Hillman (1999), the way to improve people is to improve their city. In an increasingly global and multi-ethnic city, where individualism is exasperated, new and more supportive relationships need to be enhanced, symbolically recreating a "village" dimension. It is a matter of designing not only spaces but places, not just "objects" but relationships: the challenge is filling this gap at a methodological level and doing it with minimal resources.

A right to the city should be formulated as a right to a transformed and renewed urban life, to be achieved through a re-appropriation of times and spaces of everyday life, a new configuration of social, political and economic relations, starting from a new approach to the design of urban environments. Two key principles should be regained: the individual citizen identity and the consequent possibility of dwelling the city. The re-signification of the urban space should take account of the relationship between people and built assets, as well as of the environmental effects on the individual emotions and behaviour. Beyond a traditional architectural aptitude, focused on single specific aspects, a contemporary design approach would address space/service systems, aimed to achieve more complex, multifaceted experiences. A design approach can be an important element of connection between knowledge areas, experiences and research carried out in different contexts and with different types of tools.

2.1 Urban reuse

The urgent need to stop the systematic consumption of land, energy, built and natural heritage, calls for increased attention being given to the potential of existing assets for both housing and experience (Pileri & Biondillo, 2015). Potentially, some spaces, often characterized by relevant historical architectural features, can become an effective resource by providing hospitable interior atmospheres; according to a virtuous European approach, they could give support to initiatives addressed to "revitalize" neighborhoods, guaranteeing an effective protection to the territory.

Often, the need to reuse existing spaces, fostering the communities cultural development and raising social cohesion collides with a lack of specific administrative tools, with a consequent risk that best practices could result into gentrification process (Marini, 2015; Dal Borgo et al., 2016).

When acting in ancient contexts, the research of new values of character and atmosphere inevitably finds itself involved in the exploration of the authentic vocation of places, in a dynamic interaction between past and future. In present time, an excess of building destruction is the equivalent of a loss of memories and images (Giannattasio, 2017). A challenge for newly designed spaces to be really audacious can be grafting in the old, thus engaging in a continuity and dialogue with it (Truppi, 2011). Existing buildings, landscapes and cities are palimpsests of memories, theatres of private and collective lives that have developed over time. Research in environmental aesthetics shows that people generally prefer historical places to modern architecture since they create a sense of continuity with the past, embody the group traditions, and facilitate place attachment, intensified by awareness of the place history (Lewicka, 2008).

Places remember through their monuments, the architectural style of their buildings, inscriptions on walls, etc. (Lewicka, 2008). For people who reside there, the traces play the function of “urban reminders”, the “mnemonic aids” to collective memory. Memory and imagination make people live in a tangible as well as in an intangible dimension, both contemporarily necessary to put them in relation with their past and projected into the future. In this dimension, physical reality and the narrative capacity of places are especially important. Therefore, existing buildings take on a strong civic value, allowing people to keep their common memory alive.

Therefore, whatever the scale of intervention, design in existing contexts has to deal with the fascinating and challenging persistence of memory and with the meaning that people have given to places over time. Design in existing contexts requires a special sensitivity and a deep critical capacity in calibrating the intervention such that, at the same time, the materials as well as their associated values are respected (Anzani & Caramel, 2020).

In order to link research to practical needs and user demands, design processes should include relevant parties in urban projects, building partnership with stakeholders such as policy makers, users, business, and local communities.

2.2 Care in the urban contexts

Recent research questions the capacity of the Smart City to improving individuals' living conditions and, at the same time, discusses it from a democratic point of view, due to the possible exploitation of people sensitive data. Other characteristics could be emphasized to "go beyond" the concept of Smart City, that can positively shape its future: "resilient", "flexible", "circular" city. Resilience gained the attention of the United Nations, which launched the "Making Cities Resilient" campaign (MCR) through the United Nation Office for Disaster Risk Reduction (UNISDR)[8].

Towards an advanced meaning of wellbeing in the urban contexts, the emerging topic of care highlights its potential relevance for the future generations and outlines the contribution that design, with a specific focus on the interior design approach, can offer to post-industrial society. Care involves an affective component, a benevolent predisposition to someone or something, a sense of respect and an awareness of the intrinsic value of objects and spaces. Therefore, the act of caring can become emblematic of a positive mode to address places. A strong appeal to civic responsibility seems necessary today, as there is an urgent need to protect against situations of abandonment and degradation, generated by administrative negligence and financial constraints, and in response to the sense of alienation that pervades contemporary society (Anzani & Caramel, 2020). In fact, design education and practice can generate a positive and sustainable impact on future communities if supported by specific tools based on a new interpretation of contemporary and emerging needs.

Flexibility is an environmental protection strategy as well as a way of taking care of individual needs. A circular economy concept is fundamental under different points of view. First, it refers to the economic cycle, which aims to the progressive limitation of waste and the reuse of materials, at the same time creating new industrial and job opportunities. Secondly, it refers to the holistic (circular) perspective, which highlights the interdependence between environmental, economic, and social plans, precisely within the framework of a circular economy. It worth considering that, for the first time, no. 11 of the Sustainable Development Goals has included cities among the key players of sustainable development. Besides, this is put in relationship with other goals, i.e., obtaining a quality education, promoting inclusive and sustainable economic growth, employment and decent work for all,

[8] https://www.ispionline.it/it/pubblicazione/beyond-smart-city-sustainable-city-22054

and building resilient infrastructure, promoting sustainable industrialization and fostering innovation[9].

The relations between external, environmental and design elements and internal, psychological dimension of the citizens and users should be taken into due account. A particular aspect of life quality which is often discarded as secondary, but has instead a strong valence for health, is sleep quality. This aspect of life quality is relatively simple to measure and assess; yet, together with other data related to social aspects and activities in social networks, it provides a strong insight on people's conditions.

Considering that wellbeing can be measured through psychological and neuroscientific tools, a transdisciplinary holistic perspective should be adopted to approach the connections between happiness, meaningfulness, development, the protection of the environment, social inclusion and social justice.

As more and more nations are learning, economic growth alone is not enough to produce happiness and part of the unhappiness results from the enormous inequality in the distribution of global income. The need for a new humanism should consider that we are beings in which minds, bodies, environment and culture are connected at different levels. Dwelling as a basic human action joins people and environment: it begins with the possibility of controlling a portion of space and involves both the tangible dimension of physical places and their mental representation. The paper ambition is to promote knowledge and creativity as major cultural and institutional bases of human communities, to endorse care as a guide attitude to fragile, unacceptable and rejected aspects of individuals and communities, to re-launch an aesthetic, creative, design-based approach to urban and community relationships.

3. The needs of the young generation

Because of the limited power of local administrations, a top-down process cannot take place without a bottom-up participation, which pivots on the awareness and involvement of communities and individuals. Young people live a significant evolutionary dynamic phase. On the one hand, this creates increasing opportunities for experiences; on the other hand, it increases uncertainties. Indeed, young adults seem now particularly vulnerable as they report increasingly higher levels of depression and anxiety. Understanding young people's needs for the future, with a particular focus on their personal satisfaction, could be a useful strategy to make them feel protagonist and to engage their great potential for social change. In particular, it is important to understand what meaning they attribute to their own wellbeing, and what possibility they have to transform it into action (Maggiolini, 2017).

Young adults' generation is particularly meaningful because they represent the decision-making and active citizens for the future urban contexts. They are peculiar in that they

[9] ibidem

represent a transition generation between two ways of living and interpreting the world, separated by the advance of new technologies. Their way of reading and interpreting the world could reflect their position and therefore differ consistently from that of previous generations. This has repercussions on a personal and on a policy level. At the level of the individual this could define different ways of defining the best actions, in terms of policies, to reach necessary individual and social change. Developing cross-disciplinary concepts combining universal design of ICT with pedagogy for educational, communication and social purposes could complement and support a design approach. University city-campuses may offer opportunities for lifelong learning pedagogy and meeting points for research-based, multi-disciplinary and international student projects addressing the urban challenges.

Research proposals and bottom-up design processes with a profoundly multidisciplinary approach may involve students' organizations, incoming students from Erasmus network, young workers and entrepreneurs involved through the alumni's networks as well as through start-up incubators.

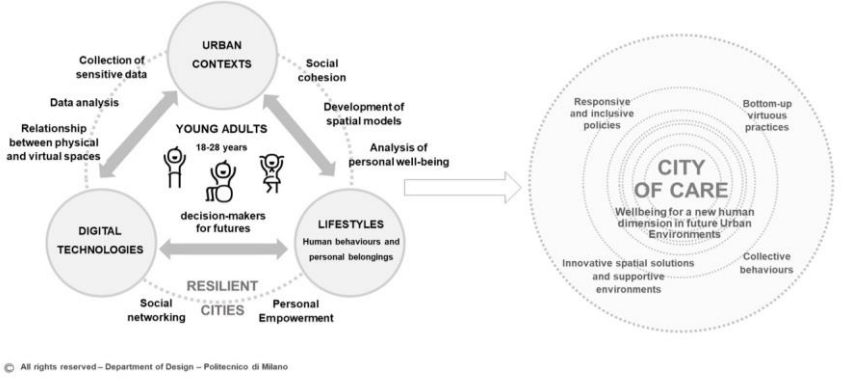

Figure 1. Involvement of young adults and design aspects in the City of Care scenario.

4. The role of interior design

Research in interior design at different scales of intervention spans over a broad field, including internal and external spaces, places, anthropic landscapes, thoughts and things. The starting point of a design vision is the human dimension with all its sensitivity and perceptive qualities. Within the design disciplines, contemporary challenges have led to an increased focus on the urban environment. Environmental and architectural psychology as well as the discoveries in the neuro-scientific field have made scholars, local companies and institutions increasingly aware of the opportunities offered by a human-centred design and

opened ever more stimulating perspectives to the design of welcoming spaces. The use of design practices, historically open to a dialogue with other disciplines, can be an important element of connection between knowledge areas, experiences and research carried out in different contexts and with different types of tools (Branzi, 2010). Aimed to seek innovative solutions in the project of development and growth of urban spaces, fundamental contributions could be provided by outlining specific characteristics of urban places related to living, working, travelling. A special attention should be given to healthy sleeping, dwelling conditions and personal relax time, which represent a relevant aspect in the everyday urban living across different people (students, working or occupied/unemployed persons) (Elgani & Scullica, 2020).

In the "city of care", this attention to younger people (age 18-28) could take place in two different ways: first, interior design should "cure" many of the meeting spaces, relationships, work, hospitality, exteriors and interiors, paying attention to the flexibility of the spaces (central theme today) to the technological equipment, (technologically "augmented" spaces) to the sustainability of the spaces themselves, and to inclusion, balancing, at the same time, the relationship between privacy and sharing.

In this regard, on the one hand, individuals need "relational" spaces in which to interact and exchange experiences, fundamental both for recreational-entertaining events and for work-related activities (this relationship is increasingly expressed by the term "bleisure" (business + leisure). On the other hand, more and more areas are also needed in which (work or entertainment and leisure) activities could be carried out in a private dimension. Every place of contemporaneity involves this type of “balance”, especially in a context where "hospitality", "inclusion" and "care" of subjects are important elements, as highlighted here. All spaces must also be adequately flexible, not only for the different activities to be hosted, but also for the microclimate, lighting and sensorial components in general (Caan, 2011).

Second, beside a general orientation of interior design should guide the definition of all spaces (architectural and urban ones), it may be desirable that specific “spaces of care”, according to the features defined above, would be created within different contexts in relation to specific places, in external and internal areas. Therefore, a more abstract spatial "model" should be studied and developed, to be then declined in different contexts and places, internal and external: from its presence in work spaces, to that within green spaces. A typology of spaces from which this model could take inspiration would seem to be that of "lounges" with a high level of comfort (for services, furniture, materials, sensory components, microclimate, ...), where you can carry out activities in the name of "bleisure" in a dimension of safeguard and individual "protection". This type of space has long been synonymous with "exclusivity" and the prerogative of a few (e.g. airport or hotel executive lounges), but in the contemporary world the model must also adapt to less "exclusive" situations, involving a plurality of subjects, according to a more democratic approach.

The approach will obviously have to be declined in different situations, and to be reconciled in function of specific spaces with their different peculiarities, activities, services and needs,

always strongly relating to the users requirements according to a "human centered" approach. At different scales, technologies as an essential aspect should be used for the individuals, avoiding a "neo-mannerist" approach.

As pointed out in paragraph 2.2, sleeping and relax are relevant aspects of healthy conditions[10]. Many "relational" components of the sleeping dimension obviously reflect on the quality but also on the different sleeping experiences. From sleeping alone, in a “personal” and specifically dedicated functional space, to sharing this space with other unfamiliar persons (hospital rooms, airport lounges, hostels or spaces for work/offices), or with "partner" persons during recreational-relational activities, or with friends in different situations (night rest, work breaks, trips, ...). Of course, the project of spaces, equipments and furniture systems both in private and in public spaces is a very challenging theme for the Design process.

Another crucial topic is the increasing importance of green spaces and green areas in relation to very different types of spaces: according to the advantages that green areas can guarantee for the individual, not only the presence of particularly large spaces and green areas, of course, adequately equipped is hoped for, but the "contamination" of green areas with architectural artefacts and also with entire cities[11] is becoming increasingly evident. Furthermore, the model must always adapt itself to the characteristics of the place so to be somehow representative of its culture, history, identity according to a "glocal" approach: an approach that today seems indispensable in an excessively globalized international context. In the development of the model, but also in its declination in different functional contexts, the participation of users in the design processes appears to be important according to a co-design approach (Rizzo, 2009) to avoid excessively "bottom down" choices and solutions and to make these spaces truly meet the needs of individuals.

[10] https://esrs.eu/

[11] as in the projects curated by the Stefano Boeri architecture studio for many architectural and urban projects designed and built in Italy and internationally.

5. Conclusions

Design seems to provide a key contribution to human everyday living in urban contexts, given its capacity to connect different knowledge areas and to propose reliable scenarios to improve dwelling conditions. A great responsibility of the design approach is stimulating a positive tension between spaces, times and new individual behaviours. It means identifying well designed solutions for the community, and not only for a single individual, also in relation to temporal structures and to ever more rapid and disruptive transformations (VV. AA., 2014). Building a welcoming and intimate dimension that can give care and comfort, even for a short time, to the individual is one of the most important challenges for the near future, whether it concerns collective indoor or outdoor spaces (Pimlott, 2018). Considering the topicality of this subject, an involvement of the final users in the design process, according to a co-design methodology, is unavoidable. A new humanistic approach seems to be more and more necessary for the design of spaces, service and technology in a contemporary and future urban context: in a more inclusive society, technology and economic development have to be considered as mere tools and not as final goals.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The power of designing choices.

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Abstract | Design has gone viral, all of us today are aware of the responsibility that design has taken on the challenges and crises of our time. After some considerations on these issues, the paper introduces the work carried out by "La Scuola Open Source" and in particular the XYZ2019 experience, and it deepens its methods and processes. A different kind of attitude emerges, balancing a state and quality of "being close" (proximity) and a dynamic encounter that provides energy (collision). The paper identifies some possible paths that match this way of acting. Is a trend inversion possible compared to a past that is no longer repeatable? Inversion defines something that is in-versus, against the common thing. It seeks the novelty by changing the verse: the newness has a subjective concept that includes individual experience and the power to design choices. 1#Introduction; 2#The world has changed; 3#XYZ2019; 4#The Affective in Design; 5#Conclusions

KEYWORDS | SOCIAL DESIGN, MAKING/HAKING, INVERSION, PROGETTARE NEL CAOS

1. Introduction

Design has gone viral and “has swallowed the world” (Gerritzen&Lovink 2019, p.33) it is everywhere. Compared with other disciplines, in the last seventy years, it passed from a semi-handcraft professional activity to a discipline with multiple different declinations. Private and public schools have sprung up everywhere, directions and areas of application have grown, stressing out borders. And all this with the crisis and the decline of other parallel fields. Where designers were once known for their ability to shape stuff, creating visual feature and appearance of goods, nowadays they work on a lot of different specializations including material or immaterial application, artificial intelligence, services, organizations, government agencies, territories, and so on. Nevertheless, how many of them are aware of what they do, of the social responsibility they have, thinking about sense and content as well as a form? The topic of design responsibility has been always part of design culture, as many experiences and authors testify: The First Thing First Manifesto (Garland, 1964), the Real world of Papanek (1970) aware of sustainability, social justice, inclusion and people's real needs; the focus on the human environment, the effort and designers’ role in the process of social change (Maldonado,1970); the designing to nurture and educate good citizenship (McCoy1993). The designers’ work requests to shift beyond issues of form and function to those of society and culture (Boradkar, 2004) also, as Mau, emphasizing the most positive side of capitalism, its ability to innovate in a socially responsible way, as a 'massive change' (Mau, 2004). Designers occupy a dialectical space between the world that is and the world that could be, they formulate a role as change agents and determine a course of action (Margolin, 2007, p.4-5) Despite the growing success of the responsible design movement, the industry is still perceived as often irresponsible, prioritizing profit and market share in the attention economy over consideration or accountability for harmful social consequences (Heller & Vienne, 2018, p.135 Kindle Ed.).

From the micro to macro, following the complexity of a multiscalar approach, new generations of designers adopt a systemic point of view, combining the detail with the big picture, investigating the physical and social, outlining critical issues and potential, experimenting the relational aspects between the form and structure of every kind of artefacts and situations. The “Emerging design” (Manzini, 2015) is a way of interpreting design and designing that is not yet mainstream, but that is expanding. It is a problem-based, solution-oriented design, defined not by the products, services, and communicative artefacts it produces, but by the tools and methods it uses. The focus of emerging design has shifted away from objects and toward ways of thinking and doing, becoming a means to tackle widely differing issues. It shifts from traditional, product-oriented design processes to a process for designing solutions to complex and often intractable social, environmental, and even political problems. (Buchanan, 1992; Cross, 2011; Manzini, 2016). “Design seems to become a lubricant for any social process imaginable” (Gerritzen&Lovink, 2019, p.14) but also the outcome of "Design as Collective Intelligence" (Di Lucchio&Imbesi, 2017; Frascara&Noël) combining the designers’ personal intelligence with the collective knowledge of the society.

2. The world has changed

Design has not changed: the world has changed, (Fagnoni, 2019) and Design has adapted itself to the different conditions, not necessarily limited within the confines of the formal definition of the product but extended as a driving force of human actions and activities in different fields of material and digital production. It is undergoing a momentous change (Margolin, 2015). The consumption collapse, in the era of the post-industry, post-metropolis, together with an unstoppable process of social and environmental ruin put us in front of the failures of the previous ones.

> "In the most narcissistic age in the history of humanity, the human-centred design reflects an antiquated and anthropocentric vision of reality. It is time to remedy with a good dose of altruistic and allocentric design" (Antonelli, 2019, p.21)

Almost thirty years ago Katherine McCoy invited designers to break out of the obedient neutral servant to industry mentality (McCoy, 1993, 2019, p.140), and Mike Monteiro has reiterated the same concept, describing how design has ruined the world (2019). The conditions have changed and consequently the purpose of the design projects. Previously industrial design concentrated work primarily on physical products. Today many of the designers' activities aim at the organisational framework, social problems, interaction and services. While during the last decades the territories and boundaries of the discipline have become frayed, the progressive transition from analogic to digital has transformed the design context. The radical changes we are experiencing, ecological, social, economic, technological, require now strong and decisive choices.

Design, as the discipline of making, always places the practical attitude ahead of the theoretical issue, and theoretical thinking always puts practice at the centre. This approach, certainly valid in the past, doesn't mean it could be the same for future designers (Fagnoni, 2018). As people who act, agents of change, they don't qualify as originators of chances through the possession of certain notional knowledge, but through operational skills, the ability to operate solutions. The Design professions are changing, adapting to the world that is progressively transformed. Laszlo Moholy-Nagy said "designing is not a profession but an attitude" and inspired by this statement Alice Rawsthorn titled her latest book (2018) offering a careful and current analysis of the new designer generations. Thanks to this attitude, they find themselves working in an independent way to face the great global challenges of our time, to which many of the systems and institutions that have organized our lives in the last century are no longer able to answer. (Fagnoni, 2019)

This happens by connecting with other's knowledge, interacting with the territory and its inhabitants, through inclusive practices of listening and co-design. The awareness emerges that it is necessary to consume fewer resources, also from an economic point of view, and at the same time designing for the triggering of new economies. Given the magnitude and quickness of the changes in society and its organization, as well as the emergence of disturbing elements within ecosystems, it raises the need Design Culture to consider a

holistic approach, to create a 'dialogic dialogue' with the local context (Manzini 2016) to nurture the spreading of active citizens.

3. La Scuola Open Source (SOS). XYZ2019. "Progettarenelcaos"

SOS is a private association[1], recently became a Worker Cooperative, whose members can be part of the staff, teachers and/or researchers. They define themselves as a community of digital craftsmen, makers, artists, designers, programmers, pirates, dreamers and innovators; a solidarity ecosystem for social, cultural and technological research and imagination; a space to the transformation of the existing. The founding nucleus, based in Bari, has expanded with a community of people scattered throughout Italy. A rich portfolio of educational activities combines who needs to learn something and who offers teaching about something[2].

As they claim on the website[3], they aim to follow the founding principle of Plato's Accademia: 'a free individual should not be forced, as a slave, to learn any discipline'; they consider Design as a 'catalyst to collectively redefine our relationship with reality', envisioning things for how they could be, altogether. They organized their School's structure to co-designing its teachings proposing openly, allowing anyone to evolve each of its aspects with time, based on learning by doing, do it yourself, opensource, hacker ethics. Learning from Nassim Nicholas Taleb (2013) they are building a model capable to adapt to mutations and making good of any erraticism and change happening.

Courses, lessons and workshops deal with a large range of contemporary topics, about design-related disciplines. They developed an original format called XYZ of which they steered 6 editions in different places. It concerns a methodological tool for knowledge sharing, an immersive, cooperative, multidisciplinary research and co-design lab. The focus is on crossing common problems to find connective solutions, inspired by the hacker learning process and principles (iterative, open, nonlinear, cooperative, informal, ethical).The XYZ2019 edition, named *Comunità Eretiche*, involved almost 100 people, among researchers,

1 Founding members were thirteen guys, their manifesto is available at the website: https://www.lascuolaopensource.xyz/en [accessed December 1st, 2020]. I knew them in 2015. Right from the start, they expressed themselves as a disruptive group. They have grown their program by working several handed, in a closed Facebook group. Each participant could share and contribute to edit the documents. Their first business plan has resulted in the actual SOS configuration.
2There are six thematic areas: teaching, research, care, hackerspace, communication, sustainability. The educational activities are available here https://www.lascuolaopensource.xyz/en/teachings [accessed December 1st, 2020]
3https://www.lascuolaopensource.xyz/en/manifesto [accessed December 1st, 2020]

teachers and designers working together with the inhabitants in the former convent, a disused complex of 6,000 square meters in Cerreto Sannita.

Table 1. XYZ groups Focus and Sense. [_DCs Table title].

	focus	sense
X team	Identity, Strategy Communication Design Propaganda	X is a cross, the opportunity for a dialogue
Y team	Tools, Hardware and Software, Making/Hacking, IoT	Y is a fork, the opportunity for choice
Z team	processes, service design, governance, UX	Z is a road, a trip in divergent directions

Here, Guido Lavorgna and Raffaella Vitelli, with their local association Convento Meridiano, carried out an extraordinary undertaking: once obtained the thirty-year concession for the use of the convent spaces they proposed a project, thanks to which they won the fifth edition of the Culturability call - regenerate spaces to share. Accordingly, they invited La Scuola Open Source (SOS) to organize a research and co-design workshop.

The XYZ2019 goals were ambitious: to co-design the communication strategy and the visual identity system (X), to reorganize spaces and work on IoT grafts in the structure (Y), to develop a governance model, design services, and deepen the economic sustainability (Z) of Convento Meridiano: kindergarten, cinema, laboratory and space of possibilities; an epicentre of social and cultural transformations.

The SOS staff invited directly teachers or tutors and proposed an open call to pick participants. Confirming the importance of design's aptitude rather than expertise's, their selection criteria didn't relate skills or profiles, but the personalities. Some students, philosophers, pedagogues, engineers, designers, architects, economists, makers/hackers, service designers, participated. Sketches and notes below try to describe and model this experience, offering methodological thinking on the heuristic, experimental, intuitive, analogic practices, and tools used during XYZ2019. The coordination team proposes the overall plan. It allocates the goals throughout the laboratory to achieve the expected results. Starting from a shared input in a common meeting (1) the group (X, Y or Z) works in small subgroups with horizontal dynamics (2) involving internal and external actors. After each working session, the group meets again, share results and proceed with the progress achieved (3). The members of the subgroups learn, teach and produce by a mutual exchange relationship (4). They carry out small businesses useful also for other subgroups. As the days pass the subgroups are combining differently, often mixing their groups of original belonging. Everything happens in a fairly fluid way, based on skills, attitudes and interests. The work progresses through a continuous exchange flow and interactions that inspire self-training.

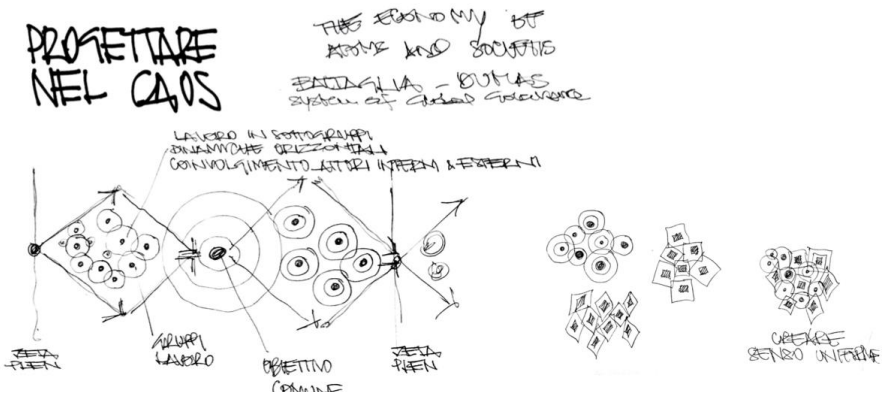

Figure 1. Processes and flows. An articulated relationships system assumes a chaotic behaviour when it does not follow strictly linear laws of evolution and development. Participants behaviours, after a certain time lapse, are atypical and almost unpredictable. Flows seem to lack a correlation between the subsequent steps; however, they are never random forms. [sketch: Raffaella Fagnoni]

Everything that was produced and shared during ten days of immersive and horizontal work, follows the wake of the ad hoc approach enhanced by the American counterculture in the '60s. Bennis and Slater (1968) indicate it as a new system of network relationships, more flexible and responsive. Adhocracy contrasts the model of pyramidal relationships with a rhizomatic one, proposing horizontal development and interchange. While the bureaucracy model follows the practice of imposition, that of adhocracy respects the practice of the proposition. The model of bureaucracy is autocratic, according to a vertical arrangement, while the approach of the adhocracy is collective with a rhizomatic development.

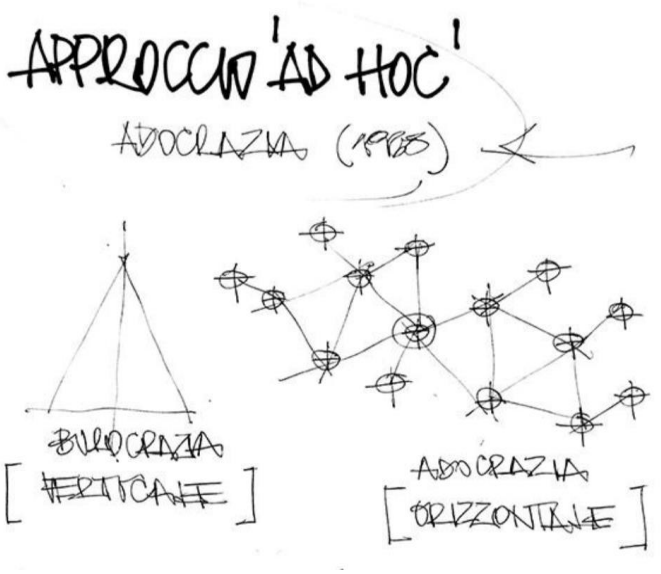

Figure 2. Adhocracy vs. Burocracy. [sketch: Raffaella Fagnoni]

With the term rhizome, the Frenches Deleuze and Guattari define a particular semantic model to be opposed to all models based on the tree concept (prevailing in all disciplines). The tree model provides a hierarchy, a centre, and an order of meaning, arranged in linear order. Instead, according to the authors, unlike trees or their roots, the rhizome connects any point with any other point, and each of its traits does not necessarily refer to traits of the same gender, staking very different regimes of signs. Compared to centric or polycentric systems, hierarchical communication and pre-established links, the rhizome is an acentric, non-hierarchical and non-significant system. (Deleuze &Guattari, 1997, p.33)

The design process (ProgettarenelCaos) is based on people enhancement and their movement autonomy, taking advantage of coordinators and teachers that act as moderators, activators and synthesizers. They behave as leaders and steering an irrepressible flow that otherwise risks overflowing. The Chaos is not an uncontrolled disorder but a generative context. It appears as a kind of harmonious anarchy in which the individual subjects, following a stream of effectiveness, organize themselves by units and positions during the work evolution. They generally maintain the same role and disposition until they

complete a specific work package. All the produced outputs are downloadable on the SOS webpages[4].

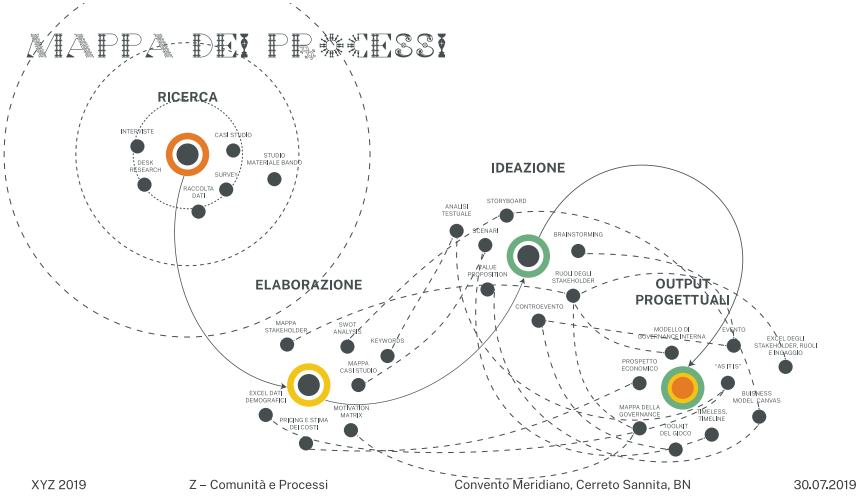

Figure 3. The map designed to show the XYZ process. Group Z, Scuola Open Source

The development of the works follows a step-by-step process, during which XYZ groups and subgroups act and proceed with multifarious interactions and connections. They are designing in the chaos, as a generative process.

[4] http://www.lascuolaopensource.xyz/blog/noi-siamo-gli-output [accessed February 13th, 2020]



Figure 5. Life and work at XYZ2019, Cerreto Sannita (Ph: Raffaella Fagnoni)

Measuring project results. Just like the most creative projects, also the XYZ2019 experience has results that are both tangible and intangible. The tangible ones can be directly verified by measuring the effectiveness of what has been done. The artefacts and services designed for the structure and local stakeholders remain as assets of the group that manages the Convento Meridiano who are using them.

Quantifying the intangible results is less easy, but we can monitor and observe them. This is a first attempt to take advantage of the experience gained and to explore them:

- the sense of empowerment of each member of the group;
- the immersivity in the local context;
- the higher performance in a mix of skills;
- the trust in people;
- the positive rebel attitude (as makers/hackers)

All the practices, to operate for tangible results, focus on human relations and obtain as an added result to the expected final outputs also the design of a community, since the developed relationships move between proximity and collision. On one hand, the state and the quality of *being close*, proximity, permits participants to share and integrate skills in the multidisciplinary group, with stakeholders and by living the place. On the other hand, the *dynamic encounter* between people and activities, that often collide, intensifies the energy. The affective and aesthetic components become a fundamental insight into an immersive designing mood.

4. The relevance of the affective

The state of "being close" highlights the affective component as the quality of projects and design processes. Empathy and attention to relationships make the results more effective. In general, the objects of design culture and also design activism are affective, designers provide intensifications that give materiality (Julier, 2019 p. 341). This affective component, however, does not only refer to the formal aspect of product design objects. As Norman stated some time ago, emotions have a crucial role in the human ability to understand the world and to permit learning new things (2005).

The emotional and sensitive component extends generally as an attitude of the project. We can also find it in the design of reuse and regeneration of spaces and situations, in place-making actions, in the staging of performances or other events, in the performance of contemporary design practices. Today many design projects come up with installations whose meaning is above all to raise awareness and make people reflect on the critical issues of our time in order to induce change. Figure 4 shows an example on the theme of human interactions mediated by new technologies in the framework of the Sencity Festival, Montpellier, 2018. The passage from a individuals' community to the connected community.



Figure 4. Montpellier, Fav 2018, Sencity. Design Installation, "Inter/Faces", a cura del Team Università di Genova, Master Degree in Product and Event Design.

In similar cases design works in a process of co-articulation. Here objects function as a *materialization of participation*. They facilitate a performative engagement in public life without disembedding from the everyday. (Julier,2019 p. 339)

The designer activist is working in a more open-ended way that goes beyond the materialization of the design. The implementation also involves a series of re-designs that doesn't necessarily mean that the design reaches an optimum point. Philosophically, of course, this has resonances with the notion of wicked problems (Rittel&Webber, 1973). The designers remain embedded with their public, their responsibility becomes a shared one, and one that gives space for the designers to usefully contribute their expertise while engaging users in taking on and continuing to develop results. (Julier, 2019 p. 339)

Design today plays such a dynamic role in so many areas. Historically, finding positive applications for new technologies was one of the key roles of design and will continue to be as technology is advancing at an unprecedented speed and scale. (Rawsthorn, 2018) A flow of new technologies promises to become part of our daily lives - quantum computing, neuro-morphing computing, including artificial intelligence, crypto-currency - and people do not always consider them positively. We frequently read stories about artificial intelligence, which, if poorly designed, can cause a considerable amount of damage. On the contrary, if we provide it intelligently and sensitively, it can help to solve problems. Designers will be fundamental in finding positive and beneficial applications for these technologies and have an incredible opportunity to identify them. The affective side takes on a considerable role in this dynamic. However, we need to balance these practices with those involving people. Here some paths to ride:

4.1 Inversion

Inversion is an exercise about shifting the constituent elements of a speech into an arrangement and overturns the normal syntactical structure. It can be based on a shift or a pass from one state to another. Anyway, it is similar to error understood as a possibility for the change of perspective. Many past philosophers, from Plato to Saint Augustine, from Descartes to Heidegger, challenged the idea of error in the search for truth. Error is one of the figures of thought involving practically all fields of human knowledge (Donà, 2012), adopted by pedagogues as a fundamental aspect of mental construction and an integral part of learning (Maria Montessori, Gianni Rodari, Loris Malaguzzi, Bruno Munari), an occurrence for important discoveries in scientific research (e.g. penicillin, Alexander Fleming, 1929). Inversion refers to something that is in-versus, against the common thing, against habit. By changing the verse, it seeks novelty, what is new in a subjective level, a concept that includes the experience and different from that of innovative, related to something that was not there before.

4.2 Craving for craft

Outside the maker spaces and fab labs, designers try to work hard to create authentic and craft-based processes. A craving for craft (Gerritzen&Lovink, 2019) diffuses practices hacking of the technical complex objects that surround us. The outlines of a novel post-digital craft appear. More than ten years after Sennett's book success (2008) good hands have regained

vigour, although electronics, computer science and artificial intelligence dominate and dematerialize customs and traditions. The good hands (virtuous, technically skilled) are also good hands (polite, doing right). These practices recover the culture of proximity between the local workers, the local economies and emerging designers.

The more interesting craft activities concern more developing products/services rather than producing traditional products because these activate alternative processes at the productive, social and economic level through the creation of startups. Through self-production, we enhance our traditions without losing them. Craft permits also to work with the local community. Even on an educational level, an alternative pathway exists. It starts with the analysis and choice of a problematic context. The following research phase evidences the peculiar aspects permitting to identify a project direction. Finally, a concept takes shape and a product/service of which a final model result.

4.3 Reuse and Recycle as Destiny

Reducing, reusing and recycling seems to be the only sustainable social strategies capable of expressing innovation, generating consensus and producing beauty. Recycle creates new value, a new cycle, another life. Recycle is an ecological action that operates pushing the existing into the future by transforming waste. It is not interesting to adopt recycling paradigm because it is an ethical action, good and right, but for the reason that today to recycle is to design. (Fagnoni, 2016)

4.4 Ecological Consciousness

Ecological consciousness is something that requires a radical rethinking of everything. First of all, of the term ‘society’, that must necessarily include also non-human entities: flies, cats, trees, oxygen. Social space has never been exclusively and totally human. We live in a biosphere, which today is becoming fragile and thin as a sheet of paper. (Morton, 2019)

4.5 Limit neoliberalism

Design schools have so far been directed to develop the ability to make beautiful objects accompanied by the illusion that they improve people's quality of life. They pursue the modernist illusion of progress, as in the famous historical film To New Horizons[5](1940) which

5Produced by General Motors, the video documents the "Futurama" exhibit in GM's "Highways and Horizons" pavilion at the World's Fair, which looks ahead to the "wonder world of 1960." It narrates how Americans are always striving for "new horizons," and "new ways of doing things." and proposes an immense, miniature diorama designed by Norman Bel Geddes. https://www.youtube.com/watch?v=tAz4R6F0aaY [accessed February 13th, 2020]

presented the vision of an ever-better world, always growing with the unlimited progress of science and technology.

The typically neoliberal vision of the world largely denies the existence of any negative implications of industrial products and systems on the environment and people. The fundamental problem, from a design point of view, is that huge portions of industries are involved in both the creation and continuance of such myths, however defective they may be. Neoliberalism encourages the unlocking of future sources of value and how design cultures work within this. Likewise, a similar dynamic is the work in design activism. Much of the rhetoric in design and social innovation is directed at tapping into underused resources and freeing up their potential (Manzini&Jegou, 2005) thus there is also a future orientation in design activism. (Julier, 2019, p. 340)

4.6 Educating to Civic sense

Design is dealing with absolutely distant and different matters. This reality imposes today an exceptional commitment of intelligence, an adaptation ready to spread good practices if we aim for the power of designing choices. Yet, in recent history, with the latest reforms of the school and university system, the trend to lower the cultural offer to pursue educational success is gaining momentum. It focuses heavily on skills and less on theoretical disciplinary knowledge, in a sort of market between debits and credits. Certainly, the skills are useful, but it is unthinkable to reduce everything to kits of pre-set and repetitive formulas and models. In addition to basic skills, theoretical knowledge allows the development of critical thinking, emotional and creative intelligence, divergent thinking, the ability to autonomy and self-determination. These are not skills: they are knowledge that becomes part of learning and can be tools of emancipation.
The conference "Designing Civic Consciousness/ABC for the Reconstruction of Civil Consciousness" (San Marino, 2019) provided the opportunity to focus and debate on teaching, on the issues related to knowledge, democracy, and civic sense: that is the willingness to work for the regeneration of the social and physical quality of the context in which one lives. Its existence implies the presence in society of widespread mutual trust and a shared idea: the trust that if I behave correctly the same will be done by others. A shared idea of what is meant by 'correct behaviour'. (Manzini, 2019, p. 24)

4.7 Designing community

Community is a social group in which relationships, emotional ties, closeness and solidarity are the prevailing aspects. It consists of several units interacting with each other: territorial (the geographical, environmental, networked and structural features); social (people, relationships, institutions, services); economic (activities, forces, resources); cultural (values, norms, behaviours, meanings). More and more clearly, the solution of social problems becomes possible only by adopting flexible and decentralized modes of operation, in

contexts closer to everyday life and based on the promotion of mixed networks, understood as a system of co-responsibility between different subjects.

Designing the community means building a voluntary, light and open group in which the individuality of each one balances with the desire to stay or do something together. It means fluid communities, without which there is only the loneliness of the connected individuality, or the reactionary attempt to re-propose the closed and identity communities of the past which, even though they were so beautiful in the past, are certainly a past that will not return. (Manzini, 2019)

5. Conclusion

My purpose has been to take a trip, moving from the contemporary situation and exploring some directions, with the aim to investigate what Design we need and what Design we could teach today. We have the power to design choices and to nurture good citizenship.

We are facing a momentous change, that someone considers a planetary procession toward decay. The consumption collapse, together with an unstoppable process of social and environmental ruin, put us in front of the faults of the previous ones. The young generations are much more sensitive to these issues: they feel anger towards those who preceded them, thinking without any scruple only about their interest. The approach of La Scuola Open Source proposes a different vision for design attitude and design education. A new kind of institute, a young cooperative, opening new perspectives. The XYZ2019 experience offers an example of co-creation and co-design. Today, the activities produced by this workshop are carried out by local people. These practices are thriving in our times as a possible solution to bridge the gap between science, society, innovation and some contemporary human problems.

Two poles balance our life: a prosaic and a poetic part. The first one leads us to act by obligation; while the poetic frame integrates each aesthetic element in our lifetime (Morin 2019, p. 12). The wonder is the emotion of aesthetic feeling that spreads desire for sharing and intensifies enthusiasm (a beautiful word from Greek: en-inside- and thèos-god-, the god inside). A more powerful and intense mood occurs, rather than a simple excitement, a feeling of energy overgrows us. Each goal seems easier to reach and every obstacle easier to fight. A contagious mood opens the chance of realizing ideas or dreams. I think the SOS guys have a terrific power of designing choices and to contribute to diffuse good citizenship.

Designers actions and practices take place at three scales: the individual one, the groups one and the institutions one. The first, the individual, is the level of People, where recombine distance relationships with proximity relationships. The second, the group, is the level of Place, where to organise places as nodes of networks and not as closed enclaves. The third, the institutions, is the level of Economy, where to address the crisis of neoliberalism with the economies of caring and reusing. Through their choices and their tactical creativity,

designers are able to act and spread out the culture of proximity to intervene on the most urgent issues. The more people will be involved in these processes, the more opportunities will be developed to turn what is preferable into what is possible.

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Acknowledgements: Many thanks to La Scuola Open Source, Alessandro Balena, Alessandro Tartaglia, Lucilla Fiorentino and all the people who are working and fighting every day, using the design tools to change things, to have their future and to build a better world.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The systemic approach and the use of new technologies to communicate cultural heritage and develop a culture of proximity

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Abstract | Today the individual is a content producer, who can share ideas and merge creations at a global range in the fastest way. Anyone is a manager of pop culture. Anyone can visit cultural places and interact with others anytime, anywhere in real time. Several Institutions in Italy are "disconnected" from the contemporary changes. This research project was thought to solve this contrast, taking into account the modern scenario and the contemporary role of culture in the social and economic environment of the cities. The research was focused on the development of networks to spread knowledge and create connections within public, the territory and the social-economic actors. Each module of the projects is designed on the basis of the "culture of proximity": the public will be part of the project, interacting in several ways, becoming the content developer. Adaptive modules regard both architectural, design and technological aspects and several communication languages.

KEYWORDS | CONTAMINATION, SYNERGY, ADAPTIVE SYSTEM, OPEN GENERATIVE SYSTEM, MULTI-SENSORY COGNITIVE EXPERIENCE

1. Introduction

CULTURE: the way of life, especially the general customs and beliefs, of a particular group of people at a particular time.

HERITAGE: the history, traditions, practices, etc. of a particular country, society, or company that exist from the past and continue to be important.

PROXIMITY: the state of being near in space or time. *

*in Cambridge Dictionary

Usually definitions help to simplify and explain a concept, today, not these particular ones. Their meanings have never been more complex as nowadays. The “definitions” are so open to subjective interpretation and are so interconnected with several other concepts that it is extremely difficult to maintain a univocal meaning constantly. The fastness and speed of interactions and exchanges of data between subjects from every corner of the globe are challenging our understanding of the usual scenarios, they are introducing more complex realities and changing every moment the content of what we usually call Culture.

1.1 Cultural Proximity

In classical studies, cultural proximity has been connected with aspects like geographical distance, the exchange of goods or persons and the similarity of political systems.

As stated by Maznevski, Distefano, Gomez, Noordenhaven and Wu (2002), culture “is a group-level phenomenon, but it influences individuals’ perceptions, values and behavior, especially with respect to social interaction”

Cultural proximity can be defined and found in several areas of research.

With “cultural proximity” we can find define the term of the extent to which people perceive similarities or differences between two cultures (Babiker, Cox & McMiller, 1980; Wang, 2009). On the other hand, a different approach stems from Pool (1977) and Straubhaar’s (1991, 2003) work, presents cultural proximity as the notion that people naturally choose media that is culturally similar.

Babiker and colleagues (1980) developed an index that measured the perceived similarities between two cultures based on the following characteristics: “climate, food, language, clothes, religion, educational level, material comfort, family structure and family life, courtship and marriage, leisure activities, and intergroup conflict”.

One of the most known applications of cultural proximity or distance is summarized by Geert Hofstede’s (1980) cultural index (Kirkman, Lowe & Gibson, 2006). This index involves six dimensions: individualism, power distance, uncertainty avoidance, masculinity, Confucian dynamism and indulgence (Hofstede, 1980; Hofstede & Bond, 1988; Hofstede, 2015). These dimensions range from the closeness of social frameworks, acknowledgement of the

inequality of power distributions amongst social institutions, adoption of preemptive measures to avoid deviant situations, and dominant as well as secular values in society (Kirkman et al., 2006).

In the last decades these indexes have been used to study, or to manage, scenarios in international trade and marketing studies, and also to explore audience predilection (Fu and Govindaraju (2010)). In examples, the results of the Fu and Govindaraju (2010) study contend that countries that are more culturally similar to the United States will also resemble Hollywood film predilection. Perceived cultural proximity was based on characteristics like shared language, food, clothes, religion and lifestyle (Babiker et al., 1980; Wang, 2009).

1.2 Pop Culture and a new Proximity

We are living in a rapidly changing world of communications, that has significantly shifted the dynamics of pop culture. Perhaps what's more interesting though are the new relationships it's created, between audience, publisher and brand.

New technologies allow us to manage an increasingly high amount of data (big data), to draw new relationships through the use of increasingly advanced processes, also thanks to the insertion of artificial intelligence. The speed with which we can generate new scenarios, expand our knowledge or keep in contact with everyone in the social world, gives us new and innumerable opportunities.

Everything changes in a bit also behavior towards culture and reality. These opportunities, these new "rules of engagement" modify, enhance, revolutionize the relationships between individuals, material and immaterial contexts and require new cultural paradigms.

In the last ten years we have witnessed the creation of new realities by information and communication technologies "The online digital world overflows into the offline analog world, with which it is mixing" .. "we increasingly lead our lives onlife ". (Floridi (2017), The fourth industrial revolution. How the infosphere is transforming the world.).

Daily life is divided between online and offline, the experiences we live are increasingly connected in a social life that takes shape, as our everyday physical life, in a way that we can no longer shoot down because it is part of our individual being and, at the same time, it is part of the collective life.

We speak of the fourth industrial revolution, of IOT (internet of things), connection between objects people and web, or at a higher level, according to the definition given by CISCO, we are now in the IOE era (Internet of Everythings) where the connection extends to all (M2M Machine to machine- IoT), M2P (machine to person - Data and Analytics), P2P (person to person - collaborations).

This was the backdrop to The Culture of Proximity study undertaken by BCMA members, Viacom Velocity – home of iconic pop culture media brand MTV. They set out to better

understand the fundamental audience attitudes underpinning this shift. The results are a clear

New centers of gravity: people have more power than ever. They also filter information in their social media feeds to see only what they want.

New intimacy: everyone is even “friends” with celebrities, messaging is just as personal as talking face to face.

New yourself: everyone chooses activities in real life that will give the opportunity to post something. The audience became the producer of the contents and the judge of the pop level they extend.

1.3 Culture vs Culture

The new globalized markets and their network entail new challenges for academics and industry practitioners. The cultural nuances are now of paramount interest, they may, or maynot, determine whether enterprises rise or flourish in global, national or regional markets. The current study is mainly concerned with perceived cultural proximity, the extent to which people perceive their culture as similar or different to one another, and levels of interaction about the marketing implications of these processes. With the onset of globalization as well as the internationalization of businesses, trading and media, recognizing the role of culture in these transactions becomes paramount in order to gauge and better understand emerging target markets.

All these studies seem disconnected from the usual idea of culture we have, the usual definition. Museums, cultural areas, cities of cultural interest they can not be separated from the changes of the modern age, they can not be “closed” to evolution or new needs of the public, they need to embrace the contemporary age and the changes and challenges the era is providing us. Thay have to be part of new scenarios in order to answer the collective culture, to build new connections with their audiences and express their potentiality. and, on the other hand, everyone wants to be POP, also the museums.

Marketing, big data, social media what do they really mean for the classical culture?

How does a city have to change its own traditional activities to answer the modern age?

How can we tackle the challenges of marketing and cultural dissemination without loosing control? Without falling into stereotypes and easy shortcuts to engage the public?

Modern technology has given the opportunity to the "Places of culture" to be part of huge networks, to be interconnected with cities and other cultural hubs. Museums, "Science Center '', cultural heritage areas, cultural tourism stops are nodes of these networks. Each one emphasizes the participatory approach with the use of interactive exhibits, encouraging visitors to experiment and explore. These nodes are spaces where culture is available to

everyone. Thanks to modern technologies they create increasingly dynamic and engaging experiences that allow the public to be more than part of a passive audience.

The research project we have developed was thought to answer these questions and suggest multiple solutions to the needs of a Cultural Institution, taking into account the modern scenario and the contemporary role of culture in the social and economic environment of the cities.

Two leading institutions in Rome, one committed on the field of design and communication, the second on cultural heritage, astronomy and science communication, have merged their experiences and needs to produce a two-year research project.

2. First steps: understanding the Scenario

Although technological evolutions make it possible to quickly exchange information and data in many places with the biggest audience, there are difficulties connecting and communicating Italian cultural heritage.

The Italian cultural heritage is huge and so complex. It is composed of buildings, museums, libraries collections, material objects and abstract compositions, everything interconnected with the cities, the history and the social and economic life of the country. All these materials usually remain in an indefinite state in time and space, hibernated and distant from the contemporary development of culture, they are incapable of being fluid and in continuous transformation (BAUMAN- La vita liquida) .

This is the local reference scenario that characterized the development of an interdisciplinary research project, "INAF Universe", developed taking into account the contemporary role that culture plays in the social and economic life of cities and the country system in which the use of technologies becomes a generator of new proximity cultures.

The research and exploration referred, in the first phase, to the area of Rome and its surroundings: a real, tangible scenario that allowed us to model the design choices starting from concrete references, represented by the elements of the system in terms of actors, places and relationships.

The contemporary cultural scenario taken into account is bigger and more complex than the local one, so the project started from the analysis of some cultural hub in Europe.

3. Objectives

3.1 Who is INAF?

INAF the National Institute of Astrophysics is the main one Italian Research Body for the study of the Universe. INAF is also the guardian of the historical astronomical heritage developed in the past centuries.

The first step to understand the strengths, the critical points and evaluate the "materials" to be used was to know INAF.

To understand INAF reality, a set of interviews to those who work within the research institute was organized. This allows us to understand the different activities INAF carries out in the field of astronomical research and its dissemination. We carried out a specific analysis of the means of communication that INAF uses, the contents and the media used to be presented to the various audiences.

INAF is the guardian of a heritage spread throughout the Italian territory in the cities hosting the Astronomical Observatories, represented by elements of the past, and historical places such as the church of Sant'Ignazio in Rome or the Casanatense Library. But INAF cultural value is not only connected to the past, INAF is involved in international research projects with high technological content in the realization or programming phase, projects of paramount importance to enrich scientific culture and knowledge. (i.e. the first images of Pluto or the first image of a Black Hole)

3.2 What are the needs?

INAF needs are related to the same needs that each modern research institutes pursue, the need to be recognized by the public and the wish to be connected with the public at large to disseminate the research that is performed inside the institutes itself.

Furthermore, because INAF is the guardian of a huge cultural heritage and plays a special role in the cultural environment of each city where an astronomical observatory is located, INAF needs to enrich its modern role of producer of scientific values, connecting the past and the future of astronomical research through its collections and the link with the historical places in the cities.

3.3 Which strategy?

This heterogeneity of contents and the complexity in narrating them was the first theme of the project activity of the working groups. The groups were represented by about 30 researchers, who through the design of the systems, responded to the emerging INAF needs with multiple strategies:

- enhance INAF's historical-scientific heritage on the local and Italian territory, starting from a flexible format, through adaptive actions capable of modeling the most effective communication strategies for the context of wintering;
- use advanced communication methods capable of reaching different audiences;
- intercept the different targets in the areas of everyday life, through the use of attractors specially designed as system nodes;
- choose advanced science and research themes, which will be capable of better explaining astronomical and astrophysical research.

3.4 Objectives

The objectives of the research have been defined and divided in two phases. The first phase of the work was dedicated to the Rome scenario, as a simulation context, then with the second phase, the project was extended to other Italian cities and Observatories.

A choice made because of the possibility of formulating strategies on a particular place like Rome and its "Astronomical" surroundings, full of opportunities and critical issues.

In particular:

- build a relationship between the astronomical places in the city, and the Copernican and Astronomical Museum of Monte Mario, in order to bring together different targets to enjoy the contents of the Museum and the surrounding area.
- identify "attractors" able to catalyze attention and convey messages more effectively (figure 1);
- take advantage of the characteristics already present in the area in terms of structures and services, to engage targeted design actions, for example by joining the nodes in the city but not connected, to quote Ezio Manzini "use the existing".
- Develop outreach interactive projects and the relative communication and advertising campaigns able to evolve in a short term inside the cities or the Observatories areas.

4. Methodology and development

4.1 First observations

The team was divided into working groups.

Researchers' observations highlighted some critical issues used as project guidelines:

- a lack of connection between the places of astronomy present on Rome territory;
- poor knowledge of the cultural places connected with astronomy in the most tourist areas of the city;
- difficulty of INAF to communicate itself and the cultural resources present on such a territory so rich in cultural, national and international values.
- the need to review the narration of the Copernican and Astronomical Museum in terms of interaction, usability and communication;



figure 1. Astronomical attractors

The observation and mapping of the activities on web platform, digital channels, public events on the territory managed by INAF, has allowed the research to underline a cultural system that is not so much known by the public at large.

Through dedicated questionnaires and interviews, interesting data emerged on the subject of this gap and disconnection that affects the recognition of INAF by an heterogeneous target. An even more evident problem if we take into account that in the area of Rome and its surroundings several astronomical institutions are established.

There are the historical observatories of the Roman College and the Specola Vaticana, the modern research centres of Monte Porzio Catone and Tor Vergata and in Monte Mario the national headquarters of INAF and the Copernican Astronomical Museum.

4.2 A "lens" for each objective

The results of the first analysis have made it possible to obtain the requested info:

- identify and map the nodes in the area, represented by the places relating to astronomy and the places with the greatest tourist turnout;

- highlight the elements defined as "attractors".

The attractors have been identified for their ability to be of high interest for the heterogeneous public and they were used, in the project, to convey the messages in a more effective and transversal way, through new AR technologies and network generation systems.

An example above all can be represented by Bernini's fountain of the Four Rivers in Piazza Navona; an important cultural attractor whose few know the relationship with the "world" of astronomy, which allows, through a dedicated App, to create alternative cultural routes to those known and proposed to mass tourism.



Figure 2. the App ASTRO connected with cultural attractors. In particular the Four River fountain. Bernini was a friend of one of the astronomers at Collegio Romano, A. Kircher, director of a huge museum, the Kircherian Museum. Inside the museum there was a strange monster, an armadillo, who inspired the image of the dragon at the basis of the fountain

4.3 Project structure

The project was carried out in a systemically way, starting from common lines that connect the public, history, cultural areas and widespread astronomical heritage.

During the first phase of development, which was established in the Rome scenario, some project elements were hypothesized according to define the system logic and a flexible model summarized as in the following map (fig.3), consisting of:

- a variable relationship area based on the reference area, within which to build a connection network between the different nodes of the system;
- the museum / historical location of the city observatory (s);

- attractors designed ad hoc and located in strategic places in the area of interactions;
- an interactive itinerant exhibition module, connecting the observers, the attractors, the cultural sites, in which to show historical and scientific contents, current INAF international projects, and contents generated by visitors through proximity social tools.

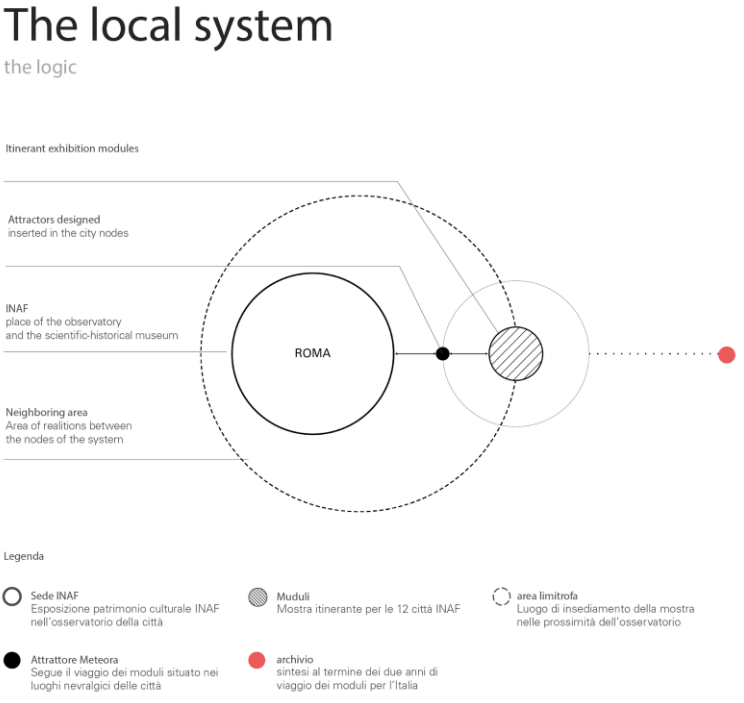


Figure 3. Local System

The research was focused on the development of networks, cultural links between "places of culture", astronomical places (in particular the Copernican and Astronomical Museum in Rome), art museums and public monuments. It also wanted to spread knowledge and create strong links with a heterogeneous public, the territory and the socio-economic actors.

The "Human centered" approach, and the analysis of the targets with the "Personas" tool made it possible to understand

- new tools,
- the routes the people plan and the services of the city with which they come into relation.
- the places where to intercept a differentiated audience, also if unaware of the cultural astronomical heritage available in the areas.

This systematic survey was useful to modulate the communication tools and where to set them, but also to select the most appropriate contents and engagement methods.

Starting from the structure and the elements of the system represented in the previous map, the research groups have defined, in addition to the common ones, different strategies to be applied.

4.4 System dynamics and its connections

The working groups involved in the project selected a certain number of activities and events to be provided to the public in cultural environments.

The architecture of the project involves several adaptive modules concerning architectural, design and technological aspects and different communication languages. It represents an organic system capable of adapting and modifying itself, through the direct involvement of citizens called to update the exposed themes and to reshape contents and interaction models.

In order to optimize the logistics and organization of the systems, as well as its sustainability, the nomadic strategy has been adopted.

The implementation of the adaptive system model in twelve cities has taken into account several activities in evolution according to the interests and feedback of the public involved. The selection or modification of the activities start from a dynamic and participatory experience.

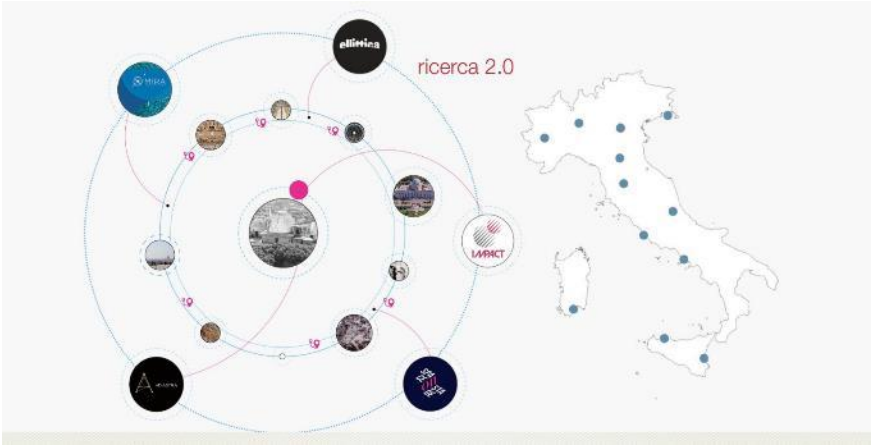


Figure 4. Distribution of second phase

The languages chosen to interact with the publics and to engage them in cultural heritages, are chosen from different cultural areas and selected for each event according to its effectiveness.

Each module is designed on the basis of the "culture of proximity": the public will be part of the project, interacting in different ways and becoming the content developer.

The method, used for the evolution and modulation of the adaptive model, is the direct feedback (figure 5.), a process whereby the result of an action of the system is reflected on the system itself to modify and correct its behavior. The citizen is no longer exclusively a user, but his contribution, through active participation, modifies and sets directions of the design changes.

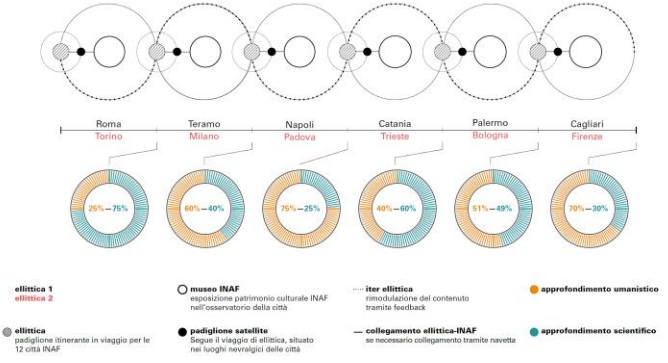
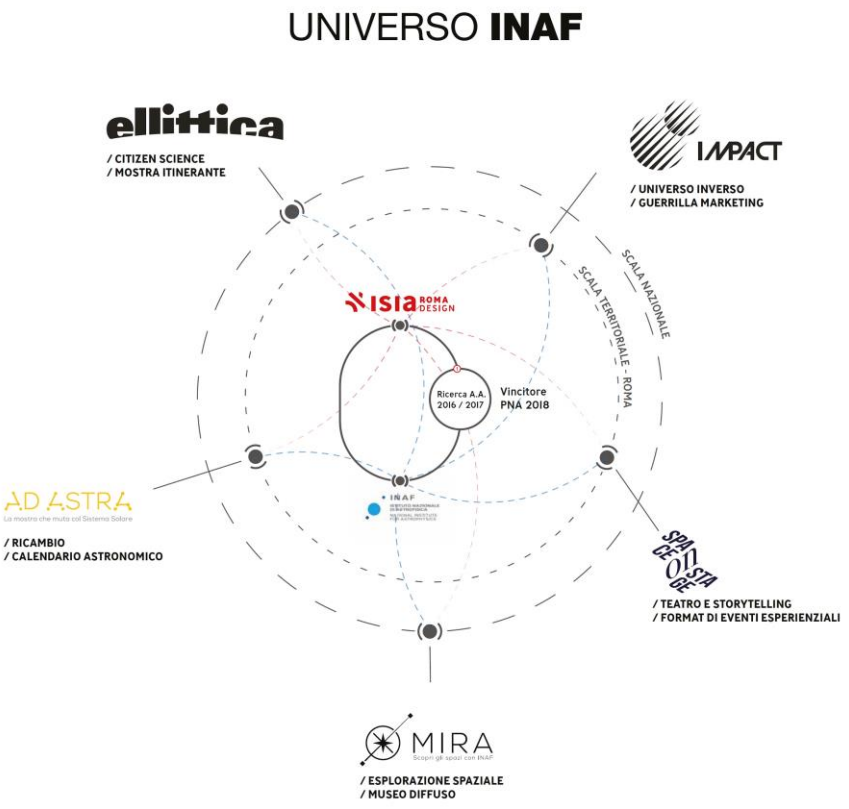


figure 5. Direct feedback from an interactive exhibit

5. Results



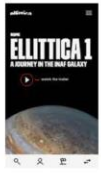
After two years of research the working groups come with several solutions to answer INAF needs. Each solution was designed following the general concepts and the guidelines of the research. Moreover, the projects/events proposed have been designed to be realistically managed and economically balanced with the possibilities of a research institutes.

Each part of the proposed activities was not in competition with the others, but they all can be part of a set of activities developed on the Italian territory.

5.1 The projects in details

ELLITTICA is designed as a nomadic exhibition that will move for two years through the 12 cities hosting the National Institute of Astrophysics departments, following two parallel branches. An organic exhibition, constantly evolving according to the peculiarities of the cities in which it settles. The decisions made at each stage are irreversible and make the two exhibitions unique.















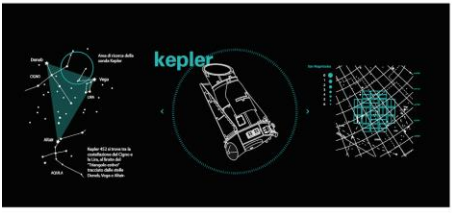


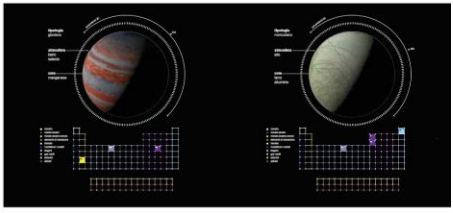




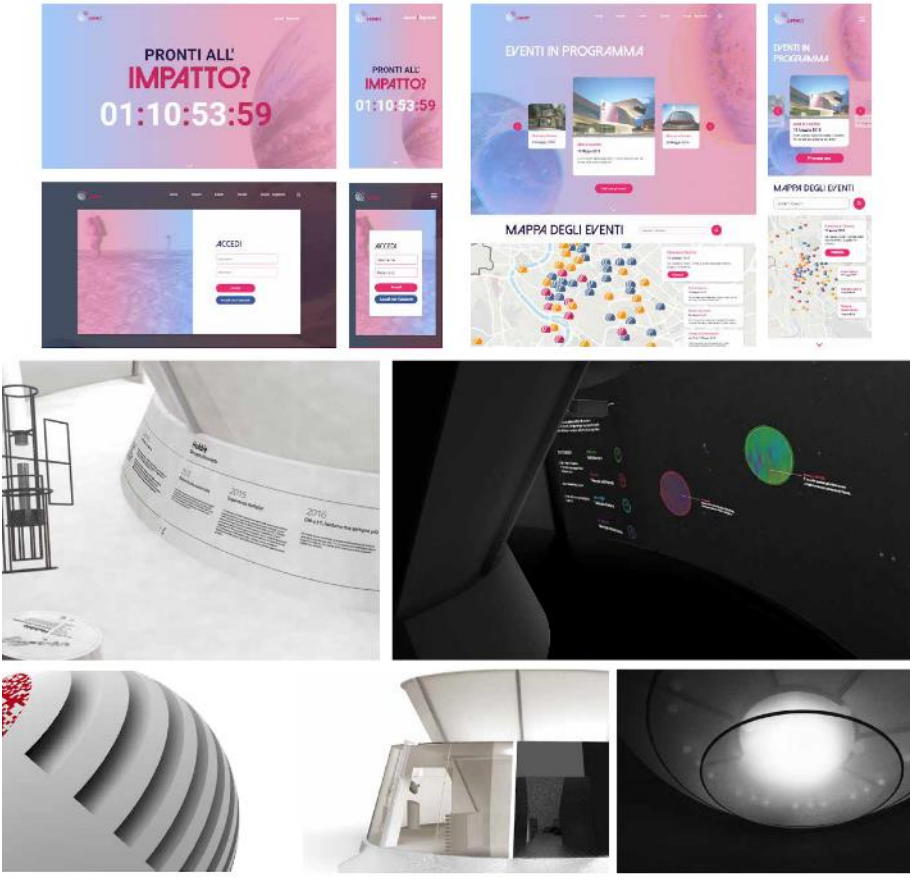




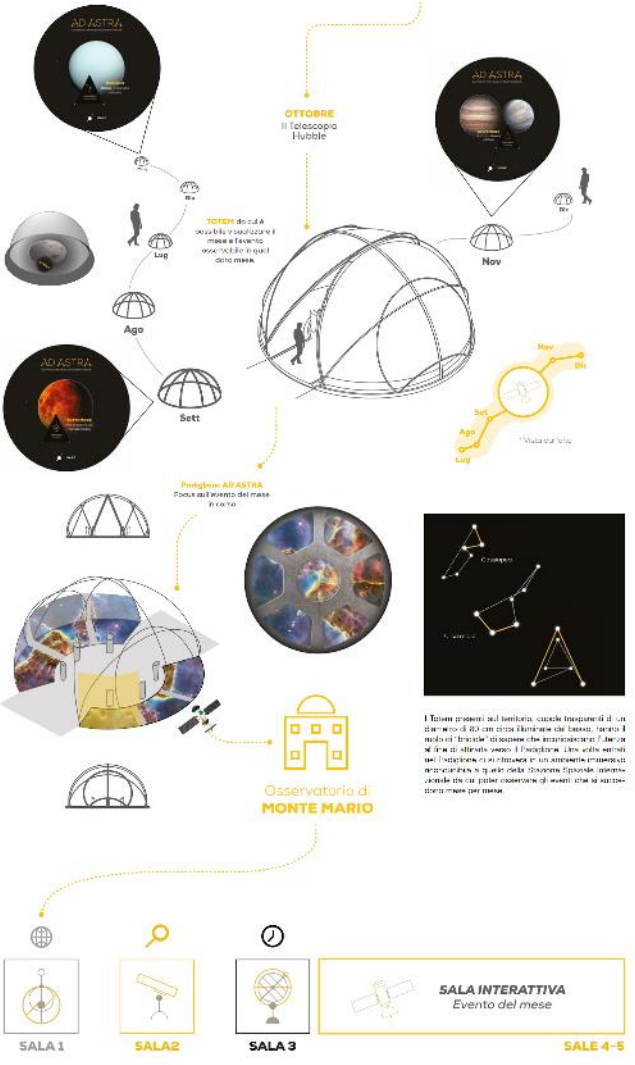




IMPACT wants to subvert the traditional visual imagery associated with space, proposing it all in the negative, where everything that is black becomes white, giving life to an opposite imaginary made of brightness and colors that stand out from the eye and attract attention.



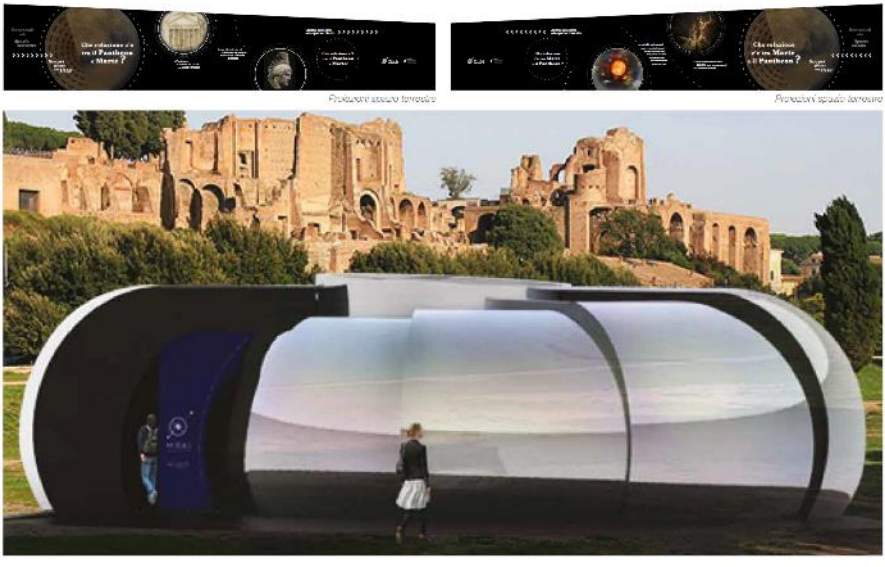
AD ASTRA A concept was developed in the Ad Astra monthly astronomical calendar, which associates the astronomical event (example "Swarm of Perseids ", August) of the month to the appropriate instrument with which to observe / experience it (" Swarm of Perseids ": Telescope). This systemic logic determines a cadence always different in terms of experience and consultation, both of the contents and of the astrophysical instruments, from outside to inside the museum.



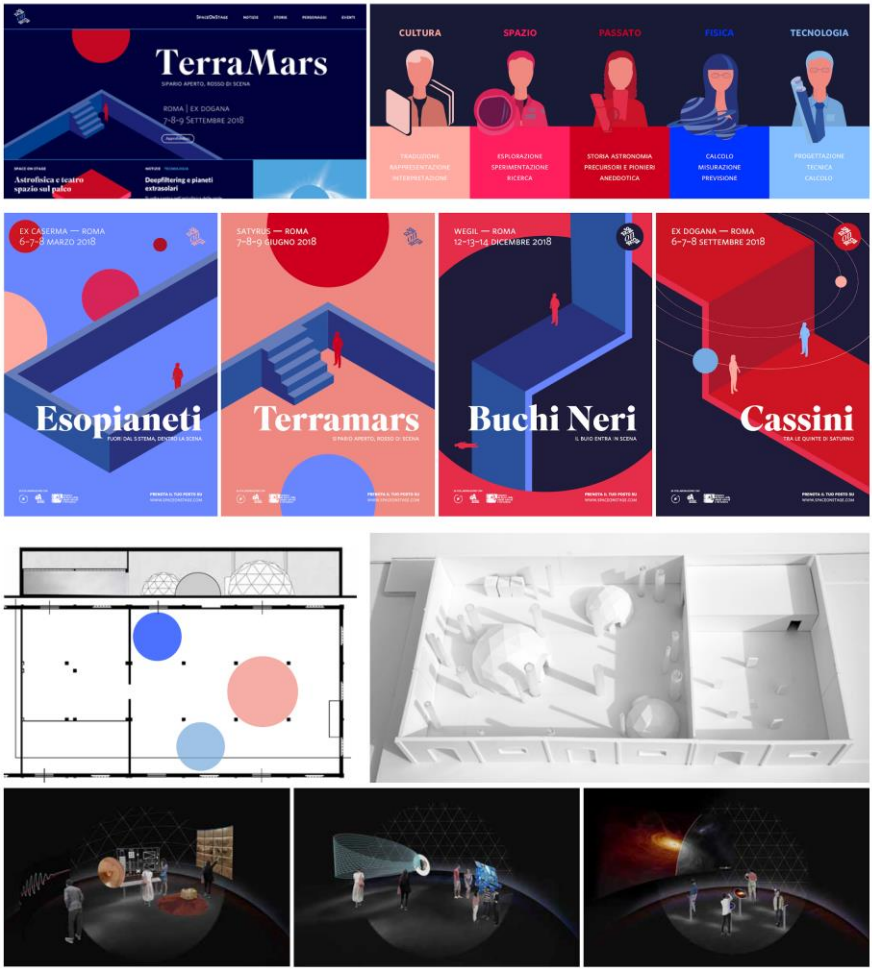
MIRA is a network capable of bringing together the Observatories, the Museums, the events and the sites where the history of modern astrophysics was made into a Diffuse Museum for the city. The user is involved and immersed in the discovery of the network through space exploration, walking through the city and at the same time discovering the phenomena of astrophysics.

Advertising urbano





Space On Stage is a format of events and a new method of use museum that divulges scientific topics in a simple tone of voice and engaging and stimulates curiosity e practical understanding of the profession e of tools through experience serial culture, founded on the link with the spectator and empathic involvement of it, dealing with storytelling techniques e with the involvement of actual actors.



6. Conclusions

In conclusion, the research achieved several successes.

First of all, they answer to the fluid definition of cultural heritage itself. The activities, public events, exhibits proposed allow the public to be visitors and producers at the same time. The audience can be part of several experiences and interact with the projects and the other visitors both in the real and digital world. The experiences will promote the knowledge of astronomical cultural heritage and the diffusion of INAF messages to the public.They allow people to be in touch with the research institutes and be part of the modern research activities with dedicated citizen science projects.

Some projects have already been proposed to public call for cultural heritage funding and they are waiting to be evaluated.

Furthermore, the results of the research have been awarded with the PNA 2018 and the ADI design award “Eccellenze del design del Lazio”, while they have been selected for the “ADI INDEX 2019” and on the go for the evaluation of “ADI Compasso d’oro 2020” award.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Towards a Design Observatory: crafting a distributed approach

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Abstract | As Design is gaining traction globally different observation models were developed to map the Design landscape. However, the application of these models in contexts with a slower maturation of Design culture and no institutional Design infrastructure can be difficult. With this challenge in mind, this paper presents a new distributed approach to support Design observation. It applies it to a case within the DesignOBS project - a project aiming to identify, map and interpret the Portuguese design landscape - and develops an online platform with the aim to create more efficient and engaging representations of Design practices and realities/contexts to multiple publics, including policymakers. The approach can benefit countries in a similar situation as Portugal, leveraging the participation of design actor-networks, encourage local initiatives, map the evolving Design landscape in collective manner, and hopefully constitute the supporting, resilient backbone to develop national Design policy.

KEYWORDS | DESIGN OBSERVATION, DESIGN ECOSYSTEM MODEL, REFLECTION-ACTION PROCESS, PARTICIPATORY PROCESSES, DESIGN SCHOOL NETWORKS

1. Introduction

Research studies undertaken by the UK Design Council (2018) as well as the Danish Design Center (2018) – two leading Design Centers in Europe –, demonstrate the potential socio-economic impact of Design, especially within the scope of innovation. Additionally, statistical evidence shows that Design plays a significantly important role in national innovation and productivity than previously recognized (NESTA, 2009). Design policies have been developed and are increasing in numbers worldwide as a result of the efforts undertaken to develop quantitative and qualitative measures for Design impact - ex. Design4Innovation (Whicher et al., 2018); Barcelona Design System (Calvera & Monguet, 2008); Design Scoreboard (Moultrie & Livesey, 2010; Moultrie et al., 2009). However, "we still need to be better at communicating who we are, and what we do" (Melander, 2019). Moreover, comparative analysis of different national Design contexts based on the application of existing ecosystem models may be ineffective since resources and conditions cannot be transferred (Raulik-Murphy, Cawood, Larsen, & Lewis, 2008).

When compared to other leading EU members, Design is rather misunderstood and thus underused in Portugal. According to the most recent Innobarometer results (European Commission, 2016), only 13% of Portuguese enterprises mention to use Design as a strategy in the business, whereas 49% of them mentioned that they do not use Design systematically (i.e. "uses Design as a central element in the company": Denmark 21%, Germany 18%, UK 17%). The lack of an effective systematic representation of Design impact has resulted in the loss of investment in the discipline within Portuguese society (Quintela, 2019). Moreover, the rapid evolving nature of Design and its diffusion in multiple areas of practice and knowledge, has also added to the confusion of what the discipline is about. With the disappearance of the Portuguese Design Center (CPD) in 2013, there are no National Design Institutions – with the exception of Design schools – that are representative of the myriad of actors within the national Design Ecosystem. As such, a more integrated and resilient observation approach of the discipline is required.

The Design schools scattered around the country seem to currently be the sole institutional infrastructure, with national presence, that still remains active and relatively independent of governmental changes and external funding (ex. European incentives). Considering the current scant resources and the status quo of Design in Portuguese society, the project DesignOBS (Towards a Design observatory in Portugal) is being established by four national institutional entities scattered around the country, to collect, analyze, interpret and represent the Portuguese Design ecosystem. It partially emerged from the results obtained through the first REDE#01 meeting (Acronym for Reunião de Escolas de Design or Design Schools Meeting) with 37 Design schools (Borges et al., 2018). Whereas REDE focuses on Design education and research, DesignOBS emerged to interpret and represent the national Design Ecosystem, including its multiple agents and evolving forms of Design practices and realities.

This study develops a new reflexive and distributed observation approach. First, it analyzes and compares European Design models currently used, and enriches the analysis with in-loco visits to key Design centers and interviews with their leaders. The lessons learned from the research are paramount to develop the reflexive approach for Design observation, enabling more participatory processes. It applies the new approach in a case with design doctorates and refines it according to the feedback from the design community. The distributed approach supports design actors – experts within their own context, namely the teaching/research staff of high education Design Schools around the country – to take initiatives and collectively shape the evolving representation of the Design landscape.

2. Literature review

2.1. Characterization of the Portuguese Design context

National Design institutions such as Design associations, forums and Design centers are either non-existent or lack a more valid representation of the agents involved in the Design ecosystem. The long-standing antecedents of design training started in 1934 with the Decorative School of Arts of António Arroio, teaching Applied Arts (CPD, 2000; Manaças, 2005; Almeida, 2009). The institutionalization of Design Education in the country began after the democratic revolution (post 1974), with the first design courses created in the Schools of Fine Arts of Lisbon and Porto. In 86, ICEP (Institute of Portuguese External Commerce) would launch the "young designer" contest that aimed to improve the relationship between Design education and the reality of industries (Castanheta, 2012). Additionally, in the 80's, the Portuguese Design Center was created and aimed to promote Design and designers at the national level and launched multiple programs such as "Designers for industry", supporting the infusion of young professionals in companies. However, the latest evaluation reports revealed that "there is still a profound ignorance in Portuguese companies regarding the discipline and its advantages" (Curado, 2013). Moreover, the lack of financial autonomy of the institution, several years of accumulated negative results – namely the poor connections established with SMEs – and a climate of austerity, sufficed to close the center (Curado, 2013; Quintela, 2019). In this context, when compared to leading European countries (ex. UK, Denmark), Design culture in Portugal still has room for improvement.

Additionally, there are still important weaknesses in the integration of Design in the Portuguese economy, particularly in the national industrial fabric, and the internal processes of maturing the strategic importance of the discipline are slow. The Innovation Strategy Portugal 2018-2030 proposed by the government emphasizes the infusion of innovation at multiple levels but does not mention "Design" once (Conselho de Ministros, 2018). Another governmental document also mentions the implementation of Design strategies for the "modernization and upgrade of industry, economy and the country" (PNR, 2019). However, no specific policies were developed. In recent interviews with Design practitioners, Quintela

(2019) mentions that “the adoption of public policy for the promotion of Design as an instrument for innovation in industry and exportation of national production, seem to be mainly driven by a set of external political and financial stimuli as opposed to internal processes of maturing the strategic importance of the discipline” (Quintela, 2019; translation from the authors).

2.2. International Design models

Countries worldwide have invested in the promotion of Design with the aim to promote the country internationally, raise awareness among local consumers about the value of Design and quality of products, and increase interests from local industry about the benefits Design can bring to business performance (Raulik-Murphy et al., 2008). These programs have evolved significantly in scope and complexity (ex. Design 2005! Saarela, 2000; Better by Design, New Zealand Design Taskforce, 2003 mentioned in Raulik-Murphy et al., 2008). Meanwhile, Design has entered the European policy agenda (European Commission, 2013) and is already part of national innovation policies across Europe (Whicher, Cawood, & Walters, 2012). This in turn, gave impetus to the creation of several EU projects to accelerate the integration of Design into government and business strategies ex. SEE platform (sharing European experience in Design innovation policy), IDeAll (integrating Design for all in living labs), €Design (measuring Design value), DeEP (Design in European policies), EHDM (European house of Design management) and REDI (regions supporting entrepreneurs and Designers to innovate) (Whicher, 2016); and more recently, initiatives such as Design For Europe (2017), have created principles and guidelines to support countries, cities and regions to take more advantage of design-led innovation.

In this context, a growing interest in the development of Design models and metrics has also emerged to better compare performances between countries, at the international level (ex. Design scoreboard, Moultrie et al, 2008; Moultrie and Livesey, 2009) and map real-world situations, to understand the interactions between the multiple actors involved in the Design system. For example, Calvera and Monguet (Calvera & Monguet, 2006, 2008) developed the Barcelona Design System model, which partially departed from the Milan Design System model (Bertola et al., 1999). Design system can be defined as a theoretical model used to “visualize in only one map the different agents and actors that, within a land well delimited both economically and geographically, act, interact and establish relationships between them related to the professional practice of Design and so, have an economic impact” (Calvera and Monguet, 2008). They outline it according to three main axes, namely (1) offer, (2) demand and (3) culture (Calvera and Monguet, 2006, pp.19). More recently, Whicher has developed the European Design system (Whicher, 2016, 2017; Whicher et al., 2012) complementing previous models that integrated system failure theory (ex. Love, 2007; Raulik-Murphy and Cadwood, 2009 in Whicher et al., 2012). System Failure theory highlights the role of government intervention to stimulate supply and demand via actions, policies or programs, and tackle failures in the way actors of the system interact (Love, 2007). Whicher identifies Design’s role in the context of innovation according to three axes with nine

components: (1) supply (research, education and Designers), (2) demand (users, support, promotion); and a third - different from the Barcelona's model – called (3) "supply-demand" (funding, policy and actors). The two first axes are similar between the models, however the third reveals a fundamental difference: whereas Milan and Barcelona's models emphasize the role of Design community to promote Design culture (i.e. practitioners and people working within Design culture promotion and production); Whicher's model highlights the role of the government, in particular, policymakers, as an overall influencer/corrector of the Design system. As such, we may observe a two-way approach with complementary views. Milan and Barcelona's models seem to adopt a more bottom-up approach to map and regulate Design systems. On the other hand, Whicher has a more top-down and institutional approach, integrating the role of other actors beyond Design systems (i.e. policymakers) to regulate systems demand and supply.

2.3. Research gap

Existing Design observation models are key to better observe and understand the importance of Design within innovation. However, these models present some limitations, especially in contexts characterized by a slower maturation of Design culture, and with no institutional infrastructure to promote the discipline.

Bertola et al. (1999) and Calvera and Monguet (2008) perspectives of Design observation are highly context dependent. They highlight local Design resources as key vectors for the construction of a Design identity and image. This perspective is effective within well delimited Design systems with a rich Design culture but may not work as well within more complex and different contexts. On the other hand, Whicher's Design model has already been applied in multiple European countries to better inform policy and thus provides means for international comparison of Design performance within the context of innovation. However, the application of Whicher's model may not be very successful in countries with limited availability of data for the indicators developed, such as the case of Portugal. Second, by adopting an inherent focus on policy making and policy makers, the indicators developed may not capture the entire spectrum of Design practices and realities, thus resulting in partial views of the Design ecosystem. Finally, the development of policies requires valid/reliable input to guide the creation of actions and programs. The inherent mechanisms to collect robust Design information are a challenge whenever there are no public institutions. This is one of the key tasks of the DesignObs project.

Bringing existing Design ecosystem models to observation practice in challenging contexts may require more embedded, networked "open" systems (Hobday, Boddington, & Grantham, 2012). Hence, we propose a new approach to support the Design observation process, while attempting to align our model with existing ones for the purpose of comparison. We build on the analysis of existing models, interviews with leaders of Design centers, and in-loco visits to international Design observatories to develop a distributed and

reflexive observation approach which could facilitate a richer representation of Design and – ideally – the creation of a more resilient national Design infrastructure.

3. Methodology

Based on the existing Design models and taking into consideration their limitations, the project DesignOBS was created to identify, analyze, characterize and represent the agents involved in the Design ecosystem in Portugal. The project emerged partially from a previous initiative called REDE, organized by 37 national Design schools and their representatives, in 2017 (Borges et al., 2018). During the meeting – mainly focused on Design education and research – numerous topics emerged which lacked important supportive national data about Design. To operationalize the DesignOBS project, an iterative process was put in place while taking into account the Portuguese context, characterized by a scattered and unarticulated Design community, a less mature Design culture and lack of national institutional infrastructures. We followed a three-step Design research process:

1. Development of a preliminary observation process based in particular on (i) the analysis and comparison of Design ecosystem models in use at the European level to better understand their advantages, limitations and complementarities; (ii) the interview and in-loco visits with leaders of key international Design centers i.e. Danish Design Center (DDC), Christina Melander, and Tokyo Design Center - to understand the data collection mechanisms put in place and main challenges faced by existing observatories; and (iii) the concept of reflection-action process proposed by Schön (1983).

2. Application of the approach on a preliminary (and manageable) case about design doctorates to create a “first portray” of the status quo of national scholarly Design research. The analysis of results led to the development of guidelines for keywords and calls for action which were presented and discussed within the REDE community (Costa et al., 2020).

3. Refinement of the iterative reflexive and distributed observation approach based on the results obtained in stage 1 and 2. The refinement of the approach reinforces the iterative reflection-action processes with and through the design community, leveraging additional interpretations of design-driven data.

Based on the literature review, we identified two main approaches in current models: whereas Whicher’s ultimate beneficiaries are intended to be policymakers to create actions and programs which could better benefit Design activity; Milan and Barcelona models seems less focused on guiding governmental action, but more on emphasizing Design as part of interweaving actions amongst business and culture, technology and craftsmanship, individual entrepreneurial initiative and teamwork undertaken by actors in (or in relationship with) Design systems (Calvera and Monguet, 2008; Bertola et al., 1999). These

two approaches take place in different levels of complexity and context (i.e. European arena versus a city), thus explaining their fundamental differences in their representation potential. The challenge thus lies in navigating both at the macro and micro levels of representation, while capturing the richness of Design in between those levels.

Additionally, the visits to Design centers (i.e. DDC and Tokyo Design center) and interviews with key leaders reveal important challenges that countries with a more mature Design culture still face. Key takeaways from the interview with Christina Melander included (1) the importance of lobbying about of Design to the government whenever there is no formal institution; (2) being able to capture the best cases of Design intervention within the public and private sectors, (3) a more compelling narrative construction about Design, so that it can reach publics beyond Designers; (4) coupling quantitative information taking into account the new ICT and social media services with those narratives whenever possible; (5) developing a national Design identity. Although quantitative studies about Design already show its inherent impact on the business bottom line (Danish Design Center, 2018; Sheppard, Kouyoumjian, Sarrazin, & Dore, 2018), it seems that "surveys are not very useful to make a connection between Design and economic values" and that "Design(ers) still struggles to articular how it(they) create value" (Melander, 2019).

Since the initial challenge of the project was to create a national Design ecosystem map, we looked at the multiple components of Whicher's model (2016) in the preliminary phase. Considering also the familiarity of the team members with Design education, the first topic studied was focused on "Design research", one of the key vectors of Whicher's model. To analyze "the number of Design doctorates and type of Design research undertaken in Portugal", data from three different governmental databases was collected, analyzed both quantitatively and qualitatively. Results showed very important disparities in the number of Design thesis concluded, and dubious quality of information (i.e. some thesis are classified within "Design course" but are not about Design). The lack of curation and reliability of information collected through the sole institutional means available, thus jeopardizes the reliability of a map built through those means. The results of this study – which are explained in detail elsewhere (Costa et al., 2020) - were presented in the second REDE meeting with 55 representatives of 23 design schools in late October 2019. The event was key to develop the first calls for action in the scholar community; build awareness and discuss the flawed mechanisms put in place to collect, interpret and communicate information about Design.

4. Crafting a reflexive and distributed approach for Design observation

Considering Design as a reflexive, embodied and continuous process of discovery and actualization involves some skeptical orientation towards what appears to be an unproblematic "first portray" (i.e. example of Design doctorates in Portugal). Schön (1983;

1992) in particular uses the term “reflective practice” to emphasize the relation and interactions between action and reflection: an actor sees, acts and then sees again to understand the consequences of their actions. Design hence, puts emphasis on this iterative actor-driven process of understanding a situation through an attempt to change it, and then changing the situation through an attempt to better understand it. Moreover, it also looks at actors and their role in the design process as key to produce and reflect upon Design materials and forms (i.e. representations). Adopting this view as a lens and looking at the DesignOBS as a material artifact resulting from this iterative reflective practice is key to build a more comprehensive understanding of Portuguese Design.

Based on the previous stages of the research process and Schön reflective-practice theory, we propose a new approach to represent and interpret Portuguese Design ecosystem. Moreover, we also detail how DesignOBS observation model and representation will according to this iterative process.

4.1. Reflection-Action process

We combine two complementary approaches identified in literature (top-down and bottom-up) to build an iterative and continuous process to support reflexivity and action (Schön, 1983) while evolving representations of the discipline at the national level (Figure 1):

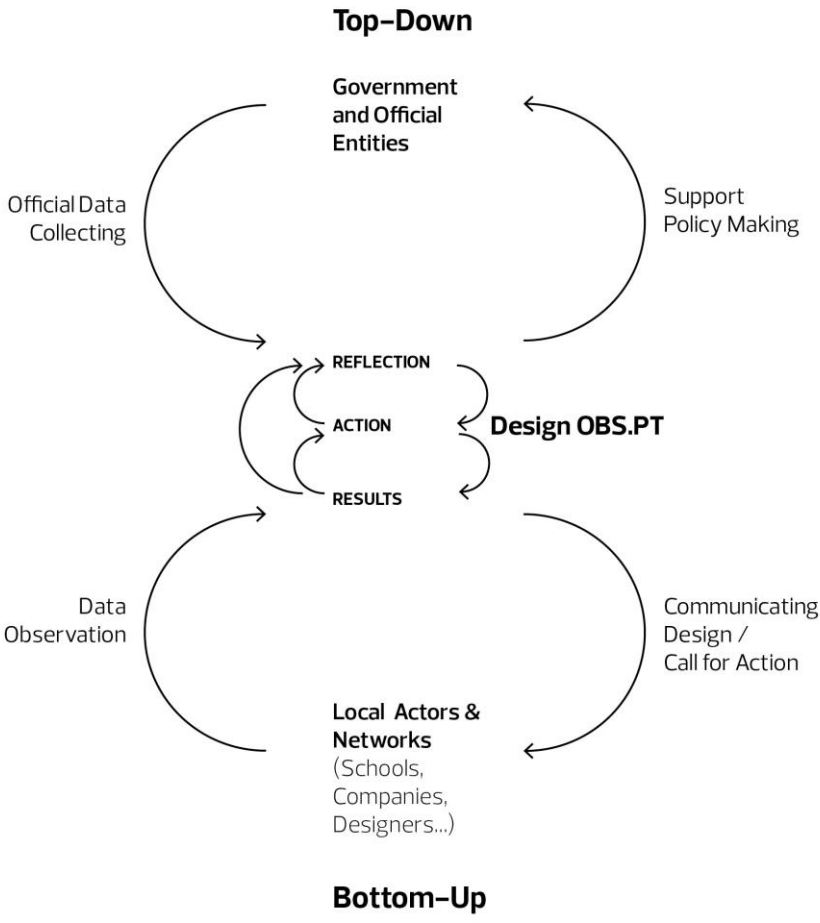

Figure 1. Observation process within DesignOBS, based on Schön (1983)

First, we verified that Design information is scattered, and institutional databases are not very reliable as they do not focus solely on Design; and are missing an important interpretative component. Some inferences ("first portray") can however (i) be built based on available data, (ii) be used to raise awareness inside the community and, in turn, (iii) leverage more coordinated initiatives/actions (Figure 1).

Second, we use distributed mechanisms and school-driven networks to collect information; and an open toolkit to support local observation. The current network of informants i.e. REDE, Design schools - are considered as experts in their own contexts and approaches, with connections with local businesses, organizations, labs amongst other actors in local Design systems. Moreover, they are currently the sole institutional and robust infrastructure at the national level. Identifying local networks is paramount for the project to expand, in a sustainable way, thus adding more intricate and detailed layers of representation. Having Design schools as champions of local Design systems provides traceable material, increases ownership of the data collected, and responsibility of the representation of the region, stimulates grassroot governance and self-organization.

4.2. DesignOBS as an evolving artefact of representation

DesignOBS (www.designobs.pt) can be interpreted as a cumulative, critical and evolving platform which aims to both (1) connect and facilitate dialogue amongst Design stakeholders, giving them visibility within the Design ecosystem; and (2) create more efficient and engaging representations of Design practices and realities/contexts, in three main topics: Design education and research, practice and culture. These topics as well as their content were created based on Whicher's Design ecosystem model. They are used as guidelines to support the research but can evolve according to the feedback of the network and need for further developments.

The DesignOBS platform aims to be the direct visible result of the application of the iterative reflection-action process (Figure 1). Considering the lessons learned from previous observatories, the models used at the European level, and the national context, we propose to collect data via an open toolkit for Design observation distributed amongst an established Design school-network (REDE). The data collected has two main levels of input as shown in Figure 2.

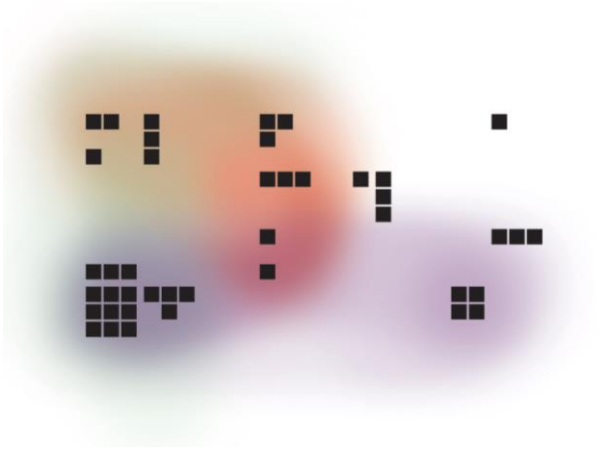

Figure 2. Objective (black) and interpretative (colour) layers of a Design Ecosystem Grid, Observatory's model.

BLACK INFORMATION, THE OBJECTIVE LAYER: The first level focuses on collecting, extracting or producing quantitative and objective information (black dots in Figure 2), which will enable a rapid creation of maps representing the diverse Design realities across the territory. It makes use of more desk research, surveys; closed questionnaires as well as direct and participatory input from the schools, to collect information. For instance, the study about Design doctorates undertaken in Portugal (Costa et al., 2020) fits within this level. First, the aggregation and analysis of results from governmental databases enabled the elaboration of a "first draft". Verifying disparities, the team searched for additional PhDs within other databases (universities which provide Design doctorate level studies) to complement and build up a more reliable map of Design doctorates. Another approach used was to ask directly to the school-network to "feed" the platform with the information available within their own institutions. Thus, they become active creators of the content on the platform. This process is being used to approach other research topics such as "characterization of Design companies in Portugal". Databases such as SABI or AMADEUS can provide some information to facilitate the creation of preliminary representations, develop interpretations, calls for actions in the community/network; and advance other topics which require more in-depth, local and interpretative observation (Figure 1). Moreover, the objective data (i.e. archives, databases) is open to the community to build on, and make additional interpretations, producing new Design discourses (colored discourses in Figure 2).

COLOURED INFORMATION, THE INTERPRETATIVE LAYER: The second level of data collection builds on the first layer of information to inspire more interpretative, qualitative, and subjective discourses about Portuguese Design Ecosystem. It is also more complex, context-dependent and prone to emergence as it embraces the inherent characteristics and identity of the regions which constitute the territory. Thus, it makes also a more systematic use of

the school-network and participatory processes to evolve the observational toolkit and collectively shape Design ecosystems. For example, the "characterization of the Portuguese Design companies" can have both a quantitative denotation (ex. how many companies exist; percentage of exports, etc.); qualitative connotation (ex. how do these companies perceive Design and designers) as well as interpretative connotations (ex. design identity of a region). This level thus, is more subjective, embedded and more prone to emergence.

This data collection process and the organization of the different elements to be observed, already constitute a landscape per se (black layer of information), like the periodic table of elements, arranged according to their properties. Instead of metals or non-metals, gases or halogens, we aim to have schools, promoters, designers, museums, companies, government agencies, amongst other elements. This structure is aligned with existing design models for the purpose of comparison, but will evolve through time, and according to the emergence of other themes and topics, adding other emergent discourses about Portuguese Design (colored layer of information).

5. Conclusions and future steps

As Design is gaining traction globally different observation models are being developed to map the Design landscape and better inform policies. However, the application of these models in contexts with a slower maturation of Design culture and no institutional Design infrastructure can be difficult. With this challenge in mind, this paper presents a new distributed approach to support Design observation. It applies it to a case within the DesignOBS project and develops an online platform with the aim to connect Portuguese Design stakeholders and create more efficient and engaging representations of Design practices and realities/contexts to multiple publics, including policymakers. The approach can benefit countries in a similar situation as Portugal, leveraging the participation of actors-networks, encourage local initiatives, map the evolving Design landscape in collective manner, and hopefully constitute the supporting backbone for developing Design policies in Portugal.

This research also presents some limitations which in turn indicate directions for future research. First, the application of the approach is restricted to the case of Design doctorates within the first level of data collection (quantitative analysis). The application thus needs to expand to other levels and topics of research to reach publics beyond Design(ers).

Second, due to space limitations, the development of the observation toolkit mentioned in Figure 1 is a topic that goes beyond this paper. The focus of this study is to define and explain the objective(s) of DesignOBS and develop its observational approach. Future research should, however, make a thorough analysis on the multiple tools and methods to be used to collect the data, while taking into consideration the objectives of the project.

Third, the expansion of the project to other socio-economic and cultural actors and institutions within Design ecosystems is paramount to gain structure and resilience. Given the short time frame and limited funding of DesignOBS project, the involvement of companies and other institutional entities, beyond Design schools is required. Thus, future steps include infrastructuring activities, to build up a network of networks scattered around the territory, enabling further connections amongst actors. Future studies should however, take into account the failures of past initiatives, centers and Design associations.

This study constitutes an important step to advance Portuguese Design observation. It develops a new approach which integrates the top-down and bottom-up perspectives based on previous Design ecosystem models. It also puts forward a more embedded and participatory approach for Design observation and interpretation. Moreover, it may also contribute to Design practice, by proposing new mechanisms of observation for countries with a less mature Design culture and more fragile Design infrastructure.

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Acknowledgements This article is a result of the project Design Obs. Para um Observatório de Design em Portugal: Modelos, Instrumentos, Representação e Estratégias, (Towards a design Observatory in Portugal: models, instruments representation and strategies) supported by Lisbon Regional Operational Programme (LISBOA 2020) and the Competitiveness and Internationalisation Operational Programme (POCI-01-0145-FEDER-032445), under the PORTUGAL 2020 Partnership Agreement, through the European Regional Development Fund (ERDF) and FCT – Fundação para a Ciência e a Tecnologia (Foundation for Science and Technology).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

When a designer encounters an artisan: a parameter analysis investigation

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Abstract This research looks at the issues related to the design and its local dimension. It investigates potential parameters as tools of social, cultural, economic, and environmental impact through the analysis of Brazilian and Portuguese partnerships. We delimited (described and analyzed) different relations to understand these experiences. A theoretical framework was produced. It comprised the description and evaluation of twenty-five case studies. This stage goes beyond its theoretical limits. It verifies in practice the proposed evaluative parameters. We conducted interviews from a semi-structured questionnaire that reached the artificer, the designer and the entities that foster these partnerships. The indicators used proved to be efficient in assessing the social, cultural, economic, and territorial dimensions. The final considerations state that impact is a two-way street. Openness is important to exchange among the various types of knowledge. Complementarity practices (scientific and non-scientific) foster dialogue to signify the world. To make it better.

KEYWORDS | DESIGN, CRAFT, PARTNERSHIP, IMPACT, PARAMETERS ANALYSIS

1. Introduction

This research looked at issues related to the local design. It aimed to investigate design as a tool of social, economic, and environmental development. It produced a synthesis description of Brazilian and Portuguese partnerships. It delimited (described and analyzed) the relations existing in this process. It also identified the elements of "disengagement" and the impact of these meetings. The study defended the role of design as a promoter of life quality not only its economic aspects. We perceived it as a factor of exchange, a driver of collaborative practices. The major interest was in the interface with local makers and the products demarcated by regional characteristics. It is an expression of a collective, or a single artisan (Sennett, 2009 and Micelli, 2011). These productions carry within themselves the particularities of a specific culture.

The first questions that guided the investigation were:

1. What is the meeting point between the design and its local dimension?
2. How does product development occur from a partnership between designer and artificer?
3. What is the impact of designing with and not for?
4. How to analyse how much this hybridization benefits both parties?

We needed the deconstruction of power and authority. We need to understand that both (the designer and the artisan) have sensitivity and conscience in their doing. That was when there was a possibility of joint action. We analysed projects involving:

- the community and their local production unit. The artisan and their social, technical, cultural, and economic context;
- the designer as a facilitator. In partnership, he unveiled the existing reality. Individuality, he presented his universe;
- the entities or institutions that fostered these partnerships and orchestrated the objectives and goals.

The co-creation methodologies recognize all subjects involved in the making. They identify the history, quality, and lifestyle of each actor. They accept the materials and techniques used and the production space. They consider the local material and immaterial heritage. Finally, they value each one involved and recognized the value of civic engagement. By that, they allowed trust and self-esteem generation.

2. Design & dimensions of local making: approximations; designers versus artisans: differences

During the research, several texts helped to understand design as an improvement tool. The focus was on the process of the idea, conception, development, and production. Especially the one carried out collaboratively with local production units or with artisans. It is worth mentioning the definition by Miguel Arruda (2013) when he said, "design lives from the meeting between the designer, the producer, the materials' manufacturer, the worker, among others".

This states the importance of teamwork. It also recognizes and respects the diversity described by Ezio Manzini (2008). These competencies are also in line with Boaventura de Sousa Santos' speech. He defends the need to discover other types of intelligence / knowledge and to respect multiculturality. Another important concept was otherness. Gui Bonsiepe presented it as a "willingness to respect other design cultures with their inherent values" (2012, p.38). It is a concept that breaks with the developed and underdeveloped dichotomy.

The projects studied had collaboration and the idea of working in common as a basis. Richard Sennett in *Juntos* dedicates a compliment to cooperation. He defines it as "a skill, that is, an ability to understand and to be receptive to the other, in a way to reach a joint end" (2012, p.9). The term symbiosis also emerged. It is a beneficial and reciprocal association of two or more different organisms. It is a system of cooperation. In some of these social relationships, there is a tendency towards a vertical path. One in which an actor establishes with his partners a hierarchy, a power of the giver over the recipient. In other cases, relationships are more horizontal and hierarchies less defined. There is dependence, but it takes on a mutual character. The result is a collective responsibility.

In these last ones, it is important to drop issues such as domination and submission, superiority and inferiority, heteronomy, colonialism. It is important to confirm the concepts of collaboration, autonomy, respect, trust, emancipation, motivation, and empowerment. The purpose of this study was to perceive, understand, and measure the impact of the other in a bilateral and interpersonal relationship (designer + artisan).

The partnership involved underwent adaptation, metamorphosis, and integration processes. It is worth noting that the other is an obstacle. It forces one to look, to understand, and to admit the differences and the similarities. By becoming aware of each ones' limit, they perceived the power that exists in the encounter. The relationships may be punctual or longer. They may be harmonious; they may become confrontations. What stands, as a result, is always another process of thinking and/or doing. Perhaps even another process of being.

It was thus believed that other parameters were necessary. They were fundamental to study the social, cultural, economic, and environmental change. To analyze the whole new structure created from design-craft development.

Therefore, another fundamental concept was the idea of local development. It explores and discoveries local potentialities. For Ávila (2000, p.69), true development could only be achieved through the education of the community itself. The artisans have to take the process reins. In this scenario, where is the designer? The artisan community is no longer passive but has an effective, active, and proactive stance. How does the designer suit in this new context? We believed that he has the role of activating the flowering. He enhances the process of retrieving the elements, stories, and traditions that result in local differentiation. But it is also important to the local community to achieve a progressive reduction of external dependence. Autonomy is required as proposed by Gabriel Patrocínio and also by Ray Lambert and Ruth Flood for the Design Council.

2.1 The place of handicraft in Brazil

The study of handicrafts in Brazil started in 1950. Lina Bo Bardi and Aloísio Magalhães reflected about the Brazilian production. Both realized that they acted in society more as articulators than as creators. They also agreed that the development would come from the meeting of culture with the technologies generated in and for the national reality (Anastassakis, 2014). The design-craft binomial was likely born with them. It is from their texts that the understanding of design's role in Brazil begins.

At the same time, the federal government has instituted national craft development programs. Noteworthy is the emergence of SEBRAE - Brazilian Micro and Small Business Support Service. Today it is a private, non-profit institution. It aims to promote competitiveness and small business development. From the '90s, SEBRAE has been carrying out local projects to foster crafts from design.

2.2 The place of handicraft in Portugal

In Portugal, there is the Statute of Craftsman and Craft Production Unit. It is a document from 2001 that gives visibility, social enhancement, and a professional dignification to craft. This and the creation of the Artisan Charter and the Artisanal Productive Unit Charter were important processes. It is a process for Portuguese know-how recognition. We also highlight CEARTE, a Center for Vocational Training for Crafts and Heritage. It develops activities of vocational training, recognition and skills validation. It fosters entrepreneurship and innovation. Their targets are individuals, micro-enterprises, and other economic actors in the cultural, creative, and heritage sectors, in particular in the field of handicrafts.

2.3 More questions

New questions then arise: How to determine the value of a partnership? How is it possible to measure the quality of life? social and cultural equity? economic growth? the environmental valorization? Evaluation is a possible response. It is a mechanism of understanding and delimitation of the project/program or service scope. It questions the transformative

potential of a given action and its impact. There are two priority questions to check the policies:

1. What do you want to measure? 2. Why do you want to measure something?

The indicator will be the element capable of informing about the reality. It is the tool or instrument with which it will be possible to perceive the change.

3. The path traveled

To understand the dimensions of the Brazilian and Portuguese co-creations, we did a compilation of projects from the SEBRAE TOP100. We also used the research by Cláudia Albino (2017). The selection of the projects that were further investigated followed the criteria:

1. They had to be a source of evidence for co-creation. There was a respectful and horizontal combination of technical-scientific design knowledge and the skills of craft knowledge. (Santos, 2002)

2. They were emancipating partnerships (Freire, 1988 and Rancière, 2002). We prioritize the search for local identities (Cunca, 2019), otherness (Bonsiepe, 2012), openness to meet and exchange (Eco, 1991), respect for cultural pluralism (Appadurai, 1996). We also considered the beliefs, *Operandi modes*, and histories of the structured relationships (Bourdieu, 1989).

After discussing the Brazilian and Portuguese production, we made a list of the project's objectives. We reclassified these data into four dimensions - social, cultural, economic, and environmental. The result was an overview proposed as goals to design-craft partnerships. We also did a list of forty-six indicators that, summing up, aimed at:

_the quality of life and culture of the stakeholders;

_increasing added value to the product or service provided; and

_the potentiation of a more intense experience of the territory.

The result was the pre-elaboration of the form adopted in the interviews (Table 1). Through it, we tried to give voice to the research subjects. We understood their ways of seeing the world and reflecting on the impact and their practice. We exposed each side; spoke out the characteristics that focus on locality. It was an exercise of mediation the exchange and the interstices between professionals.

Finally, the sample investigated consisted of 20 Brazilian and 5 Portuguese projects. It is worth mentioning that both Brazil and Portugal are countries with complex geographies. Both have diverse cultural landscapes. The north is not the same as the south; the coast also differs from the interior. We gave sight to the material and immaterial heritage, to the intangible knowledge that rose when plurality encounters.

Table 1. The form used during the investigation

1. What was the reason to do a partnership with the designer (or the artisan)?
2. Was there an impact in your way of creating objects? ☐ yes ☐ no.
If there was, please answer the following questions.

		0 – no	1 – a little	2 – moderate	3 – quite enough	4 – don't know how to answer
3.	Was it a collaborative process?					
4.	Was there an improvement in the process?					
5.	Was there an improvement in the product?					
6.	Was there a development of a new collection?					
7.	Was there an improvement in the material used?					
8.	Was a local material valued?					
9.	Was there less waste?					
10.	Was there an improvement in a technic?					
11.	Was there an improvement in production?					
12.	Was there an improvement in the production place?					
13.	Was there an improvement in the product's price or delivery terms?					
14.	Was there a formation on fair trade?					
15.	Was there a transformation of your business skills?					
16.	Was there a business improvement in its disclosure?					
17.	Did you go to an event to present the partnership?					
18.	Was there a cultural exchange?					
19.	Was there recognition of your know-how?					
20.	Was there recognition of the local identity?					
21.	Did the "new collection" reflect the territory?					
22.	Did it contribute to the improvement of economic benefits?					
23.	Was there an improvement in living conditions?					

24. From this experience, you have become more: (you can choose more than one characteristic)

☐ accepted
☐ aware of your know-how
☐ accomplished
☐ curious
☐ motivated
☐ active
☐ critical
☐ innovative
☐ empathetic
☐ flexible
☐ strict
☐ focused on delivering quality services
☐ able to evaluate your production
☐ able to work in groups
☐ confident
☐ responsible
☐ autonomous
☐ open
☐ tolerant
☐ creative
☐ sensitive to environmental issues
☐ ethical
☐ satisfied with the partnership
☐ happy

25. Is there another contribution that the partnership has made to your profession?

4. Case studies and their particularities

In the cases studied, we noticed a social and human transformation. There was an improvement in the distribution of income and well-being. Also, we verified a reduction in migration from the locality to others, especially to the large urban centers. Twenty-five projects reaffirmed the identity of those who produce. They valued each participant, improved product quality, and promoted cultural redemption and local development. In the meetings, we perceived the construction of particular modes of engagement. There was the articulation of the "modern/scientific/western knowledge structures with the native/local/traditional knowledge formations" as explained by Santos (2006, p.540). The way of grouping the projects came from the figure of the "agent of fostering". By fostering we meant stimulation. This agent was the actor who incited, articulated, and sought to realize the partnership. Thus, we defined four narratives: "Beginning with the local makers", "Beginning with design", "Starting from an entity", and "With an academic foundation".

4.1 Beginning with the local makers

We selected the projects from Espedito Seleiro (figure 1), Doutor Borracha, Bordana Cooperative, and Capuchinhas de Montemuro. We have selected them because of their narrative, their attitude of high inventiveness. We saw the peculiarities and reflections in their production, and all of them were open to personal, technical, and economic development. That is because they are in a continuous process to have more quality and more authenticity. A process that reaffirms their way of life, which reverberates their culture.

We could see it through their symbolic and identity dimensions. When these artisans approximated with design, their material and immaterial culture conceptualized. The exchanges reflect the experiences and the sharing of visions of know-how. The artisans looked for instruments to define other strategies of singularization.

Nonetheless, they also searched for product innovations and to insert their products in the market. They seek autonomy as well to assume the means of production and distribution. This is not a search for technical improvement, although in some cases this has also happened. But to reinforce aesthetic, artistic, subjective, emotive and symbolic conduct.







Figure 1. The artisan Espedito Seleiro and the chairs from Cangaço Collection made in collaboration with Campana's Brother. Available at: http://blogs.diariodonordeste.com.br/cariri/cultura/mestre-espedito-seleiro-tera-exposicao-e-mostra-do-atelie-a-passarela-neste-dia-17-em-juazeiro-do-norte/6972#images https://casaclaudia.abril.com.br/ambientes/conheca-as-pecas-assinadas-pelos-campana-em-parceria-com-espedito-seleiro/

4.2 Beginning with design

The second narrative presented is that in which actions started with the designer. We studied the approach from designer Maria Fernanda Paes de Barrosem (figure 2) in three different cases. We also presented the work from the designer Marta Martins from Ecoarts in partnership with Vista Alegre. Jackson Araujo and Luca Predabon and the designers Alexandre Herchcovitch, Itiana Pasetti, and Marcelo Rosenbaum brought the concept of affective economy. Susana António is ahead of the Portuguese initiative "The grandmother came to work".

We understood that the proximity to craft puts the designer in the market from the territorial identity aspects. The locality is the support space of the experience. The production becomes more indigenous, relational and contextual, and with great historical reference. This is because symbolic values change the way of dealing with local resources and time. The designer starts to domain the production cycle and also the inseparability of the creative activity to the production process.





Figure 2. The artisan Zana and Ipezinho lamp made in collaboration with designer Maria Fernanda. Available at: https://www.yankatu.com.br/post/2018-11-13-encontros-zana-maria https://www.yankatu.com.br/alma-raiz/

4.3 Starting from an entity

There are several initiatives, institutions, and entities that seek to foster the encounter of a designer with local makers. They enable the dialogue between scientific knowledge and the tacit one. We studied projects initiated by SEBRAE in the Brazilian states of Piauí (figure 3), Amazonas, Tocantins, Rio Grande do Sul and Minas Gerais. The partnerships from private entities were also accomplished as the ones from Loulé City Council, Instituto Supereco, Instituto Elos, Instituto Campana, and Aga Khan Foundation. They understood the projects as vectors for territorial development processes. Ones that have cultural specificities as a basis.

Some of the projects work to safeguard traditional knowledge. They prevent the disappearance of traditional techniques. They also developed proposals for market insertion. This partnership also gave greater visibility and prestige to the artifacts produced. They even increased the community's sense of belonging with the awareness of their value and know-how.



Figure 3. The process of drying Carnaúba's leaves and a basket from the collection made with designer Marcelo Rosenbaum. Available at: http://rosenbaum.com.br/projetos/agtvarzeaqueimada/

4.4 With an academic foundation

There is a demand for interaction between teaching, research, and work with communities in some universities. We studied projects developed by the Federal University of Pernambuco, Federal University of Maranhão, University Center of Eastern Minas Gerais,

and Polytechnic Institute of Castelo Branco. The CEARTE (figure 4) with various educational institutions were also involved. Their action reinforced the academic contribution to a Portuguese region.



Figure 4. Schist Villages photographs and 'Sowing the Earth on the banks of the Zêzere River' by designer Vânia Kosta. Available from: Fonte: http://www.agriculturalusitana.com/pt/ http://dedalnodedo.blogspot.com/2015/05/agricultura-lusitana-i-semeando-terra.html

We noticed that the teachers' participation as advisors allowed the deepening of the issues discussed in the classroom. It is an inseparable theoretical and practical point of view. In the cases studied there was the empowerment of the students as actors of change in the real world. They found solutions to problems of local interest. As in previous narratives, there

was also the deconstruction of power. The teacher, the student, the artisan, and the technician were all collaborative subjects. They worked in partnership to create or improve a product. Each recognized their know-how. But they were open enough to influence and be contaminated by the other.

5. In search of the common

By analyzing these 25 partnerships as a set, common features became clear:

_All refer, by choice, to initiatives involving an artisan or a local production unit and a professional or team coordinated by a designer.

_There was an interest in safeguarding the know-how of those involved. There was also interest in renewing the way of being and thinking of each actor. Respect for cultural diversity was perceived. There were induction of capital gains and the strengthening of local identity.

We understood that doing is an integral and inseparable part of daily life. The use of co-creation methodologies is important because it recognizes each subject, each story, and each knowledge.

_Therefore, all case studies have a collaborative collective component. There were explicit principles of solidarity and democracy.

_There was the empowerment of a formal and/or informal network of production, marketing, dissemination, and distribution. There was also the increasing visibility of the developed project.

_The actions promoted emancipation and developed their management skills. They used a support system, which promoted and awakened business “vocations”. There was training, information, and financial support for improvement.

Finally, we realized that there is no separation between the production process and its territory. It is geographical, social, and cultural cartography. Yet, we also realized that each locality is unique, with its landscape and traditions. Each production unit is specific and presents its challenges, resources, and potentials. Each collaborative network organizes in its way. In short, we valued each meeting as unique even though all involved human and local development.

To measure the resulting impact, we focused on the actors involved. As we said, we did a questionnaire (Table 1). The verbalization of the individuals was an instrument to analyze each existing contribution. All the questions allowed us to infer meaning based on the experience of the subjects. We organized it into themes and categories. We reduced the impact to its essence. That is, we classified it into social, cultural, economic, and environmental impact.

As seen in the final percentages (figure 5), the results of the partnerships were positive, even in the least valuable items. There was also a greater awareness of know-how, motivation, sensitivity to environmental issues, sense of accomplishment, and happiness. These dimensions are under the components of well-being. Being part of a collaborative process is already an indication of an interest in personal improvement and openness to new experiences.

93,5% for local material improvement, cultural exchange, and know-how aware

83,9% for improvement in the process and the business enclosure, a new collection was made; identity was a value, participation in an event to present the partnership

80,6% for quality product improvement, and collaborative process

74,2% for the production as a territory refection

Figure 5. Some of the final percentages.

There was no major difference between the Brazilian and Portuguese cases. In both cultures, it was possible to measure the result of the partnerships. And the development of the entire group involved.

6. Final considerations

In spite of the complexity of the proposed, the research pointed out important parameters. They were capable of constituting a new basis of analysis for future design-craft partnerships. The relevance was in the use of multiple views. The social approach to design was evident. It acted as a catalyst for plural interrelationships. The designer, at no point in the investigation, was only as an artifact producer. On the contrary, the design presented itself as an aggregating discipline. It was a network builder, qualified to collaboratively create. It reduced inequalities and assumed the role to build bridges between different kinds of knowledge.

Local production connected subjects to their historical-cultural particularities. Their encounter with design altered identities while safeguarded existing cultural heritage. It was also noticed in the cases studied the promotion of local economies and the sense of belonging.

Finally, it was important to understand that we are all artisans as already presented by Francisco Providência and Richard Sennett. That is because the designer can transform, make another evolve, but he also changes. The impact is a two-way street. It is important to be open to exchange among the various areas of knowledge. The complementarity of

scientific and non-scientific practices fosters the dialogue. It signifies the world to do it better. To be better, continuously.

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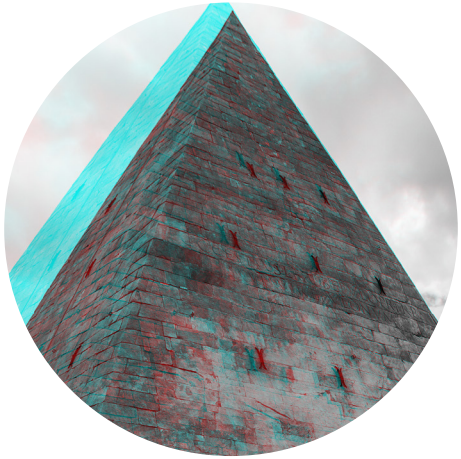
Acknowledgements: My thankfulness to the Centro de Investigação e de Estudos em Belas-Artes, Faculdade de Belas-Artes, Universidade de Lisboa.

DESIGN CULTURE(OF)

RESILIENCE

SOCIAL INNOVATION
CIRCULAR ECONOMY
SUSTAINABILITY



TRACK CHAIRS

DESIGN CULTURE (OF) RESILIENCE
SOCIAL INNOVATION | CIRCULAR ECONOMY | SUSTAINABILITY



Davide Fassi,
Polytechnic University of Milan, Italy
“The culture of resilience passes through a system of knowledge, opinions, customs and behaviours that characterise knowing how to react to the unexpected to create new balances. When applied to social innovation, the solutions that support it are to be found in people, not so much in individuals, but in how they group in forms of cohesion, in communities.”



Miaosen Gong,
Jiangnan University, China
“Facing pressing climate emergency and dramatic change of global situation. we need new resilient culture and system which calls multi-aspect and comprehensive innovations including social innovation.”



Nicola Morelli,
Aalborg University, Denmark
“Building a resilient society means giving citizens a chance to participate to a democratic process of co-designing future solutions, but also to share access to- and responsibility over- shared natural and artificial (data, common knowledge) resources.”



Maria Antonietta Sbordone,
University of Campania “Luigi Vanvitelli”, Italy
“Social linking ties are crucial to act appropriately to seize opportunities, to resist the risks, to protect one's interests and to solve problems. A well-connected community is the essential character for a development capacity-based approach (Sen, 2003) as a response to sustainable and resilient oriented development”

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

0_Textile. A Design Research applying Circular Economy in the textile field.

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Abstract | "0_Textile" is a fabric conceived as a platform that integrates variable functions and performances. Designed to be inserted in a circular system that enhances function rather than production, it is characterized by a type of flexible use that fits into a dimension of resilience, which combines continuous service and remanufacturing with the principles of healthcare and comfort.
The first application that has been studied in terms of product characterization, and presented here, is dedicated to tourist 2.0 who is about to explore the "Near Space" in the near future. In this variation, "0_Textile" consists of a light textile structure which incorporates conductive gel and gradually released glycerol as well as a series of sensors that monitor vital parameters and make up for specific critical issues deriving from the space environment and the effects of the microgravity on the body.

KEYWORDS |RESILIENCE, NEAR SPACE, NEAR FUTURE, REMANUFACTURING, HEALTHECARE

1. Introduction

Starting from the study of a type of circular economy, which goes beyond the concept of waste disposal to make room for a reconditioning and reuse of the materials used, the research project "0_Textile" is configured as a surface that integrates different functions and devices, capable of changing configuration and adapt to a type of flexible use that fits into a dimension of resilience.

The concept of resilience has been explored in various aspects, in fact, it has been taken into analysis not only in its sense of adaptation of a specific system to change but also by understanding this concept from a psychological point of view. A personal level of resilience was explored, that is, the ability to cope positively with "traumatic" events, considering all those substantial changes in the way of life that can be expected in the future traumatic.

An example of these modifications is the new possibility to move concretely in the nearby space or the need to change lifestyle to be able to adapt it to the rules dictated by the looming need to reverse the trend of industrial drifts and meet sustainable challenges.

Starting from these ideas, a general design need emerged aimed at reorganizing and positively guiding the product towards the new scenarios that the future opens up to us on the horizon. Hence the intent to design "0_Textile" not as a finished and closed product, but as a platform that makes innumerable integrations possible and this means both different reconfigurations and different uses, numerous circular applications that do not end but are updated, they do not retire but replace and repair themselves to regain functionality.

During the research phase, "0_Textile" has evolved to accommodate an additional challenge that involves using it in the aerospace sector. In fact, from the analysis of the possible applications and possible recipients of the project, "Tourist 2.0" has been highlighted as an interesting experimental study object; in fact, among the various challenges that emerge on the horizon of a near future, the conquest of nearby space is in the first place.

If resilience is a relatively new concept in the Terrestrial field and is a pole towards which it is tending in recent years, in reality, this concept is rather rooted in the modus operandi of the aerospace industry, which exports above all in the "communities" that a type of circular economy is introduced in space trips, more or less long, which sees the reuse of different resources of which the space environment is lacking but which are indispensable (such as water for example).

In these places such as the international space station, where possible, reuse is the practical solution to various supply problems and an attempt is made to extend this practice to as many operations as possible to limit the impact of these shipments as well as to make them self-sufficient.

Given the imminent question that will open regarding an amateur use of space that will open the doors to the economy of travel in the "Near Space", "0_Textile" answers questions that will emerge in this area by proposing sustainable and reusable solutions that guarantee safety and comfort for the user.

In this scenario, in fact, the 0_Textile platform can be configured in order to solve physiological problems dictated by microgravity and then propose a check on return and a subsequent update that will make the fabric available for a new cycle of use.

The study presented here is based exclusively on the design of a textile which, in order to be used, will then need to be declined in a specifically designed functional clothing.

2. Scenario

2.1 Space Tourism

It has always been in man's ambitions to conquer the space that surrounds him, to study and analyze the inscrutable is an activity that has occupied many minds of the past until the advancement of technology has allowed an effective analysis of space culminating in exploratory extravehicular missions that made pure science fiction become real.

Today, that all this is part of the ordinary, a new scenario has opened up: the "Near Space". This neighboring space can sometimes take on purposes that go beyond research and exploration, trespassing in a newborn experiential dimension that is no longer only for sector experts but for anyone: the figure of a new user is configured, the "Tourist 2.0 ".

The phenomenon of space tourism, although quite recent, already boasts several isolated cases of space travel, mainly for entertainment purposes, financed by private individuals at exorbitant amounts.

According to Northern Sky Research’s 2021 report, space tourism market will increase in the next years, generating revenues of $7.9 billions by 2030. The market is driven by suborbital tourism, which will accelerate once Virgin Galactic and Blue Origin launches take place in late 2021. Orbital space tourism is reserved to wealthy individuals who are willing to pay great amounts for a ride; a more low-key role is led by parabolic flight tourism that offers zero-G rides at cheaper cost. Despite COVID-19 delays and decades of development, confidence in the technology is growing and new developments have been made.

If on one hand progress tends to democratize the space experience dedicated to users who are not in the sector, on the other hand it is true that these "tourists" will need special precautions to face the journey by not being experts and not being used to certain physical conditions.

0_Textile project starts from these assumptions and unfolds through the analysis of some of the critical issues encountered in these trips and through a series of discussions held with

experts from various sectors (biomedical, medical, engineering, physical) who collaborated together thanks to their complementary skills.

2.2 Sustainability in Space

Sustainability in space is not yet considered a major issue if compared to safety concerns, due to the limited number of spaceships launches. Nevertheless, the expected increasing of space tourism related launches pushes to focus on the inclusion of sustainability practices into the designing and development processes in the commercial space tourism industry. Travelling to space has an enormous environmental impact in terms of pollution and use of non-renewable resources. According to scientific calculations, 1000 space tourism related launches might produce consequences on climate, with a global temperature increase of up to 1°C. On the other hand, others claim that space exploration could lead to several benefits, such as finding alternative energy sources and materials or prevent human extinction through the colonization of other planets. The main public and private actors in space exploration are well aware of these risks and are working to introduce sustainability in their practices.

European Space Agency (ESA), for example, is pursuing many projects addressing sustainability in space, such as the Clean Space Initiative started in 2012, which goal is the space debris mitigation and remediation across the space industry development chain.
NASA made important efforts in developing a sustainability policy in order to guide their operations. Its main goals include: increasing use of renewable energy, reporting, measuring and reducing greenhouse emission, preventing pollution, eliminating waste, increasing recycling, protecting and conserving water resources, managing and evaluating their operations and missions' effects in short-and-long term, operating under all regulations and laws regarding healthy environment, environmentally-sound operation and energy security (Serafini, 2019).

Maximizing resources availability through reuse or recycling, however, is not a new concept in aerospace industry. The high cost of space missions pushes to adopt new solutions. Orbital debris, mission waste and materials found in space can be used as new resources. The idea of producing directly in space is at the core of NASA's In-Situ Resource Utilization Project (ISRU), which aims to use materials found in space such as lunar ice, soil or metals and producing on site, using techniques like 3D fabrication. The first 3D printer in space was used in 2014 by astronauts aboard International Space Station (ISS).

Other virtuous examples of reuse include reusable rocket systems and engine, supported by the adoption of modularity. Another important issue regards the use of more sustainable alternatives for fuels. Blue Origin's new Shepard, for instance, uses liquid hydrogen and liquid oxygen as propellants, which could potentially be collected from the surface of Moon or other planets.

In the next future, the integration of sustainability into the space economy could lead to a cost decrease in space missions, that could in turn provide a cheaper access to space and boost the space tourism market.

3. Research development

The first step towards a real characterization of the "surface" fabric, which is useful to the space tourist, was the cataloging of the critical issues that this individual encounters in the space environment in order to elaborate concrete answers in terms of interventions and materials used in the project. As project parameters, only effects found in a maximum stay of 7 days were considered, in line with the current stay offers.

Table 1. Classification of critical issues encountered during space travel. (only those relating to short-term stays have been reported here as a maximum stay time of 7 days has been set as a design parameter, in line with current travel offers).

Critical issues encountered in the short term	Effects on the body
Epidermal thinning	- itch - dry skin - thinning of the skin - increased sensitivity - delayed wound healing - greater tendency to skin infections - decrease in skin fiber density - loss of elasticity - different or normal skin aging
Temperature increase	- prostration - skin dehydration
Different distribution of fluids	- proprioception disorders (balance and perception of the body in space) - neuro-ocular syndrome

The "clinical panel" of a hypothetical user has been reconstructed by following the consultation of numerous studies. However, since most of the subjects that have been used as a sample for monitoring on the international space station or by the national

organizations from which the tables with the reported statistical data are built, are mostly men astronauts and being the female astronaut a minority, there are not many data relating to the changes that occur on the female physique or in any case the number of data collected is not sufficient to trace the standard clinical picture that is outlined with certainty.

This has meant that the considerations made from here on are generic and do not consider the differences between men and women that normally occur in the Earth environment as they have only been hypothesized but have not been verified.

In conditions of microgravity and psycho-physical stress, some pro-inflammatory responses are triggered which are responsible for the rise in temperature that occurs during space travel. Normally, the organism manages to maintain a constant internal temperature around 37 ° C by transferring heat by means of thermal radiation, convection and evaporation.

The contribution of each of these phenomena may vary based on the effort being made, environmental conditions and the state of hydration. In space, lowering mechanisms such as sweating are ineffective since the sweat evaporates more slowly than on Earth and the body heats up quickly. With the increase in temperature, dehydration of the skin and the formation of ideal environments for the development of unwanted microorganisms (i.e., fungi, bacteria) are encountered.

To this general situation is added the fact that the bloodstream, in conditions of terrestrial gravity, does a great job of going up from the peripheral areas of the body towards the center: the beating heart. In microgravity, however, this effort is reversed since the rise of the blood is not hindered by gravity. It follows an accumulation of body fluids in the upper half of the body with consequent accumulation of interstitial fluid and swelling of the upper limbs and face, as well as worse spraying of the lower limbs with a consequent lowering of the local temperature.

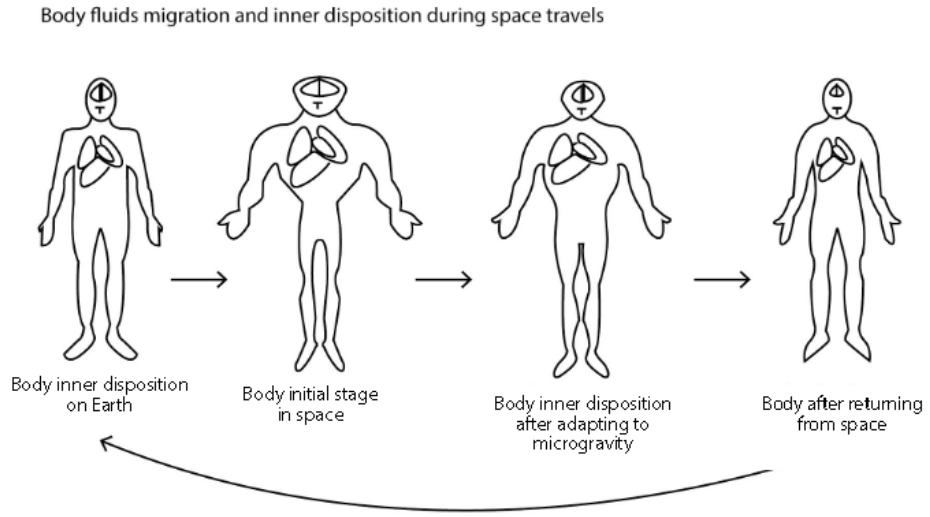

Figure 1. Scheme of body fluids arrangements during different phases of exposure to microgravity (on Earth, in the first phase of exposure to microgravity, after the adaptation phase and on return to the mainland)

By submitting these elements that emerged from the research to a team of dermatologists made up of Doctor Giuseppe Argenziano and of doctors Elisa Fulgione and Caterina Giorgio, it was possible to frame the problem and hypothesize the solution.

The specific problems submitted to them concerned:

• causes of epidermal thinning;

• possible unwanted collateral effects;

With a view to the use of what is available and a minimum supply of extra material for the design of this fabric, the research footprint has been conservative since the beginning. In fact, rather than hypothesizing additional solutions, we have been conceived only solutions that are able to preserve the natural state of the subject's body, and specifically its skin, preventively limiting its surface alteration and the subsequent problems that it could have triggered. Starting from the distinction between infantile, young and mature skins, which are those that undergo physiological xerosis, we have derived a constituent pattern of the skin considering how the psychophysical characteristics that this type of travel implies are limited to an age group between 20 and 65.

Considering how the skin's condition is optimal thanks to the action of three substances: glycerol, ceramides and fatty acids, defined by the doctor as real "bricks" constituting skin external protective film, we have faced the idea of preserving it during the decline determined by the rise in temperature.

They have analyzed a long relationship between these three substances but, in particular, it is clear that glycerol is particularly important for maintaining the other two. This is the definition of the first characterization that the "0_Textile" must support: a release of glycerol which allows, during the stay, to contrast tourist's xerosis and, for domino effect, thus limited the problems that the dehydration derived from temperature rise produced.

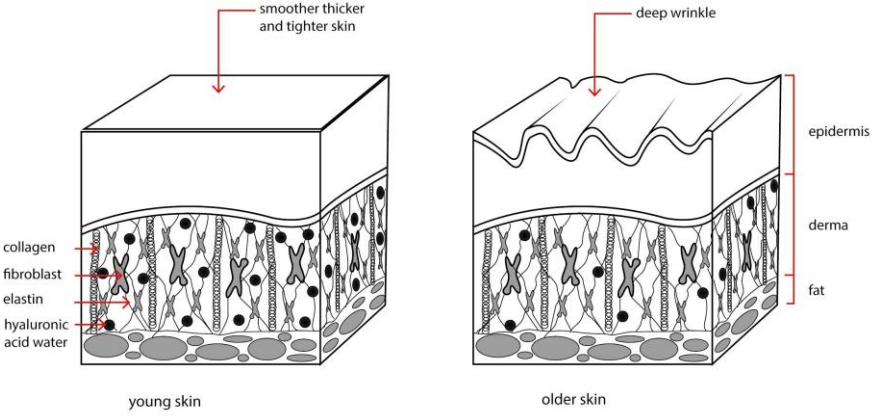

Figure 2. Differences between young and mature skin

On the issues related to the monitoring of vital parameters during the trip I collaborated with Dr Francesco Coppolino, specialized in cardiology, who provided valuable information about sensors useful for monitoring blood flow, pressure and heartbeat that can constitute a complete and constant basic clinical picture throughout the duration of the stay.

In fact, thanks to the monitoring of the user's blood pressure and heart rate, it is possible to have effective control of the health of the tourist during his stay in the space in microgravity and to be able to administer timely corrective interventions if any decompensation occurs.

Always keeping as the axiom of the project a conservative approach of the status quo of the user, as well as the idea of making a minimum use of material within the project, the first step in this sense was limited to the observation of the adaptations that the body makes in

microgravity conditions as defense of the organism against a new and unknown situation. Also, in this case with the specialist, it was agreed that intervening first on the pressure and the movement of the fluids that was expected, would be counterproductive by subverting the natural balance that the body would try to establish.

With the help of the doctor, simple cardiographic and blood pressure monitoring systems were identified. The concept is to obtain triangulation of the heart by strategically positioning plaques on the tissue with sensors that return a stable electrocardiographic signal.

To record the trace, the electrodes are positioned as follows: red electrode = left limb, yellow electrode = right limb, green electrode = lower right limb, black electrode = lower left limb, white electrode = abdomen or back (used to stabilize the trace). The fabric will be designed to accommodate these electrodes with a thickness of about 2 millimeters in its cavity, but their actual positioning will be drawn up when declining the "0_Textile" surface in functional clothing for the Near Space.

The issue of blood pressure monitoring was resolved by creating small watertight compartments in the cavity of the tissue; by blowing air into these cavities of the fabric, which have reduced elasticity, the fabric opposes the expansion of the "pocket" and produces pressure on the affected area. At this point, by positioning a small sensor that records the vibrations of the lamellar flow of the blood thus compressed and made turbulent, the user's diastolic and systolic pressure is recorded in real-time.

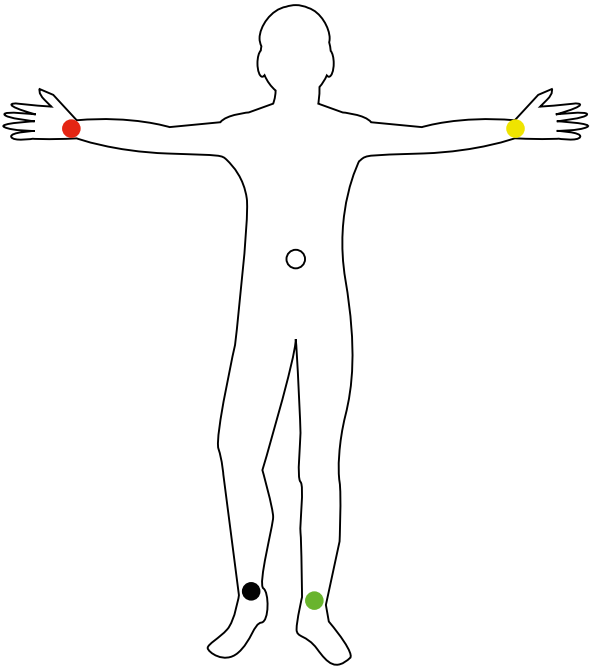

Figure 3. Scheme of positioning of the electrocardiography plates

The third advice I used was the one given to me by the engineers Massimiliano Masullo and Michelangelo Scorpio with whom I longly discussed about the possibilities of using sensors and actuators capable of dissipating some of the body surface temperature so as to allow at least a local lowering of the skin temperature and offer greater comfort to the user.

Considering the links between body temperature and heart rate, it has been shown how a slight drop in temperature can be useful in slowing down the rate and improving blood circulation. For the choice of sensors to be integrated, the study focused in particular on the use of "Peltier cells".

They are devices made up of 2 plates of very thin ceramic material which perform the following function due to the difference in potential between them: one of the two surfaces emits heat and the other absorbs it. In this way, the lowering of the surface temperature of the air at higher risk can be triggered and the opposite effect can be generated by slightly heating the surfaces of the lower limbs which are instead colder.

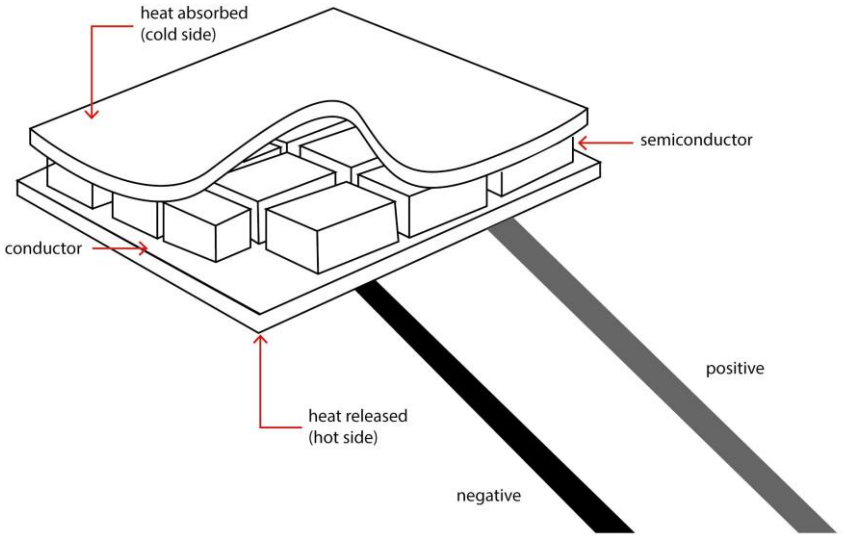

Figure 4. Functional diagram of the Peltier cell

Considering these researches particularly developed in many other areas and with satisfactory resolutions, I set myself to address these issues from a non-specialist point of view but aimed at creating a product that can be used by newbies tourists 2.0.

4. 0_Textile project

Concerning the elements that emerged from the field research phase, the design of "0_Textile" is focused with an impalpable structure made up of very thin and resistant weft and warp that supports a conductive gel (ECG type) with a reduced specific weight.

Glycerol microcapsules are housed inside the gel; this substance is released gradually according to a capsule design differentiated according to the user's residence time. There are in fact two types of release that have been identified: the matrix one and the tank one. The former releases the substance progressively with a decreasing dosage while the latter is more constant over time than on the basis of the thickness of the polymer that hosts it can have different periods of action.

The sensors that allow dissipating the heat, the Peltier cells, which have a surface of about 2 square centimeters, will be inserted inside the gel which, thanks to its conductive action, allows to amplify its effect by increasing its range of action on the skin. The sensors aimed at monitoring the vital parameters will be inserted outside the gel film and therefore in contact with the skin but will also be housed in special spaces in the fabric.

Finally, the small cavities, which will house the insufflated air producing a slight pressure on the skin, are obtained by welding two layers of the fabric, internally covered with insulating material which makes it effective as small circuits with sealed compartmentation.

"0_Textile" will be configured as surface that hosts different sensors and glycerol and will bring benefits and comfort to the space tourist. The fabric thus obtained is declined in the specific garment that is intended to be obtained so avoiding waste or surplus, being produced on a small scale, it can go through countless cycles of "remanufacturing" while keeping performance unchanged and even allowing an "upgrade" using minimal energy input without any addition of accessory material.

The application of "0_Textile" in the context of the creation of clothing for the "Tourist 2.0" is inserted within a cycle that involves the production of a certain stock which at the end of each exploration is regenerated, optimized and made available for subsequent trips. For this purpose, the next step of "0_textile" design turns towards the definition of a cycle of services (performance economy) that monetize operations capable of triggering product repair and enhancement processes, making "appealing" solutions generally excluded from traditional linear industrial economy and promoting a constant service that restores vitality to the product while maintaining high performance.

From a practical point of view, in a rapidly expanding sector such as that of private space explorations (for entertainment purposes), the need to create a type of clothing that supports the problems faced by the body when exposed for long periods to the microgravity or the so-called "weightlessness" effect. There are many solutions proposed by multiple specialized agencies and there are many experimental technologies used to design clothing that can be worn especially during the travel phases to reach the space site.

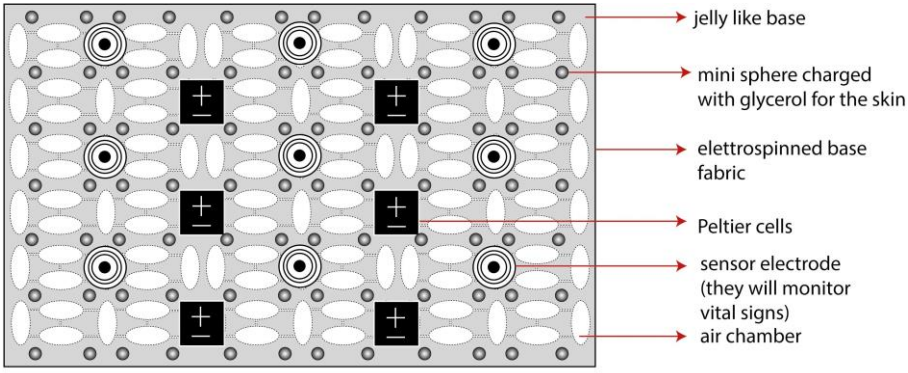

Figure 5. Integration scheme of 0_Textile internal surface

The fabric designed here is proposed as a base to be used below these structures, perfect engineering works many of which have already been consolidated, like a film, a sheath to wear during the entire duration of the user's stay; the purpose is to fill the interspace between the suit and the user's skin, guaranteeing comfort and safety.

With the creation of the fabric on a gel basis, a high percentage of the same will be made up of water, the glycerol inserted in such quantities as to be sufficient for a release that corresponds to the needs of an average user within 7 days, will be included in the gel in specific doses that guarantee complete absorption, significantly reducing waste.

The sensors, properly set at the end of each cycle of use, can perform their function for a considerable period of time and then be especially updated through software as well as inserted in regeneration processes which, using the constituent materials, are able to offer sustainable and advanced solutions. to be returned to the cycle of use.

4.1 Planning

Finally, the small cavities, which will house the insufflated air producing a light pressure on the skin, are obtained by welding two layers of the fabric, internally coated with insulating material that makes it effective as small circuits with sealed compartments.

The design of "0_Textile" is to be understood as a base surface to be used under engineering textile structures; it houses different components that as sensors or glycerol, will bring benefits and comfort to the space tourist.

The textile thus obtained:

- is declined in the specific garment that is intended to be obtained avoiding waste or surplus because specially designed;
- is regenerated, optimized and used for future trips in a cycle of "regeneration" that supports constant vitality services for the product;
- is declined in high performance solutions for advanced functionality when the same regeneration takes place following the experimental technologies and innovative materials in step with the progress of research.

The "0_Textile" fabric, as versatile as it is and placed in a circular process, can be said to belong to the fabrics obtained from materials programmed to respond to specific needs of the body in a specific context of use. The placement in the interspace between the suit and the user's skin is intended to respond to advantages in terms of *commodity, utility, facility.*

If on the one hand the use of glycerol has been the most recommended - as it helps to maintain skin hydration by slowing down the appearance of signs of aging and skin deterioration - on the other hand, a valid alternative still incorporated in the conductive gel of the basic textile structure - considers cross-linked hyaluronic acid.

Cross-linking, i.e., the union of linear hyaluronic acid molecules by means of a chemical bond, determines the formation of larger and more stable lattices that equally protect the skin from enzymatic degradation, guaranteeing a longer residence time at the site of application and a longer duration of action. This means that to achieve the same benefit, fewer administrations are required with cross-linked hyaluronic acid than with linear or glycerol; the result is an increase in the effectiveness of the benefit with a minimal amount of material even in the short-term user journey.

In the vision of programmable, regenerated and optimized textiles, taking advantage of nano-material progresses, it happens that the ability to subsidize different needs of the body is expanded. Micro-encapsulation with phy drugs or other substances contributes to the design of healthcare nanotechnologies that mediate bacterial infections or localized inflammation, as seen in aerospace.

The development of a textile base structure with Peltier cells as sensors and actuators - capable of managing the energy expenditure caused by localized rises and falls in body surface temperature - would find increased performance if a portion of the excess energy produced by humans themselves is stored to power wearable devices. The energy expenditure would do the same job as a watch battery with cleaner, more recyclable technology.

The connection of sensors to less hard electronic components results in the development of e-textiles that increase user comfort while in action, making the condition of data acquisition and monitoring imperceptible; in addition, for a more systematic study of the human body in conditions dictated by microgravity, the sensor component could include the manufacture of mini robots that in symbiosis with the body, can help to store information about the criticality of the body, to date still little known, becoming an opportunity for progress in

telemedicine, for human-computer interfaces and the study of the body at a distance. The sensors, properly set at the end of each cycle of use, can perform their function for a long period of time and then be particularly updated through the software as well as inserted in regeneration processes that, using the constituent materials, are able to offer sustainable and advanced solutions to return to the cycle of use.

5. Conclusion

At the end of the product design phase and the possible cycle of services which sees it included in a remanufacturing process, the prototyping and identification of the specific characteristics of the constituent materials are preceded by the resolution of the open questions during the assembly of the different skills requested o the product. In fact, following the consultations, there are several aspects that required a review because of the interconnection between the multiple disciplines involved and the related fields of action of the individual experts. The need, therefore, arises to further investigate the following aspects:

- Consider a relationship between blood pressure, the core temperature of the individual and dehydration of the skin in a short time span of 7 days with parameters and conditions referable to those present in microgravity;
- Check the range of glycerol activity and the release quantities that the body takes; calculate an effective dose for a release of 7 days
- Consider the degree of possible compression so that turbulent motion is triggered and blood pressure can be recorded, designing watertight cavities in which to blow air if necessary, and using a bottom fabric capable of offering resistance to the expansion of the cavity (value of the modulus of elasticity called Young's modulus rather high);
- Consider a thickness of the order of 5 mm for the finished fabric;
- Consider a specific weight of the finished fabric of the order of 100 gr/m2;
- Consider the use of renewable technologies on the platform, avoiding the use of sensors with programming limits; rather look for technologies that oppose obsolescence through the separation and replacement of the individual constituent components.

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www.universetoday.com
www.youmath.it

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Acknowledgements: We would like to acknowledge the following experienced professionals who follow the research and with their precious collaboration we have created an interdisciplinary network, which are: the dermatologist of the Policlinico Nuovo of Naples: Dr. G. Argenziano, and two other collaborators: Dr. Elisa Fulgione and Dr. Caterina Fulgione; cardiologist, Dr. F. Coppolino; engineers M. Masullo and M. Scorpio.

Although the authors have shared the general line of the paper, however, the chapters are attributed as follows.

Maria Antonietta Sbordone has drafted the following chapters: Abstract; 1. Introduction; 2.1 Space tourism; 4. 0_Textile Project; 5. Conclusion.

Viviana Vollono has drafted the following chapters: 3. Research Development.

Carmela Ilenia Amato has drafted the following chapters: 4.1 Planning.

Barbara Pizzicato has drafted the following chapters: 2.2 Sustainability in Space.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A Research on the Sustainability in Traditional Cave-Dwelling Construction Skills in Northern Shanxi Province (Jinbei Area)

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Abstract | Cave dwelling (Yao Dong in Chinese) is a form of architecture with high ecological value, maintaining the balance of natural ecology and sustainable development. The advantages of living in cave dwellings, such as warm in winter and cool in summer, and its co-existence with nature, are well-known to the world. Meanwhile, the ecological features of its traditional construction skills and the ecological wisdom left by our predecessors are worthy of our research and inheritance. This paper re-recognizes the traditional cave-dwelling construction skills, the cultural value and ecologic sustainable value of cave dwellings from a novel perspective of the resilient characteristics of the ecosystem. Consequently, it promotes the formation of traditional residential protection mechanisms, and enables the sustainable research results of traditional construction skills to be applied to modern residential buildings, making buildings more energy-efficient and people 's living environment more comfortable, healthy and environmentally friendly.

KEYWORDS | SUSTAINABILITY, TRADITIONAL CAVE DWELLING, NORTHERN SHANXI PROVINCE (JINBEI AREA), RESILIENCE

1. Cave Dwellings and Environmental Resilience

1.1 Overview of Cave Dwellings in Jinbei Area

The Jinbei area refers to the Northern Shanxi Province, China, including Datong, Shuozhou, and Xinzhou areas. It is adjacent to the Inner Mongolia Autonomous Region in the north, Shaanxi Province in the west, and Hebei Province in the east. Located at the northern part of Loess Plateau, mountainous Jinbei area has varied landscapes and diverse terrains, which is relatively complicated and barren. They are mainly wind erosion and belong to the geology of the Maowusu Desert. The cave dwellings in China have a long history, and the relatively well-known prehistoric one with horizontal style appeared at the end of Yangshao culture around 3,000 B.C. [1] Up to now, the traditional Chinese cave dwellings mainly consist of patio-style, by-cliff-style and independent-style (Figure 1). [2] Due to the uneven distribution of loess and the different geological composition in different regions, the types of cave dwellings presenting in different regions also have different characteristics. Most of cave dwellings in Jinbei area are by-cliff-style and independent-style, because independent-style cave dwellings have the convenience of not being restricted by geological conditions. In Jinbei area, where the geological composition of soil and stone is not evenly distributed, the independent-style is the generally selected one to be built.



Figure 1. Traditional Chinese Cave Dwelling Style (Photo by Author)

Patio-style Cave Dwelling // By-cliff-style Cave Dwelling // Independent-style Cave Dwelling

1.2 Environmental Resilience

In the study of cave dwelling and its environmental ecosystem, resilience refers to the ability of an ecosystem and social system to continue to function under accidental and severe disturbances. Resilient ecosystem is the backbone of sustainable environmental support systems. The key of having resilience is to anticipate how things will break down and prepare for the worst outcome. [3] The resilient characteristics of cave dwellings and cave dwellings environment are a strong guarantee to promote the benign operation of the ecosystem. In natural and human systems, cave dwellings and their own resilience adjustment functions have made the relationship between people and nature ecologically integrated, and have

formed a good situation of harmonious co-existence and sustainable development between the two systems.

1.3 Cave Dwellings and Environmental Resilience in Jinbei Area

The cave dwelling environment in Jinbei area use the phase transition resilient characteristics of cave dwellings to adapt to changes of natural environment in the manner of “follow” and “welcome” [4]. The construction of cave dwellings adapting to environment reflect the characteristic of “follow”. The phase change properties of cave dwellings in response to seasonal, day and night temperature and humidity changes reflect the resilient characteristics of “welcome”. The cave dwelling in Jinbei area is a type of passive architecture built according to local conditions, local materials, regional situation and natural environmental conditions. It not only did not cause any damage to the natural system, but also coordinate the harmonious co-existence of human and nature, creating an ecological balance between them. In winter, the temperature inside cave dwellings is 10°C higher than that outside, while in summer, it is about 10°C lower. [5] The author monitored, analyzed and compared the temperature and humidity of villagers’ cave dwellings, brick houses, and outdoor areas in Gaoyang Village, Shanxi Province for 24 hours (Figure 2). It can be seen from the analysis chart that the temperature and humidity of cave dwellings are relatively stable when those of the outdoor fluctuate greatly. The temperature and humidity of cave dwellings are more suitable for human beings to live in. This resilient function with resistance to temperature changes effectively regulates the temperature in the cave dwellings, making it more suitable for people and can also save a lot of energy consumption.

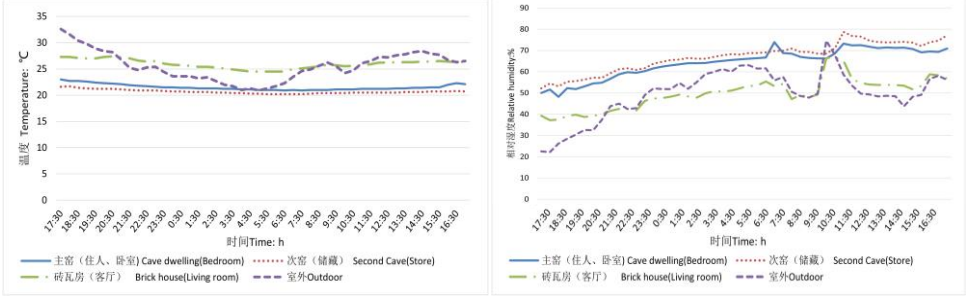

Figure 2. 24 -hour measurement and analysis of the temperature and humidity of villagers’ cave dwellings, brick houses, and outdoor areas in Gaoyang Village, Shanxi Province.

Measurement by Author; Time: June 23rd to 24th, 2019, from 17: 30 to 17:00 the next day;

Therefore, the cave dwellings in Jinbei area have the ability to respond to changes in the natural environment system, which is incomparable to our modern ordinary houses. When ordinary houses are built, they are not capable of adapting to natural environment, so most

of the buildings systems are made as independent as possible by means of active artificial intervention, such as waterproof and fire prevention. In addition, its ability to resist changes in natural environment is also weak: in the winter, more energy is needed to maintain heating; in the summer, air conditioner is required to cool down. The cave dwelling, on the other hand, only needs a small amount of energy to create the temperature environment needed to maintain the human body. The resilient advantage of its own not only does no harm to nature but also works in harmony with natural systems.

2. The Resilient Characteristics of Traditional Cave-Dwelling Construction Skills

2.1 Simplicity and Reproducibility

Reproducibility and repeatability are obvious in natural ecosystems and are also characteristics of ecological resilience. The by-cliff-style and independent-style cave dwellings in Jinbei area have the features of convenient construction, simple structure, material saving, health and environmental protection. Therefore, these two types of cave dwellings are widely applicable in Jinbei area, especially in the Loess Plateau area where wood is lacking. The “simplicity” is reflected in that cave dwellings do not require an additional supporting system. The wall and ceiling are integrated into one structure. One can use the most common natural materials to build cave dwellings. From the perspective of material classification, cave dwellings can be divided into adobe-made, stone-made and brick-made. (Figure 3)



Adobe Cave Dwelling // Stone Cave Dwelling // Brick Cave Dwelling

Take the independently constructed adobe cave dwelling as an example; it mainly uses adobe that each of it is 36cm in length, 15cm in width, and 8cm in thickness as the building material. The legs of cave dwellings are first built, with the support of wooden timbering. Then, the adobe blocks are used to build the vault layer by layer. According to the local residents, if there is no wooden timbering, the soil can be filled between the two legs to form an arched mound. Workers build a vault on the mound, and then dig out the soil inside the cave dwelling to pave the courtyard or cover the roof. This is called “tu niu” method. After the completion of main structure, the face of the cave dwelling is made. Usually, the doors, windows and vents are on the face. Finally, the top of the cave dwelling is covered

with soil to complete the whole construction of it. Whether the cave dwelling is made by adobe, stone or bricks, the construction methods are similar, except that the materials used are different. The materials used to construct the cave dwelling form the structure, dividing the cave dwelling into internal and external environments. Although the construction materials and techniques are simple, the thermal environment generated cannot be underestimated. Cave dwelling is a type of building with high ecological benefits. Different from bulk-built houses, the repeatability of cave dwellings is mainly reflected in shape and construction method, but the details are different. Each piece of material is derived from natural resources that are relatively easy to obtain and is adjusted to the actual situation during construction. So the reproducibility of cave dwellings is organic, which reflects the flexibility and resilience of traditional cave dwellings in dealing with natural environment.

2.2 Non-standard Forms in the Standard

Rudolfsky of the United States called cave dwellings or similar vernacular buildings "architecture without architects". [6] For a long time, the idea that “what is made by machines is perfect” has become an aesthetic standard for people, but now people have begun to admire irregular and gentle beauty, and pursue skills in manufacturing and processing natural construction materials. The traditional Chinese cave dwellings seem to be built according to a standard, because the external forms and the internal functions are similar. However, careful mappings show that almost none of the cave dwellings are completely the same in size. The construction materials are slightly different, even for adobe and stone cave dwellings. The mixing proportion of mortar and clay and the method of using it are also greatly different. Heating methods are also varied. Generally, the heating in the cave dwellings is through the stove connected with fire heating (Fig. 4). In Zhaishang Village, Baode County, Xinzhou, villager Wang Zaiqiang adopts the floor heating method (Fig. 5). Therefore, the furnace heating principle of the cave dwellings is the same, but there are differences in the operation mode. In fact, there are many changes in the heating methods and positions of cave dwellings: some of the stoves pass through heated *kang*; some through the chimney; some are set outside the cave dwellings. Based on the different needs, each household will have different arrangements.

Although the number of caves in cave dwellings generally appears in odd number, even-number caves are also common, and there are square-shaped caves. Depending on the surrounding environment, independent-style cave dwellings could be combined with by-cliff style cave dwellings, brick-made cave dwellings, and integrated with traditional courtyard houses. Therefore, the structure of caves is arch shape. The flexible and diverse environment presenting by cave dwellings and their combinations reflects the resilient freedom of non-standard forms in standard.



Figure 4. Schematic Diagram of the Cave Stove in Laoniuwan Village (Photo by Author)

3. The Resilience and Sustainable Development of Traditional Cave Dwellings and its Living Environment

3.1 The Adaptability of Low Dependence on Human Input



Figure 5. Schematic Diagram of the Cave Stove of Wang Zaiqiang's Cave Dwelling in Zhaishang Village, Baode County (Photo by Author)

A sustainable human ecosystem is associated with less human input in the ecosystem. Nature dominates most things, but a large amount of human input will reduce the resilience of the natural system. Since mankind's needs and desires are endless, his continuous investment in fulfilling his own desires is boundless. One day, when the society and nature cannot afford endless expenditures, human beings would face punishments from society and nature. Traditional cave dwellings in the Jinbei area have become a model of ecological

architecture due to their adaptability of low dependence on human input. In the whole life cycle of the construction, use and abandonment of cave dwellings, the energy consumption at each stage is relatively small, and the abandoned soil, stone and other materials can once again become natural resources and be reused. In comparison, buildings in cities must rely on a large amount of human input to function properly, and maintain a balance between man and nature in a highly dependent and high-consumption manner. Of course, from the perspective of living comfort level, the buildings in the city are much more comfortable than the cave dwellings, which is why a large number of residents used to live in cave dwelling leave their original places to build new houses. Therefore, improving the living comfort level of cave dwellings, matching the new lifestyle of modern people, and solving the dilemma of traditional cave dwellings being abandoned are the main difficulties in cave dwelling research. Since the current status of cave dwelling development is not optimistic, we urgently need to find practical path to develop cave dwellings.

3.2 Application of Appropriate Technology

"No-energy-consumption" or "low-energy-consumption" buildings are more suitable for rural construction. The existing traditional buildings in rural China, especially cave buildings, can be considered as "no-energy-consumption" buildings because they have characteristics such as heating from natural resources, no air conditioning, low population density, low electricity consumption and so on. However, the quality of life of rural cave dwellers is not high, and the living environment and surrounding supporting facilities are relatively backward. Therefore, the purpose of cave dwelling research should be to help cave dwellers improve the living comfort level of cave dwellings and improve the supporting services of living environment based on energy saving. Low-tech construction technique is one of the ecological characteristics of traditional cave dwellings. Using low-tech method to protect and repair cave dwellings is the main technique. With the rapid development of modern science and technology, the application of high-tech has attracted much attention in various fields of society. However, at this stage, pursuing the application of high-tech is not the first choice for the development of traditional cave dwellings. It should be suitable for the actual needs and selectively use low-tech and high-tech, that is, appropriate technology. Appropriate technology is the technology that should be chosen for the development of traditional cave dwellings. At present, the residents of Zhaishang Village, Baode County, Xinzhou, in Jinbei area has applied appropriate technology in the living environment of cave dwellings. For example, villager Wang Yongqiang's family has already used solar energy, biogas, vegetable greenhouses, rainwater collection, waste recycling, breeding and other appropriate technology (Fig. 6). Raising pigs and poultry provide economic income for the residents. The feces of pigs and poultry could be used to make biogas, which meet the needs of boiling water, fertilizing vegetable greenhouses and so on. The collected rainwater is used for watering vegetables, old wine bottles are used for building barrier walls, and solar panels are used for supplying electricity. Each format and facility complements each other to form a complete system that integrates with the natural environment system and human living

system as a whole. The living system of Wang Yongqiang's family is a relatively good attempt to apply appropriate technology. Of course, there are also some problems during operation. For example, when the temperature is not high, the existing biogas equipment does not have good production of gas. The flow direction is not well-organized, thus the amount of rainwater collection is relatively limited. These problems need to be further solved. Therefore, the application of appropriate technologies requires long-term exploration to form and improve. The appropriate technologies suitable for cave dwellings also include three-dimensional greening, wind energy, optical fiber tube, Trombe wall, and sunlight room, etc. All of these reflect the functions and role of practicality. Combining with high-tech, low-tech and traditional wisdom, appropriate technologies should be widely promoted. It is an integrated technology that is suitable for the current situations and is also a system matching the original one. Through the application of appropriate technologies, the resilience of cave dwelling can be enhanced to make it closer to the needs of people, and to achieve the harmonious co-existence among human, nature and environmental ecosystem.



Solar Energy // A Vegetable Greenhouse in the Courtyard // A Wall Made by Old Wine Bottles



Rainwater Collection Well // Biogas Well // Pigpen

Figure 6. Schematic Diagram of Appropriate Technology Application of Wang Yongqiang's Home in Shangshang Village, Tuyata Town, Baode County

4. Conclusion

In summary, the resilient characteristics of traditional cave dwellings in Jinbei area are reflected in aspects such as simplicity, reproducibility, non-standard, diversification, and adaptability of low dependence. There are many other aspects worth studying and researching, such as the biodiversity of cave dwelling environment and the multi-functional applicability of cave dwellings, etc. Many people would think of poverty when traditional environmental-friendly buildings are mentioned. In fact, simple and localized buildings can give residents more space for self-expression and allow them to get closer to nature. [7] From the angel of resilient characteristics, this paper researches and discusses the sustainability of traditional cave-dwelling techniques in Jinbei area. In this way, the unique internal mechanism can be explored from. It can also enlighten us to re-understand the values of cave dwellings from the exterior to the interior, inspiring us to use the resilient law of cave dwellings for ecological design.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

A Study of Zero Waste Fashion Design and its Possibilities within a Design for Circularity Process.

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Abstract | Sustainability has become increasingly important for the fashion industry to take ownership of which Governments support by enforcing regulations on manufacturing industries to reduce waste. Some fashion brands have recognised the economic benefits of a circular approach to production and collaborative approaches through textile innovation and the role of fashion designers to design sustainable products with minimal waste. The aim of this research is to explore the creation of zero -waste fashion garments intended for the ready-to-wear sector through a holistic Fashion Designer- Creative Pattern Cutter approach that considers garment lifecycle and environmental impact. Viewing the textile waste problem from a designer perspective, a small range of garments were created from one or two single pieces of cloth, incorporating a no-cut policy which allows garments to be deconstructed when no longer required. This enables the cloth to be easily remade into other garments as desired. The collection supports this sustainability-led fashion concept.

KEYWORDS | CIRCULAR DESIGN, ZERO WASTE FASHION DESIGN, SUSTAINABLE FASHION, CREATIVE PATTERN CUTTING, RE-DESIGN

1. Introduction

The aim of this research is to explore the creation of zero -waste fashion garments intended for the ready-to-wear sector through a holistic Fashion Designer- Creative Pattern Cutter approach that considers garment lifecycle and environmental and social impact. A study of early zero waste fashion design was undertaken, both historical and within contemporary fashion, to understand the possibilities for producing zero waste garments, which not only produce no waste at the initial cutting stage but also provided possibilities for producing a zero-waste collection of garments with the potential to become part of a circular design process. As the researcher has a background in fashion design and creative pattern cutting, this laid the groundwork for the project experimentation. What became significant in this research was that the designer needed to consider end of life possibilities for reuse and/or recycle, at the initial design stage , a process which has previously been overlooked by many designers and fashion industry brands. This design for end-of-life use, allowed for possibilities of future value creation of garments within a circular design process.

What we can say about design is that it is the discovery of something new, and what we would also now accept, in the light of the environmental cost highlighted in the fashion industry, is that good design must include some level of sustainability. The environmental sustainability problem requires widespread action now to eliminate the issue of waste within the fashion industry and slow the depletion of natural resources. The average person buys 60 per cent more items of clothing every year and yet only keeps them for about half as long as they would 15 years ago, consequently producing immense volumes of textile waste. This trend, exacerbated by the 'fast fashion' market, has led to a system overloaded with unwanted clothes. It is estimated that more than half of 'fast fashion' produced is disposed of in under a year either to landfill or is incinerated (Remy et al,2016). As Remy states, 'each year, the EU alone generates 1.5 to 2 million tonnes of used clothing, much of it unsalable due to poor quality' (2016). The linear model of take-make-dispose is hugely wasteful and destructive to the environment and despite this the global demand for clothing, particularly in developing countries, looks set to rise. With a US $3 trillion global industry employing over 300 million people (Strijbos,2018), it is a significant undertaking to educate diverse brands and manufacturers about the merits of becoming more sustainable, environmentally and economically, "addressing the social aspects of continuing mass consumerism and mass production is becoming equally imperative" (Flinn,2015).

1.1 Zero Waste Fashion

Zero waste fashion design is a design technique that eliminates textile waste at the design stage. As a prominent researcher in the area of zero waste fashion design, Rissanen (2013) presents zero waste fashion design as a holistic approach between the fashion designer and

pattern cutter, which is endorsed in this research project. Where these two roles have traditionally been quite separate, zero waste fashion design requires new approaches where pattern cutting becomes an inherent part of the design-process. Zero waste fashion design in itself is not a new process, it originates from Ancient Greek and Roman eras. Some may argue its origin goes as far back as the caveman, where textiles were so valuable that it would be incomprehensible to cut any of it away and discard as waste. Certainly, the process of producing garments without waste can be traced back to a time when animal skins were draped on the body as clothing. With the introduction of woven cloth, early known examples of clothing were lengths of cloth used to create garments, such as the Indian sari and the Peplos, Chiton and Himation in Ancient Greece. As early as 2000BC woven lengths of cloth were draped and folded around the body (Burnham, 1973). The width of any cloth depends upon the loom and how looms have developed over time is a necessary consideration. "The Ionic chiton was nothing but an oblong piece of fabric whose dimensions varied with the countries that belonged to the same culture" (Rudofsky,1947). Rudofsky, criticises the gradual deterioration of clothes making as clothes, particularly in Western civilisation, became more fitted and required the use of patterns and curved shapes, which in turn creates fabric waste.



Figure 1. Marble Funerary statues of a maiden and a little girl wearing distinctive Ancient Greek dress – c.a. 320 BC. The Metropolitan Museum of Art

The Japanese kimono, one of the better-known garments for not wasting cloth, was made from cloth woven at a particular length and width, split into eight pieces, with no fabric waste produced (see figure 2). The narrow width of the fabric used in the kimono determines its horizontal dimensions' (Tarrant, 2016) and the fit is created by tying around the obi belt.

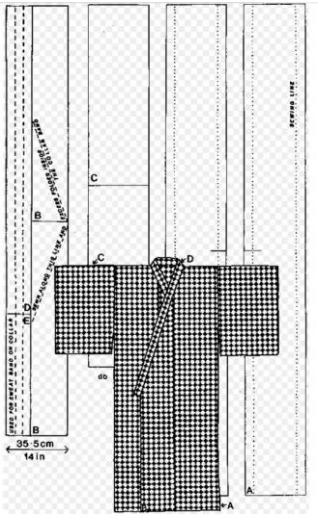

Figure 2 Kimono pattern showing the individual pieces of cloth woven to create the garment (Rissanen2016)

A sixteenth century man's shirt as seen in figure 3 was made primarily of squares and rectangles for the body and sleeves, and in the particular example, triangles were used tadd in extra ease. The pattern of the shirt showed little change until well into the nineteenth

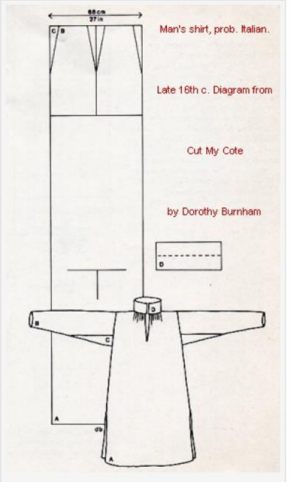

Figure 3. Sixteenth century man's shirt pattern constructed from a single cloth length (Burnham, 1973)

These garments were made at a time when raw materials were scarce and the process of producing textiles was slow. Fabrics were a luxury and as such were valuable and treated with care and respect.

> "Prior to the Industrial Revolution cloth was an expensive luxury and not easily obtainable. Therefore, fabric was carefully manipulated to use as much of it as possible, resulting in close to 100% usage" (Burnham, 1973)

Extra width for ease could be added in the form of inserted godets. A similar triangular shaped godet on this particular shirt was added to the underarm sleeve to give ease. This piece of fabric could easily be replaced when worn. The nature of the pattern produced no waste. The neckline, rather than a circular cut out, as traditionally expected, was a T-shape with any excess fabric folded in to provide a facing. No allocation for seam allowance was made on the pattern, giving a less precise form of construction compared to more traditional pattern cutting techniques. On this particular pattern, this would be particularly evident around the neckline.

This early literature concerns itself with the value of cloth, its beauty and craftsmanship, rather than the pressing issue of waste production. The eminent curator, Burnham describes various factors "affecting garment cut", the material from which the garment is made being the "factor that has the most influence on the particular shaping of it" and was probably one of the first researchers to highlight a link between "textile width, garment cut, and the resulting waste" (1973). The focus of her work highlights early origins of zero waste pattern cutting, more through lack of knowledge of sewing skills and then later through fabric appreciation and time spent producing materials of different widths on various looms. Vionnet is often quoted as the designer who laid much of the groundwork for zero waste fashion design of the twenty first century (Rissanen,2013). The one- piece approach to pattern and garment-making has historically been found in couture. Much of Vionnet's work was based around the bias cut, creating garments with as few seam lines as possible and creating fit with use of grain lines and manipulating fabric, rather than the traditional approach of designers using curved seams and darts. Vionnet's early inspiration came from studying Greek dress, particularly classical styles based on the shape of the rectangle.

1.2 Recent studies into zero waste fashion design

The term Zero Waste was first used publicly by chemist Paul Palmer who in 1974 created a company, Zero Waste systems (Zaman, 2015). He then went on to form the Zero Waste Institute to highlight the need for explicit design for reuse. Palmer established three basic forms of how humanity has dealt with the goods at their end of life, similarly explained in figure 4 below:

- First generation (Immediate satisfaction) - **DISCARDS AND DUMPS = GARBAGE**

- Second generation (Short term) - **POST-DISCARD REUSE = RECYCLING**
- Third generation (Long term) – **EXPLICIT DESIGN FOR REUSE = ZERO WASTE**

Figure 4. Three stages of product end of life. www.zerowasteinstitute.org

> *"Zero waste is a practical theory of how to wring maximum efficiency from the use of resources. It is third generation planning, where wasting is the first generation and recycling is the second" (Palmer,2001)*

It is a far more logical approach to efficient use than recycling, for example. Zero Waste states that the best way to avoid waste is to reuse everything over and over – perpetually. And that this can only be done if reuse is designed into all products right from the start, as highlighted in fig 5. It does no good to design ultimate discard into a product and then struggle after discarding to find some way to reuse the bare materials, as recycling does today. Design for zero waste considers the use of materials in their present form, without losing their capacity to be re-used once they come to their end of life (Zaman, 2015).

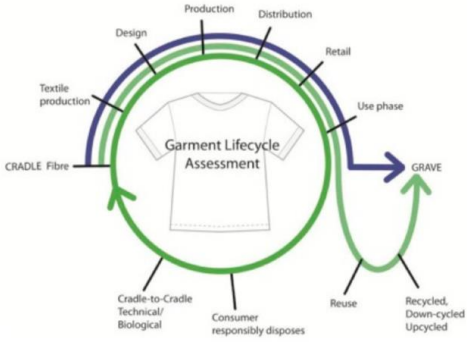

Figure 5. Garment Lifecycle Assessment" by Alice Payne, www.thinklifecycle.com

The study of zero waste fashion design has become of particular interest to creative pattern cutters and fashion designers who wish to design and create garments with reduced or no waste. Zero waste fashion design, post 2013, has quite often resulted in garments with unusual style lines and often with very little consideration to fit and form. As a commercial design approach, zero waste fashion design has so far had little impact and remains a niche approach due to the complexities of fabric width, garment fitting and also size grading (Fletcher,2014). Research on zero waste pattern cutting has tended to focus on the flat pattern cutting approach. Generally, garments produced in this manner have little fit and

form and where this does exist, it appears in quite casual construction, un-tailored to the body. Researchers into zero waste fashion design, Rissanen and McQuillan (2015) in particular, focus on the flat pattern cutting 'jigsaw' approach, designing patterns within the whole width of the fabric. The designs produced have "repositioned seams, exaggerated lines and a changed aesthetic" (Fletcher,2014), with construction techniques that fall beyond traditional garment manufacture capability. There is no mention in this early research of the end-of-life stage of these 'zero waste garments, questioning the Palmer theory of third generation 'zero waste' being described as third generation design for reuse (2001). It should be stated that as Rissanen suggests, "zero-waste fashion design is not 'good' in and of itself; it needs to be examined in a much broader context." (2013). New sustainable ways of approaching design within the fashion industry needs not only to include the design and production elements, but also garment life cycle and end of life.

Niinimaki (2013) discusses zero waste fashion as a sustainable design approach and its "capabilities and opportunities" for textile appreciation. Niinimaki uses both a theoretical and practice-based approach to zero waste fashion design to "demonstrate the potential" to change designers' attitude to garment design and production. "Self- made and unique textiles increase the value of the material and multiply its meaning to the fashion designer" (2013), a process which is crucial to the development of sustainable practices within the fashion industry. This appreciation of materials is almost forgotten in contemporary fashion, and reserves itself to slow fashion, produced in the smaller fashion design studio. Self-made and/or unique textiles increase the value of the material and multiply its meaning to the fashion designer. Artist and Designer Issey Miyake places "importance on the development of materials" for his clothing (Koike, 2016), recreating traditional natural materials, such as linen, silk or cotton, or developing new materials from advanced technologies (2016). Miyake's philosophy of A-POC, that "every piece of fabric begins with a single thread" allowing the designer to imagine the production of the material, and how much fabric needs to be produced, from the thread stage to the finished form, and how this can be achieved (2016).

Research into zero waste fashion design is most commonly associated with the work of Rissanen (2011-2016) and McQuillan (2011-2016), both of whom have identified the link needed between pattern cutters and fashion designers to produce garments with zero waste. These studies, although groundbreaking and thought provoking, have not, as yet, established a way of producing garments for the mainstream fashion industry. The emergence of fast fashion and the tragedy it has inflicted on human life and the environment, has resulted in a growing demand for more sustainable fashion-industry practices. One small part of this is a renewed interest from fashion designers and creative pattern cutters, in Zero Waste Fashion Design. Much of the previous research has been exploratory in nature, with fashion designers adopting approaches allowing them to produce

small niche collections. Further research is needed to enable mainstream industry to develop techniques for garment production with no waste.

According to Rissanen the separation between the roles of designer and pattern cutter, particularly in the mass production market, is the main challenge to addressing the issue of waste. At present “80% of garment environmental impact lies in the design stage” (Redress, 2018). To achieve a more holistic approach within the fashion industry, roles would need to move away from the traditional design to production process.

There are two main areas of waste within the fashion industry that concerns us;

1. Waste produced at the pre- consumer stage due to inefficiencies in pattern and garment width, including waste during the production of textiles in the form of fibres and inadequate quality of textiles.
2. Waste produced at the post-consumer stage in the form of used garments and household textiles.

Many researchers investigating zero waste pattern cutting have experimented with and utilised techniques such as draping with a piece of cloth or flat ‘jigsaw’ pattern cutting or a mixture of both. Townsend (2013) conducts practice-led research into how creative pattern cutting can develop the design process of patterns with zero fabric waste. The research highlights the importance of collaboration with textile manufacturers/designers, to develop the required textiles which “enhance the cut and drape of the garment”. A theory reiterated by Niinimaki (2013) whose previous research on zero waste fashion design incorporates not only the pattern cutter and fashion designer, but also the textile and material designer to inform the whole process from beginning-to-end. Townsend argues that “counting on one’s own experience of what looks right, what works together and just how far to push the fabric”, works in favour of applying rules and processes, habitually practiced (2013). A limitation of this study is the style of garment used to create the toile - a loose-fitting draped garment lacking commercial aesthetic. A question that needs to be asked is how the introduction of close fit can be developed through zero waste pattern cutting.

Carrico (2014) provides a discussion around previous research into zero waste fashion design and zero waste pattern cutting, by Holly McQuillan and Timo Rissanen, covering several ways of approaching the pattern making process. Carrico introduced a further experiment, using minimal seam and cut techniques, resulting in a simple garment form. The study provides a new and interesting development from a fashion design perspective, however further developments in the cutting processes would be useful to show how this technique could be used within the future fashion industry.

1.3 Circular Economy from a Design Perspective

This study used a designer – creative pattern cutter approach that considers garment lifecycle and environmental impact with some consideration of social impact, while producing a zero-waste collection of garments with the potential to become part of a circular design process. The circular economy principle sits on three essential criteria; designing out waste and pollution, keeping products and materials in use for as long as possible while still retaining their value and thirdly providing the opportunity to regenerate natural systems (MacArthur, 2014; MacArthur,2017). Products produced within a circular economy system are designed to eliminate any negative environmental impact as well as negative impact to human health through the use of hazardous substances in the production process, release of harmful gases from textile waste, and water pollution. The circular economy system requires products to be kept in the system for as long as possible, which requires the initial design process to take this into account through design for durability, design for reuse and design for disassembly to allow for more efficient recycling processes to come into play. Many researchers consider the circular economy to be a system which mirrors the role of nature and the need to keep the balance of the ecosystem by returning nutrients back to the soil. Looking at biological cycles with the circular economy system, problems occur when the materials used are a myriad of complex components which allows no room for extracting raw materials resulting in loss of value (MacArthur, 2014). . Supply chains which exist regionally and locally are the most attractive to a circular system, because of local supply of material production, product manufacture and use. Supply chain logistics can be organised with relatively low transport costs and without the import/export levies of crossing International borders. Opportunities for having some influence over retrieving products for further reuse, recycling and remanufacture become more possible (MacArthur, 2014). Within a circular economy system, necessary criteria to take into account would be

1. to introduce renewable bio-based materials, chemicals and energy sources.
2. to increase end-of-use recycling and energy recovery
3. to introduce sharing or pooling of resources, to make full use of assets throughout their useful life
4. to increase lifecycle through reuse and repair and remanufacture models (Lacy et al, 2020)

Until recently fashion designers have typically failed to consider end of use for the produce or material at the initial design stage. Fast fashion garments are made purely as a disposable item with no consideration for end of life. This planned obsolescence is a considerable challenge to cleaning up the impact of the fashion industry, highlighting the need for more circular design practices.

2.Method

Taking inspiration from early traditions of attaching emotional value to cloth, the aim of this research was to look at effective ways of producing a series of garments each with a single piece of cloth employing a no-cut policy to allow fabric re-use as required. To aid deconstruction of the garments at the end-of-life stage, a water dissolvable polyvinyl alcohol thread (PVA) was used in the construction process. As the research centres around sustainability and a circular process, natural un-dyed, untreated wool was used, also cellulose fabrics created in a closed loop system, alongside zips and embellishing thread made from recycled polyethylene terephthalate (PET). Where necessary in the design process a nonwoven material was cut to shape which has since initiated further research into fully -fashioning such smaller pattern pieces to eliminate the possibility of producing waste. The nonwoven textile used was a sustainable hessian, with British wool applied in a nonwoven process and naturally dyed. The benefit of this approach was to help understand how zero-waste pattern design could be taken further to create a 100% zero waste approach and to determine the factors needed to be explored for future fashion production.

An initial design sketch was made to refer to using a 2D-to-3D realisation process. Garments considered were a skirt, trousers, a jacket, and a coat. The whole width of the fabric was used and the length of fabric was estimated from the design sketch. The width of the fabric becomes a design feature and for the purpose of this experiment all fabric used was of the same width and had a selvedge which could easily be used within the design, adding to the aesthetic of the garment. This 'garment' was then developed further by draping on the female mannequin. The initial drape was developed in calico, a similar weight to the chosen final fabric. This method of drape is a tried and testing method of creative pattern cutting and one which allows the freedom to design directly onto the body form. This process was chosen for its experimental qualities and freedom to develop innovative techniques and patterns. Designing on the stand also gave the opportunity to focus on design aesthetic and quality of fit to the body.

The skirt was the most straight forward of the garments to drape from a single piece of cloth and a design which fit within the collection aesthetic was easily achieved. Some decisions were made during the process regarding the raw edge of the wool along the weft grain, where there was a possibility of light fraying. A bias trim was attached to prevent future fraying, however this in itself would create further problems with disassembly at the end-of-life stage. It was questioned whether it was more important to prevent fraying for future redesign, or to leave the fabric raw for future disassembly. Further research to establish this is ongoing.



Figure 6. Photo of skirt made from a single piece of cloth, full width.

The trousers were created from a width of cloth cut into 2 equal pieces down the warp grain. Although this created smaller pieces of cloth to work with for future designs, it did allow for the trousers to easily be created without further cutting. Pleats created the fit required around the waist and poppers and recycled zips were used for fastenings. The trousers had no crotch shaping and although this created no problems with the smaller ladies' sizes (8-12 UK sizes), this would restrict movement and comfort for larger sizes. The introduction of a fully-fashioned piece for the crotch is considered for further research.



Figure 7. Photo of trousers made from two half widths of cloth.

The jacket shown in Figure 6, was created from a width of fabric, pleated into the waist to create a fit. The difficulty with this garment was one width of cloth being too small for the whole jacket and two widths of fabric being too much. The introduction of a collar and rever to the jacket was difficult to achieve without cutting the cloth. Further experiments are ongoing to create an outcome to fulfil the concept of creating a garment from single pieces of cloth with no cutting. For this early collection, the garment was completed with an additional garment created from a cellulose based fabric, in a whole width.

The coat was made from a heavier weight version of the same cloth. This weight was too thick to create pleats and therefore darts were used to create shaping to the waist. The wool properties were such that these darts could then be moulded and shaped with steam to create a pleasing shape around the hips. The coat was eventually made from 3 widths of fabric, one for the sleeves and collar, one for the coat length from the waist and one width for the main body. On disassembly of the coat, the darts could be pressed out and the stitching did not mark the fabric in any way. As traditional with a fabric of this nature, a lining would be inserted; the research is again ongoing.



Figure. 8. Photo of coat made from full widths of heavier weight cloth.

3.Conclusion

A small range of garments were designed on the stand. The method is outlined in this article. The experimental processes described are the result of creating garments from a single piece of cloth with a no-cut policy to address textile waste from garment-making and consumption. This was complicated by attempting to create an element of fit within the garment which differs from current research in zero-waste fashion design. The purpose of this method was to allow for ease of deconstruction of the garment at its end of use, when the fabric could be used to make another garment. The design for disassembly allowed for the materials to be reused without future products losing value. The durability of the chosen fabric would keep the garment in useful life for as long as possible. The local production of the natural wool fabric as well as localised production of the garments would allow for greater possibilities for retrieving the garments for further reuse and/or repair. The trousers and skirts were easier to achieve from a single piece of full width cloth. The coat had to be made in three separate widths but still facilitated greater use of the fabrics on disassembly. There was very little fraying with this fabric, although this needs to be assessed as the garment is worn for longer periods.

The fabric for this design experiment was initially chosen for its quality and natural properties, but in the final creative design experiments, it proved to hold its drape, while still providing a structure to the garment. It was concluded at this stage that elements of fully-fashioned pattern pieces would be beneficial to the fit and aesthetic of future designs. It was also discovered that the use of water dissolvable thread was relatively unreliable as, while strong enough to hold the garments together under normal conditions, it would not be suitable for general garment construction. Further research into this circular design process is ongoing.

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Acknowledgements: I would like to thank Professor Rina Arya for her kindness and support with this research paper.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Awareness, compatibility and equality as drivers to resilience in sustainable design research.

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Abstract | Nowadays resilience, beyond its relevance for economic studies, is becoming of fundamental importance in Design for sustainability, inclusion and social improvement. Around this term, the authors have developed and experimented a design strategy, tools and methods for sustainable and inclusive design researches and teaching, which are based on three concepts: Compatible, Aware and Equal. The approach is human centred with a mix of different applied methodologies that variates according to the context and the research purpose. Multidisciplinarity and Co-Design are constant, while tools like QFD have been redesigned and adapted to the new methodological requirements. In this paper, authors will discuss about their design strategy by analysing some experiences in various fields such as cultural heritage or Internet of Things for increasing awareness, sustainable lifestyle and intergenerational sociality. Three examples will be illustrated evaluating their result and impact on the society in terms of awareness, compatibility and equality.

KEYWORDS | RESILIENCE, SUSTAINABLE DESIGN, DESIGN RESEARCH, DESIGN METHODS, HUMAN-CENTERED DESIGN

1. Introduction

According to Bauman (Bauman, 2012), the world is losing its solidity day after day. Organizations are becoming more versatile, life forms more fluid, projects more flexible, and choices are becoming less rigid and, if possible, reversible. This (almost) fluid world emerges from the previous (almost) solid world of the XX century. In fact, in the last century, industrial societies were more stable and solid. The productive and organizational society was more solid as well as the connections between people and communities.

This solidity was mainly related to two reasons: the first reason was the poor-mobility of goods and people. In the XX century, people were economically “confined” to their land and their physical houses since traveling and moving were very expensive and only for very rich people. The second reason is linked to the limits of information transmission. Communications were slower for the language barriers and for the slower speed of the communication media. In addition, one layer of solidity was added by permanence over the time of social and cultural conventions. Such conventions in fact guaranteed a solid resistance to the mutation of local organizations. Nevertheless, the scenario of the world is different now. The global connectivity has gradually “melted” the solid structure of the old world. Consequently, the rigid social conventions have softened, the solid relationship between people has weakened and it has gradually established a world composed of light, variable, flexible and reversible organizations. This new world, colonized by a neoliberal economy and characterized by sudden changes, generates many problems such as lack of work for young people, social and economic inequalities and mass migration phenomena. This is also called “the fluid society” by Zygmunt Bauman.

A phenomenon that has increased the sense of precarity that characterizes the liquid society of Bauman can be considered the climate change, whose consequences are becoming more and more perceivable in Italy as well as in the rest of the world. In November 2019, Venice’s inestimable cultural heritage suffered huge damages due to the extraordinary height of the tide. Millions of euros were estimated as necessary to repair structures and to cover the missing income of tourism. The situation was so severe that the major of Venice declared a state of emergency. Considering the extraordinary magnitude of the event, the main culprit was climate change. (Henley & Giuffrida, 2020). Between the 26th and 30th of October 2018, several consecutive days of thunderstorms and very strong winds, called "Vaia storm" by meteorologists, caused considerable damage throughout the Triveneto area, affecting, alpine forests of the Dolomites.

Heavy rains and specifically the intense sirocco wind, reached an exceptional speed of 200 km per hour and felled 8.5 million cubic meters of timber. The figure was never recorded in Italy, on an area of 41 thousand hectares of land. Federforeste and Coldiretti have assumed that the total number of trees felled is 14 million. In the entire Triveneto area the estimated economic damage was 2.14 billion euros (Il Post, 2020).

But this is not just an Italian issue, it is a global problem. In December 2019, climate change was the main topic discussed during the UN Climate Change Conference. The conference was about the implementation guidelines of the Paris Agreement at COP 24 in Poland last year. The key objective of the conference was to complete several issues with respect to the full operationalization of the Paris Climate Change Agreement (UNFCCC, 2020). In this continuously changing context, Andrew Zolli and Ann Marie Healy (2012), propose the concept of Resilience as a key factor to overtake sudden, social and environmental alterations.

From the Latin verb “re-salio” which means “bounce back” the terms resilience is widely used in several fields. Within the Material science, Resilience is the ability of a material to absorb a shock without breaking (Accademia Della Crusca, 2020).; In Psychology, Resilience is the ability of the person to react positively to traumatic events (Treccani, 2020), while, in Ecology, Resilience is the ability of an ecosystem to return to its initial state, after a disturbance has occurred. The term “Resilience” has become of common use even in economic disciplines. This is probably due to the increasing frequency with which economic destabilization happens. Especially in Italy, there are everyday cities ruined by economic dislocations or companies which are bankrupt due to globalization and ecological transformations. Changes that alter the native secular lifestyles of small and big communities.

Resilience is becoming increasingly relevant in social awareness because it represents a viable reaction to today's constant mutations in this volatile global economy. Since it is clearly difficult to predict such sudden changes and consequently develop and provide instruments to strengthen societies defences, a strategy that could increase structural resilience of communities is required. Design disciplines are trying to participate in the definition of such a strategy through new approaches, focusing on methods that are not any more merely based on the humanization of technologic solutions. Since one of the main causes of the diminished resilience of society is its liquefaction, the reduction of stable connections, interactions and cooperation between individuals, families, groups, organizations and institutions, design disciplines are called to give answers in terms of projects able to redefine how services and institutions absorb unpredictable disturbances through participation, awareness, solidarity.

Developing resilience means developing skills such as agility, cooperation, connectivity, and variety to prevent crises, stress conditions, and to implement adaptive strategies quickly and efficiently. Our unit is operating in human-centred design research on topics regarding societal issues. We are developing and testing methodological tools and projects in the area of design for sustainability, inclusion and social improvement. Our strategy of intervention is based on three basic concepts: Compatible, Aware and Equal. Compatible: A design that considers the impact of its projects on people’s physical and mental health, trying to foster a lifestyle more compatible with human wellness. A design that aims to reduce the unsustainable impact of human behaviours on communities, society, environment and the

earth's ecosystem. Aware: A design that aims to increase human awareness about the consequences of people's daily choices on themselves, their society and the environment. A design that fosters connection, interaction and cooperation between individuals to increase their awareness and solidarity sense and belonging to communities and society. Equal: A design that aims to create equal opportunities for access to products, services, and systems for the benefit of the largest part of the population beyond physical, cultural, economic, social and any other kind of distinction. A design that aims to increase society's resilience through the empowerment of citizens, providing them new tools and methods for cooperation and participation.

In the following chapter we will expose three of our recent design research projects, different in terms of context, objectives and results but all united by a common strategy and methodology, based on the three concepts previously described. All the projects follow a mix of human centred methodological tools such as QFD, codesign, participative design that is adapted to every case study.

2. The INCEPTION project

Regarding accessibility to cultural heritage and, to the historic buildings – the discussion is often limited to architectural barriers. These constraints represent the traditional attitude of thinking about disability as a personal attribute which is characterized by a reduction of human physiological ability (for example a handicap that limits autonomy and mobility). However, cultural heritage is not only something physical and perceptible but sometimes it concerns also the intangible experience generated by history, art, and culture and associated with the built heritage. Moreover, although ability biases create effective solutions for individuals with similar abilities and circumstances, they exclude a much wider group of people.

As the World Health Organization (2011) reported, it is necessary to consider disability as a complex phenomenon, which regards the interaction between people's bodies and nowadays society features. In this term, it is possible to interrupt the idea of disability as a personal health condition and start to consider disability as a mismatched interaction between people and their own world (Holmes, 2018). From this perspective, these mismatches are more visible today due to technology complexity that produces exclusion to people who are not physically impaired. Therefore, the same mismatched interactions are presented to cultural heritage. As reported by the corresponding author (Mincolelli, 2012), the exclusion to the cultural heritage is produced not only by the building itself but mostly by lack of accessibility to its cultural information: the physical distance, the limited data accessibility, the communication tools inadequacy (due to technical and linguistic reasons) limit the experience of a common cultural heritage to a great part of the European citizens. Regarding nowadays technology, although many potential solutions are available to facilitate access to cultural information, there are several factors that limit digitalization and Cultural

heritage inclusiveness such as resource limitation, the lack of standards and big data management issues.

The first research case was developed to tackle the aforementioned problems. Inception is a multidisciplinary research project coordinated by the Department of Architecture of the University of Ferrara and financed by the European program, Horizon 2020. Its purpose is to enable and promote inclusiveness and accessibility of the European cultural heritage through Information and Communication Technology (ICT), which can increase knowledge, enhancement, and dissemination of its cultural asset and value through the Web (Di Giulio, Maietti & Piaia, 2016). The project followed a Human-Centred approach and Co-Design was used to develop the platform in collaboration with the main stakeholders and users. They not only co-designed the platform, but they also actively participated throughout the entire design process.

In particular, INCEPTION developed an open-standard Semantic Web platform for sharing 3D HBIM models (Building Information Models for Cultural Heritage) to be implemented in user-friendly Augmented or Virtual Reality operable on different digital devices. This specific configuration can catalogue every cultural heritage artefact data (including also context data), which can be subsequently communicated to a wide audience. The aim of this configuration is to make cultural information freely accessible to all (Pauwels, Bod, Di Mascio, & De Meyer, 2013).

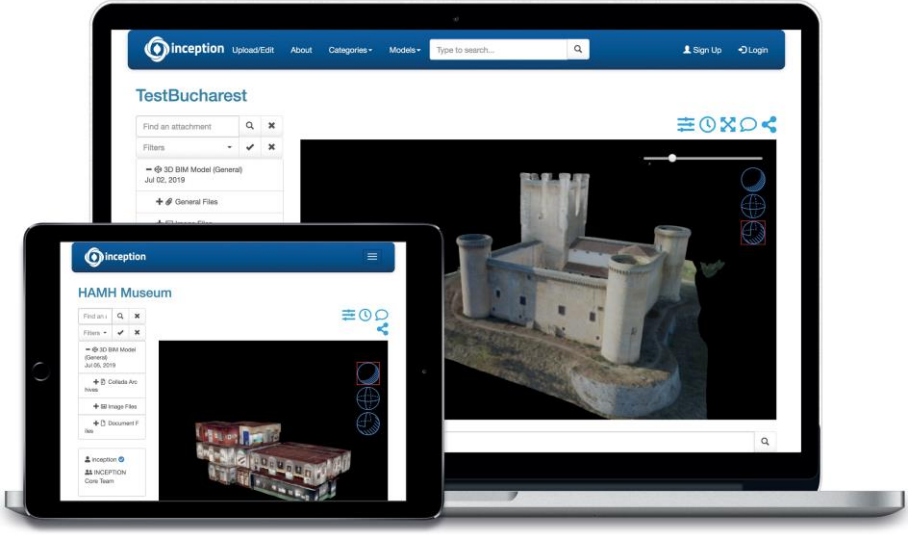

Figure 1. Representation of the beta version of the INCEPTION web platform, which is accessible on different digital devices. In particular, two 3D examples of HBIM models.

Considering these characteristics, the project can be firmly considered resilient under all of the three concepts described in this paper. INCEPTION is intangible and compatible due to its digital nature. Digital technology accelerates the migration from the physical property of a given product to the bits of a virtual experience or service (Anderson, 2009). The physical dematerialization makes INCEPTION accessible and on-demand to all, decentralizing at the same time its system through a ubiquitous communication generated by the Web (Kelly, 2016). Furthermore, this process makes accessibility to cultural heritage easier and stronger. In fact, the 3D model properties can be elaborated and processed without running the risk of distorting the original configuration of the historic buildings.

Digitalization makes INCEPTION also equal because the platform is designed to be accessible and open source to all. In fact, a versatile service adapts itself to the numerous people categories, from the expert necessities to the common citizen's needs. Linguistic or cognitive barriers – in terms of perception, navigation or cognition of virtual information (Thatcher et al., 2006) – can be overtaken by the User-Centred Design approach because it allows finding inclusive solutions that accommodate those needs, capabilities, and ways of behaving (Norman, 2014).

Finally, INCEPTION is also aware because is participative starting from its development. Digital media, indeed, are able to support people's cultural actions (Manovich, 2013), such as accessing and elaborating knowledge; sharing or remixing information; engaging in interactive cultural experiences to visualize digital contents. Regarding inception, those operations can be performed by people directly on the INCEPTION platform. The cultural heritage is available for all European citizens in an interoperable way, in which people can interact or work with the HBIM models in different levels of details: download or upload its files, gain or enrich the information of every 3D source, or simply explore it corresponding documentations. Moreover, since every digital model maintains all the technical and historical information of its corresponding building, INCEPTION acts as a huge digital archive for the safeguard, for the restoration, and the reconstruction of every built heritage. This including the last extreme case of the fire-damaged Notre Dame cathedral in Paris (Agency Research Executive, 2019). For this reason, all the interactions with the platform are capable to increase people's personal knowledge about the European cultural identity on people (Maietti et al., 2017), stimulating them to be more participative and active in preserving it over the time.

2. The HABITAT project

Another project carried out by the research team was the project HABITAT (Home Assistance Basata sull'Internet of Things per l'Autonomia di Tutti): the project was financed within the POR FESR 2014-2020 program of the Emilia Romagna Region in Italy, which started in April 2016 and ended in July 2018. The multidisciplinary team that developed the project was composed by the by the CIRI-ICT group (Centre for Industrial Research of the University of

Bologna which specializes in radio frequency systems) who was the leading partner in the research; CIRI-SDV (Life Sciences and Health Technologies of the University of Bologna who are experts for the technical validation of inertial sensors.



Figure 2. The Habitat project prototype and test with elderly users.

The HABITAT project aims to develop and test a platform based on the Internet of Things for the realization of adaptive and supportive living environments. The members of the research team developing the part of the project related to Design Research decided to apply a design methodology that could ensure a high level of usability, accessibility, and inclusiveness (Mincolelli et al., 2019). The final choice was the application of the User-Centred Design approach, also known as UCD (International Organization for Standardization, 2010), the reason of that option was linked to the main objective of the project itself: the development and testing of a platform composed by smart objects with a TRL - Technology Readiness Level (Mai, 2017) of 5 (that means that the prototypes were expected to be tested in a natural environment and not in a laboratory; the starting point of the technologies used for the project was a TRL of 3rd grade, also known as proof of concept) and, at the same time, the integration between technological aspects and human factors.

The chosen approach, which is characterized by a multi-level problem-solving process, allowed the research team to analyse and predict how the user would interact with the final products, and also to verify and validate the research contents and the design development (Mincolelli, 2008). Given the specificity and the peculiarities of the different users involved in

the project, it was important to set up a research methodology that would allow the optimization of the characteristics of the domestic ecosystem by developing an open, flexible and customizable platform that could change its behaviour according to the needs of the individual person (Mincolelli, Marchi & Imbesi, 2017).

The HABITAT project consisted in designing, prototyping and testing a home ecosystem composed of objects with natural interfaces but equipped with sensors governed by Artificial Intelligence, able to improve the user's self-sufficiency and capable of facilitating an active ageing for older people, without forcing them to face the difficulties related to the learning of new interfaces and communication systems using the Internet of Things. Those daily objects were supposed to ensure a high level of usability, ergonomics, and inclusion through the creation of customized profiles based on the analysis of the needs of each individual person (Imbesi & Mincolelli, 2020). The system also allowed to catch, elaborate and monitor a series of data for the analysis of the quality of ageing, in the short, medium and long term.

The HABITAT project can be defined as "compatible" because it tries to analyse how daily activities of the users can be modified, in order to consent healthy ageing for them that can directly and indirectly positively impact to other people and to the whole society. It was "aware" because it allowed primary users, secondary users and stakeholders to understand how the elderly's quality of life can have significant consequences on the community and on the environment. Lastly, it was "equal" for its inclusivity that aims to give the same opportunities and the same level of usability and accessibility for products, services, and systems to the largest number of users, including the ones belonging to niche categories needing special requirements.

3. The PLEINAIR project

The team is carrying out another research regarding the PLEINAIR project. The project started in July 2019, will last 2 years and is funded under the action 1.2.2 POR FESR 2014-2020 of the Emilia Romagna Region. One of the problems (Ministero della Salute, 2017) the world population is facing is the sedentary lifestyle; this aspect has negative and concrete consequences on multigenerational users: from children to the elderly. At the international level, it is estimated that one adult in four (aged between 18 and 69) and three out of four teenagers (aged between 11 and 17) do not do any type of physical activity or exercise, as recommended by the WHO. In Europe, according to the WHO, the sedentary lifestyle causes every year one million deaths (about 10% of the total).

The project team has identified one of the possible solutions to reverse this constant and dangerous drift: sharing and realizing better lifestyles to improve people's quality of life, social and recreational activities for greater physical activity. These are the reasons why the INCEPTION project has been developed: Free and Inclusive Parks in Networks for Recreational and Physical Intergenerational Activity.



Figure 3. System general layout of the PLEINAIR project

Usually one of the weaknesses of the existing playgrounds is the one of being very sectorial; Such playgrounds meet only the needs of specific users. There are beautiful playgrounds for children, modern skate parks for teenagers or life paths for the elderly but, it is difficult to see a park that simultaneously targets multi-generational users. Parks where the child can play, collaborate and deal with different users, such as the elderly and adults. Even if in different contexts, there are already best practices (International Child Development Initiatives, 2012) that prove how sharing heterogeneous activities by different users can widely benefit all the users involved.

PLEINAIR is made up of a highly specialized scientific-industrial research team: the partners TekneHub and A.I.A.S.have cultural and methodological skills aimed at the Human-Centered Design approaches. DataRiver, CIRI SDV and Future Technology Lab have proven competencies in the sector of IoT/IoMT, sensors, as well as data management, Machine

Learning/Artificial Intelligence. The industrial partners – that are important for their skills in terms of industrial and experimental operation – are Ergotek s.r.l. (wooden seats and furniture), Sarba s.p.a (playground equipment and urban furniture), mHealth Technologies S.r.l (healthcare furniture sector). The main goal is to create playgrounds and inclusive contexts in order to carry out outdoor socio-recreational activities. A context that can adapt to the needs and necessities of each person, personalizing the interface with targeted motivational strategies. To achieve this objective, the team plans to develop and create the Outdoor Smart Objects (OSOs): auxiliary objects or ludic tools equipped with actuators and sensors that detect important parameters for a correct and healthy lifestyle. The network of possible solutions is wide and open, as the adaptation through the auxiliary objects will occur thanks to the development of distributed artificial intelligence within the OSOs.

The project is ongoing and follows design research approaches and methodologies aimed at satisfying people's needs. Users (understood in the broadest sense) have been and will be constantly and frequently involved in the research. During participatory working days, tools such as the co-design will be applied in order to plan and design together with the users. Therefore, the project is permeated by the concept of resilience.

PLEINAIR is definitely a Compatible and Equal research project: the signals that gave birth to and think about the project are closely linked to concepts concerning people's health and lifestyle; improving the – physical, social and inclusive – the quality of the surrounding environment in order to raise people's quality of life. The objective of PLEINAIR is the development of OSOs that allow creating inclusive contexts in which people of different ages, skills, cultures, sensitivity, and abilities can carry out recreational-social activities together, without physical, cognitive or social barriers.

The research is certainly Aware: one of the strengths of the constant and systematic use of Human-Centred Design methodologies (such as the co-design) is to trigger an emotional bond with people from the first phases of the research; thanks to this "trigger" it is credible to be able to make people more aware of both their needs and the shortcomings (or not) of the surrounding environment. One of the most significant problems we are experiencing, especially within Public Administrations, is the one regarding the management and maintenance of the park. Being able to design a context together with the people belonging to the neighbourhood community where the park is located, can create inclusive and virtuous dynamics for its good maintenance. Involving people and making them active actors within the strategic choices for the realization of a park, crucially increases their responsibility on the context conceived all together.

4. Conclusion

Within the context of climate change and fluid society, the impact of our approach in design research is aiming to improve every day's life quality in terms of awareness, compatibility, and equity. To clarify the connection between the projects INCEPTION, HABITAT, PLEINAIR

and the resilience in terms of equity, awareness, and compatibility the Table 1 has been done.

Table 1. Conclusive Table with relationships between projects presented and the concepts of equity, awareness and Compatibility.

	INCEPTION	**HABITAT**	**PLEINAIR**
Equity	Accessible to all, remove linguistic barriers by means of HCD.	Does not leave behind fragile categories but encourage social and inter-generational inclusion	The project aims to create recreational-social activities together, without physical, cognitive or social barriers.
Awareness	Promotes awareness of the territorial identity	Promote awareness of elderly's life quality and the impact on the society among primary, secondary users and stakeholders.	Human-Centred Design methodologies (such as the co-design) trigger an emotional bond with people and stakeholders involved.
Compatibility	Digital and intangible	Promote healthy ageing for a positive impact on society	Improve the quality of the surrounding environment

Projects such as INCEPTION, HABITAT, PLEINAIR are intended to foster a resilient culture that helps to preserve the territories' integrity and society's sustainability and empower citizens through their communities and pass this empowerment on to future generations. Each project enhances a resilient culture on a different level: HABITAT promotes a resilient, inclusive society that does not leave behind fragile categories such as the elderly, but rather encourages them to be active and autonomous within their limits and taking advantage of a dignified and sustainable help provided by the society they belong to. PLEINAIR is instead focused not only on fostering a healthy and active lifestyle of individuals, but also on encouraging dialogue and closeness between different generational groups, increasing connections and interactions between citizens of different ages. Finally, INCEPTION not only represents a participatory strategic tool to create a crowd-based backup of data useful in an emergency (as in the case of the fire of Notre Dame in Paris) but it also promotes awareness and understanding of the territorial identity.

Dive deep into the design research and into the human-centred design, the resilient approach is not only useful to improve everyday life but also to promote a sustainable progress of the society. Promoting equity, awareness, and compatibility not only can contribute to grant a sustainable development of human society through the design of products, services and institutions, but also by encouraging individuals to consider and adopt

behaviours that empower their community. Design research for promoting resilient culture can represent an alternative perspective, a counterbalance to the diffusive consumeristic and individualistic mindset that can be considered the greatest danger for an equitable and united society.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Circle Sector: exploring the role of designers in a circular economy

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Abstract |In this paper we research the role of the designer in the framework of a circular economy. We explore what methods, attitudes and strategies designers deploy to facilitate the transition from a linear towards a circular economy in and around the city of Genk, Belgium. First we elaborate on the context of Genk. We continue by questioning our role as designers in this context by elaborating on the Circle Sector project. An archive, lab and studio that maps, experiments and prototypes with locally available materials. We will explain our method of mapping, experimenting and prototyping with these materials. We conclude our research by highlighting our role in the framework of a circular economy.

KEYWORDS | CIRCULAR, ECONOMY, DESIGN, ROLE, CULTURE

1. Introduction

The city of Genk as a laboratory for circular economy

Circle Sector started as a project in 2018 to research the role of designers in the framework of a circular economy. Our research and design work is situated in the city of Genk, Belgium. Genk is a former coal mining region that, after the closure of the coal mines in the 80s, is focused on industrial manufacturing often linked to the car industry. However since the closing of Ford Genk in 2014 the city of Genk, its residents and local companies are trying to reimagine their role in a post-industrial city. Many of Genks's residents have skills in the manufacturing industry but are left without an employer as most industrial manufacturing has moved away. The policy makers of Genk look towards design and innovation to generate new opportunities for industrial activities and local employment. One of the potential paths to explore deals with activities within a circular economy. In 2015 the city of Genk published a paper titled; "Genk as a laboratory for circular economy" (2015). One of the triggers for setting up the Circle Sector lab, archive and studio at our design and research campus located in the city of Genk.

Circular economy: Challenges and opportunities for design

Circular economy holds a vision of a future where material flows mimic biological cycles. To turn this vision into a reality the linear system of taking, making and disposing resources needs to be transformed into a circular one (Macarthur, 2013). Hawken (1999) highlights the potential designers have to impact the system since up to 90% of the environmental impact of products is determined during the design stage. Which stresses that designers have an important role to play in the transition from a linear towards a circular economy. Preston (2012) argues product designers can play a key role in the transition from linear to circular if they embrace circular design strategies such as reuse, repair, remanufacturing and recycling. These strategies have been popularized by Braungart and Mcdonough (2002) as Cradle-to-Cradle design. Cradle-to-Cradle focusses on overcoming the technological barriers to facilitate the transition towards a circular economy. They have resulted in many technological innovations that follow the principles of circularity. But the linear system of taking, making and disposing continues to produce a lot of waste. Although the technical focus is fundamental to make the circular economy a reality they are not the only barriers to overcome. Kirchherr (2018) reports that cultural barriers such as changing company culture and consumer awareness, have the largest impact in slowing down the transition from linear to circular.

A fundamental reorientation of the business models on which the linear economy is based need to be transformed to facilitate a transition towards a circular economy. This creates uncertainty about the future and results in resistance to change in industry and policy. The linear economy not only represents a system it also represents a culture where citizens embrace the role of passive consumers, companies make and sell products without taking their environmental impact into account, policymakers support the linear system rather than questioning it and designers often create more troubles than solving them. Rittel (1977)

described this complexity as a 'wicked' design problem that involves social, economic, political, cultural and environmental challenges. If designers want to facilitate the transition from linear to circular they need appropriate strategies that go beyond technological problem solving.

Dan Hill (2012) describes social, economic, political, cultural and environmental barriers as the dark matter of design. The culture context, business model or vision of the future in which products, services or systems are designed. Similar to dark matter the culture of an organization or vision is hard to perceive, yet it shapes the physical properties of the designs it produces. Imagine a car, it is clearly defined by its material properties. However the vision of the car company on the future of mobility, its business model, the relationships with its customers, … are part of the dark matter that shapes the car. Hill (2012) argues that dealing with the dark matter of design requires a strategic design approach. One that encompasses both the questions and the solutions of design problems which challenges the problem solving role designers play.

2. From Problem solvers to trouble makers

What role can designers play in facilitating a transition from a linear towards a circular economy?

Designers often take on the role of problem solver who proposes solutions in the form of drawings and prototypes for a given problem framed by a client (Cross, 2000). Yet, designed solutions like single used packaging can cause more troubles than they solve. They help a client deliver and sell its product to a consumer. The designers of the packaging can consider circularity by choosing mono materials that can easily be recycled. Problem solved from the perspective of the client. But these single use packages also create new problems. In theory recyclable packaging can circulate in many loops. In practice they end up in water streams, break down into microplastics and cause harm to the global ecosystem. Although the intentions of the designer and client might be good by proposing a recyclable packaging material, their design decision still can cause harm in unforeseen ways.

Tony Fry (1999) argues that good intentions are not enough, designers need to learn how to operate in an increasingly complex society by exploring the future consequences of design decisions. We encounter this critical attitude in speculative design. Where possible futures are explored through design. Speculative designers like Dunne and Raby (2007) start with posing questions; what future is possible, plausible, probable or preferable? The speculative strategy also considers things in its larger context, the cultural environment in which product, services or systems are used. Speculative design borrows strategies from 'future studies' but combines it with the tactile nature of design. Victor Margolin (2007, p.4) points out that designers have the unique ability to make future situations tangible. By designing prototypes that enable the "staging" of future use situations in a physical space. Ilstedt and Wangel (2013) argue that prototyping enables to reveal the dilemmas and opportunities in a design space.

To facilitate the transition from a linear towards a circular economy designers need to learn to address the dark matter of design. Shaping the cultural context in which products, services and systems are used. This requires a critical attitude where design is used to generate a dialogue about what circular future is possible, probable and preferable. John Thackara (2005) argues that facilitating a transition requires an on-going and collaborative effort of people with various backgrounds. Creating an environment where stakeholders with different backgrounds and expertise can collaborate is the ambition of the Circle Sector project. The goal is to make circular futures tangible in order to explore and evaluate their potential.

3. Circle Sector approach

The scale of the linear economy poses a challenge for creating a collaborative environment. The linear economy is spread out across the world which creates a lot of physical but also cultural distance between the people who design, produce and use products. The physical distance impacts the environmental footprint of the product. The cultural distance makes it very complex to facilitate a constructive dialogue between the people who design, make and use things.

In contrast to the globalized linear model, Circle Sector is organized on a regional scale to establish an ecosystem of designers, producers, policy makers and citizens. The goal is to draw together new relationships between these actors and set-up decentralized production chains with a minimal environmental impact.

Our approach to achieve this goal is threefold; mapping, prototyping and testing. We start by mapping locally available resources. Materials and expertise that can be found in and around the city of Genk. We organise labs that are integrated into the curriculum of the productdesign department of campus C-mine in Genk. In the labs the design researchers and students experiment with local available resources. In the Circle Sector studio, we transform our design experiments into prototypes of circular products, services and systems. The prototypes act as props that represent a possible future of a circular economy. They can be used to experience and evaluate the potential impact of the circular economy. Mapping, experimenting and prototyping is an iterative process that involves local companies, policy makers, experts, citizens around the campus C-mine of the LUCA School Of Arts in Genk.

3.1 Mapping

Our process starts with mapping materials that can be found in and around the city of Genk. Like a chef who challenges himself to only work with local ingredients we start by looking for locally available resources that we can use for designing circular products, services or systems. The mapping process follows a bottom up and qualitative approach. By visiting local industries, interviewing the employees and translating that documentation into a narrative we aim to tell stories about opportunities and challenges of available resources.

One of our mapping exercises focused on a plastic recycling system within the region. Single use packaging is sorted by citizens, collected by waste management services and processed by a local recycling firm. The plastic waste is a mix of various plastics that are transformed into a granulate. The granulate is melted to make public furniture like picnic benches. It is promoted as an example of circular economy. However, the recycling process also has its limitations. When different types of plastics are mixed, the quality of the material downgrades. The colour palette of the recycled granulate is limited to different shades of grey. The volume of single use plastics is growing exponentially resulting in an overstock of recycled plastic granulate. Should we design more solutions using the recycled plastics or question the way we use and perceive them? Plastic as a material is quite sustainable; it lasts for several hundred years and can be remelted to make new products. But we use it in an unsustainable way for single purpose products like packaging. The relationship between material properties and how we use them needs to be considered when designing new systems for circular economy. These insights provided the base for the CS Lab 'plastic systems'. Where our design students explored alternatives to recycling plastics.

A challenge in drawing together new relationships on a regional scale is creating an inspiring storyline that includes the perspective of the participating partners. We are still learning appropriate storytelling strategies from journalists, photographers and video makers. But we see this a crucial skill to make new connections between industry, policy and citizens. Stories can be documented and shared. Important qualities in generating a collaborative culture around circular economy.



Figure 1. Recycled plastic benches by Eco-Oh!

3.2 Experimenting

The next step in the Circle Sector proces is experimenting with materials from the Circle Sector archive to unlock their potential. To do this, we organise labs together with industry around specific topics like colour, plastic, algae, …. In each lab we try to involve expertise from industry, science and policy. Together with the parters a state of the art design challenge is formulated.

Recently we organised the Circle Sector Colour Lab where we experimented with coloring processes based on agriculture waste streams. The agricultural region around (City name) is focused on fruit production. About 20% of the apples and pears are labeled unfit for consumption. During the lab we extracted pigments from the fruit and used them to dye natural textiles. The experiments we conducted propose an alternative to the chemical colouring processes of the textile industry. The experiments provide an opportunity to open up a dialogue about colour processes in the textile industry. We facilitated the dialogue by organising an exhibition around the colour lab topic. This also provides the students that participated in the lab a platform to share their experiments. One of the issues raised is the stability of the colour. The biological colouring processes can't 'fix' colours, so they degrade when they are used and washed. This is seen as a problem form industrial textile production. Based on the results of the Colour lab we argue that degrading of colour over time could also be seen as a quality.

The Circle Sector labs aims to highlight the possibilities of locally available resources. By presenting them in a different context to the public, industry and policy it creates new opportunities for collaboration.



Figure 2. T-shirt made from bio cotton dyed with pigments made from food waste. Design by Karel Op t Eynde, picture by Anke Van Asbroeck.

3.3 Prototyping

The experiments created in the lab create opportunities for setting up new pilot projects. Custom Territory is such a project that originated in the Circle sector Lab. It is an ongoing research project focused on reimagining fixed roles within the sneaker industry; designers, producers and consumers. With the support of a design researcher and art director the project evolved into a research and design project in collaboration with a local shoe production company Ambiorix and fashion incubator MOOI.

Custom Territory is a collective of shoemakers, designers and wearers that aims to decentralize the global sneaker industry into local territories where boundaries between designing, making and wearing can blur. In collaboration with local actors CUSTOM TERRITORY transforms locally available resources into custom creations to generate a contextual design language. Each territory represents a different city and develops into its own aesthetic. Through this process Custom Territory draws Retake-Remake-Reuse patterns that reconnects materials, expertise and infrastructure.

Custom Territory proposes a decentralized production model for the shoe industry that is focused on repairing resources rather than then turning them into waste. It aims to be the first step in facilitating a transition from a linear towards a circular sneaker industry by showing how it could work.



Figure 3. Custom Territory prototype made from local available resources. Picture by Laurens Thys.

4. Discussion

We framed our research in the following question; What role can designers play in facilitating a transition from a linear towards a circular economy? We differentiate ourselves from the problem solving perspective (Cross, 2000) by embracing a critical attitude (Dunne & Raby, 2007). We argue that our added value is that we can make circular futures tangible (Margolin, 2007) in order to assess together with local stakeholders if they are possible, plausible, probable or preferable.

Adopting a critical attitude by posing questions rather than proposing solutions

The mapping exercises helped to make available resources visible, connect them and understand the system of which they are a part. They also made it possible to explore the challenges and opportunities of using local resources in a specific area. Our mapping exercise of the plastic recycling industry revealed several challenges; such as the limitations of the recycling industry. The mapping strategy requires a critical attitude, like an investigative journalist who researches the complexity of a specific issue. Storytelling is important to share the story of a specific issue.

Drawing together new relationships between industry, policy and citizens

By experimenting with locally available resources and documenting experiments the potential of a local circular economy can be made tangible. In the CS Colour Lab where we extracted colour pigments from fruit waste and applied them to textiles it brought together an agricultural sector with the textile industry. The experiments developed by our design students made that connection tangible. Although they are by no means ready for industrial production they do open up a new conversation between partners that never talk to one another. These results were also exhibited to spark a dialogue with the public about the potential of biologic colouring processes. Drawing together relationships requires designers to zoom in and out between a system perspective and hands on experimentation.

Making possible futures tangible to explore their potential

We argued that making the vision of a circular economy tangible is crucial to facilitate the transition towards it. We applied this in our Custom Territory project. In this project we developed a workshop format which provided participants a temporary stage where participants can explore and practice their role in a circular system. Custom Territory has been shown at several cultural institutions and events. It helped to open a dialogue with several actors about the potential of a distributed production system for the shoe industry. However the true challenge of this and other projects is to move beyond the prototype and integrate it within the industry. The prototype is the first step. We now have to develop new strategies to test the Custom Territory ideas in an industrial and commercial context.

Future Challenge: how to make the Circle Sector project sustainable?

Circle Sector started as a project in 2018, it is too soon to evaluate if it contributed to a cultural change in the city of Genk. Our biggest accomplishment so far is the integration of the Circle Sector in the culture of our own organization. Circle Sector is now part of our design curriculum and research agenda. Circle Sector creates a context where design students can explore their role in a circular economy together with local partners. To ensure the continuation of the Circle Sector project we have to overcome several challenges. We have to look for funding from both industry and policy, Without losing our critical position between industry, policy and society. This will require other strategies that help to integrate the principles of the circular economy in the culture of an organization, a political agenda or business model of a company.

5. Conclusion

Besides overcoming technical barriers, a transition from a linear towards circular economy requires a cultural shift in the role designers, policy makers, citizens and industry leaders play. If designers want to facilitate this transition they need appropriate design strategies that move beyond the problem solving perspective. In the context of the Circle Sector project we explored mapping, experimentation and prototyping strategies. We suggest that designers; adopt a critical attitude by posing questions rather than proposing solutions, learn how to draw together new relationships between industry, policy and citizens and develop skills to make possible futures tangible with the goal of exploring their potential together with local actors. These strategies help to discuss and experience the potential of a circular economy. Strategies for embedding the principles of a circular economy in the culture of an organization, a political agenda or business model of a company still need to be explored.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Cooperatives enterprise, incubators for the co-design of a new organizational and management model for sustainable development.

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Abstract | In the global economic context, cooperative enterprises have a considerable impact, with approximately one billion people worldwide estimated to be members of cooperatives (ICA e International Cooperative Alliance, 2015). In the historical evolution of the cooperative enterprise, they were born progressively, different typologies according to the most emerging collective problems (Depedri & Turri, 2015). However, the profound changes in the socio-economic context have expanded the emerging social needs, resulting in greater complexity that has challenged the established resilience of cooperatives. This complexity has led to the creation of a study based on the approach of Systemic Design (SD). Thanks to the primary tool of SD, the Holistic Diagnosis (HD), is possible to determine the current scenario and its complexity. The first phase of analysis of the context of reference is viewed from multiple points of view, such as economy, society, demography, and culture to identify strengths. With this background, the aim of this study is to define the first basis to design a new organizational model for social cooperatives, in the Italian context, to face the actual fluid situation. Specifically, the study highlights the cooperatives hidden potentialities to improve the structure of the organization and provide effective answers within the economic context. The HD is the first step to develop new organizational model for cooperative enterprises to be replicated on similar business models. To reach this goal a literature review is settle to highlight the actual gaps and a case study is analyzed in depth in order to obtain original data and validate the first hypothesis.

KEYWORDS | SOCIAL COOPERATIVES, HOLISTIC ANALYSIS, ALTERNATIVE APPROACHES, SYSTEMIC DESIGN

Introduction

In Europe, the term social enterprise refers to those enterprises defined as organisations whose mission is to produce goods and services to meet the needs of local communities, social groups and people, sometimes in fragile conditions. In every European region, these enterprises have different definitions and frameworks, some studies have investigated the birth and development of this type of enterprise (Borzaga & Santuari, 1999; Barr, 1992). However, the main reasons behind the birth of social enterprises can be identified in:

- market crises due to the lack of homogeneity of information between producers and consumers; social enterprises offer an alternative to government-led interventions by creating a more socially embedded, equitable economy (Ridley-Duff & Bull, 2015).
- inability of the welfare state to meet the needs of public services; social enterprises sell or offer social services, programs, and/or products to fulfil human needs, by addressing the social problems that humans face (Rasheda, 2019).
- Individuals and/or groups of people who take actions to meet their ethical, ideological or religious aims (Hansmann, 1980; Weisbrod-,1975; Costa,2012).

The distinction between social enterprise and social cooperative has been the subject of different studies (Defourny, Nyssens & Brolis 2018; Linzalone, 2013; Chell, Nicolopoulou & Karataş-Özkan, 2010). The International Cooperative Alliance (ICA), whose task is to promote and strengthen autonomous cooperatives around the world, has come up against the difficulty of defining uniquely the form of the cooperative so as to reconcile all experiences on a global level (Vella, 2010).The first univocal definition was profiled at the 1996 Manchester Congress with the following description: "an autonomous association of people who come together voluntarily to meet their economic, social and cultural needs and aspirations through the creation of a jointly owned, democratically controlled enterprise". At the legislative level, cooperatives have been officially recognized in the European Union by Article 48 of the *Trattato di Roma*, which defined them as a specific type of "company". From this moment on, each member state has designed regulatory frameworks to protect the interests of members and third parties.

Among all the member states, Italy was the first to create *ad hoc* legislation to regulate this type of enterprise (Kerlin, 2006). With the law n.381/1991 art.7, the Italian normative defined social cooperatives as non-profit entities subject to an advantageous tax regime with the aim of "pursuing the general interest of the community to the human promotion and social integration of citizens". More in detail, Law 381/1991 distinguishes three types of social cooperatives: 1) Type A social cooperatives dealing with the management of social and health services, education, and cultural activities; 2) type B social cooperatives, which have the objective of introducing "disadvantaged individuals" into the world of work (at least the 30% of the cooperative's workers); 3) Type C social cooperatives represent a category made up of consortia of social cooperatives. The consortia may have different characteristics, of mutuality, territorial, cross-sector and experimentation for activities in new cooperative sectors (Borzaga, 1996; Borzaga & Janes, 2011).

In general, in Italy social cooperatives, even if they are not the predominant form of enterprise, still play an important role within the national economic context. According to the Euricse (European Research Institute on Cooperatives and Social Enterprises) report which examines both sectoral differences and the economic situation in national context, the number of social cooperatives in Italy is about 14,000 Although the Euricse survey is among the most accurate, it remains difficult to make a clear distinction between type A and type B cooperatives. However, to date, the Italian National Institute of Statistics (ISTAT) remains the main source for making historical comparisons between data, to frame with growth percentages, the phenomenon of social cooperatives in Italy, for example, referring to ISTAT data we know that in 2015 working cooperatives and social cooperatives had generate the most value added of whole cooperative sector equal to 73%. The strong growth of social cooperatives is partly due to legal regulation and partly to the growing demand for welfare services both from the community and from the individual founders of social enterprises (Galera & Borzaga, 2009). In this regard, to correctly frame the flowering of these enterprises it is important to underline how towards the end of the twentieth century in Italy there was a crisis of the welfare state that had become inefficient and state centred. In this period of economic and social crisis, cooperative enterprises began to flourish. Thanks to their social mission, cooperatives became the answer to market and government failures, which were mainly due to budget cuts that led to an increase in unemployment with a subsequent growing economic disparity and an increase in people at risk of poverty and social exclusion (Riva & Garavaglia, 2016). In this context, the strength of cooperatives lies in their ability to promote an alternative model of growth and development to that commonly adopted by for-profit companies. The alternative model translates into the creation of opportunities for economic and social inclusion and the ability to adapt political decisions to the interests and values of stakeholders (Linzalone & Lerro, 2014; Kerlin 2006). Moreover, there is a large part of the literature that has highlighted the factors related to the resilience of social cooperatives (Cecop-Cicopa Europe, 2010; Euricse, 2015; Depedri, 2010). The human capital, among other factors, is a key element for the success of social enterprises. Indeed, much research has shown that workers in social cooperatives show greater commitment and loyalty. These elements translate into lower turnover but an high organizational effectiveness and productivity (Carpita & Golia S., 2012; Becchetti, Castriota & Tortia , 2013). In recent years, in order to withstand competition in the market with other types of companies, there has been increasing diversification within social cooperatives, which contributes to the development of multidisciplinary in terms of both professionalism and services offered (Euricse, 2015). On one hand, this multidisciplinary has contributed to increasing the resilience of cooperatives in the economic context, making them capable of facing and resisting the current economic crisis; on the other hand, a more varied composition, and a continuous drive for innovation in the organization flows allow a better adaptation to the social changes underway. Moreover, the merging capacity, the strengthening and renewal of the supply chains have contributed to increase productivity and competitiveness in this sector. In agreement with Shaw E. and Carter S. (2007) we can state that social cooperatives have been identified as an innovative model to address

emerging socio-economic needs. However, despite the positive aspects, some research and studies also explain the difficulties that social cooperatives have had to face in the process of affirmation (Linzalone & Lerro, 2014; Thomas, 2004). Nevertheless, type B social cooperatives enjoy an advantageous tax regime, the outsourcing of public social services from social enterprises and the reduction of their budget are threatening the prosperity of cooperatives. Some studies have identified as major problems perceived by cooperatives: (i) the difficulty of opening to the market and becoming more independent from the public sector; (ii) the decrease in public procurement contracts by public authorities contributes to increased competition on cost-effectiveness by forcing cooperatives out of the market; (iii) the difficulty of obtaining financing and late payments by clients (Euricse, 2014; Riva & Garavaglia , 2016). Although in the past, social cooperatives have been fully able to respond to social needs, in the current context characterized by a strong complexity and also by a progressive reduction of resources, they are increasingly called upon to respond to new and particular needs (Linzalone & Lerro A., 2014; Depedri & Turri, 2015).
In this framework, the present paper aims to study the current situation of Italian cooperatives not only in terms of growth and in terms of development, as already discussed in the literature through statistical, qualitative and quantitative studies. Rather, we want to investigate in deeper the internal organization and the problems related to the management of human and material resources. To this purpose, we will use the Systemic Design (SD) approach, an alternative business and design model able to provide interconnected solutions to the typical complexity of current situations, without neglecting social, environmental, and economic contexts. The analysis is strengthened from a real case study, a cooperative in Northern Italy, in order to work with primary and original data, like the historical evolution, the sectors of activity, the internal structure and the organizational flows of the work, and so on. The first step in the SD methodology is the Holistic Diagnosis (HD) to map the current scenario in all its complexity. Since the HD requires a deep level of detail, we decided to start with a single case study to use it as a reference to develop the analysis of other comparative case studies in the future, especially outside of Italy in order to have a more European scenario. The result that the study wants to achieve is to understand what are the critical issues in the current organizational model of the social cooperative, with respect to the new needs of the economic and social context. Once the criticalities of the current model and the needs of the reference context have been identified, we will proceed with the SD methodology in order to design a new model of social enterprise organization that can be replicated also on other similar realities. A fundamental aspect is also to facilitate the birth of new synergies that can involve not only public administrations but also private subjects, single citizens, or companies. The limits of the research are mainly related to the difficulty of finding all the data necessary to carry out an accurate mapping of the cooperative under examination. In fact, the cooperative in question has been in business for 30 years and has gone through many different phases that have brought with them changes in human resources and activities. In addition, there is another difficulty in obtaining information on the organisational flows of the work due to defined but not so rigidly defined roles within the cooperative as in a for-profit company, which makes the

changeover and maintenance of information more dispersive. However, we feel that by applying the SD methodology we could make a significant contribution in the innovating sector. We aim to increase knowledge about social cooperatives as an innovative business model aimed at meeting the emerging needs of today's society and to develop a new organizational strategy that meets both economic growth and workers' needs.

Method

For many years, there has been a concern to understand the growth of social cooperatives and their development in different territories. Some research has adopted qualitative methods to explore the co-evolution of social enterprises and the welfare state in Italy (Testi, Bellucci & Biggeri, 2017; Corbie, 2012). Different methods have been proposed to assess the economic benefits that these enterprises are able to achieve (Kohonen, 2012; Arogyaswamy ,2017; Cordes , 2017; Gordon, Wilson & Tonner , 2018). However, given the strong growth and development of social cooperatives and because of the difficulty in finding financing for their activities, impact assessment has become a much more discussed topic in recent years. In fact, quantitatively assessing the social impact of a cooperative can serve both the financiers, as a basis for evaluation, and the social enterprises themselves, to understand if their work is working and if it meets its objectives. The literature has developed a lot on this issue, applying different methodologies, for example, the activities and outputs created (i.e. jobs, tangible products, cost reduction…) have been examined and evaluated as main indicators of benefit delivery or results (Olsen & Galimidi, 2009). Then there are approaches such as Social Return on Investment (SROI) and Blended Value Accounting that seek to combine financial value with social value to define a single parameter that represents the company as a whole (Kroeger & Weber , 2015). Therefore, we want to try to go beyond the evaluation of the most easily measurable or immediate results (Arogyaswamy, 2017), because these types of evaluation have a big limit in the field of social cooperatives, and especially type B social cooperatives: it is not always possible to give back the results of an activity in monetary terms. For example, the inclusion of a disadvantaged person in the labour market can be evaluated in economic terms as a monetary amount saved to the state for the economic support of that individual. However, being able to assess how long the individual will remain in the labour market or whether or not he or she will have negative effects is not taken into account. In relation to this, it is therefore useful to ask whether it is no longer necessary for type B social cooperatives to talk about social impact monitoring rather than evaluation.

According to what has been described, in the current framework of cooperative enterprises there is a fair degree of complexity both in terms of what to assess and how best to assess it. The aim of the paper is to investigate through SD the complexity of the relationships between the company, the workers and the results achieved, finally defining a new system based on social, environmental and economic sustainability. The SD is an alternative design approach able to provide interconnected solutions to the complexity that characterizes the current situations, including in this process also the economic, social, and environmental contexts (Battistoni, Giraldo Nohra & Barbero, 2019). For our study and for the promotion of

an even stronger social cohesion and flourishing of local economies, the SD intervenes with the HD. The HD is an analysis process that determines the context of the system, considering both the quantitative and qualitative characteristics of the scenario under examination. Through the data collected through HD, problems and levers for change are identified. The next step will then be to define guidelines for co-designing a new system whose results are accessible and understandable to all stakeholders.
The HD, applied to our case study, is divided into two steps: the first involves in-depth analysis of the cooperative's internal relations and its operational context; the second is divided into top-down and bottom-up analysis to map the relationships with the entire value chain. Initially, we proceed to analyse the current organizational forms of workflows and the policies in place, the basic activities in the cooperative's sectors of reference and, finally, we identify all the potentialities that can be stimulated to promote sustainable development.

Specifically, phase 1:

We analyse the cooperative enterprise from its birth and historical evolution, then we examine the organizational structure from multiple points of view: workers' composition by age, cultural and economic dimension, scope of intervention. The data are collected directly at source thanks to the collaboration with the cooperative under examination and with its members. The information collected shows that the co-operative has most workers with fixed-term contracts and the majority are of Italian nationality; in fact, only 13% of the workers are of foreign origin (Fig.1). The average age of the workers is quite high, more than half of them are over 50 years old, and this factor has been identified as an influential aspect in the cooperative's capacity for growth and development. Having an older workforce implies greater difficulties in implementing internal changes especially about the digitalisation of processes and the transfer of knowledge. Most of the workforce is male, but this is due to the types of work carried out which often require greater physical strength but in no way attributable to discriminatory issues (Fig.2). In this context, the most important factor is the type of people the co-operative hires to fulfil its social mission. A 30% of the workers fall into the category of "socially disadvantaged people", which according to Italian law includes ex-prisoners, ex-alcoholics, and people with past drug addictions or in recovery, people with physical and mental disabilities. A peculiarity of the co-operative in question with respect to other co-operatives of the same type is that it chooses among disadvantaged people those who do not have any kind of work experience. In this framework, it is necessary to point out how much the social mission can influence and, in some ways, slow down the development of the organisation. Often these people are trained with the aim of making them acquire knowledge and skills useful for the job, but very often, they cannot sustain career transitions to roles that require responsibility. For the initial phase of historical analysis, interviews were carried out with the president of the cooperative and with the older members. For the organizational flows, information was collected through interviews with the department managers (Gardeners, Cemeteries, Selected waste collection) and took part in the weekly meetings in which the problems faced during the week were brought out. In this way, the designer has an immediate feedback on the validity of the data.

Once phase 1 is finished, it is necessary to frame the potentialities for the development and change of the cooperative and to do so it is essential to move on to phase 2: top-down and bottom-up analysis. In this phase, we proceed to map all the relationships with the stakeholders involved to identify the strengths and weaknesses on which to work together. HD requires a high degree of detail, fundamental to map and understand the intrinsic complexity of the study context. According to the HD results an high dependence from public institutions emerged, tangled relations with employment office for workers recruitment and internal resistance to change especially in the management sector.

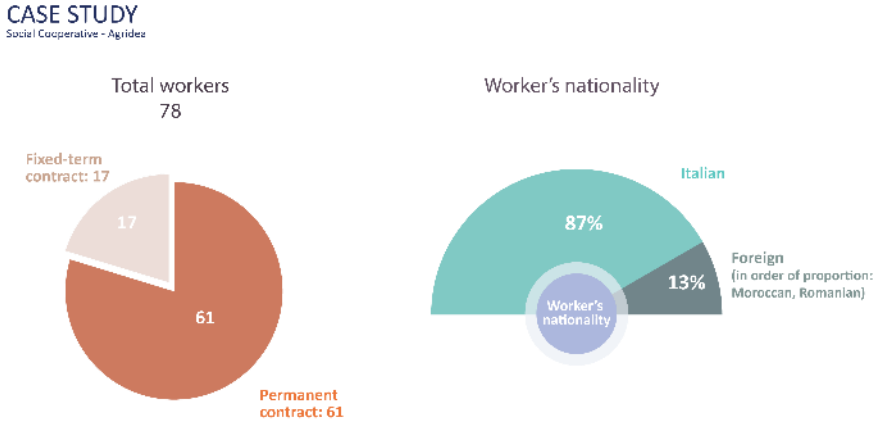

Fig. 1 type of contract and workforce nationality

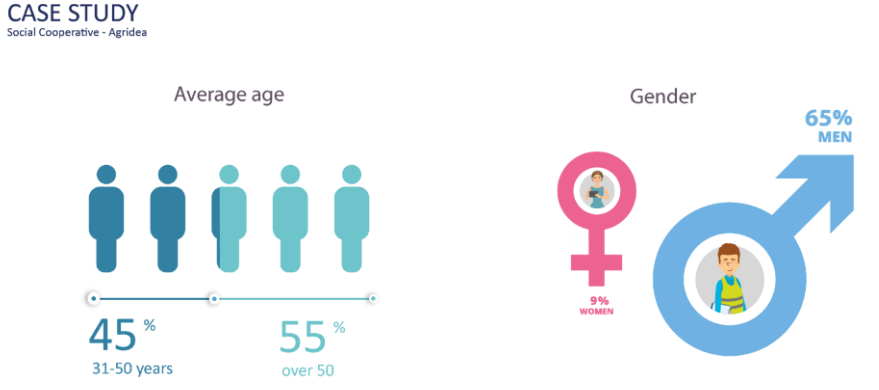

Fig.2 Workforce composition

Case Study

The type B social cooperative, Agridea is based in Turin. It was founded in 1992, following the publication of Law 381 of 1991, as a spin-off of another social cooperative called Stranidea. The initial sector of activity concerned the management and maintenance of green areas and there were five social workers in total. In 1993, the management of cemetery services was included, and so the second sector of activity was born. However, the first important development was in 1995 when Agridea was entrusted by the city of Turin with the management of urban green areas with a 2-year contract. Thanks to this first contract, the cooperative can obtain loans that it will use to buy the necessary equipment and to train its workers after this first big leap, the intention to create a more structured organization begins to manifest itself. In 2005, in collaboration with a Consortium, Agridea started to test the separated waste collection from the markets. The cooperative has grown significantly; to date it has about 70 workers and dependent members of which 30% are disadvantaged, as required by legal regulations. The governance model adopted by the cooperative is a traditional one, i.e. there is a board of directors, in this case represented by the president, vice-president and director, and a Board of Statutory Auditors, which supervises the work of the administrative body. The analysis of the organisational structure has shown that Agridea adopts a hierarchical model, which today is found almost exclusively in companies of minimum size. This model is functional thanks to the speed of transmission of orders and the transparency and clarity of relations. However, this organisation makes difficult the specialisation and the creation of “key roles".

Results and discussion

The growth of social cooperatives throughout Europe has gone hand in hand with the evolution of social problems. In Italy, too, this phenomenon has triggered a growing development of this type of enterprise. The SD approach with HD, promotes a multidisciplinary approach that brings together different stakeholders from different levels of the cooperative (managerial, operational, collaborative contacts with external bodies...) and provides the starting point to establish an innovative co-design. From the first part of the HD emerged a strong ability of Agridea to reinvent and develop itself in a quite autonomous way. In fact, since the birth of Agridea (1992), analysing its historical evolution, two years of economic loss have emerged, one in 2006 and one in 2010. The losses have always been absorbed in a maximum of two years and all sectors of activity have been maintained. This fact can be summed up in a good ability on the part of the management sector to manage difficult situations and to be able to recover. At the same time, we point out that in both years of crisis, all the workers remained in Agridea, no one resigned or was dismissed, a factor that shows a strong link on the part of the employees with the cooperative reality, which in turn contributes to strengthening the resilience of the cooperative. Another aspect that emerges is Agridea's willingness and ability to structure its

office staff in a more hierarchical way and with better defined roles, in the last few years this has improved the difficulties in managing the three sectors of activity: gardeners, cemeteries an selected waste collection. While on the one hand the hierarchical approach allowed a better management of tasks and work, on the other hand it contributed to a centralisation of responsibilities especially in the sector heads. This has led the co-operative to have a strong dependence on the people who incorporate these roles and who have become "indispensable" for the proper functioning of the whole organisation. Initially, what appeared to be an already consolidated organisation, HD brought to light the most hidden criticalities (Fig.3). When looking in detail at the organisation of a single sector, critical points emerged in the various areas. For example, the sector leaders must deal with the management system and the preparation of the daily programme according to the work to be carried out. The management system requires digital skills, which the managers have acquired through training. This training has not been extended to other workers who could potentially replace the current sector managers, so the co-operative does not currently have people capable of replacing the current managers in office tasks. This leads to two others closely related problems, a managerial culture, which is not encouraged and unilateral substitutability, i.e. the heads can fill in the gaps in the operational area, but the opposite is not possible. The head of each sector must interface with the administrative area for customers and suppliers, which constitutes an additional burden of tasks for the sector heads who, especially at certain times, e.g. holiday periods, monthly closures of activities in terms of budget, have an overload of tasks to perform that sometimes forces them to stay beyond the 8-hours working time. Finally, from the analysis of the production area and therefore, of the management of the workers, a strong operational-strategic dependence between the teams of workers and the sector manager emerged. There is a lack of intermediate responsibilities among workers who are unable or unwilling to take responsibility for operational and organisational choices even when they would be able to support them thanks to previous experience. Moreover, there is no horizontal mobility between sectors, although it could be activated in some tasks.

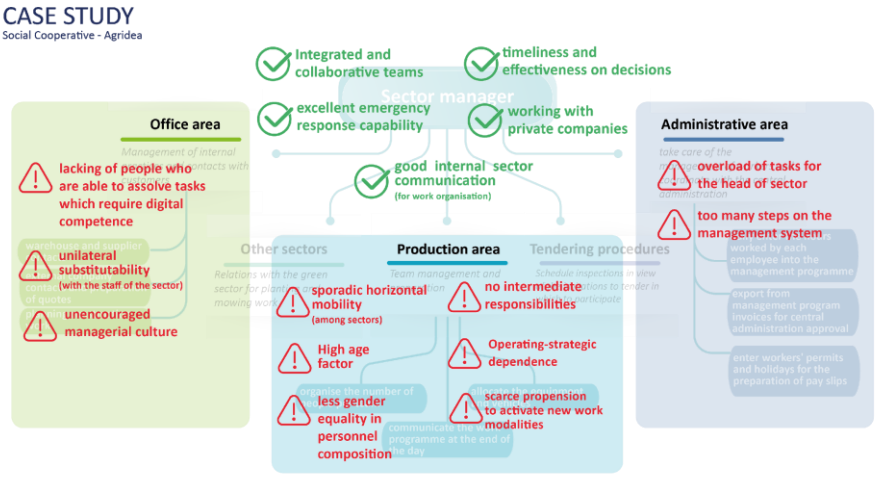

Fig.3 Criticalities and potentialities of a sector

Among the positive aspects that emerged, there is certainly good internal communication between sectors and efficient timing in making decisions, especially in response to work emergencies.

The teams are integrated and collaborative in two sectors (gardeners and cemeteries) while the sector of selected waste collection sometimes suffers from conflicts between workers. Furthermore, among the critical aspects that emerged between the first and second phases of the analysis, there are the difficulties in communicating changes and their acceptance. Communications between the sector managers and the workers are quite efficient but there is resistance for some subjects, especially in monitoring the proposed changes at organisation and management level. Interviews with the president and the workers' members showed that of the three sectors, the selected waste collection is the one that has had the lowest growth and for which there has been no news for many years. At the organisational level, there has been a strong propensity to solve problems in the immediate future, probably thanks to the solid experience of 30 years of work. At the same time, an inability to plan solutions to problems that are repeated cyclically (i.e. at seasonal level or annual) has also emerged. This may be partly due to have mostly works through tenders with variable durations: it is difficult to apply a method for solving problems that there is no certainty of having to deal with those problems again. Based on these assumptions, we decided to deal with the transmission of information as a first step to be able to implement organisational changes in the future. Given the nature of the company and its workers, it is indispensable that all the workers of the cooperative are aware of the processes active in the organisation of work, in this way it is possible to raise awareness towards the assumption of greater responsibility and collaboration.

In this perspective, an active training course was started which involved a first group of 30 people. At the end of the training, we expect to be able to identify among the workers those

who have shown greater predisposition in assuming roles of responsibility and who are evaluated by colleagues as reliable. The final intent will be to implement changes in the cooperative not only as regards the organization chart but also in the management of workflows. Moreover, the organizational changes should come through a co-design process within the workers.

Conclusion

The paper analysed through the methodology of SD the case study of the type B social cooperative, Agridea, in order to have some preliminary data and reflection on how the organizational model could be more effective in this times. The intent of mapping the growing complexity in the economic and social context that cooperative enterprises must face is to design a new organizational model concerning both the internal structure and therefore the roles and responsibilities of employees and external activities. With the new model, the aim is to develop new supply chains and new synergies, able to make the cooperative strong and resilient in the territory and in the context of action. This new type of social enterprise will be able to contribute to the development of new local economies, and the social impact will be greater as the relationships and actions undertaken increase. Above all, not only an innovative organizational model will be valuable outcomes of this research, but also the way in which this will be designed. This study aims to be the first step in the development of a project that will lead the Agridea cooperative to concretely implement the new model of organization. In addition, the paper contributes to the scientific literature by providing a deeper knowledge on the needs that social cooperatives must diversify within the national economic context. Moreover, it wants to contribute to the development of a more sustainable cooperative economy with full respect for the social mission.

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Acknowledgements: We thank the constructive comment of the reviewers. A special thank goes to the Social Cooperative Agridea as the first case study of the research project and for its willingness in data collection**.**

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Craft Your Future: Building a circular space through the European digital craft

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Abstract | Within the framework of the Erasmus + KA2 Strategic Partnership in Vocational Education & Training program, the Craft your future project is being carried out. The aim is to show the result of three years of work in the regions of three countries as a Case study. At this time, we are evaluating the impact and disseminating the achievements. We already have interesting evaluations to share in this congress. The Craft Your Future project unites educational institutions, students, local authorities, creative centres and (social) businesses in creating a strategy that help regions use intangible cultural heritage to increase their attractiveness, boost local economies and build a future based on regional resources. The Craft Your Future strategy is founded on the vision that young people are the source of tomorrow's economy and therefor need to be in the lead in designing future strategies. Developing students' leadership competences, pro-activeness and entrepreneurial mind-set will steer change and innovation.

KEYWORDS | CULTURAL HERITAGE, CRAFTMANSHIP, DIGITAL TECHNOLOGIES, SUSTAINABILITY SHAPE OUR IDENTITIES AND LIVES, CIRCULAR ECONOMY

1. Theoretical framework

One of the most detailed difficulties in time that perhaps best describes craftsmanship is that of a *"careful, deliberate planning, skill and execution process in which a consistent relationship between the artist and the object occurs"* (Oxman, 2007). In this process, the object and tools are not clearly defined, but rather inform a gradual process of searching for forms. If you added this description the concept of Pye on manual work, in the *"quality of the result is not determined, but depends on the judgment, skill and care that the creator exerts while working"* (Pye, 1968), we will see that the technological factor not determined to the craft but that participates in the relation between who designs and the own object that constructs.

It is true that we are not aware of the benefit of handicrafts both in terms of the possibilities of obtaining short series, unique pieces and even restoring existing artifacts or objects, as well as in the benefit of the community, as much more sustainable manufacturing units, circular and close than the industry represents. To these productive and economic factors, the cultural ones are joined, because we have a heritage that many times, we do not know yet having had a real and important presence in our regions.

In this sense, UNESCO will tell us that any effort to safeguard traditional handicrafts should focus not on the preservation of handicraft objects, however beautiful, precious, rare or important they may be. In this sense, the creation of conditions that encourage artisans to continue producing handicrafts of all kinds, and to transmit their skills and knowledge to others, is defined.

To give an example of what craftsmanship for the economy of a country still entails and the value it represents, just cite as in a country that historically suffered more the impact of industrialization than in others, it approximates 3.4 billion pounds in the UK, which represents 0'3 of the country's GDP. But at this point, what does craftsmanship mean to our young people, how do they perceive it and what future could they develop in that productive, economic and cultural context? Professors Martin Woolley and Amalia Sabiescu (2015), can give us an orientation or clue to this question when they talk about traditional and new skills around crafts. The first of these are the improvements that these new ones bring about the digital transformation, incorporated in the manual manufacturing process; the second is the promotional one, in its help both to commercialize and to make crafts known; the third is to register and disseminate knowledge and craft skills; and the fourth, the one used to transfer the skills and knowledge of manual manufacturing to new production contexts.

This leads us to assess these points of view from which we would have to reflect future reflections, which we will consider useful to establish a clear encounter between handicrafts, digital technology and the circular economy: one, the change of the business model around

the crafts; two, the use of technology itself, in which reflection revolves around its personal or collective incorporation, taking advantage of the emergence of maker or fablab spaces; three, the one that revolves around its social perspective and its impact on the community or region, with the collaborative results that can be developed; and four, how can this implementation of the so-called digital crafts be carried out, with what resources to count and the interests that may be taking place in each case.

Several authors come to interpret and define digital crafts, as a new way of making crafts that uses these processes and technologies to develop their proposals (Shillito, 2013), which not only depends on the usual or accredited craftsman, but on other professionals with guidance creative (architects, designers) or technicians (engineers, makers), but whose goal is to solve unique 'artifacts' or very short series. Other cases, understand that the main craft trade today goes through digital specialization, and that these experts 'non-craftsmen' are the new digital artisans (Jabi, 2013), the result of interdisciplinary education. Close to that principle, the concept of personal manufacturing, somehow identifies that idea of taking advantage of digital manufacturing spaces where that tactile counterpoint is provided, to that of the digital environment (only based on computers and images) as Negroponte reflected at the time (1995) and specified Gershenfeld (2005). Doyle (2016) proposes the idea that digital craftsmanship comes from computational thinking, digital manufacturing and robot construction, separating it from traditional craftsmanship by appropriating their meanings (related to inherent materialization). Authors like Carpo (2012) argue that the digital world does not have to be seen as an alternative or a substitution to crafts, but as a complementary dimension, which has allowed architects, designers and engineers' greater freedom in the physical world.

Regarding this last vision, we understand that a new world of opportunities for artisans and creative opens up, by allowing technology to perform geometries and tasks that were previously impossible or more complex, to be able to combine materials, and all this in a simpler, faster way and economic in many cases (Martínez Torán et alt., 2012). Juan Carlos Santos (2011) defines this opportunity as techno-craftsmanship, to this progressive incorporation propitiated by digital manufacturing, and where the role of designers appears as fundamental. There are variables that bring us closer to a new mode of craftsmanship under the influence of digital transformation, such as the examples of customization that have been possible thanks to these digital manufacturing technologies. This customization represents that beginning of a closer relationship between production and digital consumption that allows the creation of unique designs based on user specifications. However, the design methods used in the creation of these forms are not yet sufficiently exploited given the potential that digital technology allows creating unique, hybrid and / or individually designed forms (Bunnell, 2004). On the other hand, the ability to produce customized products with moderate prices, predicts a paradigm shift of what has come to be called personal manufacturing. Each time the concept of *fabbing* is understood, applied and appreciated, while young (and not so young) entrepreneurs design their own shirts, print

bound volumes of their own written or illustrated work, or sell jewelry that they themselves have designed (Bell et al., 2010).



Figure 1. Spanish students from UPV at Craft Your Future training week Leewarden, Netherlands, October 2018.

Digital manufacturing has also transformed processes in the last twenty years, and has allowed the validation of the work of architects and designers through "research through manufacturing" (McCullough, 2015), and maker culture (DIY) is intervening through tools such as Arduino, robotics and electronics in this new model of crafts that incorporate other 'trades' when prototyping (create a digital model, 3D printing, programming, etc.). McCullough believes that digital manufacturing takes craftsmanship, especially the model configuration process, and the variations it makes with its creation. From the maker culture, it coincides in those aspects related to the selection of resources, the adjustments to the model and how it calibrates those details that allow solving the 'artifact' according to the chosen process.

Different initiatives of recent years, such as the Lab Craft (Craft Council) exhibition, have made it clear that the best work occurs when an artisan marries his skills (trade), aesthetic sensitivities and knowledge of the materials, with the possibilities of digital tools available today (Fraser, 2010).



Figure 2. Craft Your Future training week in Bulgaria. The week lasted from Monday 2nd to Friday 6th of September 2019. Students realised that the knowledge about crafts that is still very much alive in Bulgaria, combined with new digital techniques and preferably made of renewable raw materials is a source of inspiration for the design and manufacturing of new, future-proof products.

Within the project Craft Your Future we indicate that we want students to be in the lead. We do this based on the conviction that you can only really learn when the student takes control of his or her own learning process. As a basis for this we take the principle of work-based learning. In other words, we bring real time activities and real issues in education or let students look up real time issues and activities in order to come to learning from them. This does not happen by itself. As an educational institution, it is therefore necessary to make arrangements for collaboration in connection with the relevant network. We also call this 'organizing spontaneousness', a framework within which students can get down to work and ask to investigate. In this approach to work-based learning, we see reflection as the motor of learning. In it, reflection (before, during and after) should ensure that students make choices in learning and that learning becomes meaningful as John Dewey expressed it in his pedagogical vision (Woerkom, 2015). This specifically involves reflection as a systematic and critical process, aimed at acquiring knowledge and leading to action (Woerkom, 2015; Mittendorf, 2015). This process of reflection before, during and after leads to new actions and leads to self-regulation (Zimmerman, 2002). Self-regulation, however, is not something that students have or that arises by itself (Kostons, Donker, & Opdenakker, 2014). This requires concrete efforts of both students and teachers (Kostons, Donker, & Opdenakker, 2014; Katholieke Universiteit Leuven, 2016; Zimmerman, 2002) in building up self-regulation

skills. It is therefore a misconception that self-regulation can be expected directly from students or that self-regulation is synonymous with self-reliance (Luken, 2008). When lecturers expect students to adopt a self-regulatory approach, they will have to support and supervise a lot in this. This is the core and essence of the educational approach to be developed in Craft Your Future! To this end, not only the educational material will be developed, but also the regional network will be involved to make this method of self-regulation possible (freedom within frameworks). The 'introduction' of self-regulation in education therefore means that instructors will need to provide a great deal of support and guidance in order for students to take the lead. Instructors will have to get used to their new role, which is more coaching and focuses on the student rather than their subject (Lucassen, 2016). Important in promoting students' self-regulating skills is the use of hints (reflective questions) and modelling (Kostons, Donker, & Opdenakker, 2014; Katholieke Universiteit Leuven, 2016). Teachers can give these hints when they see the connection between the elements that are connected within Craft Your Future; i.e.: using craft principles through new techniques to realize a circular economy. After the teachers themselves had gone through the phases of self-regulation in an equivalent assignment and setting as the students, they really understood what self-regulation was and how they could apply it. This is what the educational approach within Craft Your Future provides for. The reflective questions designed in the model of self-regulation (Zimmerman, 2002) also help in practice to promote self-regulatory skills among students.



Figure 3. Craft Your Future training week Bulgaria, projects and presentations about the different cultures proposals.

Regarding the integration of these digital processes in education, manufacturing processes and digital "doing" are a new and important chapter in the processes of creativity, literacy and expression resources for children and young people in their training processes (Blikstein,

2013). Today, the range of accepted knowledge has expanded, to include not only programming, but also engineering and design (Astrachan, Hambrusch, Peckham, & Settle, 2009; Yasar & Landau, 2003).

Now fossil resources are getting scarcer there is more demand for waste material and renewable resources. In addition, the pollution impact of oil and other fossil-based materials has become more transparent that people are more active in looking for alternatives (Sumter, D.; Bakker, C. & Balkenende, R., 2018; Andrew, R. M., 2018).
Ellen Mc Arthur developed the model Circular Economy, a framework to change the economy from a use-and-through-away-system into one that can be restored a redesigned. Thinking this way demands a new approach for product designers.
Designing within this model aims to think about the biological systems using renewable resources and technical systems re-using existing material to use for production, consumption and end of use to create a waste-free future (Chamberlin, L.& Boks, C., 2018). Designers are challenged to approach this waste-free system in creating tangible products as intangible services to establish a sustainable cycle.

We live in a world where products are designed to be replaced as often as possible and not designed to last as long as possible. Due to marketing we are triggered to buy new products even sooner than the products' end to even hasten this process, quite the contrary to the crafts which are made to last.

Circular focuses on the resources of sustainability and stives to consider the entire lifespan of a product as a complete process (Mugge, R.A. 2017). Looking back to the crafts, we can learn a lot of craftsmen how they gained their resources and reused them. The role of cultural heritage including the stories of family ties and traditions, attached to the crafts products, gave people an identity and made people proud. This resulted in preserving these products carefully.

2. Work methodology

To start working on a project in which circular economy, craft and digital technology can be used. Students and teachers define a societal problem first that they would like to approach by the three subjects. These matters are from a sustainable perspective and affecting the direct region of the institutes. To work on the problem, the students' research what stakeholders are involved and use the Local Value Chain model by Eileen Blackmore to do this. The aim of this model is to map out all the activities concerning the societal matter, in order to look at where value can be added and benefits can be created at the same time. In addition, there is the circular value chain in which the principles slowing down, narrowing and closing of material flows are important added by social values to the value chain in which sustainability, society, quality of life and creative design power as important pillars. In this model the links in the production chain affects the effects on the environment and society and use the power of the region. The local value chain consists of a core, surrounded by 5 links and a core value at the output of each link. The values are; less waste, biodiversity, reduction of CO2 emissions, generating local knowledge and employment, new

revenue models and changing buying behavior. The product and system designer plays an important role in our model and has a connecting role between all links. Design is the discipline of generating solutions to problems and developing opportunities by "making" something. The designer was caused to make lasting change and improve the quality of life. Students and teachers learn how to redesign systems into sustainable systems, using the model as methodology and the three pillars of the project as approach, as well as an active engagement of the external stakeholders.

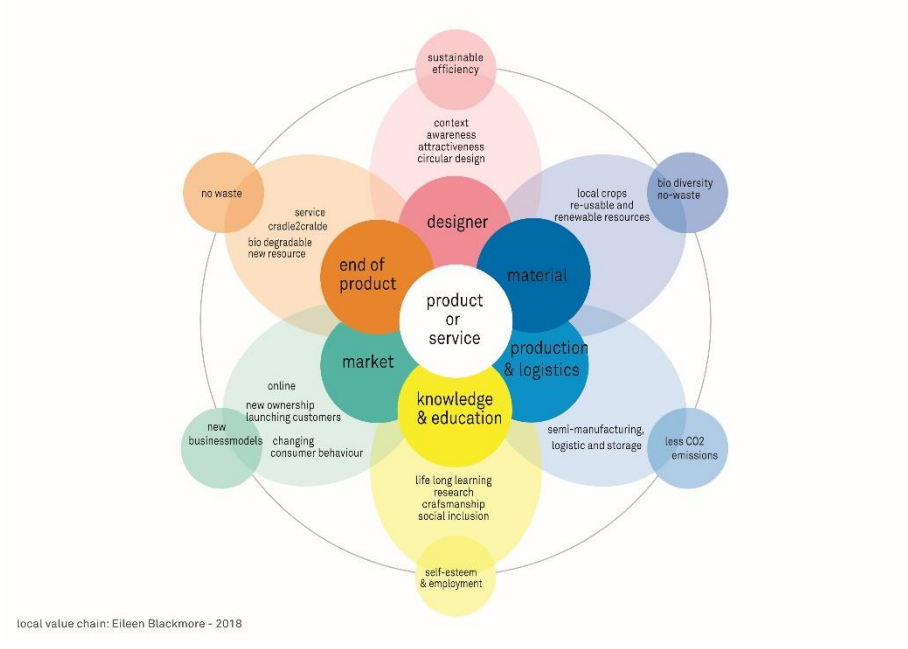


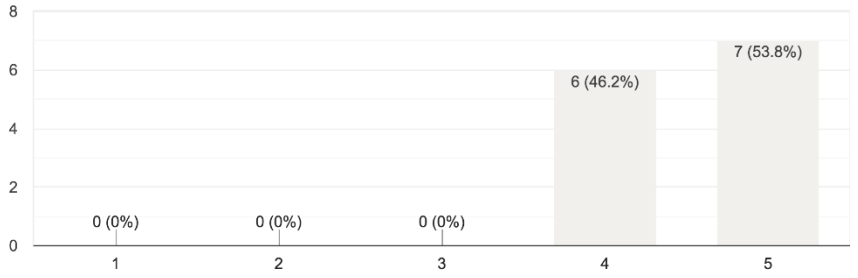
Figure 4. Local value chain by Eileen Blackmore (2018)

3. The results: First evaluated indicators of the Craft Your Future project

The project partners already evaluated the Leeuwarden meeting after the processing the data extracted by the responses of the young participants of the meeting, for which our partner of the Universitat Politècnica de València has taken responsibility. We can announce as a very satisfactory data that young people considered the knowledge they obtained about the traditions and crafts of the region as a very high (84.7%), and what is relevant for the EU, which can be assumed for their future (Craft your future).

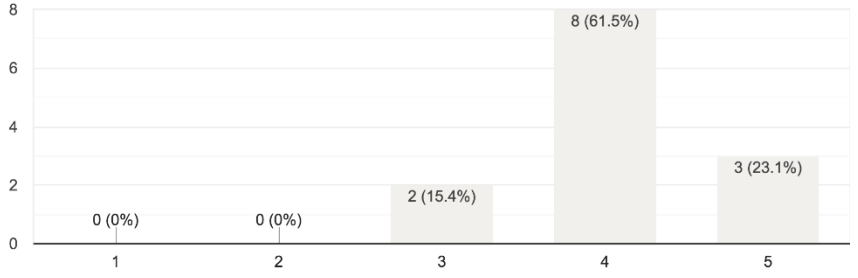
We can advance that among the most satisfactory data, young people considered the knowledge they obtained about the traditions and crafts of the region high-very high (84.7%), and what is relevant for the EU, which can be assumed for their future.

Table 1. Graph on the response that young people gave, after the first meeting of the project, to the importance of cultural heritage and crafts. (1 = Strongly disagree; 5 = Strongly agree)



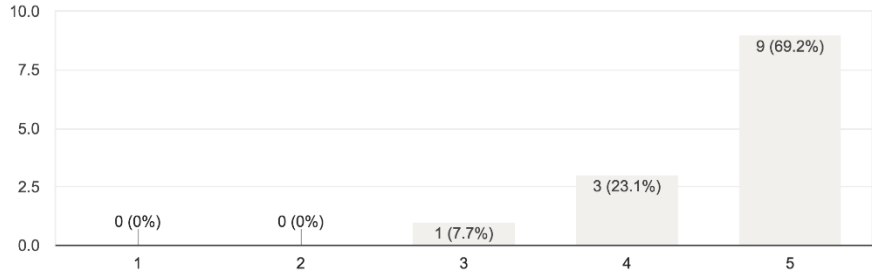
Regarding the effects and importance of the circular economy, a very similar result is also reproduced (84.6%).

Table 2. Students received examples of circular economy during the meeting held.



Regarding the interest and the possibilities of innovating through digital manufacturing technologies, the data is lower but with a high figure of 76%, although they consider it very important for them (also in 84.6)
Other relevant figures are the stimulus that has creatively meant for them to participate in the meeting (92.4%), and the relevance of being able to access spaces that enable this creativity (92.3%), as was the DLab.

Table 3. Students believe it is important to develop creativity and have meeting spaces that stimulate that creativity in the EU (fablabs, hackerspaces, creative hubs, etc.)



Regarding the meeting held in the Netherlands, the data reflects both satisfaction and the fulfilment of objectives in a very high order. 69.2% recognize that they can develop competencies around the project areas in a short-medium term and that this can influence at the labour level (77% would like to work in some of these lines in the future), and 53.8 believe the possibility that innovative projects can be developed around these three areas is very high.

Table 4. Young people believe that it is very possible to innovate through crafts, circular economy and digital technologies

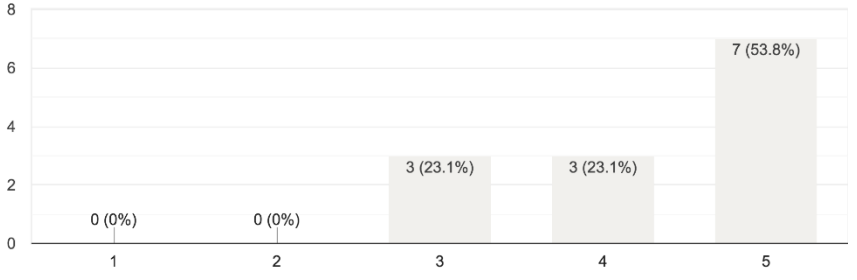
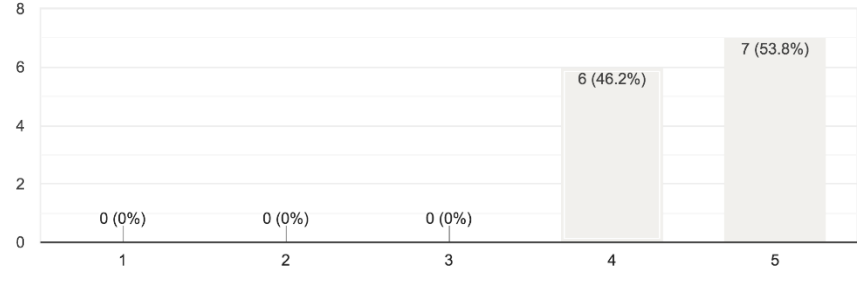


Table 5. For them, more initiatives that work on these areas in the EU would have to be developed



A 77% would be interested in deepening with more training in these areas and 69.3 believes that it would be necessary to have specific information on the Internet, 100% being those who believe it is necessary to develop more initiatives of this style in the EU. Almost 80% believe that teachers would have to provide them with more information in this field, and believe that their classmates would like to meet her (84.6%).

4. Conclusions

In this contribution, horizontal results such as management, evaluation and dissemination give rise, indirectly, to how the cooperation between the partners takes place; the development and the quality of the activities carried out (toolkits, activities, workshops, exchange of experiences, participation of young people, partners and stakeholders', etc.) and ensure their impact.

The quantitative and qualitative supervised indicators that act as criteria to evaluate the results are at least:
• Correspondence between objectives - activities - results;
• Impact achieved in the target groups;
• Comparison between actual and expected quantitative parameters;
• Implementation of the exploitation strategy,
• Efficiency and overall sustainability.

To be more specific, the team of researchers has developed a methodology based on a questionnaire that measures skills acquired in the three pillars of the project, and based on the drafting of a Quality Evaluation Plan. Based on these premises, the development of evaluation indicators for the evaluation of the effectiveness of the project, its progress, the quality of the IO (Intellectual Outputs), the impact on the target group (numbers and feedback), the TNM and the Organization of Multiplier Events (number of participants and their feedback).

The evaluation activities that are included in the IO development methodology and that belong to the activities that lead to the final result, include a baseline measurement after the target groups (students, teachers, working world) participated in the initial Craft Your Future activities. An impact measurement was also made after the students have completed the program. The indicators we show measure the provisional impact reached on the young people who participated in the first exchange of the three countries.



Figure 5. Crafts in today's economy. The Tryavna and Gabrovo (Bulgary), training week (2019), coincides with a large international Craft Congress. During the congress, artisans will not only show their products, but especially their skills, and they will discuss the role of crafts in the current economy. We will bring this knowledge and inspiration back to the Netherlands.

The Regional Partnerships aim to bring together like-minded people and organizations. This defines a strategy that helps regions use intangible cultural heritage to increase their attractiveness, boost local economies and build a resource-based future. Regional strategies and action plans are pioneers in the formulation of actions that are unique to the specific regions involved in the "Craft Your Future" project. It is a strategic regional project on how new technologies and the circular economy can be used to elevate traditional crafts to the new demands of the 21st century.

The project brings together educational institutions, students, local authorities, creative centres and companies in the creation of a strategy that helps regions use intangible cultural heritage to increase their attractiveness, boost local economies and build a future based on regional resources The Craft Your Future strategy is based on the vision that young people are the source of tomorrow's economy and, therefore, should be at the forefront in the design of future strategies for the regions .

The final result will be different deliverables in which the action commitments of the interested parties involved are exposed in various formats (digital and activities fundamentally), guaranteeing the impact and sustainability beyond the useful life of the Craft Your Future project. The contents of the project may be used as best practices and transferred to other regions, and may be widely shared with other schools.

The European project Craft Your Future (ref. 2018-1-NL01-KA202-038952) has been supported in its 2018 call by the European Union, through the K2 Erasmus + program. The following European organizations from the Netherlands, Bulgaria and Spain participate as partners in this project: Friesland College, Learning Hub Friesland Foundation, Stichting House of Design, The Fabric Association, NGPI Tryavna School, Oceanonaranja (FabLab VLC) and Universitat Politècnica de València.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Creativity as a Driver in Social Innovation Processes.

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Abstract | The value of culture and creativity in the development processes of post-industrial economies is internationally recognised and plays a decisive role for growth, competitiveness, sustainable development, innovation, employment, social cohesion, the sense of belonging and the spread of shared values. This takes the form of urban regeneration that become spaces in social aggregators, but also in social innovation practices as events, collaborative and aggregative projects, which provide contents and new meanings to territories that are often "unidentified" and "disidentifying", creating opportunities for relationships and networks between social actors, who in turn are bearers and propagators of new values and identities.
Richard Florida 15 years after the release of his first book (Florida, 2002), in the new essay "The New Urban Crisis" (2017), notes the consequences of the rise of the creative class in terms of gentrification and social inequality at the urban level, which have made large urban sections inaccessible to the popular classes with the expansion of the "service class with very little creative or qualified tasks. Perhaps the original sin of the Florida theory consists in not having considered that the "creative class" cannot be merely the engine of economic growth - albeit of a creative economy ... - but that it is necessary to rethink the role that the creatives must have with respect to the society, going to fill the educational role - if not even duty - advocated by Antonio Gramsci when he speaks of the intellectual class (Antonio Gramsci, Prison Notebooks, Einaudi, Turin 1975, vol. III, 1550-1551).
This concept is connected in some way to that "Design when everyone designs" by Manzini (2015) which recaps about the role of "creativity bearers", and specifically design, in contemporary society. A role that Manzini defines as that of an expert designer, facilitator of bottom innovation processes.
A facilitator therefore, and also an educator, who works to bring out those capabilities that the philosopher Amartya K. Sen defines as a fundamental piece to build a measure of well-being as an alternative to the so-called "GDP approach". The development, which Sen defines

in the Human Development Index, is primarily the development of people and communities and economic indicators are freedom, quality of life, justice: a fundamental paradigm shift in which the criteria for defining poverty are no Longer attributable to a lack of resources but rather to an insufficient freedom to conduct adequate existences or a lack of capability (Sen 2000). Cultural production is closely linked to the territories in their complex anthropic and social stratification and it is impossible to think about the development of a territory without taking into consideration the social capital as a whole. Francesco Zurlo, about the concept of creativity, believes that this is a term that has now been abused and that it is, and must be, linked to a territory and a social capital.
A development that takes place through culture cannot therefore be considered only from an economic point of view, but rather in terms of increasing the skills of various kinds, distributed over a territory that thanks to creativity can grow in a virtuous process.
Perhaps this is the great challenge for the cultural and creative industries: to make an ethical choice according to the logic of social responsibility of culture, promoting actions that have a real social relevance, encouraging participation and placing the public at the centre. A choice therefore not dictated exclusively by the economic return but also by the intent to produce value by creating more active and aware communities.

KEYWORDS | SOCIAL INNOVATION, FESTIVAL, CREATIVITY, CULTURE, ETHICAL & CIVIC DESIGN

1. The value of culture and creativity in territories development

The value of culture and creativity in the development processes of post-industrial economies is now universally recognized at an international level. From the report on the economics of culture prepared for the European Commission by KEA – EUROPEAN AFFAIRS of 2006, to the "Unlocking the potential of cultural and creative industries, Green Paper" of 2010, it emerges that culture plays a decisive role for growth, competitiveness, sustainable development, innovation, employment, social cohesion, a sense of belonging and the dissemination of shared values. Cultural activities, in addition to the classical activities related to the cultural heritage, also include the creative sector (creative industries) which includes a set of functions linked in more or less direct forms to production, such as design, architecture, advertising, as well as a composite set of activities related to the information and communication industry.

The spread of well-being and the full satisfaction of basic needs make the "consumption" of culture possible and the demand for added value of consumer products increases more and more, with a demand for products and services in which the creative and innovative component becomes fundamental. In new economies, the symbolic value of material goods becomes increasingly important and the competitive factor of a product is increasingly linked to the quality, experience and meanings it is able to generate. Companies no longer invest in culture or design for merely promotional and communicative reasons but to create content and meanings.

According to Symbola's 2019 report " Io sono Cultura. L'Italia della qualità e della bellezza sfida la crisi.", it is precisely through creativity and design that Italian companies have shaped their products by redefining their meaning, connoting them culturally, strengthening their competitiveness and at the same time enriching a positive image of Italy, ensuring that products "Made in Italy" are among the best known brands in the world. It is even more important in the contemporary context, with the pervasiveness of technologies, to be able to count on "hybrid figures", on the "managers of complexity" as Piero Dominici defines them, "on curricular profiles that know how to hold together imagination and rationality, creativity and methodological rigour, the human and the technological aspects." (Interview with Piero Dominici in Morning Future, 2018)

In Italy the studies and publications of the last decade on the role of creative classes and cultural districts (from Santagata to Sacco) highlight a paradigm shift and the expansion of the very concept of "culture" which is no longer limited only to the material, artistic and architectural heritage and to the level of education and innovation, but it opens up more and more onto territorial capital as a whole and onto human and social capital in particular. The interaction between culture, with its creative components, and the sustainable development of complex territorial systems clearly emerges in the words of Sacco and Blessi:

> “In all the components of the economic, social and environmental reality, the role of culture is increasingly to operate as a synergistic agent capable of providing other sectors of the system with content, tools, creative practices and added value in terms of symbolic value and identity through the enhancement of local assets. Therefore, the importance of culture in the social growth processes of urban areas is also evident, whether they are subject to territorial upgrading processes or when it is necessary to complete the infrastructure planning action.” (Sacco, Blessi, 2005, p.3).

What has been said so far has materialised in the redeveloped spaces that become social containers and aggregators, engines of urban regeneration (not only on an infrastructural but also on a social level), and in the events that provide content to often disidentified and disidentifying territories, turning into occasions for relationships between individuals and for building networks between social actors, in their turn carriers and propagators of new values and identities.

However, it is true that creative processes alone are not sufficient to univocally determine territorial developments. If we think of powerful urban redevelopment and regeneration interventions such as those determined by international events such as EXPO and the Olympic Games or the recovery of industrial areas from the end of the 1980s in many cities in Northern Italy (two cases are the Bicocca in Milan and the Lingotto in Turin) it should be noted that these operations did not generate a real involvement of the communities, giving rise to phenomena of gentrification which further excluded the working classes from development. The local communities have not identified themselves with these operations and evidence of this is the recent refusals of the candidacies for the Turin and Rome Olympics.

Richard Florida in 2002 with the best-selling book "The Rise of the Creative Class" theorised the fundamental economic value of creativity and going beyond the concepts of information and knowledge economy, affirmed the birth of the "creative economy" and the rise of the "creative class" in advanced capitalist countries. The creative class, made up of scientists, engineers, university professors, artists, architects but also doctors, lawyers and managers, has the social function of generating new ideas, new technologies and / or creative content, revolutionising the old hierarchical and formal ways of managing the economy and work and becoming in fact the real engine of globalised development. New poles of development will be those urban centres which, based on the 3T (Technology, Talent and Tolerance) are able to attract this emerging social class.

Richard Florida's so-called "repentance" 15 years after the release of his book is dealt with in his new essay "The New Urban Crisis" (2017) in which he notes the consequences of the rise of the creative class in terms of urban social inequality with a strong gentrification, which has made large urban sections inaccessible to the working classes. In addition, the creative economy and outsourcing have seen the ranks of the "service class" swell, the employees of the services with very uncreative or unqualified occupations: waiters, carers, supermarket cashiers, and finally the well-known "riders". The spread of populisms that culminated in

Trump's rise in America and Brexit's victory in the UK, the returning illiteracy that seems to be getting stronger, actually appears to contradict Florida's optimistic vision: the three Ts, Technology Talent and Tolerance, which constituted the engine of the new creative economy, do not seem to have given rise to a similar response on a social level.

Perhaps the original sin of Florida's theory lies in not having considered that the "creative class" cannot be solely the engine for economic growth - albeit of a creative economy - but that it is necessary to think about the role that creatives must have with regard to society. The "creative people" has first and foremost an educational and ethical duty towards society as Gramsci stated in relation to the role of intellectuals:

> "The way of being of the new intellectual can no longer consist in eloquence, the external and momentary engine of affections and passions, but in actively mixing with practical life, as a builder, organiser, persuader (...) When a distinction is made between intellectuals and non - Intellectuals in reality we refer only to the immediate social function of the professional category of intellectuals, that is, we take into account the direction in which the greatest weight of the specific professional activity is heading, whether in intellectual processing or in muscular-nervous effort. This means that if one can speak of intellectuals, one cannot speak of non-intellectuals, because non-intellectuals do not exist. There is no human activity from which any intellectual intervention can be excluded; homo faber cannot be separated from homo sapiens. Finally, every man, apart from his profession, has some intellectual activity, that is, he is a "philosopher", an artist, a man of taste, participates in a conception of the world, has a conscious moral course of conduct, therefore helps to support or to modify a conception of the world, that is to arouse new ways of thinking " (Gramsci, 1975, pp. 1550-1551).

This definition that - with a certain visionary nature, includes the creative class as a whole as formulated by Florida, is connected in some way to that "Design when everybody designs" by Manzini (2015) confirming the need to question the role of "Bearers of creativity", and specifically of design, in contemporary society. A role that Manzini defines as that of the expert designer, facilitator of innovation processes that arrive from below.

A facilitator therefore, but also an educator as advocated by Gramsci, who works to bring out those capabilities that the philosopher Amartya K. Sen defines as a fundamental element for building a measure of alternative well-being to the so-called "GDP approach", because in addition to this economic indicator there are freedom, quality of life and justice. Development, which Sen defines in the Human Development Index, is primarily the development of people and communities, and this implies a shift of attention from material goods and resources to skills and freedoms, proposing a fundamental change of paradigm in which the criteria for defining poverty are no longer attributable to a lack of resources but rather to an insufficient freedom to lead adequate lives or to a lack of capability (Sen 2000).

In fact, cultural production is closely linked to the territories in their complex anthropic and social stratification and it is impossible to think about the development of a territory without taking into account the social capital as a whole. Francesco Zurlo, wondering about the

concept of creativity, believes that this is a misused term and that it is, and must be, linked to a territory and a social capital.

In all this, Design and "design driven innovation" (Verganti, 2008, 2011), and therefore an innovation not driven by technological innovations or driven by the market, but connected to the "socio-cultural regimes" in force, appear among the mechanisms with the greatest thrust (Lombardi, Macchi, 2016): keeping the fluidity of knowledge, identifying new technological combinations and, above all, generating new meanings and new functions, helping to define new interaction strategies that meet not only territorial needs, but also and above all those of the end user.

A culture based development cannot therefore be considered only from an economic point of view, but rather in terms of increasing the skills of various types - distributed over a territory that thanks to creativity can grow in a virtuous process - of education - to complexity and critical thinking - and citizenship - respecting legality, differences and responsibility (Petrocelli, 2019).

And perhaps this is precisely the great challenge for the cultural and creative industries, that of making a choice that we could define as ethical according to the logic of the social responsibility of culture, promoting actions that have an effective social relevance, encouraging participation and placing the public in the centre. A choice therefore not dictated exclusively by an economic return but also by the intent to produce value by creating more active and aware communities.

If we think of an event like a Festival, a topic that we will discuss as a pilot project in the next paragraphs, the first level of value production is certainly that of the usable product / service, which, however, represents only a tool to achieve the second level of value production, or rather that of the participatory process, which has the most profound and strategic effect, aimed at stimulating community processes. On this second level, the main ingredient lies in the ability to activate territorial networks and alliances with the aim of encouraging the birth of a real urban cultural system that makes the impacts of the actions promoted sustainable over time. Last but not least the educational and training level, understood in its entirety and therefore not only as an expansion of knowledge but also as education for citizenship, aware of the need today, in the rapidity of technological and social evolution, of transversal skills, of flexibility, critical skills and to identify and solve complex problems, but also empathy and sharing. All these skills are constitutive of the designer, or rather of the "citizen designers" who "have both a social and a moral responsibility to use their visual language to address societal issues either within or in addition to their professional practices" (Resnick, 2019, p. 39).

2. Design Driven Innovation strategies for and with the territories, the case of COSè festival

> "In Italy, as in all the other territories of the world, we make things. In our country particular things are produced: Italy is famous for Design and Fashion objects, with an increasingly high added value. In particular, the plain that stretches from Florence to the sea is a vast area where things are produced. A place, the place of things, therefore. Things that populate our homes and that sometimes, due to their ever-growing number, when they become waste, end up besieging us. Things must therefore be rethought: it is necessary to restore a deeper sense to objects, to recreate new emotional relationships with them, to extend their life (so as not to make them become waste). The challenge starts in childhood. Hence the idea of a festival for children and young people dedicated to education about things, because after all, the challenge for a new model of more sustainable development also starts from there ".

These words written by Giuseppe Lotti in the press release (2016) contain the idea of the COSè Festival, which was held in two editions, in 2016 and 2017, between Calenzano, Campi Bisenzio and Sesto Fiorentino, in the middle of the plain between Florence and Prato. The festival was born and was created as an event aimed at local communities with a particular focus on the complex relationship we have with things and a target that ranged from children, to young people, to students of the Design Campus, but also to families and in general to the inhabitants of the plain.

This challenge certainly starts with young children, being more sensitive as well as easier to educate in practices focusing on safeguarding our ecosystem, in every sense. Hence the idea of a festival for children and adolescents dedicated to education about things that in the previous words gives a description of its mission and the starting point that effectively generated the executive project of the COSè Festival[1].

The theme of the first edition (2016) was "us and things" - and was aimed at rethinking the objects that surround us and giving them a deeper sense, recreating new emotional relationships with them -, the 2017 edition instead worked on the theme of "the work behind things" - to be understood as the commitment, the stories, the times and the places behind the objects that surround us, but also the crafts that are no longer there.

[1] The COSè Festiva was conceived and designed by the Design Laboratory for Sustainability of the University of Florence coordinated by prof. Giuseppe Lotti with an extended partnership that involved Convoi social cooperative; LibLab, Library-workshop for children and teenagers; the Municipality of Calenzano and with the involvement of many other territorial entities, including the main sponsor, Centro Commerciale I Gigli. In the 2014/2015 academic year, a thesis was developed: "COSè. us and things, the festival "- by Irene Fiesoli and Ambra Quercioli, Prof. Giuseppe Lotti (supervisor) - Master's Degree in Design, which analysed the theme and developed a coordinated image and graphics of the event.

Around these two macro-themes, programmes of events were organised, of which there were a great variety, both in type and in their reference target: they included workshops, exhibitions, meetings with book authors, open readings, guided tours to local companies, shows and events, some dedicated specifically to schools for all age groups and others open to the public at large. The different lines of action, the quality of the contents and the ability to stimulate users as regards contemporary issues and problems, (from compulsive purchasing, to the theme of migrants, to that of work, sustainability and many others) provided the elements for which the festival has managed to attract an ever wider audience, also involving a particular target such as young people, who recognised the event as an alternative cultural and social moment with respect to the predominantly commercial products that the territory offered[2].



Figure 1. Workshop "Things with art", Fausto Gilberti, 2016 edition.

The primary educational goal of the Festival materialised in workshops on the theme of sustainability, with the desire to make people reflect on the fact that every day we buy

[2] The festival in only two editions was able to involve 350 pupils from Nursery Schools, 350 pupils from Primary Schools, 350 pupils from Secondary Schools, 350 pupils from Secondary Schools. In addition to these, the festival has reached, thanks to the many open events: 2,000 citizens, 1,500 families, 1,800 young people and university students.

something by making choices that affect not only our lives, but also that of others: producers, workers, those who live in a certain area, future generations and that even in our small way we can choose quality products, opt for companies that respect workers' rights and the environment and avoid waste.

Among the laboratories that developed these themes certainly those that stand out are *How many things… WorkSHOPping!* (2016 edition), *I buy things…Therefore I am!* (2016 and 2017 edition), *Refuse or reuse?* (2017 edition) – held in collaboration with the CONVOI non-profit cooperative – which have analysed in depth the general theme, stimulating reflection on the role of the consumer, or better consumer-actor (Fabris, 2010), who chooses on the basis of his own wishes and no longer only his needs; they talked about compulsive shopping, an extremely topical subject for adolescents; they also tackled the theme of the reuse of waste in creative, practical laboratories.

Other events, on the other hand, were aimed at making children and adults aware of some social problems and in particular the transformations of an increasingly intercultural society, where the boundaries between people as well as the different cosmologies of objects - also coming from cultures remote from ours -, do not disappear but interact with each other:

Also on this subject were the workshop *Amo non amo*: *what can you do with a ball?* (2017 edition) inspired by Anna Baccellieri's book, which gave an insight into the differences that exist between children around the world, some who can play with a ball and others who simply don't have the time and are often employed in making toys that they will never use. Two very important exhibitions were organised on the same subject, both of them held in the main halls of I Gigli Shopping Centre. One is the exhibition "Work Right!", in collaboration with the International association Poster for Tomorrow, which has supplied 100 posters, by graphic designers from al l over the world, winners of the competition dedicated to the Right to Work; an exhibition with a great visual and emotional impact that explores the theme of the second edition of the festival, "the work behind things". Lastly, a very important project, the exhibition "Le Cose degli Altri", in collaboration with Caritas Florence and 3 reception centres for refugees in Calenzano, Campi Bisenzio and Sesto Fiorentino, comprising portrait photographs of people seeking asylum in this country, accompanied by their life stories and the story about a particular "thing" that for the people interviewed represents their "home".

These objects of affection were then represented through their absence in the photos, filled with illustrations depicting the most similar possible version of the objects left at home or lost on the journey.

On this project apart from the exhibition there was the meeting Things from the sea, to discuss with experts and people directly involved the drama that many people have to suffer, people fleeing from wars and famine in search of a better future. At the end of the meeting, thanks to Giulio Carlo Vecchini, luthier, who made a guitar -- *Mare di Mezzo* – using

the fragments of the boats that arrived at Lampedusa, giving life to an evocative concert for guitar and voice.

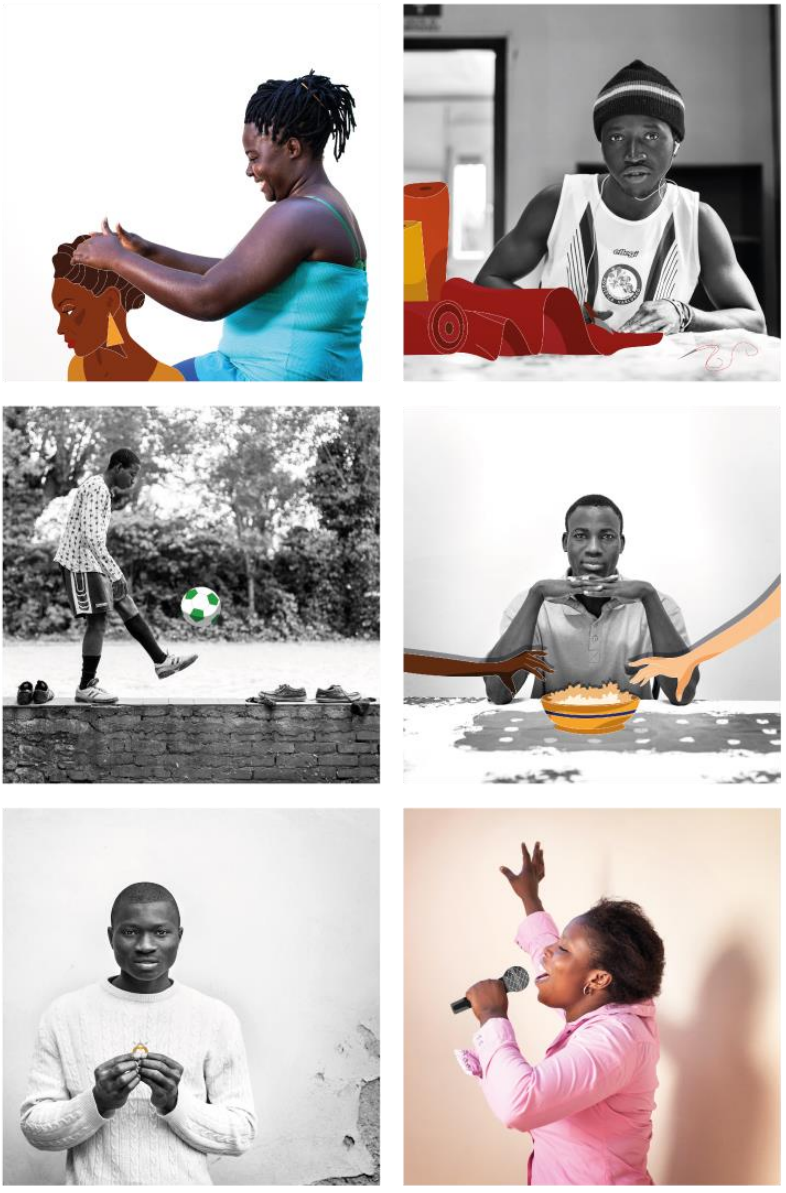

Figure 2. Selection of some photos protagonists of the photographic exhibition "Le cose degli altri".

Still other events were aimed at making known and reflecting the reference territorial context, through meetings and exhibitions relating the thousand forms that work takes today: from the craftsmanship of the artisan to robots, through visits to factories, events and meetings in collaboration with companies, associations such as ADI Association for Industrial Design or Artex.

It can be claimed that the main characteristic of the COSè Festival is that it is an “open festival”, in that in the two editions it succeeded in involving dozens of actors present in the area. It had an important role because it increased the level of social aggregation within the event in a territory through culture and creativity in a dimension that was not that of "selling", to which the many events scattered in our territories have accustomed us, such as festivals and fairs and cultural events mainly used as a tool to promote tourism and trade.



Figure 3. Merchandising COSè Festival.

Certainly most of the events have been designed to address a public of children, seen as the users who could learn the most important topics for the future and put them into practice as they grow up. This is above all through play, as the basis for the teaching methodologies aimed at the world of childhood, as the child learns spontaneously, free from any constraints, becoming in some cases himself the creator of the game. In addition to this didactic and pedagogical character, play has always played a cultural role too, as through games and toys it is possible to trace a story from one era to the next, of the type of relationship between adults, children and society. *As La Cecla also underlines:*

> "Games, toys […] tell us about the image that adults have of children, the idea of children's 'task' in society. Of course, children also play alone; they invent ways to play with the world on their own, but adults 'take advantage' of the seriousness of child's play to guide it along the channels of what they expect from children. In this sense, toys are the matter of a relationship between two categories of humans who, although 'familiar', are foreign and divided. "(La Cecla, 2013, p. 62)

In the current transformation period, in which the relationship between adult and child must also be reviewed, it is fundamental to understand the importance of children's ability to "play with the remains of the world to recompose it in their own, new way" (La Cecla, 2013) which can become one of the truly innovative strategic levers to rethink the world of the future. Precisely because of the experience gained during the COSè Festival, we have understood that through some play-workshops it is possible to promote children's creativity and re-establish an adult-child relationship based on new principles; the smaller ones learn by playing and the older ones begin to reflect on a different future. So if for the little ones the "world of things" is approached in an exploratory way, for adults it is approached in a reflective way. In fact, the child explores the multitude of things in his objectivity; the adult instead reflects on them following more complex and elaborate processes. However, the form of learning that most characterised this festival experience and that was interesting in terms of social impact was that among peers, in which the child - as a social innovator - challenges the world as the adult has always known it. The child then poses questions to the adult that he had never thought of and cannot answer. In fact, the child can play this role of destroyer of schemes" because he lacks models inherited and / or imitated from the social context in which the adult is already immersed, and perhaps contaminated.



Figure 4. Laboratory "I materiali delle cose" (2016 edition), on the themes of Sustainability: environmental, economic and socio-cultural.

The COS'è festival therefore set itself as a tentative to catalyze and direct, through a Design Driven strategy, the energies and the various actors present in the territory in a sort of common platform of capabilities of individuals and society for the production and circulation of knowledge on the one hand and identity construction on the other. The visits and the involvement of manufacturing companies or other entrepreneurial entities ascribable to social entrepreneurship, the involvement of public institutions have in fact constituted an important attempt to give identity and meaning to the many "non-places" spread throughout the territory as is the emblematic case of the "I Gigli" shopping centre, the main sponsor of the Festival, which has become the theatre of exhibitions with a high social content and educational and recreational workshops that have involved " I Gigli" customers.

The festival therefore becomes the tool not only to produce tangible and accessible value, but also to generate aggregation, through participatory and formative processes, aimed at stimulating the community, understood as the set of bodies, structures, companies and people. It is an example of how it is possible to concretely try to activate, or reactivate, territorial networks that in some cases exist on the territory but that very often unfortunately find themselves with their nodes disconnected from each other, placing a small piece in trying to intervene on global problems that in one way or another affect us all.

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Acknowledgements: This contribution was shared and agreed between the authors in content and conclusions. Specifically, Irene Fiesoli edited paragraph 2.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design culture (of) resilience. Space & Service design taxonomy, overcoming undefined space & service design contexts

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Abstract | Space and service design is an emerging discipline, triggered by contemporary social-cultural-economic challenges. Shifting from traditional spatial emphasis, the focus is on the user-centeredness and systems of spaces and services, addressing touchpoints as spaces, communication systems, objects and the intangible scenarios, interactions and experiences. Comparative literature research revealed that existing service design methods and tools were found to provide insufficient responses to the combination of space and service. Through maximum variation sampling a taxonomy system for service spaces and tools simultaneously addressing service and spatial touchpoints was developed and provides critical reference points that allow for comparison of the situation pre-intervention and analysis of the intended effectiveness of the adapted situation. Finally, the article describes a space and service design process of "the Make Learn Space" for the city of Leuven, a project in line with two societal innovation challenges, namely Design for New Learning Environments and Design for Circular Economy.

KEYWORDS | SERVICE DESIGN, DESIGN METHODOLOGY, SPACE AND SERVICE DESIGN, SOCIAL INNOVATION, CIRCULAR ECONOMY.

1. Introduction

Contemporary social, cultural and economic challenges such as ageing and social inequality to ecological and technological changes have encouraged designers worldwide to reflect on their roles, approaches and their responsibilities regarding these topics. Space and service design is an emerging discipline, triggered by social innovation and focusing on these contemporary social-cultural-economic challenges through design (Fassi, Galluzzo, & De Rosa, 2018). Shifting from a traditional spatial emphasis in design towards a user experience-centered approach, the discipline aims to offer added value for the users of service spaces and contexts (Felix, 2011 a and b; Stickdorn & Schneider, 2010; Van Geetsom, 2018; Tu Ngoc & Fassi, 2018). Research has suggested that, for users, services and goods or touchpoints are inseparable (Penin, 2017) thus the priority should focus on the design of a system of spaces and services that jointly meet the needs of the stakeholders as well as individuals, clients and communities (Ou, Wang, You, Tao & Liu (2017). Throughout the design process, designers equally address the touchpoints – including spaces, broader context, wayfinding, communication systems, furniture, objects - as the intangible scenarios, interactions and experiences (Van Geetsom, 2018).

Since 2014, Thomas More University of Applied Sciences in Mechelen, Belgium, offers a postgraduate in Space & Service Design that combines the design of spaces and services. Utilising only real-life projects that involve real clients and users, an authentic learning experience responds to the demand of predominately local or regional partners by improving their service spaces and user experiences. Over the past five years a design thinking methodology has been developed, based on service design methodology; combining participatory, multidisciplinary, user-centered, interaction and social design approaches.

Educational practice and ongoing empirical research revealed that prevailing service design methodology and tools provide insufficient responses to the transdisciplinary approach (Hormess, Lawrence, Schneider & Stickdorn, 2018; Fassi, Galluzzo, & De Rosa, 2018; Collina, Di Sabatino, Galluzo & Mastrantoni, 2018) of spatial design and service design. While working on these projects and appraising the initial spatial situations and user-scenarios, the need arose to provide more instruments - including tools and the methods to apply them - to aspiring designers and professionals. Like many design challenges, the multiple layered space and service design projects involve many stakeholders and disciplines and deal with wicked problems (Buchanan, 1992). The creation of a taxonomy system for service spaces and the creation of applied design tools are particularly relevant in space and service design projects (Fassi, Galluzzo & De Rosa, 2018). These address the supporting touchpoints of the services and assist the designers and aspiring designers in holistic complex problem solving (Buchanan, 1992).

This paper describes the development of a new space and service design taxonomy model through maximum variation sampling. The taxonomy model supported the development of

more suitable tools and facilitated the choice of the tools for the design of services and spaces. The goal was not to provide more tools –more of the same- but to create tools that offer practical advice regarding the research process and therefore also the learning process.

2. Methodology and goals

2.1 Limited tools and undefined baseline situations

In the interdisciplinary approach of space and service design, spatial design is no longer considered as designing well-shaped containers but as an essential element; as important as the design of the services and as important in supporting organisations, people and activities (Felix, 2011 a and b). Spatial design stimulates the ongoing use of intangible services and it is these tangible features that evidence the existence of the service. The spatial service system identifies the services and defines the scenarios for continuous interaction between people, spaces, objects and communication tools. These evidence-based and holistic designs of spaces, objects (e.g. furniture), communication tools and services are jointly capable of fulfilling the user's need (Van Geetsom, 2018).

The conventional spatial design process follows the Double Diamond model (British Council, 2015). In service design, key attributes and specific tools are applied to each phase (Felix, 2011; Vezzoli, 2014; IDEO, 2015; Thoelen, Cleeren, Denis, Peters, Van Ael & Willems, 2015) in order to facilitate the investigation of design solutions that support complex challenges. While developing educational methodologies and practices for space and service design, tools and methodologies that were potentially appropriate were investigated. The research question "Which tools can facilitate the phases of the design process and include both spaces and services?" related to the final goal of the research: to use integrated space and service design tools and methodologies that simultaneously incorporate the tangible as well as the intangible features of a service, and will guide designers throughout the entire design process.

Because various effective service design tools and toolkits exist, a comparative literature research of service design tools (n=32) was conducted. Toolkits supporting the complete Double Diamond process, literature about service design methodology and the application of specific service design workshop approaches were examined. Analysis proved only a small number of tools considered "spatial context" as an essential touchpoint. While an existing service space always hosts an existent service (Penin, 2018; Fassi, Galluzzo, & De Rosa, 2018) the examined service design tools offered little opportunity to evaluate or elaborate on existing tangible service contexts and none carried the spatial data through the entire Double Diamond process.

Drawing from literature, the service system design is seldom explicitly incorporated into conventional interior design, interior architecture or architectural design methods, though

social design, user-centered design, co-creation and participatory design are often used in contemporary design project of public spaces and buildings (Di Prete, Crippa & Lonardo, 2015; Poot, Van Acker & De Vos, 2015; Camocini, Petrillo, Rebaglio, 2015; Lucas, 2016; Wagne & Watch, 2017). Although these are all also approaches or characteristics of service design, there is little explicit reference within the vocabulary of architectural or interior design to that of the design of services.

The literature review concluded that prevailing service design toolkits that address a complete service design process provide inadequate responses to space. In addition, the methodology for spatial design projects offers no explicit and structured approach to managing spatial and service design simultaneously.

2.2 Testing and developing

The following step in the research process was the selection and testing of existing tools which addressed the space as well as the service and to appoint them to specific phases in the Double Diamond process. Existing tools were adopted, and the aspect of “space” was added. By testing the tools, new challenges emerged: which tool is appropriate for which situation? By working with real-life clients, public service organizations and NGO’s, the baseline situation of the project was often different. Sometimes the organisation already operates in an existing building, thus the spatial context causes limitations and constraints. Sometimes the organization already offers services and sometimes they do not. Applying the correct tools, then, is not always self-evident. One needs to research the tangible and intangible contextual situation in order to be able to define the design challenge. Next to this, design briefs also begin from different starting points and thus require different methods and tools (fig. 1). If the design of space and service design go hand in hand (Collina, Di Sabatino, Galluzo & Mastrantoni, 2018; Fassi, Galluzzo, & De Rosa, 2018), how these different baseline situations be distinguished?

To gain a better understanding of divergent baseline situations of design projects, a comparative analysis of 25 space and service design requests was conducted. The methodology for the baseline assessment of service contexts provides information on the situation the design outcome aims to change and provides critical reference points that enable one to compare the existing situation to the effectiveness of the adapted space and service. In order to select and adapt existing service tools and to create new ones, it was necessary to apply tools that were responsive to the initial service space situation.

From 2014 till 2020, the Design Department of Thomas More received 25 relevant design requests from public services and NGOs for service and spatial design challenges for public and semi-public buildings, spaces and contexts. Through maximal variation sampling (Creswell, 2015) four types of baseline situations were distinguished from these 25 requests.

The methodology to determine the essential baseline situation of the service context, was named the Taxonomy of Service Spaces. The next part of the paper describes different baseline situations and illustrates them by design projects examples.

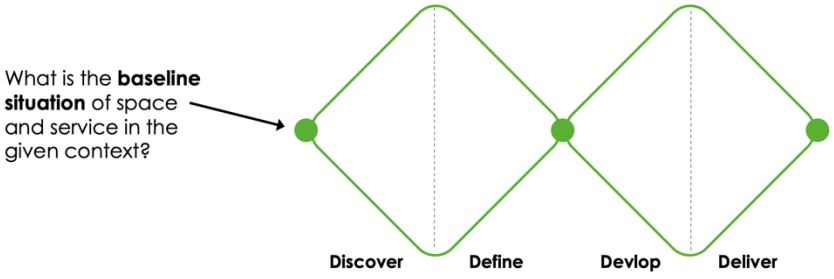

Fig. 1 The unsecure starting point in The Double Diamond design process model (British Council, 2015).

3. Space & Service Design taxonomy

3.1 A space and service exist

The Taxonomy of Service Spaces is an analysis method to overcome the indetermination of the space and service design context and problem. Before the Double Diamond's first diverging phase "discover" begins, the following questions are asked: "Is there an existing building that needs to be used?", "Is there a certain space or specific spatial objects that should be used?", "Is there a specific outdoor area that was determined?" If the questions are affirmatively answered by the (future) service provider (fig. 2), the next question is suggested: "Are there already services offered in the allocated space that need to be taken into account?" If this is the case, the current spaces and services need to be examined, evaluated and improved or expanded.

Six projects (n=6) were identified that had a baseline situation with existing tangible components and intangible services. In these cases, the service provider operated from an existing building, offered existing services and wished to improve both or complement existing services with new ones.

In 2018, the elderly community WZC De Lisdodde[1] in Mechelen asked to design outdoor services and experiences for their residents in order to stimulate them and support their health as well as offering them a platform to interact with fellow residents, neighbours and a neighbouring school (photo 1 and 2). This project illustrates the baseline situation with an existing site and the position that designers must take existing services into account.





Photo 1 and 2. Existing space and existing services: Space & Service Safaris for and pitches with and for the residents of Elderly Community De Lisdodde (2018).

3.2 Existing space but no services

A service provider can be in the possession of a space, but the necessary services and scenarios must be designed from scratch and the designated spaces, objects and communication tools, must be evaluated and adapted to the requirements of the service, the service provider's expectations and the needs of the users.

The majority (n=12) of the design assignments for public service organizations and NGOs were found to be in this situation; the client was in the procession of a building and wanted to develop appropriate services for a specific target group in order to respond to a specific social need.

[1] https://delisdodde.zorgbedrijfrivierenland.be/



Figure 2. Baseline situation within a designated space (Van Geetsom, 2020).

In 2018, the NGO Ekisande2 requested to design the services and transform an existing school building into a health care centre for a local rural community in Bwera, Uganda. The building initially accommodated educational services and a primary school, but with the success of the NGO, there was a growing number of pupils and a new school building was being built. This in turn provided an opportunity to use the former school building and the site around it to provide health services that were lacking in the area of Bwera. This brief called on space and service design students to organise these newly developed health services and experiences on this site. (photo 3 and 4). This project was an example of an existing building which had no existing services. The selected student project will be executed in Uganda in 2020.

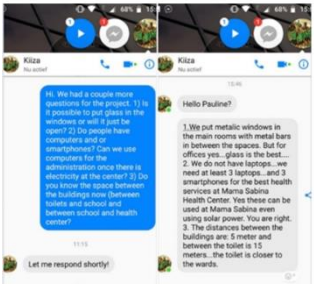



Photo 3 and 4: Existing space | no services: FB communication with client/user in Uganda after and before the visits. – Transformation of a school building into a medical care centre +

[2] https://ekisande.com/?lang=en

services for Bwera, Uganda - Design: Verbeke, P. (Belgium), Verhas, E. (Belgium) & Liu, Y. (China) (2019)

3.3 No designated space or objects, existing service

Another baseline situation that occurs is that there is no designated building, assigned room or touchpoints, nor an allocated outdoor space within the broader service context. Here, the same questions as in the previous situation will be posed: "Are there already services offered by the service provider?" In this situation, current services need to be investigated, assessed and improved.

According to the analysis of the 25 design requests, two service providers (n=2) showed the need for tangible objects to make their invisible services visible and required the creation of touchpoints in which users/users and users/service providers could interact. The service providers lacked physical elements in the environment which would evidence their existing service.

A sample of this baseline situation is the project for the organization Community Building[3], a social non-profit organization financed by the Province of Antwerp. Assisting socially disadvantaged families in legal, housing, financial and educational issues, one of their goals is to inform families about the importance of going to pre-school in Flanders as research suggests that beginning school at a later age leads to learning deficits. Their existing door-to-door information sessions lacked tangible features they could use to help explain what going to pre-school education could mean to families who often do not speak the local language. In 2016, space and service design students designed touchpoints that evidenced the service and extended it by use of new service venues and user interactions (photo 5 and 6). The project was executed and is currently in use.

[3]http://www.samenlevingsopbouw-antwerpenprovincie.be/nl/welkom_1.aspx





Photo 5 and 6. Existing service | no tangible spatial objects - Mobile school and related services to inform socially disadvantaged people in Mechelen about going to pre-school education – Design: Tytgat, T. (Belgium), Blockx, L. (Belgium) & Fendt, T. (Germany) (2016) (Photo: Isabel Rottiers)

3.4 No designated space or objects, no existing service

The last baseline situation is one in which there is no determined space, nor a developed service. In this case an organization or start-up wishes to establish a service, hence there is a need to assist with the development of the service and the relevant touchpoints. These touchpoints can be places, spaces, objects and communication elements. In the service case survey of 25 space and service design requests, five projects (n=5) were in this situation. The broader spatial context was determined e.g. the city of Leuven, the urban context of the Gandhi neighbourhood in Mechelen.

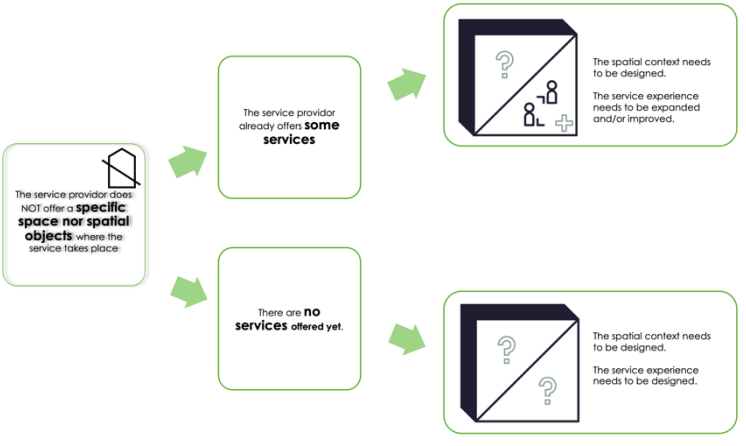

Figure 3. Baseline situation without designated spaces (Van Geetsom, 2020).

Characteristically of this baseline situation, the governmental organization SOM[4] (SamenOnderwijsMaken/ TogetherMakingEducation) formulated a general space and service design idea for the city of Leuven in 2018. Their wish was to enhance the talent development of young children and simultaneously stimulate the awareness of their talents and self-confidence. However, there was no designated space besides the broader city context of Leuven and there was no previously designed service or experience. One of the requirements was to make the future service tangible in the urban context and to share the young people's talents (photo 7 and 8).





Photo 7 and 8: No service | no spatial components: Design for talent development in the city of Leuven – Design and photos: Verbeke, P. (Belgium) (2019)

3.5 The baseline situation influences the choice of tools

Once the baseline situation is determined, the design team can select the suitable tools for the different phases of the design process: design problem discovery, design challenge definition, the development phase and the delivery phase.

Design thinking tools are used to find, in a structured and effective way, solutions to wicked problems (Curedale, 2017) but should leave enough freedom to be creative (von Thienen, Meinel & Nicolai, 2014). In the Double Diamond method (Design council, 2015), divergent thinking and converging thinking is used twice. By broadening the spectrum and gathering as much information as possible about the context and existing services and experiences, critical analysis of this data can be continued in the second phase. This results in re-formulating the design needs and the relevant design challenges. These core values form the

[4] https://www.samenonderwijsmaken.be/

basis for diverging again; in search of varied user-centered solutions, the last convergence heads towards the final, appropriate, tailor-made and preferably tested outcomes.

In case of an allocated building and existing services, in the first phase both the tangible situation and offered services need to be examined as well as the relationship between both. Methodologies such as observations and service safaris explore and examine tangible features and intangible services prove to be very useful. The data is visualized by context maps and storyboards appointing qualities and shortcomings of both the tangible features as well as the intangible services.

Checklists enumerating all essential aspects of the design of services and spaces can help to avoid gaps in the investigation of such complex projects. Common data about the building's dimensions and proportions, construction and techniques, the existing/ available/ sustainable material and the site orientations and buildings' views can be investigated through traditional methods such as observations and measuring.

However, other elements correlate with service design: the history of the building and users, the surrounding buildings and organizations, the circulation and organization of functions, the current and possible users' profiles and their ergonomic and health-related requirements, the relationship and interactions between the different users and between users and the site, the existing problems and needs of the user(s) towards the context, the underlying needs of the (future) user(s), the legal requirements afflicting users and building, the current organization stationed in the context, the current and future stakeholders…. Tools which identify and bring into view both the tangible and intangible are required.

The following section of this paper describes through purposeful sampling (Cresswel, 2015) an empirical study of a Space & Service Design students' design process, through a real-life, participatory project for the public service Making Education Together (SOM) organisation of the city of Leuven; the 'MakeLearnSpace'.

4. Purposeful sampling: a circular urban learning space

4.1 Towards circular city laboratories: a MakeLearnPlace for the city of Leuven

SOM (Making Education Together) is a partnership between diverse educational platforms of Leuven and together they create diverse solutions for the challenges of today and tomorrow with a specific focus on education with the intention that every learner can develop and use their maximum potential. Via a MaakLeerPlek (MakeLearnSpace), a workshop, inspiration and inter-generational meeting place, people in Leuven can share spaces, materials, ideas and knowledge. The MaakLeerPlek offers the physical and mental space to the learner in order to develop and influence their personal learning process. The workshop and meeting place must be an open and easily accessible area that accommodates a programme which goes beyond sectors, roles and structures and which starts from societal challenges (SOM, 2019).

Being part of an estate project, the space and service design project will be only temporarily hosted by the Vanorshoven Mills and Silos (photo 9 and 10), a former and iconic industrial building in a new and vibrant urban development area. After three to five years, the service and touchpoints should be able to be relocated to other venues within the city. Therefore, and following the organization's vision, the required project outcomes should be socially, environmentally and economically sustainable and circular; comprising of modular and circular furniture and spaces, communication and information systems.





Photo 9 and 10. The Vanorshoven Mills and the Silos (source: SOM, Leuven)

4.2 Application of the taxonomy

Utilising the Taxonomy format, one could conclude that the client and future service provider designated a building and offers no services yet on site. Although the site is only temporary, future user experiences and supporting touchpoints should be developed in such a way that they can be organized in the current buildings. At the same time, the circular spatial appliances and service systems should allow for transfer to other locations in the city.

During the Discovery phase, nine student teams investigated the current tangible and intangible context starting from the position that the spaces were determined and that only the preliminary goal of the client existed regarding the services. The research question concerning the status of the tangible and intangible context was divided into nine sub questions: addressing the current tangible interior/exterior spaces, the broader city context, the current vision, organizational structure, services and stakeholders of SOM, the experience, perception and the future expectations of by-passers, best practices of urban learning services and urban learning spaces, circular economy theory and concepts.

The nine student research teams conducted research of design and research for design (Van Geetsom, 2016); looking to the design challenge from different perspectives through both field and desk research. The client, experts and teacher-researchers participated throughout the four development phases.

In the period of Discovery, student teams gathered insights by experiencing and measuring the site and surroundings. They captured qualities and shortcomings concerning the current built space, dimensions, functions, orientation, ergonomics and accessibility, wayfinding, user traffic in and outside the building, the inter-action with the nearby surroundings, (public) transport, city hotspots and wayfinding. In order to guide the transdisciplinary (Fassi, Galluzzo, & De Rosa, 2018) design process and to obtain a holistic and complete view of the project, the teams were asked to use existing service design and spatial design methods and new Space+ServiceDesign tools that emphasise space and service simultaneously (Table 1.). At the same time, the theory of circular economy and design was studied in order to ground this position within the project within the Ideation and Development phase.

The second phase defines the real design challenge, taking the qualities of the current situation into account. Nine international and multidisciplinary design teams were formed. By analysing the previous results, using convergent thinking, the teams' main targets and key factors for success were set and presented to the client, stakeholders and experts in the domain. Which current and future stakeholders and users should be addressed? Which services should be created? Which spatial and communication elements should be kept, improved or invented?

Going through the third quarter, the multidisciplinary design teams investigated different solutions and options; thinking broadly. They applied brainstorming and braindrawing, testing and modelling. To guide them on circularity, they used the mirror of the Circular Economy Butterfly diagram (Ellen MacArther Foundation, 2017) to define objects, build elements and service systems. They pitched the design concepts to the client, stakeholders

and experts and iterated previous designs and compared their ideas with the pre-set requirements in the Definition phase.

Table 1. Designated space/no determined service: Baseline situation research and S&SD tools options.

Phase	Discover	Define	Develop	Deliver
Tools and output	SSD Resources SSD Interview tool SSD Current user's mood boards SSD Current user's experience SSD Current space vs time tool SSD Giga-mapping SSD Current stakeholder map SSD Cultural probes box *Plans, pictures, video/3D-model* *Service safari* *Case study and market research*	SSD Priority charts SSD Design challenge SSD Future personas SSD Future stakeholder map SSD Future user's mood board *Design team canvas* *Project agenda* *Word cloud, mind map*	SSD Future designer's mood board SSD Future user journey *Business model canvas* *Prototyping/mock-ups/video*	SSD Spatial service system map SSD Service space touchpoint matrix SSD Future user journey SSD Future personas *VR-experiences, plans, elevations, 3D's, models, video* *Mock-ups of touchpoints*
Characteristics	Period of discovery, gathering inspiration and insights, identifying site, visitors and needs, seeking content information, gain knowledge and acquire inspiration about the specific topic.	Analysing the research results, defining key elements and major design goal.	Period of ideation, various options to solutions are investigated, pitched and iterated.	Delivery of the final result by defining the tangible and intangible features of the S&SD, different steps in the realization, using adequate and user-centered visualization tools.

Finally, the design teams delivered nine finalised space and service design solutions. They envisioned the future personas and stakeholders, the spatial service system, the interactions between touchpoints and users and among users. The teams visualized the pre-service, service and after service in customer journeys within the available spaces. They offered narratives about future spatial scenarios, models, mock-ups of touchpoints and VR-experiences aiming at offering the client realistic estimations regarding the intended output

and emphasised the difference between *what is the space looking now* and *how it will be used in the future*. Technical plans, specifications and road diagrams proved the technical viability of the project and allowed the client to make the next step; the execution of the project.

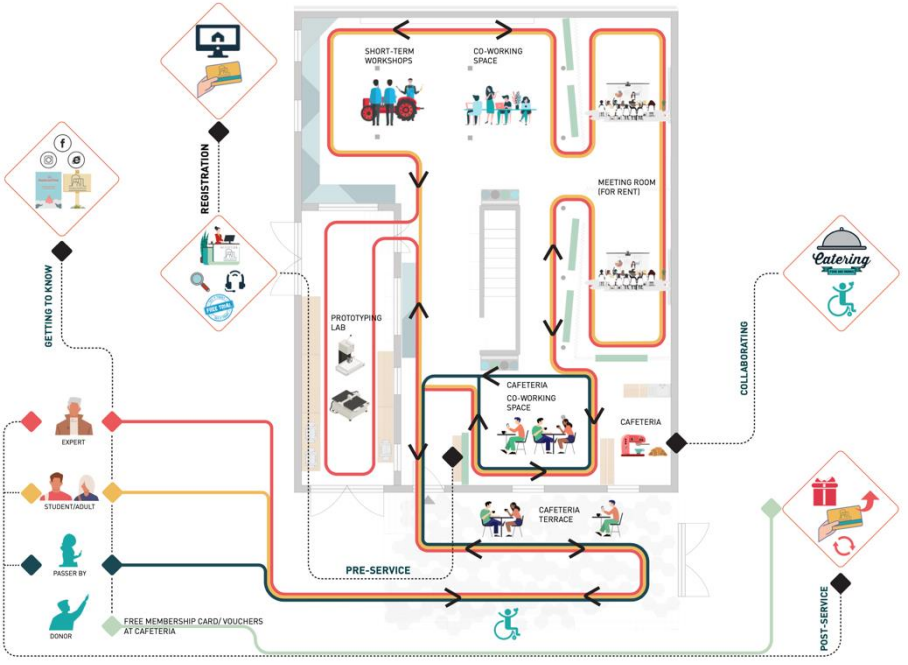

Figure 4. Spatial Service System Map – Design: Bui, A. (Vietnam), Mols, A. (Belgium) & Hamaway, C. (The Netherlands) (2020).

The screening of the student outcomes revealed that out of the nine team projects and based on the circular economy theory and the Butterfly diagram, one project succeeded in designing circular objects. Two projects reached the level of designing circular objects and circular spaces and six projects offered circular spaces, objects, services and systems. Students' feedback revealed that even stronger process guidelines and checklists would help to generate the best overall solutions. Next to this, it was suggested that adding extra layers such as circular economy, inclusive design, project budget, legal requirements make a wicked design challenge even more wicked.

Conclusions

Spatial design has evolved into a Space and Service Design field with new applications and social-cultural-economic interpretations. Through empirical research, educational practice, experiments on methodology and application of tools, and through extensive participation and feedback of numerous stakeholders, a new design culture in the field of spatial design and service design has been established.

The course referred to in this paper responds to the needs of regional, real-life partners by improving their service spaces and user experiences. Over the past five years a specific design thinking methodology has been developed. Based on service design's as well as spatial design's core characteristics, it combines participatory, multidisciplinary, user-centered, interaction and social design approaches. Using the Double Diamond as a reference, the methodology addresses both space and service and provides (student) designers a strategy to respond to complex baseline situations and design challenges. Users are able to specify the baseline situation and articulate the needs of the client, users and space. By distinguishing what is there and what is not there, it provides designers a starting point and guidelines that allow for the delivery of a complete design response to both the space as well as the service needs.

In ongoing research, new tools were and are continued to be developed to respond to identified gaps. The final set of tools will incorporate references to existing suitable tools but also offer new guidelines that will guide the designer through the space and service design process. In closing, Space and Service Design is a young and emerging discipline and requires ongoing research, experimenting and further feedback from the design field and clients about the effectiveness of methodologies and tools related to different situations.

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Design education and forest environments – learning from and with living systems

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Abstract This paper considers two design student projects at Otago Polytechnic, Dunedin, New Zealand completed in 2019 in partnership with local environmental groups, who are environmental kaitiaki (guardians) of local forests. Both projects required empathy including and beyond human-centered design. Design students were compelled to listen and learn carefully, working with the needs of others, including the non-human. Students became part of a local community – and shared forest experiences – in order to see through the eyes of others (including birds) and to craft communication design responsively. This paper considers forests as integrated ecologies in which humans are always implicated, and considers how design processes may potentially expand and grow as responsive living systems, so that designers (and design educators) may become more conscious actors in the world.

KEYWORDS | MORE-THAN-HUMAN CENTRED DESIGN, LANDSCAPES, DESIGN AND ECOLOGIES, PROJECT-BASED LEARNING

Introduction

In 2019 two groups of senior communication design students at Otago Polytechnic in Dunedin (New Zealand) engaged with design projects in partnership with two local environmental organisations. The projects required us to go outside – to learn in, from and with – our local forests and their designated caretakers. The results of these projects included a high level of student engagement outside the classroom, and in some cases the development of useful outcomes for the host organizations. As a teacher these projects helped me to reflect on the value of developing relationships through design.

In this paper I will first briefly describe the two projects, and use some examples from student project outcomes to illustrate the kinds of engagement we had as a result of working with these two local communities. I will then consider the models we use for thinking about and teaching design and reflect on contemporary theorists from outside of design. These will be drawn together to consider how projects such as these might help design theories grow as responsive living systems, so that designers may become more conscious actors in the world, as Stuhr-Rommereim and Day suggest "interwoven with our environment" (Stuhr-Rommereim and Day n.d).

Project 1: Town Belt Kaitiaki

According to *Te Ara*, New Zealand's online encyclopedia:

> " Town belts are large tree-filled wilderness spaces that encircle cities and are, in theory, protected from development. Though the idea of town belts emerged in Britain in the early 19th century, the first ones were created in the new settlements of Australia and New Zealand in the 1830s and 1840s." (Te Ara website: parks and gardens)

Unlike most other cities in New Zealand, Dunedin's Town Belt is relatively intact, and is comprised of 202 hectares of forest and sports grounds in the central urban area of Dunedin and across several suburbs.

Dunedin's Town Belt Kaitiaki is a collaborative, student-led education programme for local schools and early childhood centres. Currently there are 15 schools and centres who are located nearby the Town Belt and participate in the programme. *'Kaitiaki'* is a New Zealand Māori word that translates into English as "trustee, minder, guard, custodian, guardian, caregiver, keeper, steward" (maoridictionary.co.nz 15 February 2020).

The Town Belt Kaitiaki is facilitated by an education co-ordinator (Claudia Barbirat in 2018-2019) who supports student ambassadors from these 15 schools and their use of the

Dunedin Town Belt as both an outdoor classroom and a space where they can put what they learn into practice, using a collaborative community education model for conservation[1]. The school children and teenagers meet regularly. They have developed a vision for their role as kaitiaki of the Town Belt and have embarked on a number of student-led projects. According the Dunedin City Council website "[projects] range from advocacy of the Town Belt, improving recreation opportunities, monitoring wildlife and predator trapping…The purpose is to help young people to value and understand the significance of the Town Belt and its *mauri* (life force) and learn to sustain and care for the environment." (Dunedin City Council website 12 December 2019).

The Communication Design programme at Otago Polytechnic uses a 'project-based learning with communities' approach, where teaching and learning about design is paired with live community projects, engaging primarily with social and environmental organisations. In this way formal learning outcomes are embedded within project design. Students engage in work-based learning, and develop professional social skills alongside their design literacies. The results often demonstrate both broad and deep learning, in a process that is shared. Client organisations learn about their own design needs and about the design process while students (and teachers) learn about their client organisations' work and communication needs. The learning conversation allows for multiple perspectives. Our senior students report feeling confident and prepared for work at the end of their degree, having several live projects in their portfolio, and an extended range of experiences such as facilitating relationships, conducting research, development and design to both prototype and final handover stages. The Town Belt Kaitiaki project fitted well within the kinds of projects we work with, and included the added challenge of having children and youth as stakeholders.

The project began with research. Many of our students had never heard of the Town Belt, and their first task was to go out and explore it. We developed maps of our collective experiences before meeting with a group of Town Belt Kaitiaki (TBK) student ambassadors, and used these maps to discuss experiences related to specific sites, listening to the group's aims and current projects. Our clients ranging in ages from 8-17, articulated their work, and together we identified a range of design outcomes that our students could develop in partnership and prototype, and could be usefully employed by the TBK in achieving some of their aims.

[1] A collaborative community education model for conservations found in a few other centres around New Zealand, including the successful **Kids Restore the Kepler (**https://www.kidsrestorethekepler.org.nz/) and **Kids Greening Taupo** projects.



Figure 1: Experience maps are part of the Discover phase of the Double Diamond model

Listening, empathy and respectful language were required when we worked with the ambassadors as they became 'project partners'. Design students used a design thinking process to better understand the needs of the group. The Double Diamond process was developed by the British Design Council in 2005. It follows the four phases – Discover, Define, Develop and Deliver.

For this project, design students spent their course time conducting site visits, developing experience maps, making historical and design research, and developing agile responses to the brief. Some of the projects completed the Double Diamond where they have managed to iterate, test and design a refined design outcome that the TBK have used, such as a logo and brand story. But most of the design student teams finished a low-fi prototype including paper and online maps, wayfinding solutions, classroom resources for teachers of 3-7 year olds, a guide for social media engagement and an event management toolkit. Many of these were user-tested at a TBK student ambassador *hui* (gathering) and with schools. Through the ongoing iteration of design outcomes, design students were encouraged to revisit sites throughout the Town Belt, and consider what they too had learned through first-hand experience that could provide ideas for the ongoing design conversation.

The design prototypes became 'thinking tools' or ways for both students and partners to communicate sites, experiences and opportunities with each other and with others. In the process of working together in this way we all learn.



Figure 2: TBK student ambassadors workin on website wireframe ideas with design students

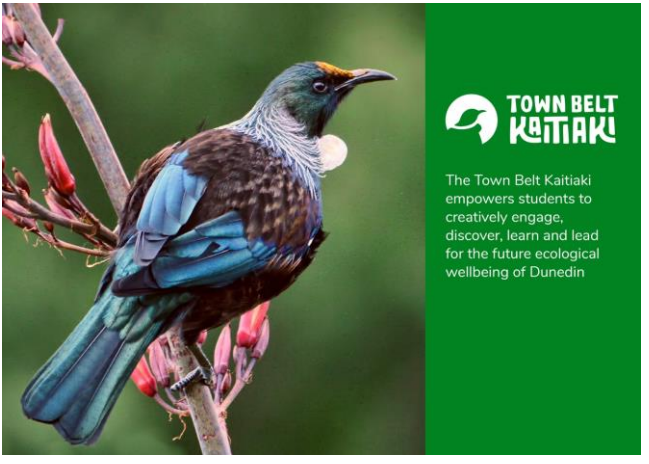

Figure 3: Tui was the native bird chosen to represent the Town Belt Kaitiaki, as it is a territorial song bird, guardian of the forest. The resulting brand and design outcomes are centred around concepts of guardianship (kaitiakitanga). This core value is supported by empowerment (whakamanataka), caring (manaakitaka) and education (matauranga) for the future of the Town Belt. Original image (left) from franzjoseftours.com, Student logo (right)

As a result of our designs the Town Belt Kaitiaki student ambassadors have formed a stronger and deeper understanding of their purpose. The project enabled stronger

engagement with other members of the community (Department of Conservation, Signal Hills Studios and all the participating schools) and has activated a new sense of togetherness, empowering the TBK ambassadors in their mission and vision.

Evaluation from both Town Belt Kaitiaki co-ordinator Claudia Barbirat and TBK student ambassadors was very positive. “The most amazing collaboration yet! The project meant so much to TBK and was so in the spirit of our programme.” *Claudia Babirat, TBK education co-ordinator*. Similarly design students felt educated and empowered through the collaboration. “I’ve lived my whole life in Dunedin, but I never heard of the Town Belt until now… the difference with this experience is working with young clients. We were learning together.” *(Student course evaluation)*

The project required listening, observing and finding opportunities. Alongside this, students engaged in developing environmental, cultural and social literacies, an entrepreneurial mindset, and interpersonal skills. Through engagement in this project design students begin to understand themselves as members of the local community with responsibilities for ongoing action, through their increased environmental and cultural literacy. TBK’s values became the designers’ values, including guardianship (kaitiakitanga), empowerment (whakamanataka), caring (manaakitaka) and education (mātauranga). The project required design students work outside their classroom, with others in collaborative ways, including the urban forest.

Project 2: Orokonui Ecosanctuary and The Kākā project

Prior to the arrival of humans, Aotearoa New Zealand was a site of many endemic species. As a result of the country’s long isolation from other land masses many of New Zealand’s animals and plants are not found elsewhere – including 245 species of birds[2]. (Te Ara website: plants and animals)

However the arrival of people – first the Polynesian Māori, and later European settlers – saw the demise of many of these.

> “Early European explorers and colonists remarked on the volume of the birdsong. But burning and milling trees reduced and fragmented the bush area available to birds, while introduced predatory animals depleted populations and completely exterminated some species. Around 50% of native bird species are now extinct in the North and South islands.” (Te Ara website 2 February 2020) https://teara.govt.nz/en/native-plants-and-animals-overview/page-3)

In contemporary Aotearoa New Zealand a number of ecosanctuaries – offshore island, fenced and mainland – to provide protected habitats and nesting sites for some rare and endangered species. Orokonui Ecosanctuary is one of five fenced sanctuaries.

[2] 71% of these extinct species were endemic to Aotearoa New Zealand.

> "A predator fence surrounds 307 hectares of Coastal Otago forest, pests have been removed, habitat enhanced with weed control and planting, and many rare and endangered species re-introduced." (*Orokonui website 2019)*

Orokonui Ecosanctuary is located 25 minutes north of Dunedin (and Otago Polytechnic) and is the site of another senior design student group of projects in 2019, including two design honours students. The Kākā Project was developed by design students Katherine Woodfield and Georgia Ryan, collaborating with Information Technology student Nick Mulrooney. Their project focused on developing design solutions that would help to educate local communities about behaviour and best practice in regards to Orokonui's flock of native parrots, known as kākā. Kākā are described as an indicator species (Recio et al 2016). They are vulnerable to predation, especially while on their nests, but if kākā are safe, the environment is likely to be safe for a range of other species. While the sanctuary will be safe, kākā will fly beyond the fence.

> "In 2019 it was rare for any sanctuary visitors ever see the kākā flock, because they spend most of their days outside the sanctuary, only coming back at dusk to visit the feeders. Most of the flock are tagged, but of the kākā that have hatched in the sanctuary or that the Orokonui staff are aware of, almost half of them are missing and presumed dead. This is due to impact from predators, inhospitable environments, and human interference." (*Woodfield and Ryan, The Kākā Project 2019, p7*)

The Kākā Project involved a year of research and project design, and included weekly visits to the sanctuary, meeting regularly with sanctuary staff and taking walks in the forest. The students engaged in literature and context reviews, expert interviews and stakeholder testing. Slowly, over the year, their relationships grew stronger, with each other, with neighbours and project stakeholders and with the Orokonui forest and birds.

> "Through these regular meetings and discussions, we realised the research aims of our project were how to educate, encourage and empower local communities to help local kākā thrive. Our tool of choice as designers was through interactive multimedia storytelling. … Our hope was that through applying our storytelling and design skills we would create products that are innovative, engaging, fresh and effective." (*Woodfield and Ryan, The Kākā project dissertation 2019, p7*)

Through their research and design process Woodfield and Ryan consulted with local Māori and identified important connections.

> "A Māori approach to these conservation issues provides a deeper understanding of (*kaitiakitanga*) – connections between the land and the people who live upon it. Our project needed to respect these connections, and it also needed to emphasise the

> importance of kākā, both as an indicator species and as a *taonga*[3] species." (*Woodfield and Ryan, The Kākā project dissertation 2019, p34*)

Secondly, they identified a range of approaches suitable for interactive multimedia storytelling, selecting two media and two strategies for targeted communication.

A choice-based game and website was selected for its ability to generate empathy around local contexts. This was developed using 2D assets, and modelled on a rural lifestyle property, such as those found immediately outside the sanctuary. This game was entitled 'Neighbours' to relate directly to its initial audience, those living near the sanctuary and within kākā territory.

Alongside this, a playable Virtual Reality environment was developed to encourage flow, as players were encouraged to see through the eyes of a kākā as they return to the sanctuary in the evening, and could listen to other kākā as they about their day's experiences outside the sanctuary. This was a concept or pitch, a single playable space, that demonstrated how the game could work.

Both playable screen-based experiences were designed to help local people[4] better understand the risks of their own behaviours and backyards for kākā, and how sometimes simple changes can keep kākā safe. Examples included backyard trapping to eradicate stoats, covering compost bins to discourage rats, and planting food sources the birds liked to forage for rather than feeding the birds human food such as nuts and fruit.

Research, interviews and direct experience informed their storytelling, and through regular checking and correlating information, the students assembled a variety of stakeholders.[5] This example demonstrates students making connections between published research, their first hand experiences and their proposed design-led storytelling.

> "…(this article) concludes that juveniles are more "innovative, curious and exploratory" (Loepelt et al., 2016). This is in line with the general characterisation of juvenile kākā we have observed from experts and in person. Juvenile kākā are a good example of a protagonist or main character in a game." (*Woodfield and Ryan, The Kākā Project dissertation 2019, p12*)

[3] Taonga, according to Maoridictionary.co.nz is a "treasure, anything prized - applied to anything considered to be of value including socially or culturally valuable objects, resources, phenomenon, ideas and techniques".

[4] The proposed games were targeted towards local nearby communities, through schools and hoped to be available for visitors to play at both Otago Museum and the Orokonui Visitors' Centre.

[5] Such as Orokonui, Otago Museum The Halo Project and Predator-free Dunedin



Figure 4: Kākā Virtual Reality visualization. Image provide by Katherine Woodfield and Georgia Ryan 2019.

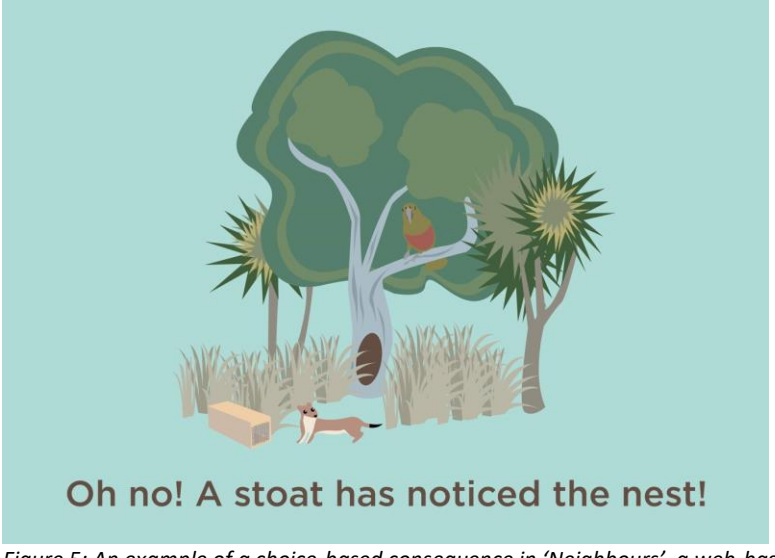

Figure 5: An example of a choice-based consequence in 'Neighbours', a web-based game designed to engage Orokonui's halo community to better understand how they can create backyards that are safer for kaka. Image provide by Katherine Woodfield and Georgia Ryan 2019.

From their design research the students reflected on the nature of their relationships and how to encourage others to respect and both actively protect and leave space for the birds' own needs. One of the main themes that emerged through this research was the importance of maintaining healthy boundaries between people and nature. "Not pets, not pests" was the term Woodfield and Ryan chose to describe this relationship, where the effects we can have on each other are explained in terms of healthy distance.

> "…in this world it can be easy to forget that we are a part of nature too and that we are holistically connected to the world around us. It can be easy to forget how to interact with our native plants and species, with introduced pests, or with a curious parrot that finds its way into your backyard. … we want to encourage people to think actively about the choices they make in their backyards… (and to) think about the experience a kākā has in this world, and how individual actions may affect them…

The students found that storytelling and gameplay could help people experience this healthy distance, but realise other forms of connection too.

> "By combining storytelling, technology and conservation, we hope that people will come to realise that the world of an ecosanctuary and the world of a backyard are not separated, but connected and dependent. " (*Woodfield and Ryan, The Kākā project dissertation 2019, p49*)

Through our regular visits to the sanctuary Design students were compelled to listen and learn carefully, walking and talking about the experience and their changing ideas, and working with the needs of others, including the kākā themselves. In the process of working in this way, we became part of a local community – forging close connections. We would often sit silently in the forest listening to the activity around us. Listening was an important way to learn, but students asked many questions, and became well versed in the behaviour of the kākā flock, who we rarely saw at the sanctuary during the day.

Dynamic systems in which we are always a part

As a group of colleagues[6] we have developed methods for working with environments and communities, drawing upon the Double Diamond approach, combining direct first hand experiences, experience and journey mapping, developing stakeholder relationships, conducting expert interviews and literature and context reviews before analysing, developing prototypes, and seeking feedback from participating stakeholders and users, iterating and prototyping.

However, as our work has led us beyond human users, I look outside of design writing to reflect and make connections that we can introduce to design thinking too. Donna Haraway,

[6] Denise Narciso and Ana Terry were co-teaching on the Town Belt Kaitiaki project, and Denise Narciso has worked as a co-teacher in a number of other projects since 2017. Other teachers assisted with project development including Martin Kean and Morgan Oliver.

is a feminist and biologist, who reconsiders the ways we think about our human place in the world. Haraway's (2010) book *When Species Meet*, inspired me to consider our design classroom experiences beyond their immediate educational outcomes. Haraway's challenge in the opening pages of the book, is to question our separate wholeness as beings, drawing upon "co-habitation, co-evolution and cross-species sociality" (Haraway 2003) in order to refocus on ourselves as always in dynamic co-operative systems equally biological and social.

Within these systems Haraway encourages curiosity, a quality we foster in design studios too. "Curiosity should nourish situated knowledges and their ramifying obligations." (Haraway 2010, 289). 'Situated knowledges' is a term Haraway uses, proposing that we value 'embodied' accounts of knowing and that we consider all we know as mediated through specific and historic contexts. "Situated knowledges require that the object of knowledge be pictured as an actor and agent, not as a screen or ground…"(Haraway 1988, 592). Haraway insists that we engage in the "power charged social relation of conversation" (Haraway 1988, 592). A conversation requires us to position ourselves, to speak as well as listen, to accept in order to respond. Conversations require humility and patience. These two projects both required many conversations with a variety of project partners and stakeholders. Beyond that, a special kind of listening emerged within both student groups, with implications beyond the human. Through our work with forests and their inhabitants and human caretakers, design students did not dwell in the past nor harked for a return to a previous untouched time in New Zealand's history. Rather they sought to understand our connections – with each other, and beyond human – and by implication our responsibilities.

Our conception of nature as separated from daily human experience has its roots in Eurocentric meta-narratives and dualist ontologies. A history of designers working with nature is identified by Louise St Pierre (2019) where a continuum of changes beginning in Europe in 1500's continue to shape the way that designers think and work, through the separation of human thought and earthly matter. While St Pierre traces a history of attempts by designers movements to reconnect this dualism, human-centred design continues to position humans as actors, and frames nature as powerless. This is in stark contrast to Haraway's 'objects of knowledge' that she insists are positioned as actors or agents. St Pierre advocates for humility, and specific and place-based practices, supporting Blenkisop's call to "…turn to nature as a teacher: "New relationships and commensurate language will arise slowly out of action–actual engagement in new ways of being present to, and interacting with, the world." (Jickling et al, 2018: 36, in St Pierre 2019, 105).

St Pierre is advocating action-based engagement of designers in the first instance, a practice also required in both projects described in this paper. We could not have gained the same level of engagement with our design environments and communities without direct engagement. Although direct engagement is a premise of human-centred design, social relations that extend beyond the human would be unusual. Our work with forest environments and birds sought to create and share a social approach through a design-led enquiry.

A third article also helped me to consider these projects. Juanita Sundberg is contemporary Canadian writer, her article 'Decolonizing Posthumanist Geographies (Sage, 2014) – although not written for design educators – provides both a critique of dualist conceptions of nature, but she also proposes ways or methods for working differently.

Sundberg identifies three steps for practicing in ways that decolonize posthumanist thinking about our natural environments, and in each step, I have found parallels in the teaching and learning projects described, or in the New Zealand education context that I am practicing within.

I summarise Sundberg's three steps and consider the how these may be identified in the two design projects.

Step 1: Sundberg's first step is locating the self, 'identifying the position you learn from'. Sundberg proposes that we recognize our position but that the goal is to move beyond it, using the term 'homework' to describe this. "…homework starts from where we are but the goal is to move beyond identity politics to take responsibility for the ontological and epistemological worlds we enact through the paths we walk and talk." (Sundberg 2015, 40). This echoes Haraway's situated knowledges. In a simple way, our students are making first steps towards recognizing and negotiating their position through leaving their classroom, and working with others. They start to propose that the work of designers is much more focused on relationship building, and seeing through anothers' eyes, and that other's eyes could be those of a parrot.

Step 2: Sundberg's second step is 'Learning to learn about multiplicity'. She builds from the concept of 'walking with' put forth by the Zapitistas in 2005, which proposes 'participatory reciprocity', framing knowledge as a social activity. In this Sundberg believes we must make room for indigenous knowledges, protocols and methodologies.

A number of Māori concepts were employed by both consultants and stakeholders throughout our projects. These concepts are not easily translated, and are inseparable from the experiences of working with other indigenous frameworks. The Kākā Project students, while not indigenous, identified the importance of respecting and making room for Māori concepts, and did not separate this from other forms of knowledge. They described the birds as *taonga* (treasures) alongside the fact that they are an indicator species – a biological term – embedding cultural value as inseparable from environmental and ecological value. The concept of *kaitiakitanga* (guardianship) held both projects together, connecting students with both their forest environments and their environmental caretakers, and both had consultant activities through formal partner relationships with local *runaka (*tribal) representatives.

Step 3: Sundberg's final step is recognizing walking as a performative co-production of knowledge and space …"Dialogic practices/politics of walking and talking, doing and reflecting…the path to social change must be walked and talked " (Sundberg 20015, 40).

During both projects, design students were required to leave the classroom and learn through direct experiences, and through working with others including regular forest trips. The powerful process of walking and talking cannot be underestimated, and shaped the nature of both project experiences, as we learned from each other, from and through the forest experience.

Sundberg's three steps connected with Haraway and St Pierre's efforts to define a relationship-based engagement with more-than-human and natural environments.

Design education

Designers and design educators have started to embrace and communicate open-ended and dynamic environmental processes as responsive systems; however through projects such as these we start to see the limitations of some of the design frameworks and processes. We need to continue to ask questions of human-centred design and its methods. This will require different interpretations of agency, environment and action for designers and design educators. We need to continually consider how we can broaden human-centered design processes to include the more-than-human in social relations and reflect this through teaching and applying skills such as humility, listening and making room for other sorts of knowledge, including the non-human. We need to be critical of design processes that don't recognize the necessity of being specific and located, and those that consider a single design process as universal.

These projects did not start out to seek to be critical of established methods but required listening, observing and finding opportunities. Alongside this, students engaged in developing environmental, cultural and social literacies, and interpersonal skills. In many ways collaboration is at the heart of these projects. Teachers work collaboratively with students who are working in design teams with others. Beyond the classroom however, students learn to work with stakeholders in a collaborative way, including the co-design of potential design solutions. These projects are founded in developing strong relationships, and out of these emerge trust. In these cases relationships extended beyond human relationships, to include specific forest places, at times both performative and relational. While to claim that we became "interwoven with our environment" (Stuhr-Rommerein and Day 2012) would be an overstatement, these design education experiences did become 'thinking tools' to help us communicate sites, experiences and opportunities with each other and with others.

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Acknowledgements: These projects were co-taught with Denise Narciso, Ana Terry and Morgan Oliver with project support from Martin Kean. Many thanks to Katherine Woodfield and Georgia Ryan and the year 3 students of 2019 for your work and engagement. Our projects would not have been possible without willing partners Town Belt Kaitiaki and Orokonui Ecosanctuary, we look forward to more opportunities to learn together. In 2020 The Kākā Project received funding for further development from the Otago Regional Council's Eco Fund.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design educators in the 21st century: Applying The Compass methodology to prepare future designers as changemakers in a culture of resilience.

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Abstract | Design education faces new challenges due to the growing globalization, dynamism of markets, the development of technology and high levels of complexity in various systems. The Circular Economy has been proposed as a restoration concept that implies reusing materials, using renewable energies and reducing waste. Designers have the opportunity of leading sustainable innovation by considering the long-term implications of their actions. Design educators should focus on teaching future designers to think critically to fulfil the responsibility of designing a sustainable world. Nineteen instructors at our design school were certified by The Index Project® to teach the Compass® methodology. This paper describes major takeaways self-reported by the participating instructors through the final article assignment delivered to Index. Findings from each article were classified and compared using a matrix to determine common and individual discoveries. Data analysis enabled us to identify successful aspects of the methodology when applied to the variety of cases and areas of improvement for future development. The Compass proved to be a flexible frame of action to organize, structure and manage the design process. The fundamental aspect valued by instructors and students is the focus of the method on maintaining coherence between FORM, IMPACT and CONTEXT throughout the design projects.

KEYWORDS |DESIGN EDUCATION, DESIGN TO IMPROVE LIFE, DESIGN FOR SUSTAINABILITY, DESIGN CULTURE, RESILIENT DESIGN

1. Introduction

Currently, design education faces new challenges in response to the growing globalization, the dynamism of markets, the incessant development of technology and high levels of complexity in various systems. The traditional Linear Economy model of consumption ("take-make-dispose") is unviable due to constraints in the availability of resources, scarcity, and the damage of the environment (Stegall, 2006). The Circular Economy model has been proposed as a system that is "regenerative by intention and design" (Ellen MacArthur Foundation, 2015) shifting the disposal 'end of life' of products and systems, for a restoration concept that implies reusing materials, using renewable energies and reducing waste. Confronted with this rapidly changing reality and the world's actual complex challenges, such as the Covid 19 pandemic, designers have the opportunity of leading innovation by considering the long-term implications of their activities and thus, design educators must focus in teaching future designers to think critically to respond to the responsibility of designing a sustainable world (Andrews, 2015).

Design educators need to constantly strengthen their knowledge, skills, and abilities, by incorporating pedagogical and creative approaches that enhance their students' and their own learning and mindset building process. Instructors must empower students with the concept of design as a way of living, thinking, and thriving. Consequently, design students who develop a resilient mentality, can transform problems into innovative and sustainable solutions for social welfare, improving people's lives.

Our design school counts with a wide variety of instructors, trained in different and specific areas. As a design school in the 21st century, we aim to install a common and valuable design culture to transmit to our students the core mindsets and roles of designers as relevant actors in society. Considering the influence and responsibility that design has in the preservation of the environment and in transmitting ecological literacy (Orr, 1992) to the global population through design, we signed an agreement of collaboration with the Danish NPO: The Index Project®, which considered certifying nineteen of our instructors in the methodology "Design Compass to Improve Life®". In order to receive the certification, each participant (or team) had to design and implement an intervention in which they applied the methodology to solve a challenge detected in their work at the Design School.

Section 2 of this paper reviews the implications of the transition from a Linear to a Circular Economy, the role and opportunity for design and designers in this scenario, the need for educating designers for sustainability and some of the resources, methodologies and tools available for them. In addition, it describes the Compass methodology. Sections 3 to 6 are centered in displaying the variety of interventions designed by the instructors and major takeaways from their experiences applying The Compass methodology to solve diverse challenges.

2. Literature Review

2.1 Towards a Circular Economy, the role and opportunities for design and designers

Today, the world faces a major environmental crisis as a result of the development of The Linear Economic model which benefited some aspects of productive systems–oriented mainly to consumption–deeply damaging the environment and the natural resources reserves (Andrews, 2015). In this scenario, the Circular Economy model has been proposed and is beginning to be successfully implemented as a way to 'design out' waste (Ellen MacArthur Foundation, 2015) by rethinking productive systems to favor disassembly, reuse, and produce cleaner energy. But the environmental and sanitary problems we face today are not only influenced by the physical attributes of products. There is a need to transform the values by which we live in the world, which represents an "extremely complex sociological dilemma" (Stegall, 2006).

In this context, design as a discipline and designers as practitioners, have a relevant role (Kolko, 2015), and a responsibility as changemakers in a culture of resilience. If designers supported the development of the Linear Economy in the past, they have today the "potential of facilitating and even leading the development of a Circular Economy'' (Andrews, 2015). Stegall (2006) proposes the concept of "intentional design", based on designing products that support positive, and constructive ways of living in the world. If design is focused on the well-being of people and the planet, it can actually improve people's lives (LUTNÆS, 2019), and even likely be able to influence in the way people live and in the "values they hold" in the future (Stegall, 2006).

But how can we influence as design educators to provoke a change in mindset of future designers? Probably the first thing that we need our students to question is the responsibility of creating more products that respond to a culture based on consumption and premature obsolescence and motivate them to shift the paradigm to replace the concept of 'consumer', with the concept of 'user' (Andrews, 2015; Kolko, 2015; Stegall, 2006).

2.2 Design education for sustainability

Educating designers for sustainability is described in the literature as a fundamental aspect of design curricula (Andrews, 2015; Stegall, 2006; Orr, 1992). At the same time, the concept of 'circularity' is proposed as a powerful 'rethinking device' to produce creative solutions and stimulate innovation (Ellen MacArthur Foundation, 2015). Designers educated for sustainability, will be able to incorporate sustainable thinking in their projects (Andrews, 2015), and will understand local needs, cultures and ecosystems to produce adequate solutions to diverse challenges. Future designers will only design for sustainability if they

develop their own ecological literacy first. This way they will also spread ecological literacy to all members of society through intentional design (Stegall, 2006).

The design process used historically by designers has been described as a 'designerly' way of thinking that alternates iteratively the space of the problem and the space of the solution. Through these cycles, the problem is framed and re-framed and the ideas with which designers seek to solve them evolve and are modified (Dorst & Cross, 2001; Wiltschnig, Christensen, & Ball, 2013). Designers 'engage in a dance of process, creativity, and often conflict' (Kolko, 2011), making sense of challenges identifying constraints and requirements of their users.

There are diverse models and methodologies that have been developed to support designers in their evolution to a more sustainable design practice. The "Cradle-to-cradle" approach (Braungart, M., McDonough, 2002) proposes that products should be designed so that after their useful life, the materials they are made from become nutrients for new products or for living organisms. Eco-design (Brezet, H. Van Hemel, 1997), defines a series of strategies to manage and assess the ecological aspects of a design and its productive process based on the Eco-design wheel. The Circular Design Guide developed by the Ellen Mc Arthur foundation (EMF) and IDEO was created to support circular principles in organizations and has proven to be effective as a hands-on guide (Reigado, Fernandes, Saavedra, Ometto, & Da Costa, 2017).

All of these methods support the movement towards more sustainable modes of production, and the development of critical innovation. As described by LUTNÆS (2019), critical innovation "calls for everyone first to consider what situations to change, then the socio-ecological consequences of intended change, and who would benefit from a specific situation changing". Andrews (2015), complements the previous by pointing out the need for designers to approach problem-solving in a holistic way, orienting their thinking and practice of design towards the Circular Economy to create sustainable products and services.

The Compass® methodology developed by The Index Project® is a model proposed to structure the design process which can be combined and complemented with the methods mentioned above to create sustainable solutions to improve people's lives.

2.3 The Index Project®

The Index Project®, formerly INDEX: Design to Improve Life®–born in 2002 in Denmark–is a Danish NPO with global reach that inspires, educates and engages people in designing sustainable solutions to global and local challenges. The organization promotes the application of design and its processes to create better solutions in vital areas of the lives of people and communities worldwide. The development of their design approach is coherent with the literature revised on the belief that our globalized and knowledge-based world demands different skills from those needed in the industrial traditional linear economy. Societies need critical, innovative and responsible citizens who can ideate solutions for

complex challenges using cross-disciplinary, user-centered and sustainable processes, methods and techniques applicable by everyone (not only by designers).

Although they agree on the relevance of Design Thinking and the creative methodologies connected to it as a means to provide future generations with the skills needed in the 21st century, they insist that mere design thinking is not enough. They suggest that design methodologies must be deeply anchored in what the organization in 2002 coined Design to Improve Life; a user-based design approach that ensures that the triple bottom line of economic, social and environmental sustainability is always taken into account.

2.4 The Compass® methodology

The Compass® (The Index Project, 2012), is the backbone of the learning initiatives developed by The Index Project®. It is a problem-solving and planning tool that integrates the three fundamental competencies of didactics, process facilitation and 'design to improve life'. It guides the design process by helping students and/or professionals to navigate, focus and stay on track, while encouraging curiosity, engagement, creativity and innovative thinking.

It uses the parameters of **form, impact and context** in four phases: **prepare, perceive, prototype and produce**. In this way, fundamental aspects of the development of a design solution are covered such as function, potential, level of innovation, propagation and economic, environmental and social sustainability. In addition, it examines usability and cultural/geographical factors, specifically in the context where the solution will be implemented. Combined, these parameters assess the real possibilities of a design to improve people's lives.

FORM: evaluates the surface, material, interface, color, coherence and aesthetics of the design.

IMPACT: is centered in the relevance and real potential of the design to improve people's lives and in its economic and environmental sustainability.

CONTEXT: focuses in the context in which the design will be inserted, the relevance of the challenge and the solution in the culture and geographical location in which it will be implemented.

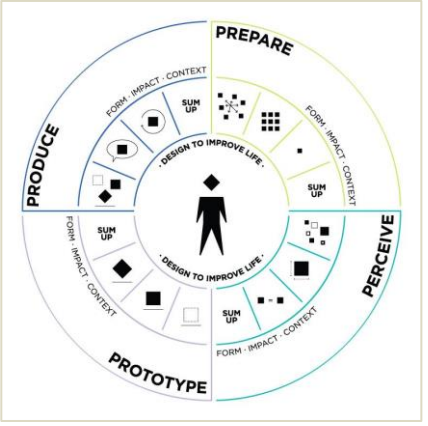

Figure 1. The Compass® methodology developed by The Index Project® Each of the four phases are composed by a series of steps that ensure the form-impact-context triad is being assessed.

3. Methodology

Nineteen instructors at the Design School participated in the training program to learn how to use the Compass. The selection included academics dictating a variety of courses in the three majors that the school offered at the moment (Graphic Design; Space and Object Design; and Digital Interaction Design). The training program consisted of sixty-five class hours hosted by two members of The Index Project®, divided in two weeks spaced by 5 months (March/August 2018). During the first week, participants were introduced to The Compass methodology going through its four phases and concluding with the delivery of a fast one-day team assignment. During the second week, the training focused on deepening the acquired knowledge and exercising various facilitation roles to enhance the learning process of instructors and students. The training was finalized with the planning of an implementation intervention using a whole Compass cycle by each instructor (or groups in case of co-teaching teams).

This paper describes preliminary results in the form of main takeaways self-reported by the participating instructors through the final article assignment delivered to Index and from the feedback given by The Index Project team. Findings from each article were classified and compared using a matrix to determine common and individual discoveries. Data analysis enabled us to identify recurrent successful aspects of the methodology when applied to the variety of cases and areas of improvement for the future development of the Compass.

4. Intervention cases

Table 1 displays a description of the intervention cases designed by the instructors individually and in teams depending on the selected challenge. The election of the challenges was free, limited only by the requirement of planning and executing a whole Compass process (going through the four phases). The majority of the instructors developed plans related to their courses, but some teams also designed workshops for organizations or collaborative projects between the Design Schools and companies or institutions. For example, one of the groups chose to use The Compass methodology to develop, plan and frame a strategic vision for the University, which for the Index team "*shows a great overview that you can actually use design-based tools in an academic context*". Another instructor used a real-life challenge: cycling in the Municipality of Concepción to empower students to use their knowledge and skills to improve their communities' lives.

Table 1. Intervention Cases designed by the instructors at UDD.

WORKING GROUPS	Area of intervention	Title of the intervention
CASE 1: 3 instructors	**Organizational/**Strategic Planning Design for Schools at UDD	Towards a strategic approach in universities: Design tools for strategic planning to envision the future.
CASE 2: 1 instructor	**Academic & Collaborative**/2nd Year Graphic Design Studio jointly with Ashoka Chile	COLLABORATIVE DESIGN / Temporary Exhibition Information System to disseminate the experiences of young Chileans who are agents of change.
CASE 3: 2 instructors	**Organizational**/Workshop for the development of a Security Project in *Mutual de Seguridad*	Compass Training Workshop to frame a challenge and define a security project for professionals and managers of Mutual de Seguridad.
CASE 4: 1 instructor	**Academic & Collaborative**/ Joint project between UDD Design and the Municipality of Concepción	Application of the Compass® methodology to improve bicycle user experience in the city of Concepción Chile.
CASE 5: 1 instructor	**Academic**/Final Year Project Studio	Defining the Final Year Project challenge: using the Compass to work collaboratively, actionate ideas, and develop a first prototype of solution.
CASE 6: 1 instructor	**Academic**/3rd year, Space and Objects Design Studio	The Compass by Index: Innovative learning experience in an Object Design Studio.

CASE 7: 1 instructor	**Academic**/Idea visualization in the Idea Laboratory course	Idea visualization system as an educational tool to maximize the efficiency of the creative process focused on the initial stage of idea germination for social innovation projects.
CASE 8: 1 instructor	**Academic**/Integrated Design Studio in the fourth year of the Design degree program	Intrinsic motivation as a driver of design learning, towards a sustainable and human-centered outcome.
CASE 9: 1 instructor	**Academic & Collaborative** /Ideation and Creativity Studio, first year students	The Compass® as a support tool for the development of projects in the Ideation and Creativity Studio; innovation in health for the Regional Hospital of Concepción-Chile).
CASE 10: 1 instructor	**Academic**/Final Year Project Studio	Promote competence development an attitude towards innovation throughout the design project.
CASE 11: 1 instructor	**Academic**/Interdisciplinary course design	The Compass for interdiscipline: Interdisciplinary courses design through the Compass Methodology.
CASE 12: 2 instructors	**Academic**/Integrated Design Studio in the fourth year of the Design degree program	Incorporation of the Compass in Integrated Design Studio at UDD.
CASE 13: 2 instructors	**Academic**/Ideation and Creativity Studio, first year students	Use of The Compass in First Year Design Studio to teach the stages of a creative ideation process.
CASE 14: 1 instructor	**Academic**/First Year Visual Semiotics course	Structuring and prototyping of a theoretical-practical curricular activity that measures the development of competencies and learning results in the course Visual Semiotics with the support of the Compass Methodology.

The following images illustrate the collaborative and active design process that The Compass methodology fosters in various contexts of application.

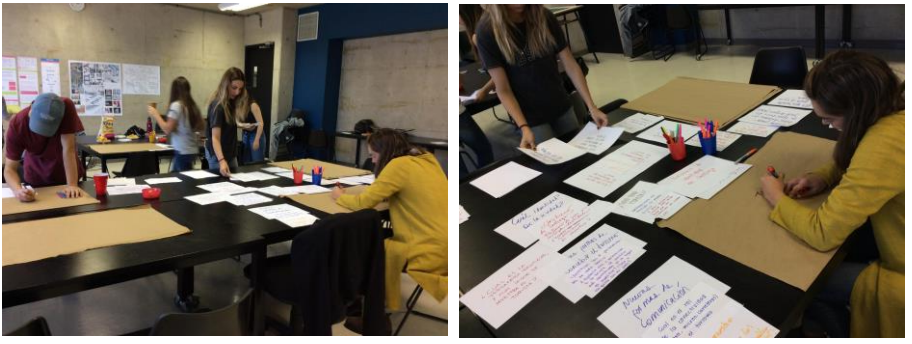

Figure 2. Organizing and selecting ideas about topic of interest.



Figure 3. Collaborative Mind Mapping and Personas

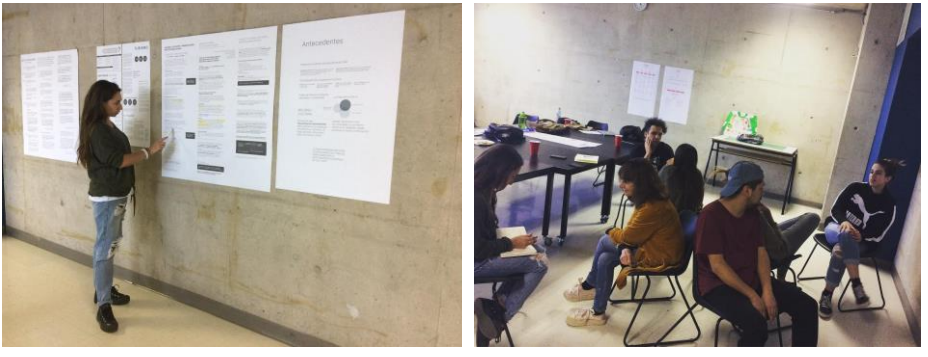

Figure 4. Interview and observation data analysis and Oracle Round.



Figures 5 and 6. Strategic Planning Design for UDD Design School.

5. Main Takeaways described by instructors and The Index Project team

- **Alternating divergent and convergent approaches:** The Compass methodology enables to flow in the dynamics and challenges that are present when alternating between divergent and convergent approaches. This is highly useful when facilitating a design process, as it provides a solid overview of the interdependency between the space of the problem and the space of the solution. Participants reached a high level of motivation and commitment participating in the activities which greatly favor creative and divergent thinking so necessary to design and plan with future vision. In addition, teams were able to converge and agree upon the large number of ideas generated by working collaboratively.

- **Focusing in action:** The dynamic experience of using The Compass and its various techniques keeps the process active and creative. The four phases are oriented towards action and critical thinking is experienced through hands-on activities that foster collaboration and decision-making. In addition, the use of the body and movement is supportive of a philosophy of teaching that in the words of an Index facilitator: “isn’t solely about the mind but, just as much about the body”.
- **Supporting teaching and project structure:** The Compass methodology supports both teaching and learning. It considers how to foster creative thinking in students and at the same time pushes instructors to plan their activities in a detailed way, considering their learning objectives and expected outcomes. The structure given by the four phases of The Compass combined with setting clear learning goals for each of them gives students a clear understanding of what to achieve in each step of the process. Students demonstrated that they understood the fundamental aspects to consider in their design processes after experiencing the use of The Compass.
- **Exploring Mindset, Motivation and Fun:** The Compass techniques are very strong in the early phases of the design process forcing participants to develop an exploring mindset and not jump into defining solutions before the challenge is thoroughly understood. This approach pushes students towards change and out of their comfort zone. The energizer techniques provided in the Teacher’s Guide proved to be useful for students to gain energy when the design processes become exhausting and extra challenging, “shake-up and renew the work environment, hence boost the motivation” (Index team member).
- **Creating a learning community:** Students and instructors shared the confidence they felt by being part of a learning community while using The Compass. The techniques offered by the Compass, especially in the first two stages (Perceive and Prepare), enabled facilitators to create an appropriate environment for all participants to have an opportunity of being heard. In addition, students worked collaboratively which contributed enormously to the quality of their projects. The “four learning spaces” defined by the methodology (roles of facilitators during the process), opens up a completely different learning community and an inspiring constructive feedback culture in the classroom. Instructors described they felt more connected to their students’ topics of interest and personal visions and also more objectively critical about their proposals.
- **Assessing coherence for sustainability:** The FORM-IMPACT-CONTEXT triad and the instruments available to analyze them, supported students to question and assess their ideas by collaboratively assessing the variables in the following way:

  FORM: What is the solution I am creating? Why does it have that form? Is it sustainable economically, socially and environmentally?
  IMPACT: Who is the user of my design solution? What does he/she really need?

CONTEXT: What is the context were my challenge is inserted? How does that context define the solution? Why is my solution adequate for that user and context?

6. Areas of improvement for future development of The Compass methodology

- **Data Analysis Tools:** Instructors observed that even when some students collected interesting and relevant data from their users, they did not know how to process, interpret and synthesize that information in order to generate insights for their projects. Complementing the Compass with specific tools to organize and approach the analysis of observation and interview data would support this gap.
- **Connecting objectives towards expected outcomes:** Instructors concluded that listing up objectives and expected results for every phase of the process enables them to plan clearly. Incorporating a technique to intentionally connect these aspects could contribute to the coherence of design projects and teaching-learning plans.
- **Deepening user study:** One of the main difficulties faced by the students was the identification and understanding of the user. The "personas" technique helped them to imagine and visualize a possible user, but they were not proactive in deepening on the users' lives and empathizing with them. This distance from reality influenced their ideation process decreasing the degree of innovation, adequacy of their solutions and coherence of their projects (which weakened the FORM, IMPACT and CONTEXT triad).

7. Conclusions

Through this initial overview of results of the fourteen intervention cases implemented by our instructors, we conclude that The Compass is a flexible frame of action to organize the design process. It is not a specific design tool to develop product design, or eco-design, but a structure that enables to manage the creative process and combine it with other instruments. Going through each phase enabled students to visualize the project as a whole and organize their actions towards a clear objective.

The fundamental aspect that we highlight is the focus in maintaining coherence between the triad of FORM, IMPACT, and CONTEXT. The constant recapitulation of these three dimensions during the four phases of the process enables to transform research data in

empiric evidence that materializes through innovative, sustainable and adequate solutions that improve people´s lives.

As partners of The Index Project®, we peruse to analyze all of the implementation cases in more detail, compare them and work towards evolving The Compass and its future impact in design education and project development.

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Acknowledgements: We are thankful for the dedicated work of The Index Project® team to teach us the Compass Methodology, and the access to the reflective articles facilitated by the participants to develop this paper for the Cumulus Conference.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design for Social Impact and Crafts Communities in Turkey

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Abstract | A considerable amount of social impact projects promise the revitalization of the crafts sector and empowering of the artisans. While a part of ongoing projects around the world might be considered successful, the rest loses the essence of working with the craftspeople and is rather another design project for consumerism.
Therefore, this research examines various cases from around the world that tackle the issues surrounding poverty by working with craft communities. This online survey of social development projects, semi-structured interviews with artisans and one of the author's own observations in craft workshops in Turkey reveal the opportunities, problems, and areas of consideration for design practice. These findings are expected to pave the path for designers in creating a more conscious effort in working with socially, economically and culturally diverse communities and enhance the relationship between the craftspeople and designers.

KEYWORDS | DESIGN FOR SOCIAL IMPACT, CRAFTS, DESIGN INTERVENTIONS, EMPOWERMENT

1. Introduction

Design is usually associated with mass-production and high-end markets and some scholars criticize designers for not devoting their time to the world's real problems (Papanek, 1971; Fuad-Luke, 2007). However, there are many examples of design interventions that have positively affected the lives of less fortunate people (Pilloton, 2009). Margolin states that design for social impact, or design for development in his words, has existed since the 1960s and "since the 1960s, it has been introduced sporadically to the development process, although it is yet to earn itself a permanent place in that process" (2007). However, designing for developing contexts usually happens from afar and designers tend to invest their free time or pro bono activities around this concept (Fuad-Luke, 2007; Donaldson, 2008). Papanek asks, "Isn't it too bad that so little design, so few products are really relevant to the needs of mankind?" thereby criticizing designers with no interest in developing countries or rural problems (1971, p.62). The contemporary design world favors consumption-oriented design over socially responsible design (Pilloton, 2009, p.10). Pilloton suggests that "beyond the individual egos of those in the profession, however, the design firm is a mechanism that traditionally caters to corporate clients and their target consumer markets" (ibid., p.14).

While writing about the design for 90% of the exhibition of Cooper- Hewitt National Design Museum, Chick and Micklethwaite claim that developers might have good intentions toward local output in the developing world; however, the projects are usually designed by Western designers (2011, p.155). Admittedly, the criticism here is not for the designers' good intentions; however, there are a plethora of diverse layers in development projects that need to be taken into account. Briefly, societal norms, legal framework, budget, governance, financial access, cultural beliefs, continuity of use, and availability of materials can be named as consideration points (Rogers, 2014).

Manzini says that design is at the core of the problem of the world's situation today (2007, p.77). Though it can also become the answer to contemporary issues since "it [design] is the social actor that above all others, by its very nature, has to do with the everyday relationships of human beings with their artefacts" (ibid.). As Pilloton explains:

> "By adding design to the social entrepreneurship equation, we form a symbiotic relationship between people, product, and profit, bringing design to more socially and fiscally sustainable arenas while giving enterprises a tangible and deliverable tool around which to structure production, job creation, and economics." (2009, p.17)

In his book The Green Imperative, Papanek lists seven specifications for a designer, and the last two especially are more striking for the sustainability-conscious designer. These

specifications are “the wisdom to anticipate the environmental, ecological, economic and political consequences of design intervention” and “the ability to work with people from many different cultures and different disciplines” (1995, p.8).

2. Social Impact, Design, and Crafts

Crafts are “any profession that requires the use of the hands and is limited to a certain number of mechanical operations to produce the same piece of work, made over and over again” (Hirszowicz cited in McCullough, 1996, p. 12). Against all odds, crafts continue generating jobs in developing and developed countries “at a minimal cost” (Richard, 2007). However, crafts are facing numerous challenges today. The UNESCO report points out that one of the obstacles in passing cultural values on to subsequent generations is the restriction in sharing the age-old knowledge with outsiders (2003). Though craft skills and techniques were passed down the generations, it is also known that some of the traditional crafts are declining since there are only a few practitioners left and no one will learn their invaluable skills (The Heritage Crafts Association, n.d.).

Risatti claims that in the contemporary world, after the Industrial Revolution, crafts have been diminished by design; by machine production (2007, p.153). However, Shiner says that craft and design are “historical partners” (2012). Kaya and von Busch (2018) argue that empowerment by design is a way of colonizing the craft practices since craft enterprises aren’t strong competitors versus mass-production. They suggest that two options for crafts are either abandoning them or turning them into products for tourists (ibid.). To comprehend the situation better this research looked at examples from around the world for which designers and craftspeople worked together.

2.1 Cases from Around the World

The first example is a non-profit organization called Potters for Peace that “offers support, solidarity and friendship to developing-world potters” and produce low-cost ceramic water filters (Potters for Peace, 2006). The design work is based on the engineering of a clay water filter, and the organization trains local potters in building these ceramic filters with specific materials so they can create hygienic water filters (ibid.).

Another notable example comes from the Philippines where Ann Wizer started a recycling project in 2006, working with trash collectors and women who turn this trash into handcrafted accessories. This project involved over 180 women and their guild began strengthening from its very inception (Invisible Sisters, 2009). This project shows the benefits of participatory design methods as a way of understanding people and their needs. It is also notable that Mahatma Gandhi suggested “the poor of the world cannot be helped by mass production, only by production by the masses” (cited by Schumacher, 1973, p.163). Potentially, manufacturing in groups, such as the Invisible Sisters do, can be an alternative

approach to tackling the social and environmental problems associated with mass-production and mass-consumption.

In another example, Kara Pecknold focused her dissertation work enabling craftspeople in Rwanda. As part of this project, she had to develop a technique for mutual communication; because none of the parties knew the other's language during the workshops she conducted (Pecknold, 2008). The result was a brand (Covaga) and identity development for the exported craft products (ibid.).

Similar to the projects above some companies organize social responsibility projects in order to give back to the community. These firms work with NGOs or form their own teams to work with local communities. The Italian company Moroso has developed a furniture series called M'Afrique by bringing together famous designers like Tord Boontje, Patricia Urquiola, Birselplusseck, Dominique Petot with craftspeople from Africa over a period of two years in 2009 (Moroso, 2011). The project claims to be empowering the craftspeople (Moroso, 2011), however, the longer-term sustainability of this kind of endeavor is questionable when the outcomes are so extravagantly styled and fashion led. Although the products can still be found on the company's website, Moroso's positive impact on the craft communities remains doubtful (Reetzke, 2012). However, the designers like Birselplusseck and Stephen Burks- who curated the first M'Afrique installation- still work with the artisans in Senegal (Birselplusseck, n.d.; Stephen Burks Man Made, n.d.).

Max &Co. worked with the local women in Nairobi, Kenya to develop limited edition bags (Colosimo, 2009). Because this company is in the fashion industry, the timeframe for the accessories produced by the Kenyan women was a maximum of two months.

Although the cases mentioned above had some positive impacts, one can also criticise the misuse of these uniquely grown, precious talents for the sake of, for instance, producing a piece of high-fashion furniture that is likely to last in the market only for a couple of months and then production comes to an end.

In contrast, working with Hella Jongerius, the Dutch designer, IKEA created a workshop in India, in which, once the production of IKEA pieces had finished, the women were allowed to continue working and being productive (IKEA, 2009). The continuity and long-term impact are key factors in development projects.

On another positive note, governments also started revitalization projects for traditional crafts. In Asian countries, a project called One village one product (OVOP) was launched starting in Japan to inspire artisans for manufacturing unique products (Rana cited in Tung, 2012). An example of culturally significant retrieval of lost crafts comes from the Middle East. In 2010, the government of Oman set up a training project to revive the silversmith craft and the production of traditional Omani Khanjar daggers, which have been worn by the men of the region for generations. Over recent decades, traditional Khanjar making had migrated to Pakistan and India and with it the traditional metalworking and fabrication skills (BBC, 2010). The training courses set up by the Omani government turned out to be

especially attractive to women- whereas traditionally, Khanjar making had been carried out by men. Moreover, with the skills learned for Khanjar making, came new possibilities for female accessories, as additional product lines. Many of the women are planning to open up their own businesses once they have completed the training program (ibid.). The government also set up standards for Khanjar production to allow only the licensed workshops to produce the traditional daggers (Al Mukrashi, 2016). Considering the words of Merriam, craft-related businesses empower women and decrease the need to migrate to bigger cities (cited in Chick and Micklethwaite, 2011, p.150). Apart from the technical and practical aspects of this project, the attempt to preserve the heritage and bring lost values back to the culture is a less tangible but culturally important aspect of this initiative.

A recent initiative, Atlas Harran, is "developed with a democratic approach bringing a diverse group of professionals together to open discussions and set the project framework collectively. This is why a commission was put together including academics and other professionals from design, archaeology and creative entrepreneurship" (Atlas Harran, 2018) with support from the local government in Southeastern Turkey. Working with local women and refugees, houseware objects are designed based on local capabilities and resources. Trainees gained new skills and the craft workshops continue employing them.

As Chick and Mickletwaithe (2011) say, crafts are basically about the culture in which they are cultivated. Therefore, it is inevitable to question the involvement of a third party – here the designer. Chick and Mickletwaithe also mention that the projects are usually delivered from the Western world to the less developed contexts - too abruptly, without considering the impacts (2011, p.154). Melles et al. (2011) also criticize social design solutions for being "band-aid or parachute products" in developing countries. The same authors suggest for social design projects the criteria to consider are "need in context, suitability to culture, affordability in community, skills creation for locals, local maintenance, usability and flexibility, empowerment and freedom from the top-down solution" (ibid.). There might not be a simple answer to all these concerns, and it is not easy to evaluate the projects/design propositions reviewed above. However, it can be said that continuity and acceptability by local people are the most important criteria for developing design interventions in craft sector since it is a vulnerable area (Starr, 2010).

3. Crafts and Design in Turkey

The fieldwork in Turkey interviewing craftspeople (felt makers, Oltu-stone prayer beads makers, coppersmith, and traditional Harik shoemaker), designers who worked with craftspeople, and people from craft-related organizations (e.g., development agency officers, chamber of commerce workers, vocational training center educators, culture and tourism center officials, and non-governmental organization volunteers), and craft retailers revealed issues concerning the crafts enterprises, possible ways to rejuvenate the craft

sector, and the situations to be aware of while intervening with the crafts communities. Initially, this study's aims were:

1. identifying the current skills, capacity, knowledge, resources and limitations of the traditional crafts sector,
2. developing a data inventory of existing craft-related enterprises, products, processes, markets, schools,
3. interviewing various actors (e.g. craftspeople, retailers, local authorities) to comprehend the local context and issues,
4. informing the development of a feasible approach for design to contribute constructively to the crafts sector and to help determine if such a contribution was required or helpful.

During the semi-structured interviews, informants were asked about the difficulties in the sector and possible ways to overcome these challenges. Respondents were also asked how the crafts could be made more visible and what they envisioned for the future of crafts. Their answers indicated a need for change to keep crafts alive.

3.1 Reasons for the Decline in Crafts' Production

Since the foundation of Republic of Turkey in 1923, there has been a dramatic decrease in the number of craft practitioners (Öztürk, 1998). A coppersmith from the Eastern Anatolia region explained that practitioners have declined from perhaps a thousand people to about ten in the last thirty-two years, during which time he has been practicing. The field study shows there are a number of different reasons behind this decline.

Materials Supply: Adequate and timely local materials supply was found to be problematic by craftspeople. In some cases, materials are imported, and people ignore the local alternatives. In other situations, the import of raw materials affects the perceived authenticity of products. Alternative material sources are considered particularly by designers working with the craftspeople. For instance, a designer shared her experience in using up-cycled and recycled materials to produce handmade bags.

Economic Concerns: While the disappearance of crafts is not due solely to economic concerns, craftspeople do complain about not being paid well. Even master craftspeople talked about quitting their jobs because of the economic struggle. Economic problems are also related to increased competition – handmade products have to compete against less expensive goods from abroad and with mass-produced goods, which are more affordable.

Training: This age-old knowledge is usually transferred from father to son or mother to daughter, and the work is kept alive. Unfortunately, due to the current situation of the sector, a decline in the prestige of craft jobs, and fast changing consumer trends there has been a decrease in interest among young people.

Personal Satisfaction: Craftspeople who were interviewed are clearly committed, heart and soul, to their work. Even though their hard work does not often pay very well, craftspeople

feel lucky to have chosen their jobs. On the other hand, craftspeople are concerned about their working conditions. One of the junior craftspeople who is fashioning Oltu-stone prayer beads describes their work as painful since they have to sit down all day for long hours while dealing with some chemical substances used for fashioning the prayer beads with silver.

3.2 Potential Areas for Design Interventions

Respondents (craftspeople, designers and local authorities) suggested that the sector needs to undergo change to be more visible and to be kept alive. Their views are categorized as updating the crafts to fit in different markets, innovating the production processes and material use, developing regulations especially on government level and creating a viable way for passing the tacit knowledge to the next generation.

Updating: The importance of being up-to-date was mentioned and suggestions from informants vary from working with a designer, employing new production techniques, creating contemporary products, and finding an alternative function for traditional goods and ways of making.

Updating these age-old traditional products might be either utilitarian or aesthetic, to open up new markets. Development of production processes, materials, utilities, or appearances is expected to keep them alive. An expert of culture said during an interview, the update of these obsolete craft objects is required while retaining their traditional values.

Respondents suggest that keeping traditional crafts and products alive requires adaptation to contemporary lifestyles. Creating up-to-date products or producing goods for diverse and expanded markets might be a way forward for forgotten traditional products, according to informants.

Innovation: Traditional crafts are becoming lost one by one in Turkey. Innovation is one of the ways that respondents felt could be a way of making traditional crafts visible. Production of another type of wooden clog, the Takunya, is one of the crafts, which are on the brink of extinction. A designer who works to revive this craft explains that the craft did not change at all over the years. The skills were passed from father to son and they always crafted the same product.

Alteration of the production processes or the traditional products was achieved when felt producers worked with designers in Western Turkey; however, the younger generation still has difficulty in convincing the senior masters for different ways of making. The felt maker explains that he would not be able to create the new product line consisting of felt and silk shawls if he did not own the workshop.

Interviews show that an innovative approach is required for the rejuvenation of traditional crafts. Using different materials, exporting to new markets, employing contemporary production techniques, and creating new products by using old production techniques were considered as innovative approaches by the respondents.

Policymaking: Oltu-stone prayer beads in Erzurum face credibility problems since there is an imported stone from Georgia which is similar to Oltu-stone. There are mass produced prayer beads from the Georgian stone sold all around Erzurum. An Oltu-stone master explains that the mass-produced Georgian stone beads cost almost a fifth of the original Oltu-stone prayer beads which makes it difficult to market especially since they both look the same to the customers. There is a chamber of merchants and craftspeople in every city, including the field studies area, but only the felt maker who lives in Western Turkey mentioned being a member. Craftspeople admit that there is a lack of networking amongst each other nowadays.

Competition, lack of networking between craftspeople, and non-standardization of quality will continue to erode an already diminished sector. Developing strategies together with the local development agencies will enable craftspeople to create trust between the customer and their products.

Knowledge Sharing: Crafts are learned through apprenticeship. The time required to become a master may vary for each type of craft; however, the master-trainee relationship remains constant. Over time, traditional crafts have lost their status. Hence, the masters could not find apprentices in most cases. All craftspeople who were interviewed agreed on the disinterest of young people in learning this age-old knowledge. Attempts to pass on inheritance by training young people seem ineffective. A master explains that the training courses for crafts were a scam and a dedicated traditional shoemaker explains that the Ministry of Culture organized courses where he had the chance to train almost a hundred apprentices. Unfortunately, none of the trainees continued working due to work and market conditions.

Even though craftspeople have economic difficulties, there is an undeniable turnover from the crafts sector economically. A designer acknowledges that her work with craftspeople gets attention for the economic outcome. An interviewee said that related academic departments have a significant role in preserving traditional crafts by transferring knowledge and transitioning skills when required.

There is a network growing among the interested organizations and individuals that support the sharing of the age-old knowledge of craft making globally. However, there is a lack of robust mechanisms to ensure the sustainability of such initiatives. Interviewed craftspeople were not aware of such organizations. Education is another way of transferring skills and sharing knowledge. There are attempts to train young people provided by local authorities from time to time. Interviewees who participate in such activities agree on these courses' ineffectiveness. A shoemaker initiated his organisation to keep the traditional Harik shoemaking alive, but he resents the fact that there was no support from the local government.

3.3 Prerequisites for Design Interventions in Crafts Sector

The literature review revealed that some design interventions create sustainable solutions in developing contexts, whereas top-down solutions were not embraced by local people. Considering the issues related to top-down interventions, this study asked how the craft sector could be developed and made more visible in Eastern Turkey. The interviews then indicated requirements for interventions for traditional crafts' rejuvenation.

Determining the Risk of Cultural Deterioration: Interviewees conveyed their concerns about cultural deterioration and exploitation. An interviewee told about his observations when he visited a local market in Eastern Turkey that the silversmithing disappeared and then twenty years after there were only bad replicas being sold.

Interventions, especially in different cultures, require being attentive to local conditions and local views, not dictating what the trends are or changes should be or make decisions on behalf of the craftspeople. A designer/researcher who works for a social project with women acknowledged the significance of knowing where design could intervene. The craftspeople are masters of their own trade, but it becomes easily exploitable when an academic person intervenes with their work.

There are different social norms and barriers in various contexts, and the realization of such issues is required to ensure the viability of interventions. Another designer observed a change in families whereas, in the beginning, the spouses were against the participation of women in the training courses. In time, they started inviting the designer over for dinner.

Intervening with traditional crafts to rejuvenate and enable development for continuance may not be positive in every situation. As a result, considering the cultural background of traditional crafts before intervening was suggested by the informants to prevent loss in meaning and cultural deterioration. Furthermore, top-down approaches were regarded as a potential cause for exploitation of traditional values. Consequently, understanding social norms in context is likely to result in solutions that are more robust.

The Necessity for Passing on Inheritance: The socio-economic difference is dramatic between the Western and Eastern parts of Turkey. This gap and the commercial opportunities for menial tasks in the west contributed to locals in the east leaving their homes and migrating to Western Turkey. Projects for restoring the age-old crafts are in progress in various parts of the country. One of the designers said, "I will try to revive this type of weaving (Çarpana Weaving) which is about to be forgotten". Another interviewee who conducted a crafts-based project in the region suggested there was a decline in migration after feeling economically secure.

Traditional crafts are learned through apprenticeship and most of the crafts run in the family. Since the income generated from the traditional crafts is in dramatic decline, the majority of interviewed craftspeople do not pass their craft inheritance on in the family, or they cannot find an apprentice, and this causes the extinction of traditional crafts.

Enhancing the Interaction between Craftsperson and Designer: Informants who were included in an intervention project for traditional crafts' rejuvenation were asked about their experiences. A designer said some of the master craftspeople were not willing to share their skills and the designer stopped working with them after seeing degenerated replications of his designs.

An officer at a regional development agency claims that craftspeople were not interested in joining strategic conversations and development projects. Field research shows that there are challenges when designers work with craftspeople. Moreover, findings suggest ways of collaboration between designers and craftspeople such as consulting about the materials, techniques; leading the production by making the first design and letting them produce accordingly, and/or observing these non-designer makers and learning from them.

Although practitioners, designers, and local authorities can have difficulties in cooperating, there are ways of enhancing their interaction. Indeed, design interventions for craft practices might be a relatively minor contribution, and the designer has to consider whether there is a productive contribution to be made or not. Therefore, the designer must take into account why, how, when, and where to intervene with artisans' work.

4. Conclusions

The capability of design is underestimated in many cases evaluated for this study, and this usually results in disappointing short-term propositions rather than self-sufficient, long-lasting initiatives. Clearly, not all social development projects will be outstanding, but design can be a powerful tool when it is employed appropriately and inclusively. In that sense, design for the craft sector offers a variety of opportunities that can usefully and productively develop. While such an approach may help, there are a host of intangible contributions associated with conventional ways of making that lie beyond the reach of measurement, effective analysis, and quantification. These relate more to tradition, culture, values, world views, locally appropriate and traditional skills, tacit knowledge, and local experience uniquely attuned to the culture and geography of the place, community and deeper, often ineffable, notions of human meaning and fulfillment. These more profound aspects also have to be acknowledged if the priorities, understanding, and values that are currently eroding crafts and, more generally, the planet itself and its unique cultures are to be challenged and overcome.

The field study affirms that there's a decline in craft production due to material supply, economic and personal concerns, and lack of interest from the younger generation. Furthermore, potential opportunities for traditional crafts in Eastern Turkey were also investigated in this paper. Updating, innovation, policymaking, and knowledge sharing are among the ways identified by interviewees to boost and rejuvenate craftspeople's work conditions, quality of products, product's market value, and creativity.

Understanding social norms is a key factor when intervening with crafts because the craftspeople, their families, and the products they produce might be appropriate only for the culture in which they originate. The interaction between craftsperson and designer is a delicate issue since they usually come from a very different background. Unfortunately, past interventions have tended to cause a risk of cultural deterioration because they lacked sensitivity to and protection of the meaning, aesthetics, and/or functionality of traditional goods.

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Acknowledgments: The authors would like to thank Turkish Cultural Foundation for their support.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design Plugin: Using Design Thinking Approach in Smart Sustainable Cities Education

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Abstract | In this paper we propagate the use of "design thinking" as a highly useful human centered approach for solving complex challenges, like developing smart sustainable cities, which require applying knowledge from different fields for fulfilling the synchronized needs of the people, business and environment. Students in a one semester programme on Smart Sustainable Cities were trained to use the design thinking approach in a specific case (Hilversum municipality as a garden city of the 21st century). This study reveals that there is great appreciating among students for using design thinking techniques, especially with regards to finding the real human needs, identifying opportunities and concepting / prototyping / testing ideas. It is however not self-evident that students will apply design thinking skills for their project work, despite the fact that design thinking skills are part of their 'tool box' offered during the program. Therefor the design thinking approach needs to be used as the guiding framework for such complex project subject.

KEYWORDS | DESIGN THINKING, SENSE-MAKING, CHANGE MAKING, LEARNING APPROACH, SMART SUSTAINABILITY

1. Introduction

1.1 Context

Since the beginning of the 21st Century the majority of the world population lives in an urban area. This imposes huge challenges for the cities of the future. How do we solve problems related to energy, mobility, and waste in the city? How do we ensure that new innovative businesses will provide sufficient employment in the city? And how do we ensure inclusiveness, participation, and tolerance in the city? These questions challenge us to develop integrated sustainable solutions for economic, social, and environmental problems. In this paper we propagate the use of "design thinking" as a highly useful human centered approach for solving complex challenges, like developing smart sustainable cities, which require applying knowledge from different fields for fulfilling the synchronized needs of the people, business and nature. While using the design thinking approach in real world cases, students learn to apply it in any developing work. Also learning the other key subjects becomes easier and more motivating, when by design thinking approach the students find the real needs to focus on.

1.2 Purpose of this paper

This paper studies the design thinking perspective applied in an educational program on smart sustainable cities. It elaborates on the following topics: how the design thinking approach was introduced to the students, how students felt about it, what kind of results were achieved in the projects and how beneficial the design thinking approach was for the results.

1.3 Approach / method

The delivery of the design thinking approach in the minor program Smart Sustainable Cities was studied from three different angles. First, it was evaluated from the learners' perspective by carrying out surveys among the participants in the course. Secondly, the delivered designs were reviewed to assess the impacts of the design thinking approach. Third, personal insights of the staff involved in teaching the design thinking approach were added to analysis as well.

1.4 Outline of the paper

The paper continues with a description of the design thinking approach used in the minor program on Smart Sustainable Cities (SSC) (Section 2). Section 3 will present the results of using the design thinking approach, the student experiences, and teachers' insights. In section 4, we will draw the conclusions.

2. A4DT - Approach Four Design Thinking and Minor Smart Sustainable Cities

2.1 A4DT – Approach Four Design Thinking

Design thinking has been a growing phenomenon for about a decade now, but still it is many times only superficially understood and labeled as “a buzzword” with no deeper meaning or professional credibility (Huang, 2017). For designers and the design world it is something that has been done always as part of their regular design work. For the need of a simple definition of design thinking, differentiated from the design as a profession, A4DT - Approach Four Design Thinking - definition was developed in the Turku University of Applied Sciences’ (TUAS) Design Thinking Research Group, see Figure 1 (Karhu, 2020). A4DT combines four core elements of design to an articulated and easily understood model that can be applied as an approach for any kind of human challenges. These four core elements are human experience, holistic views, experimenting, and concept design:

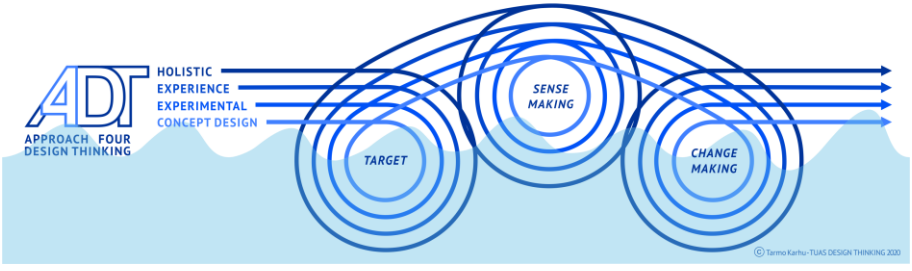

Figure 1: A4DT - Approach Four Design Thinking (Tarmo Karhu, 2020)

A4DT - Human experience (empathy): Understanding people's experiences and emotions is a key factor in finding the real needs and developing the appropriate systems and services for them. According to the Design for All principles, products and services should be accessible, understandable, and pleasant for everyone. In practice, this can mean, for example: various product versions, customizability and personalization, multi-channel communication, and semantic compatibility between the content and the expression. In action, it means designing for the users with the users in generative ways (Sanders & Stappers, 2014).

A4DT - Holistic view (context): Seek out the contexts of the target matter, the different existing connections between people, things, and systems. In the same process, possibly incomplete connections and development needs may also be seen. A holistic view utilizes the variation of distance and precision (remotely and close) and the perspectives and experiences of different stakeholders.

A4DT - Experimenting (empathy & context): Prototyping is a way to develop things: by experimenting with the idea, in practice, functionality, potential shortcomings and essential aspects of different user perspectives can be quickly detected and further developed into the next experiment and so on constantly refined. Rapid prototyping is also an excellent mean of communicating when a common understanding of a subject is created. In addition to user-centeredness, speed and risk-aversion are key factors in the development, compared to the development, where plans are only tested late in the process (slowness and cost).

A4DT - Concept design: It is worthwhile to concretize the promising opportunities into different alternative concepts, for opening the possibilities commonly understandable. In practice, the possibilities are different definitions associated with, for example, the changing world (megatrends, trends), the following alternative developments and the possible changes in people's needs and activities. The concepts are examples of what these developments and changes may mean in practice or how the following challenges can be resolved, and opportunities exploited.

In A4DT, perspectives and ways of doing combine with parallel and alternating levels, where, as the understanding grows constantly, the designs are constantly refined. Here, design thinking is defined more as something that happens in the early phase of developing, the phase of sense making. The possible change making that follows, will be executed by applying the needed methods of design, engineering, etc.

Design Plugin is a TUAS way of educating different organizations and experts, not just engineers, for the design approach. Based on 4DT Approach, it opens the Human and Holistic viewpoints and gives methods and tools for Experimenting and Concept design in all kind of development and innovation work. The concept of Design Plugin is an analogy to merging the core elements of design thinking inside the systems instead of just adding separated design elements and methods from outside and using them superficially and mechanically. Design Plugin aims at expanding the mindset of non-designers towards greater sensitivity on human and holistic perspectives and connections. Expansion of mindset is possible through both, personal and collective experiences and insights in working on real world challenges from the companies and organizations: experimenting with the different human perspectives and the fresh perception of the surrounding world leads to finding the real needs and opportunities, the possibly surprising new connections between them (Nielsen & Thurber, 2016), and ultimately to alternative solutions.

2.2 Minor Smart Sustainable Cities

The Smart Sustainable Cities (SSC) minor is a one semester program at the University of Applied Science in Utrecht[1]. It offers a multidisciplinary approach to the complex question of

[1] See https://www.internationalhu.com/exchange-programmes/smart-sustainable-cities for more information on the programme.

how to create sustainable and healthy urban living environments. In the program, students from different academic backgrounds and different countries collaborate on real-life projects commissioned by stakeholders in the Netherlands, other EU countries and even from South-East Asia. The minor program consists of 2 courses, 15 ECTS each, i.e. 'Smart Sustainable Cities – introduction' and 'The Sustainability Challenge':

Smart Sustainable Cities. In the cursory part of the minor (15EC) participants will learn about the ins and outs of Smart Sustainable Cities, they will learn more about energy, mobility and circular economy in various workshops, and finally they will learn how to apply relevant methods and techniques for researching, designing and advising on / about Smart Sustainable Cities. The latter includes for example the building blocks for social design, business model canvas, entrepreneurial skills, co-design techniques, research skills. Excursions to best practices are also part of the program.

Sustainability Challenge. During the Sustainability Challenge (15EC), participants will work independently in a team on behalf of a real commissioner (for example the municipality). Students will explore the sustainability challenge that the commissioner is facing, they will design smart, creative and innovative solutions for this challenge and advising how this can be converted into a viable commercial proposition. These assignments all have a multidisciplinary character; every student can therefore contribute to the solution from his or her own discipline.

The Minor has been developed within the ERASMUS+ project ESSENCE (European Sustainable Solutions for Existing and New City Environments) by five Higher Education Institutes: TUAS (Turku, Finland), UPV (Valencia, Spain), MMU (Manchester, United Kingdom), HAW (Hamburg, Germany) and HU (Utrecht, Netherlands). The project features extensive collaboration with local municipalities and companies, providing real-life projects for students. The teaching in the Minor is shared between the experts from sustainability, engineering, business, and design, to allow for a truly multidisciplinary approach to solving sustainability challenges; obviously design thinking being a key approach to start with.

2.3 Co-design and design thinking week of the SSC course

During the second course week design thinking approach was introduced for the students using the TUAS model, Approach Four Design Thinking (A4DT), that include the key aspects of design thinking in a simple form. Students also had some other tasks with their studies, but basically the week was reserved for the design thinking and co-design themes. Monday started with a short introduction lecture of the A4DT and design thinking in general. Since the students were already informed about the course project work during the first week, the project theme (see section 0) was used as a case in the design thinking week too. Students were grouped into five teams of 5-6 students, by considering the students' different skills and personalities in forming the most balanced groups possible. So-called DiSC profile questionnaires were used to self-assess students' behavior, thereby distinguishing between four aspects: dominance, influence, steadiness, and conscientiousness.

MONDAY – A4DT: HOLISTIC & HUMAN VIEWS

After the general design thinking introduction, student teams started to work on various tasks: first with the Holistic viewpoint (Sensing the Whole and the Details), continuing then with the Human experience (Empathizing). The aim was to increase understanding of the different levels with the different weights in the complex challenge (megatrends, trends, signals etc.), and the different human views (user personas) – the empathy for the people in the constantly and by multiple reasons changing surrounding world, the living environment.

TUESDAY – A4DT: HOLISTIC & HUMAN VIEWS – SENSING THE ENVIRONMENT & PEOPLE

For the first fieldwork day students got the assignment (Sensing the Environment & People) to go out for observing signals (Jalonen, Lehti, Tonteri, Koskelo, Nousiainen, & Jäppinen, 2017) in the real environment of the project case with open and fresh senses, and to talk with and listen to the people there.

WEDNESDAY – A4DT: EXPERIMENTAL CONCEPT DESIGN

Creativity grows, if the soil is fertile and well turned: the experimental concept design phase builds on the holistic and human views' findings. So, the deeper students have jumped into the target world and peoples' lives, the more there is material to build on and develop from. For that reason, the third day started with the students unwrapping and sharing their field experiences from Tuesday.

THURSDAY – A4DT: EXPERIMENTAL CONCEPT DESIGN - IDEATING, PROTOTYPING AND CONCEPTING

The second fieldwork day was for prototyping, testing ideas and finishing the concept idea presentation, a visual pitch of it, for the Friday.

FRIDAY – VISUAL PITCHES OF CONCEPT IDEAS INCLUDING A4DT ELEMENTS

Each student team had prepared a visual pitch presentation about their concept ideas. Pitching time was limited to ten minutes, and each team had to give constructive comments of the pitches in general, the concept ideas and the possible effects of using design thinking approach in them.

2.4 Hilversum case

The external client of the Smart Sustainable Cities project case 2019 was the Dudok Architecture Centre (DAC). DAC's mission is to increase public appreciation for architecture and spatial heritage in Hilversum, where the work of architect and urban planner *Willem Marinus Dudok* (1884 – 1974) serves as a main source of inspiration for DAC.

About a century ago, the town of Hilversum, which is now the hotspot of Dutch radio, television, and other electronic media, grew rapidly. Dudok was in charge of designing the

necessary urban extensions at the time. He based the design of the urban extension on the principles of the Garden City, made famous by, amongst others, Ebenezer Howard[2]. Through a social housing program, Dudok contributed to the increase of people's quality of life. Schools and libraries were planned in order to disclose knowledge to all layers of the population. Public amenities were included to make the city safer, cleaner, and healthier. In the 1920s and 1930s, administrators, architects, and urban planners from all over the world came to Hilversum to see how the town was being developed.

In the year 2020, the DAC wants the students to investigate what it could mean for Hilversum to become a 'Garden City of the 21st century': what does it take from several perspectives - residential, labor, health, networks, infrastructure, monuments, climate and energy - to convert Hilversum into a city that - again - attracts people from all over the world to contemplate the latest developments in sustainable urban development? Now that Hilversum can no longer expand, due to the surrounding nature, focus might be on innovative energy strategies, integrated sustainable development and a 'media city' profile in which working and green space have been integrated with a healthy living environment. DAC explicitly asks for speculative exploration of possible futures, not only based on today's knowledge, but especially on investigation and exploration of new horizons that may not be feasible right now but stimulate creative thinking about sustainable futures. Preferably, students should focus on innovative solutions of the three primary challenges for the near future: climate, energy, and food and how these relate to living, working, infrastructure and health. Principles of Ebenezer Howard's theory of the Garden City should be revived by confronting them with today's challenges and urgencies.

3. Results

3.1 Students' output from design thinking week

Student teams were about to utilize the smaller tasks during the week for the concept ideas and the visual pitch of the three chosen concept drafts.

The students who went for observing the target area (neighboring town) and met the people there, found more opportunities to study of and design for, than the students who relied only on the memories of their earlier visit there, which was done without the holistic and human view awareness of the design thinking introduction and workshops.

[2] See Sharifi (2016) for more information on the garden city concept.



Figure 2: Examples of concept drafts delivered by the students.

3.2 Students' project outputs

After the design thinking week in the project phase of the course, student teams produced the following outputs: project plan, the final project presentation, and the final project report. In these outputs, teams presented, among other required things, the selected and used methods for the research. Teams chose the methods by themselves and by approval of the tutoring teacher. Each of the five teams had a different tutor. Even though, the assignment was to design concepts for the future needs, design thinking was regarded as one research method in many. So, it was not necessarily selected as a research method. Still, since the task was to create visioning concepts for the future, design thinking elements were somehow present in working. On the other hand, from the design thinking point of view, the importance of human aspects also can be easily neglected.

3.3 Students' experiences - two surveys

There were two simple surveys conducted among the students to get insight in their experiences of design thinking and applying it both in exercises (A4DT) and the Hilversum project. The first survey was about the design thinking week itself, and the second one in the end of the project and the whole course. The response rate for the surveys was quite low: in the first survey 30% (8/27 answers), and in the second 44% (12/27 answers). Even though, the response rate could have been much better, from the qualitative point of view, the surveys gave understanding of the students' viewpoints and some perspective for developing further.

Survey 1. SSC 2019 - wk2: Design Thinking

The first survey was about the design thinking approach in general and the execution of the design thinking week. Students were asked about their study field, earlier experiences or knowledge of design thinking and about how was the week's program from their point of view.

Of the eight survey repliers four were studying engineering, two business, one design and one sustainable development. Half of the respondents already knew something about the

design thinking approach before the course. The design thinking week included some introduction lectures and workshops. Five out of the eight repliers regarded the lectures useful for the SCC minor and the project and six of them regarded the workshops useful. Following A4DT steps during the week were regarded as good way to build understanding of design thinking and especially the user point of view. One respondent liked the final concepting assignment but felt that not all students understood how the earlier exercises paved the way for the concepting assignments. The main critique was about the intro lectures being too long and taking too much time of the workshopping exercises.

So, as the students came from different backgrounds with different experiences and knowledge base, there were also contradicting opinions of the success of the design thinking week. Still, most of the repliers felt positive about the week, and all open answers gave input for further developing the course.

Survey 2. SSC 2019 – the Hilversum project

The second survey was about utilizing design thinking in the course project work, the Hilversum case. The survey started with the same basic question about the students' field of studies: five engineering, three business, one design, one sustainable development, one sustainability and economics, and one facility management student. The first subject question asked: "Would you say, you applied Design thinking approach in the Hilversum project ("A4DT", "Double Diamond", "Stanford D.school" - models etc.)?" Eight out twelve students replied: "YES". The following questions were about "WHY and HOW?". The answers were various: few emphasized the human viewpoint and working with the personas, few for identifying the problems and needs, some the prototyping and some just as a good structural base. For the four "NO" answers explanations were about forgetting to use it by being too immersed in the project to not feeling that it suits very well for the project in hand.

The following fifth question "Did you apply following methods in order to successfully execute your project? You can pick several options." opened the design thinking with twelve individual methods. Totally 60 alternatives were selected. The alternatives are in listed in Table 1.

Table 1: Survey 2. SSC 2019 – the Hilversum project "What design thinking methods were used?

Design Thinking method	n	%
Search for the right needs (need finding) before creating solutions	7	58%
Observe the (Hilversum) surroundings	9	75%
Observe people and their behavior (in Hilversum)	7	58%
Talk with / interview / listen to people (in Hilversum)	6	50%
Share ideas to people (in Hilversum) for communicating with them	2	17%
Apply Personas & scenarios in testing ideas	7	58%
Apply Empathy map in testing ideas	1	8%
Share created Personas & scenarios to people (in Hilversum) for communicating with them	1	8%
Prototype (material / immaterial) for testing, understanding and/or communicating	4	33%
Share prototypes to people (in Hilversum) for testing or communicating with them	4	33%
Create alternative concept ideas before choosing the final one	11	92%
Test concepts with people (users)	1	8%
Something else, you would like to share with us?	0	0%

Some methods are more general and some more namely as design thinking or design methods. Still it indicates that students have applied design thinking more, than they have realized themselves. It also becomes clear that design thinking methods in the later stages of the approach, such as prototyping and concept testing have been used less (probably because of time constraints).

The sixth question "For the project execution & results: How useful / beneficial were the previous or some other design thinking methods and tools that you applied, on scale 0 to 5?" followed with the open replies for the seventh question "WHY, HOW and WHAT?". Half of the repliers assessed the usefulness as 3, the average being slightly above, 3,17. One answered the maximum 5 and none the minimum 0. Many open word responses regarded it useful because of the human viewpoint:

"Searching for the right needs, observing and interviewing were helpful to find out the real needs and current situation of Hilversum (´s citizens)."

"Very useful, because we really listened to the residents and visitors and observed the city instead of only working on our ideas."

"The creation and application of personas gave me more empathy for future users of concepts and their needs, especially how most of the needs can be met by applying an overall concept."

"It is important to design for the actual users of the concept/product and find out how many people would actually be interested in it."

"It was crucial to find the needs of residents."

Also, few responded that design thinking framework gave a useful structure for the project and that prototyping was a good way to communicate with the people:

"Showing a prototype in the form of infographic was easier for them to grasp the concepts"

"Making an actual prototype of the design helps in showing people what you mean and bringing all the ideas together into something visual"

The last (voluntary) question asked for "suggestions to improve the SSC-minor from the Design thinking perspective". In the students' eight responses few asked for a clearer explanation about the benefits, for example by using more examples of how design thinking can lead to better results:

"It could be more clear from the start that this is a really useful method for a project."

"Talk less about models and more about examples of original ideas and how design thinking leads to innovation…"

"Connect design thinking tasks more to the project."

"…to show the students that they can and maybe depending on the task really should use the design thinking approach."

3.4 Other reflections

Students' feedback for the applying of the design plugin and A4DT design thinking approach has been supportive: rather than following lectures on the subjects, students like to work in multi-disciplinary projects and for the real companies' and organizations' needs. Finding the real needs and opportunities based on the human and holistic perspectives and experimental concept ideating is a revealing experience: creativity – the connection making – grows naturally by the process of sense making. Based on that understanding and insights, the alternative solutions for the given challenge can be easily justified. Contrary to these positive experiences there are also some observations that challenge the application of this type of design approaches. For Example, it was not self-evident that students will apply design thinking approach for their project work, despite the fact that design thinking skills are part of their 'tool box' lectured during the program. Students easily stick to a more traditional linear waterfall approach because they are more familiar with that.

4. Conclusion

It is clear that design thinking gets better understood by more doing and less talking about doing. Even though, sometimes students expect lecturing, keeping the lecturing in minimum and concentrating on meaningful project assignments and smaller tasks that apply the theories behind, leads to insights and deeper understanding of subjects. As A4DT model can be introduced and reasoned quite quickly (below), there is still need for developing the different ways of applying the model and its viewpoints.

> *HUMAN*: You are not an expert of everything, especially of other people's experiences and emotions: you need ways for better understanding of other people's experiencing, and it happens by communicating and doing together with people.
>
> *HOLISTIC*: Connect to the real world: isolated ideas work only in isolated world, which does not exist.
>
> *EXPERIMENTATION*: Experiment and prototype with people quickly: failing fast is not failing at all!
>
> *CONCEPT DESIGN*: Create alternative concepts from the alternative points of views and for the alternative future possibilities based on the available, collected and created data: concrete design concepts with prototypes are much easier to communicate and learn about than big amounts of raw data.

Designing and executing a large course, such as the case course Smart Sustainable Cities, requires expertise from several fields, which all play important roles in the whole. Since the SSC course was designed in an international and multidisciplinary collaboration, it requires many compromises, and continuous developing by smaller and bigger experimentations in each course implementation. As the subject is complex and requires multidisciplinary approach, the developing the implementations is challenging too. While design thinking is not actually a research method, it is easily expected to be as such. That way it is also easily misunderstood among non-designers, who may have totally different mindsets for the research and problem solving.

One conclusion of this paper is that design thinking should rather be the approach that frames the whole course and especially the project challenge. As the main framework of the SSC course, design thinking could improve the coherence of the course and easy-to-understand perspectives for the sensemaking of the complex subject. A4DT – Approach Four Design Thinking, would serve as a framing model for the whole course, and the process models, such as Stanford D.School's Design Thinking Process or Design Council UK's Double Diamond (Van Patter & Pastor, 2016), could give structuring for different tasks, assignments and projects as parts of the course.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Codesign as an operative framework for Responsible Research and Innovation: the case of Krakow Technology Park

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Abstract
The governance of emerging science and innovation has been conceptualised as a major challenge for contemporary democracies. Responsible Research and Innovation (RRI) emerged to tackle this issue by placing an emphasis on broad public engagement in the field of policy design based on the early involvement of multiple actors - citizens, civil society, researchers, industry, public sector and policy makers. Nevertheless, such early engagement is facing many challenges and it rarely goes beyond the stage of consultation (Grimpe, Patel, Wilford, Niemelä & Ikonen, 2013; Delgado, Lein Kjølber & Wickson, 2010; Chilvers, 2008). The SISCODE project, funded under H2020, identifies the application of co-design approach to overcome this challenge. This paper documents the experimentation conducted in one of the SISCODE living pilot in Krakow to support a public engagement action between policy makers, citizens and stakeholders. Addressing the acute issue of air pollution in Krakow led to a strategy of ecosystem activation applying co-design involving a variety of actors with a twofold objective: co-designing a policy as a prototype and experimenting with it through a process of development of tangible solutions.

KEYWORDS | CO-CREATION, CO-DESIGN, POLICY DESIGN, RESPONSIBLE RESEARCH AND INNOVATION, PILOTING, BOTTOM-UP INITIAVES

1. Introduction

The influence of science and technology on people's lives has been increasing continuously, certainly providing unprecedented benefits to humanity. Science is focusing its research effort on a wide set of Key Enabling Technologies (World Conference of Science, 1998), which are not only very important for innovation processes and therefore for industry and the technological players, but also for society and individuals as well, enabling solutions for specific and global challenges and changing societies, economies and working conditions. Significant impacts have already been generated in fields like health, quality of life, operations in the domestic, urban and wider environment, in transport, services and industry as well, which has a wider impact on consumers and markets. However, hand in hand with these developments, a considerable degree of public mistrust of science and fear of technology has been building up among different population segments. It is related to the fear of some individuals and communities that they will be the ones to suffer some direct and indirect negative consequences of technical innovations, which are being introduced to benefit only a privileged minority. In certain circles, citizens face scientific assessments and statements with suspicion (Wynne, 2006; Palliser & Dodson, 2019), since they fear the bias of possibly partial evaluations and impacts. European institutions have since long recognised the importance of developing and intensifying the relationship of science and technology with citizens and stakeholders, involving them in the knowledge sharing, priority setting and in the co-creation process. This started in 2001, when the European Commission published a Communication setting out the Science and Society Action Plan, the EU interventions to shorten the distance between Science, Technology, Innovation (STI) and citizens it continued with the Science in Society strategy and finally developed into the Science with and for Society (SwafS) programme and Responsible Research and Innovation (RRI) themes in Horizon 2020. This strategic setting has deepened the discourse on Public Engagement (PE) and Responsible Research and Innovation (RRI), demanding the deep involvement of multiple actors throughout the entire process - citizens, civil society, researchers, industry, public sector and policy makers - in science and innovation (Jasanoff, 2003; Owen et al., 2012; Meijer et al., 2016).

Narrowing the focus citizens are one of the key sources to establish the priorities and to guide the development of solutions and therefore it is necessary to establish a structured and regular dialogue with them and with stakeholders, facing the challenge of going beyond a mere communication effort and putting in place mechanisms to engage citizens in a science-society co-creation action of priorities, expectations and concerns shifting the role of the public from consultation towards real co-creation.

A useful approach to be applied to operationalise these twofold objectives is co-design (Bason, 2014; Brown, 2009; Sanders and Stappers, 2011; Deserti & Rizzo, 2012).

Over the last 10 years, co-creation has emerged as a significant novelty especially with the diffusion of Social Innovation (SI), a bottom-up process - social in its means and in its ends - in which social innovators, creative communities, citizens, vulnerable groups and civil servants co-produce the solutions they need at the interplay of state, private sector and civil society (Terstriep et al., 2015), tackling complex societal challenges (social inclusion, employment, migration, climate change, etc.). As the results of the SIMPACT, SIC, SI-DRIVE, Transit and Transition EU projects among others have pointed out, co-creation is an inherent part of SI. SI develops in co-creation ecosystems (Terstriep et al., 2015), as described by the

quadruple helix model (Committee of the regions, 2016; Carayannis et al., 2012) and often adopts design approaches, methodologies and tools to start from situated problems and develop solutions through a process of co-design and co-production engaging all the affected actors. In these contexts, co-creation starts from the needs, competencies and experiences of each actor, and strives to set up new modes of interaction that will flow in new assembly and network configurations. If well conducted, the process may lead not only to the generation of new solutions, but also to the reconfiguration of the same socio-technical system where it takes place. In other words, change occurs not just at the level of the outputs or single organisations, but across the entire ecosystem within which co-creation occurs. This overall system - which could be described as the complex combination of ideas, institutions, regulations and policies - constitutes at the same time the environment where more responsible approaches to science and innovation can unfold, and the result of their diffusion.
In this paper the authors present results of the SISCODE H2020 project. In particular, the paper describes and discusses results from the long terms experimentation conducted in Krakow where the Krakow Technology Park, as a project partner, led a project of the co-design of new solutions and policies to face the issue of air pollution in the Małopolska Region where the city is located. The results obtained from the experimentation show potentialities for co-design to become one of the most suitable approaches to shorten the distance between STI development and the society's needs and challenges.

2. The Project SISCODE

The SISCODE project (www.siscodeproject.eu), funded under H2020 and coordinated by the Department of Design of the Politecnico di Milano, aims to further push the frontier of the vision of RRI based on the principle of inclusiveness, involving all actors at an early stage, allowing innovation and STI policies to be conceived in a co-building mode in order to ensure shared responsibility. SISCODE aims at establishing, testing and validating 10 pilots across Europe as co-creation ecosystems (European Commission, 2016), which actually shape the scientific and innovation process and demonstrate the effectiveness of real involvement of societal stakeholders in the acceptance and use of STI in everyday people life.

2.1 Co-design as a framework to operationalise co-creation in Public Engagement and RRI

To reach the project objectives SISCODE have adopted the co-design approach, methodologies and tools that already have shown to be one of the most suitable knowledge domains to practice co-creation starting from situated problems and developing solutions through a process of co-design and co-production engaging all the affected actors. In these contexts, co-creation starts from the needs, competencies and experiences of each actor, and strives to set up new modes of interaction that will flow in new assembly and relationship configurations. The role of the co-creation pilots is to experiment with design methodologies and tools as an approach to shorten the distance between ideation and real implementation of solutions and policies (implementable co-creation). The

experimentations verify the hypothesis (and will produce knowledge) to make RRI implementable by introducing design methodologies and competences in the organisational, institutional and policy domains where it develops. The introduction of new knowledge and competences is expected to trigger transformations in the co-creation ecosystems to overcome the barriers and constraints to the real implementation of RRI. As the experimentations in the pilots proceed, the project aims to further verify the hypothesis of the application of the design process as a learning framework for policy makers to reconnect small-scale experimentation in real contexts with high level policy design.
The SISCODE system of pilots will represent a space where policy makers experiment with a design-based learning framework. SISCODE is based on the hypothesis that the introduction of effective co-creation in RRI and PE should be primarily based on its practice, or else on a learning-by-doing framework that can be complemented with reflection to achieve a sustainable transformation. This is not only in line with generic organisational learning principles (Cohen & Levinthal, 1990; Senge, 1990, Wenger, 1998, Bouwman & Grimmelikhuijsen, 2016; Beckman & Barry, 2007) but also with the way in which design knowledge and culture is built, which is historically bound to practice. In such a setting, the role of prototypes and context-based experimentations, core ingredients of the co-design approach, can be regarded as key for developing co-creation knowledge and for its appropriation in the field of policy making. The scheme in Figure 1 represents the SISCODE learning framework (Rizzo et al., 2017).

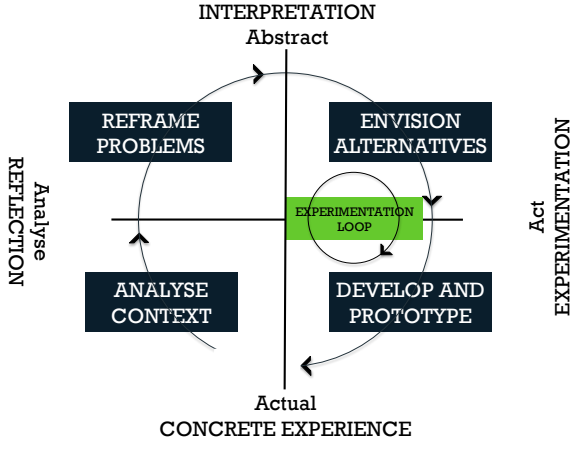

Figure 1. SISCODE design-based learning framework

2.2 SISCODE methodology for pilots' implementation

To implement this learning framework SISCODE proposed a design-based methodology to be applied in each of the single pilot projects run within the project. The use of design tools and methodologies have been defined in a modular toolbox composed of different tools for each of the phases in the design cycle to put co-creation in practice in all the pilots notwithstanding the differences among their specific challenges.

The methodology is put in practice by 10 co-creation pilots across Europe as real-life experiments. Each pilot follows a co-creation journey previously defined within the project and depicted as a scheme in Figure 2.

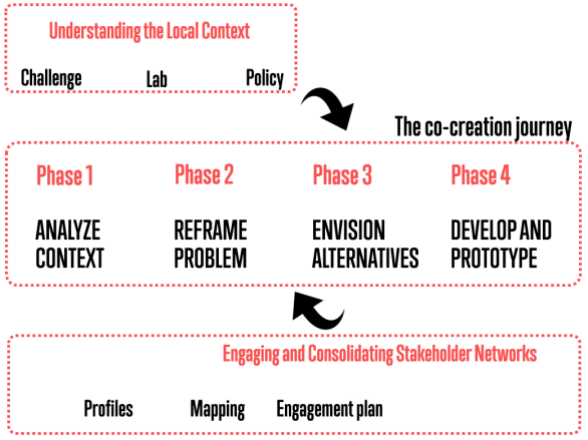

Figure 2. SISCODE's co-creation process proposed for the pilots

Starting from an analysis of the local situation, citizens and the policy environment, an initial challenge has been defined for each pilot based on the local context and the already existing relations with local authorities and policy makers influencing mainly the first three phases up to the ideation phase in which alternatives are envisioned. Throughout the entire process, stakeholders were to be identified, mapped and involved from the analysis until the prototyping phase. Each of the four phases contains activities defined by the pilots when drafting their co-creation journey. Those activities are again interrelated with specific design tools varying for the different pilots depending on their challenge, context and environment. In the following, one of the ten cases is represented in detail describing the co-creation journey, the ideated solution and individual reflections on opportunities and obstacles identified throughout the process.

4. KTP – Krakow Living Pilot

Situated in the Polish city of Krakow, the Krakow Technology Park (KTP) is a joint venture of State Treasury, the Municipality of Krakow, the region, various universities and the largest steel producer in Poland. Its main focus lies on the local development of the surrounding Malopolska region with an emphasis on technological development and innovation providing direct support to businesses. Their living lab has already experimented with co-creation, mainly from a business point of view and involving users and stakeholders mostly in the final phase testing already developed products. When required by the client, also wide

ranges of stakeholders have been involved in various stages throughout the development process of past projects. In the context of SISCODE, KTP has been involved with 2 specific aims: working on relevant societal challenges and involving a consistent group of stakeholders to identify together a potential solution to experiment with.
KTP has decided to work in partnership with the Malopolska region and the city of Krakow to tackle air pollution as one of the biggest issues for the region and its citizens.

4.1 Challenge analysis

Starting from the challenge of the air pollution the first activity that KTP has conducted with the regional authorities has been to analyse and reframe it into a problem where citizens could have an active role as co-designers.
Pursuing concrete goals in terms of lowering emission consist of a few different dimensions such as industrial pollution monitoring, development of the system of public transport, providing alternatives for traditional heating systems. One of the most important factors are the citizens of the region and their behaviour regarding everyday activities like heating and mobility. This reduction of emissions shall be dealt with by mobilizing residents.
Based on this premise KTP aims to create a space for stakeholders, policy makers and citizens to co-design a policy that includes citizens and motivate them to change attitude and habits in order to reduce air pollution. With a strong focus on air pollution and mobility, the challenge is a part of the new Air Protection Programme of the region for 2021-2030.

4.2 Co-creation journey

To tackle the previously described challenge, a co-creation journey based on the SISCODE approach has been developed by KTP splitting the single phases in activities and assigning specific tools of the SISCODE toolkit to be applied during these activities as well as addressing expected outcomes as a guideline for the experimentation (Fig. 3).
The results from the execution of this journey are described successively with a strong attention to the outputs of the single phases and the step-by-step development of the prototype.

	Activity	Tools	Expected Outcomes
1. Analyse Context	1.1 Desk Research	Desk research, Key facts, Interviews, Research participant map	Outline of the local challenge Varied stakeholders list
	1.2. Interviews with relevant stakeholders	Interest Groups Discussion Research Planning Survey Activity Network	Participants on board Data/ information collected, pilot for further analysis Outline of the perspectives of key stakeholders regarding the challenge
	1.3 Synthesize & analyse data	Initial opportunity map Trends matrix Convergence map Buzz reports	Situational analysis Map stakeholders Identification of trends and initiatives Repository of ideas and solutions Initial Report of this phase

	2.1 Understand the data collected	Mind mapping Insight clustering matrix Persona definition	Outline of the clear vision of the local challenge Data summary and visualisation
2. Reframe Problems	2.2 Aligning the pilot concept with knowledge gathered	Comparative analysis Concept sorting Concept scenarios	Realistic / feasible defined problem/ challenge Report on the chosen local challenge
	2.3 Frame opportunities	Brainstorming exercise Best practice identification	List of possible opportunities
3. Envision Alternatives	3.1 Idea generation	Brainstorming exercise Convergence map Soft „hackathon" / Design challenge	Summary of tenable ideas
	3.2 Idea selection	SWOT analysis Concept sorting Solution evaluation Concept grouping matrix	Summary of the selection of the appropriate idea
	3.3.Generate a concept	Concept scenarios Persona definition Solution roadmap	Report of solutions and policies (D3.2)
4. Develop & Prototype	4.1 Concept development	Solution storyboard Description of prototype Competences plan Strategy roadmap	Fully elaborated and detailed concept with outlined operational plan
	4.2 Prototyping	Solution prototype Solution Enactment Pilot development and testing Implementation plan	Report on the tested prototype

Figure 3: KTP's definition of their co-creation journey

Context analysis

The context analysis has been carried out starting with a desk research on the current status analysing reports and official documents as well as already active policies. The challenge has been discussed and refined iteratively in various meetings with stakeholders and policy makers on the basis of the data coming from the analysis of the context. Furthermore, an opening meeting with more than 220 stakeholders attending brought together keynote presentations, moderated discussions and Q&A's. The challenge has been refined and narrowed down in the end of this stage leading to the following objective:
How to improve the quality of the air in Krakow by motivating citizens and supporting decision makers with relevant co-creation tools and instruments?

Reframe problems

Based on the analysis and the narrowed challenge, workshops have been conducted aimed at refining the problem to be addressed. The direct output of the workshops were personas and empathy maps representing the target to be addressed with the upcoming solution. Apart from the methodology and exercises of the workshops, a particular focus has been set on advertising and reaching out to potential participants in order to gather representatives of all relevant stakeholders. The work initiated with the officials of the region in charge of

developing the new Air Protection Programme has been brought forward mainly carrying out open consultation meetings with KTP functioning as a facilitator and mediator. Citizens have been engaged in workshops in order to better analyse their needs and potential opportunities in reaching out directly to single citizens.

Envision alternatives

Collaborating closely with the region, the legal document in development defining the Air Protection programme (needed to officialise the rules, restrictions and actions to be taken by the industry for the following years) has been decided quite early to be a fundamental element of the prototype of KTP. The policy has been then developed with experts and citizens by activating a campaign to inform the policy itself by hearing from the citizens. Here co-design workshops have been implemented involving sufficient numbers of citizens directly inviting and involving specific local communities in order to get a better understanding of the perspective of citizens and their daily challenges.
Targeting the citizens on the other hand it has been decided to develop a more tangible solution to make the policy more visible and understandable with and for the inhabitants of the affected region. Co-design workshops have been conducted specifically oriented at envisioning concrete solutions based on SISCODE canvases leading to new insights.
From the numerous gathered ideas, eight of them have been selected and given into the hands of policy makers for further refinement and implementation. All of them have been taken into consideration by the experts preparing the first draft of the Air Protection Programme and have been used as a base for a Smogathon.

Develop and prototype

The drafting and finalisation of the document for the air protection programme mainly requested various consultation meetings uniting stakeholders and mediating between actors defining the legal boundaries and procedures needed to launch the official document. The draft has been published and presented to all interested stakeholders collecting feedback to then prepare a second version. In parallel, a Smogathon organised by the Municipality of Krakow and KTP developed a prototype of an app for end users to deal with the issue of air pollution. The winning project – a platform supported by an application and a monitoring system for industrial pollution - is to be developed and tested first in one county and subsequently with a broader public.

Effective Stakeholder Group	Level of engagement			
	Co-Producing	Co-Designing	Consulted	Informed
Marshall Office of Malopolska Region	×	×	×	×
City of Krakow, Air Quality Management				×
The Metropolitan Association, Krakow			×	×
University of Science and Technology		×	×	×
Krakow University of Technology		×	×	×
Krakow Smog Alarm Activists		×	×	×
ICT companies, SMI's, Start-ups		×	×	×
Media/wider public		×	×	×

Figure 4 Stakeholder engagement

Throughout all phases, various stakeholders have been involved at different levels of co-creation, ranging from being solely informed to co-producing solutions (see Fig. 4).

4.3 Final solution and outcomes

The final solution consists in two components, the first one is a legal document defining the rules and restrictions of the new Air protection programme of the Malopolska region and can be defined as the legislative frame more addressed to the industry and politics while the second element is a web platform connected to a mobile app and specific monitoring instruments that has the main goal of informing citizens and making them aware of the single contribution each of them can make. Both components of the solution have the common goal to reduce air pollution in the Malopolska region.

1. Air Protection Programme for the Malopolska region
The document for the Air Protection Programme officially applies rules, restrictions and indications for the industry on how the reduction of the air pollution in the region in the following years is to be achieved. Its development included 6 open consultation meetings with over 250 participants representing the various groups of interest.

2. Multichannel solution to provide transparent information on industrial pollution and raise awareness among citizens
The prototype consists of a web platform, a mobile app and monitoring instruments whose functions have been co-designed during the various workshops. The implementation of the solution itself is being carried out in a co-production process that involves the pilot, different stakeholders from the county and region, policy makers and the winners of the Smogathon to make certain that all involved parties have the possibility to express doubts and contribute to the final service.

4.4 Transformations, outcomes and reflections

Malopolska is the first region in Poland having started to update the regional Programme for Air Quality Improvement laying a foundation for the other regions with a strategy of activities and specific tasks, actions and obligations representing and considering all affected actors. The co-creation process itself sets new standards for the public administration and policy makers and for the citizens.
With respect to the public administration and policy makers one need identified throughout the entire process of co-designing solutions has been the necessity to provide clear and easy support instruments and tools, that are not too abstract for them completely new to design practices. Tackling such a complex problem as air pollution in a co-design mind set has been found challenging to not only involve all interested parties, but also to consider their interests and needs in all moments throughout the process. Also, the restrictions arising from operating in the field of legislation and law have been limiting the freedom of action

adding a further layer of complexity. Despite the immense challenge it laid out, the co-design approach did succeed in supporting the alignment of the various stakeholders leading to a realistic and implementable solution and the failure of past experimentations exclusively applying top-down approaches to avoid this complexity have not produced satisfying outcomes (Pressman & Wildavsky, 1973; Van Meter & Van Horn, 1975).
However, as an outcome of the numerous workshops with stakeholders and citizens, KTP managed to elaborate a list of policy gaps identified in these working sessions analysing them and elaborating suggestions and recommendations on how each of the issues could be tackled. Furthermore, as a result of the positive feedback on the workshops and the methodology applied there, the region decided to conduct more co-design activities in a different project rolled out at national level. The positive feedback from the regional authorities and their proactivity to apply co-design can be perceived as an enormous success and an important step towards the implementation of consultation processes.
With respect to citizens it emerged how much they are willing to introduce changes in their behaviours and more than this willing to collaborate with public actors even though they are often already discouraged by previous experiences and administrative barriers which can hinder involvement and lead to initially scarce participation. The results from the pilot seem to suggest a positive effect of the co-design approach experimented in SISCODE as the outcome of a process of involvement (from problem definition to solution co-production and experimentation) on the actors' engagement. This type of engagement has received very positive feedback and seemed to have also positive effects on the acceptance of the final solution when the citizens participated in its development and currently in its experimentation.
A first general reflection that the authors can draw from these results is that co-designed solutions might be more likely to be accepted both by citizens and policy makers if those have been actively included in their development and were given the opportunity to discuss problems and needs. The different workshops run during the pilot development (from analysing the problem to co-designing the solution) functioned as a space for discussions appreciated by all participants.
Furthermore, the process of engagement of different stakeholders along the entire process of development of the solution suggests two additional reflections.
First, co-designing a policy implies the engagement of different levels of governance from the local to the regional one and asks for overcoming silos that are still in place in traditional policy design processes. On the basis of the indications coming from the pilot the co-design approach to the policy development allowed the Malopolska region governance system to experiment with a more holistic approach to local and regional sustainable development. Specifically, co-design in workshops enabled policy makers from the different governance levels to gain an in-depth understanding of the barriers, drivers and issues that affect a policy implementation at each level. This understanding supported the policy makers from to develop a more coherent solution to the requirements that governance posed.
Secondly, the involvement of the citizens in the process of policy design rarely can move from public hearing if it is not supported by some level of tangibility and materialisation of

the policy itself. With this respect the pilot results show the benefit that the implementation of a prototype as a service for the involvement of the citizens in the monitoring of the air pollution shortened the distance between the policy and the acceptance of its expected impact/s.

5. Conclusions

The design-based methodology and tools for co-creation applied in the SISCODE project succeeded with respect to the general project aim to introduce in RRI a practical based approach to operationalise it. By putting together science, innovation and technology potentialities with the needs coming from the society in a process of co-design of solutions seems to be promising with respect to the advancement of the more traditional mechanisms of public hearing and consultation that are still prevailing in policy design field.
The importance of the co-design tools and their appropriateness and adaptation for the specific KTP case has been stressed as a fundamental point for successful co-creation in the context. At the same time the application of a co-design process to policy design has pointed out the complexity of a collaboration that must proceed from bottom up (citizens and stakeholder) to top down (governance levels) and vice versa encountering barriers that depend on cultural, economic, legal, societal and regulatory factors that are in place and can prevent real co-creation to occur.

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Acknowledgements: This work was supported by the European Union's Horizon 2020 Research and Innovation programme under grant agreement No. 788217

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing community: creating resilience through collaboration

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Abstract | Community must be placed higher on the circular economy agenda if a truly sustainable future is to be realised. This paper will explore the changing definition of community, looking at previous classifications and modern thought to attempt to provide an up-to-date definition that is fit for the future of our multifaceted, complex society. The paper will argue for this new definition to be included as part of the discussion around the circular economy. The research shared in this paper are the initial results from a project that is attempting to make visible and tangible the connections and communities that circular economy organisations are part of. By making visible the connections this research hopes to encourage the design of community as an integral part of the circular economy and a resilient future. The paper will conclude by arguing how the results will contribute to the field of circular economy research.

KEYWORDS | COMMUNITY, CIRCULAR ECONOMY, RESILIENCE, SOCIAL CAPITAL, CONNECTION MAPPING

1. Introduction

Today's society needs to build on community connections more than ever. If the wicked problems facing humanity are to be tackled to bring about a more resilient society then a collaborative community-based society is needed. Designers have the skills and knowledge to intervene and deliberately design community to be stronger and more resilient to the changes being brought about by the climate crisis. This paper responds to the *Design Culture (of) Resilience* track, making its particular contribution through offering a new definition of community for use in a circular economy and a more sustainable future. Through exploring the initial results of a research project, the authors will demonstrate the importance of collaboration to circular economy organisations and how these collaborations and communities can bring about a more resilient future.

2. History of community

This section will explore the history of the term 'community'. If a new definition is to be suggested, then it is important that the term is contextualised, and a thorough examination of the changing definition is explored.

Prior to the Enlightenment there was very little to separate the notions of community from society. Society, at this time, could be seen as a series of contractual agreements related to politics and economics; this was often how friendship and kinship, the basis for community, was also seen (Delanty, 2010).

2.1 Enlightenment to modernity – belonging

It was not until the late 1800s that a distinction between community and society started to be made. From this period onwards, throughout most of the 20th Century, community was theorised in three ways: nostalgia for a 'lost' ideal that has been destroyed by modernity; a loss that can be recovered and realised; or an idealised future utopia to be achieved (Delanty, 2010). These differing theories are all linked by one key thread, that community provides a sense of belonging.

Some scholars in this period saw community as intrinsically linked to a 'traditional', rural way of life that had given way to modernity and life in the city, often referred to as society. Social groups, and the relationships that come from these groups,

> "may be conceived either as having real organic life, and that is the essence of *Community*; or else as a purely mechanical construction, existing in the mind, and that is what we think of as *Society*" (Tonnies & Hollis, 2001, p. 17 original emphasis)

Once 'community', made up of social relations, had been lost to the mechanics of society, there was no way it could be recovered.

The total loss of community to society is an idea that has been robustly criticised by many subsequent scholars (Delanty, 2010). There was a recognition of the conflict between tradition and modernity, however, there was a strong argument that the cities of modernity were not as isolating and self-absorbed as previously made out.

> "There is in our contemporary societies a truly collective activity which is just as natural as that of the smallest cities of previous ages" (Durkheim & Giddens, 1972, p. 5)

Modernity saw a raise in the ‘cult of the individual’ (Durkheim & Giddens, 1972), which argued for self-determination, allowing individuals to practice ‘organic solidarity’; the freedom to choose communities based on personal interest rather than geographic or familial ties; communities formed by a conscious collective. The third way to view community, that of a utopia to be achieved, was a theory favoured by left-wing scholars such as Marx (Delanty, 2010). The definition of community laid down by this paper is focused on active, existing communities, so is not the place to discuss these ideas.

2.2 20th Century - communication

During the 20th Century ideas around community became more focused on communication as a central part of community formation. Research from the Chicago school described city-based communities as "a mosaic of little worlds” (Park, 1915, p. 608) where an individual could express different sides of their personality, "living at the same time in several different contiguous, perhaps, but widely separate worlds" (ibid). Within the city, individuals tend to be connected through 'communities of interest' rather than traditional, familial communities. Different types of community studies have grown out of these beginnings, such as political and activist community studies, or community as a place for state intervention such as welfare (Abu-Lughod & King, 1997; Hemphill & Leskowitz, 2013; Warren & Jones, 2015). The following section will focus on more abstract ideas of community, which will help to inform the definition of community proposed within this paper.

2.3 1980s - beyond ‘face-to-face’

In the 1980s a branch of community theory began to develop, moving towards community as an imagined concept, rejecting the idea of community based on social interactions (Anderson, 2006). Communities, rather, are developed through a shared, imagined connection, such as the nation or region. Mass communication establishes, reiterates and reaffirms the basis for the imagined community, enforcing and reinforcing the feelings of kinship among the community. There are subtle verbal and non-verbal communications that go into the creation and re-establishment of a community, it exists through symbols and signs that are adopted by the community and used to signify its boundaries (Cohen, 1985).

> "The reality of community lies in its members perception of the vitality of its culture. People construct community symbolically, making it a resource and repository of meaning, and a referent of their identity." (1985, p. 118).

A recent, specific example would be that of climate activist group Extinction Rebellion, they have a simple, recognisable brand that is easy to reproduce, a symbol of an egg timer in a circle (Figure 1). Wearing this logo demonstrates through visual communication to other members of the group that you are aligned with their ideas about climate change.



Figure 1: Extinction rebellion logo

This section shows that community is less centred on locative relations, but more imagined through self-identification re-enforced by signs and symbols. The ideas of community as imagined and bound by symbols becomes more significant as society moves into the age of the internet. The focus of community theory moves online, and the idea of networks start to become more important.

3. 21st Century – community and networks

As laid out in the previous section, a definition for community can be proposed for the pre-digital eras as: *providing a sense of belonging to an imagined structure, phenomena or group, whose boundaries are reinforced through verbal and/or non-verbal communication.* Within this definition we can include communities that an individual choses to be part of, and those that they in through circumstance (of birth, location, race etc). In communities of circumstance an individual still has the choice as to whether to be an active member of that community.

Communities become networked through each individual member, who has the autonomy to be actively involved as part of the conscious collective. Each of these members can be part of a number of communities, and as such, act as links between the different communities. In this sense communities can be seen as nodes in a wider network. The digital era makes communication between these nodes easier and quicker. Again, looking at the Extinction Rebellion example, this group has many communities across the UK working on their own local issues, but each local community node is connected and supported by the wider regional and national community. The individuals who make up each group also bring their own priorities for their area and can link the local and national groups to wider communities.

This section will look at how community theory has been linked with network theory and how this can start to influence our definition of community to incorporate issues of sustainability and resilience.

3.1 Degrees of separation

Linking networks and community theory can first be explained by exploring intrapersonal ties. An individual's social world is made up of many relationships based on either strong or weak ties (Granovetter, 1973). Strong ties are formed between people who know each other well, developed over a long period of time, such as family and close friends; weak ties, on the other hand, are connections established quickly and more superficially with people such as work colleagues or sports club members. Weak ties can be used to create 'bridges' to other communities (Putnam, 2000), links which can enable networks to be formed. Weak ties alone cannot make a community, however, the potential bridges created through weak ties can be essential for the survival of said communities. Strong and weak ties together can be seen as the basis for the formation of a community, although a community does not form randomly, "the relevant aspects of the social environment can be seen as a foci around which individuals organize their social relations" (Feld, 1981, p. 1060). These foci can be any number of things that draw people together, and weak bridging ties allow for a wide diversity of people to be brought in.

3.2 Social capital

Connecting a group of weak tie individuals around a focus will not create a lasting community, the ties have to be worked at and maintained. This happens though the development of social capital between community members. Social capital is a phrase used to describe an individual's worth to society through their intrapersonal skills, connections and networks. Individuals all have a level of social capital which is formed through connections with other people (Coleman, 1988). There are different types of social capital: bonding, bridging and linking (Halpern, 2005; Putnam, 2000). Bonding social capital is formed through strong ties and exists in closely linked groups such as a family or religious congregation. This type of social capital is good for mobilising solidarity among a specific community but can be exclusionary towards outsiders (Putnam, 2000). Bridging social capital, created through weak ties, is inclusive and outward facing, it facilitates the interaction of a diverse section of society. This type of social capital can be seen in organisations and clubs, it provides "better linking to external assets and for information diffusion" (Putnam, 2000, p. 22). This type of social capital can be seen to bridge different communities and provide links to other sections of society. Bonding is better for getting by and bridging is better for getting on. Linking social capital is concerned primarily with power, and who access to it. It is

> "the extent to which an individual's, or community's, networks are characterised by linkage between those with very unequal power and resources" (Halpern, 2005, p. 25)

Communities with low levels of linking social capital can be seen to be very unequal, where money and power are concentrated within a small group that is inaccessible to the rest of the community. There are three structures for the development of social capital: obligation, reciprocity and trust; knowledge and information; and norms and sanctions (Coleman, 1988). This can be explained by, if person A does something for person B then person A will

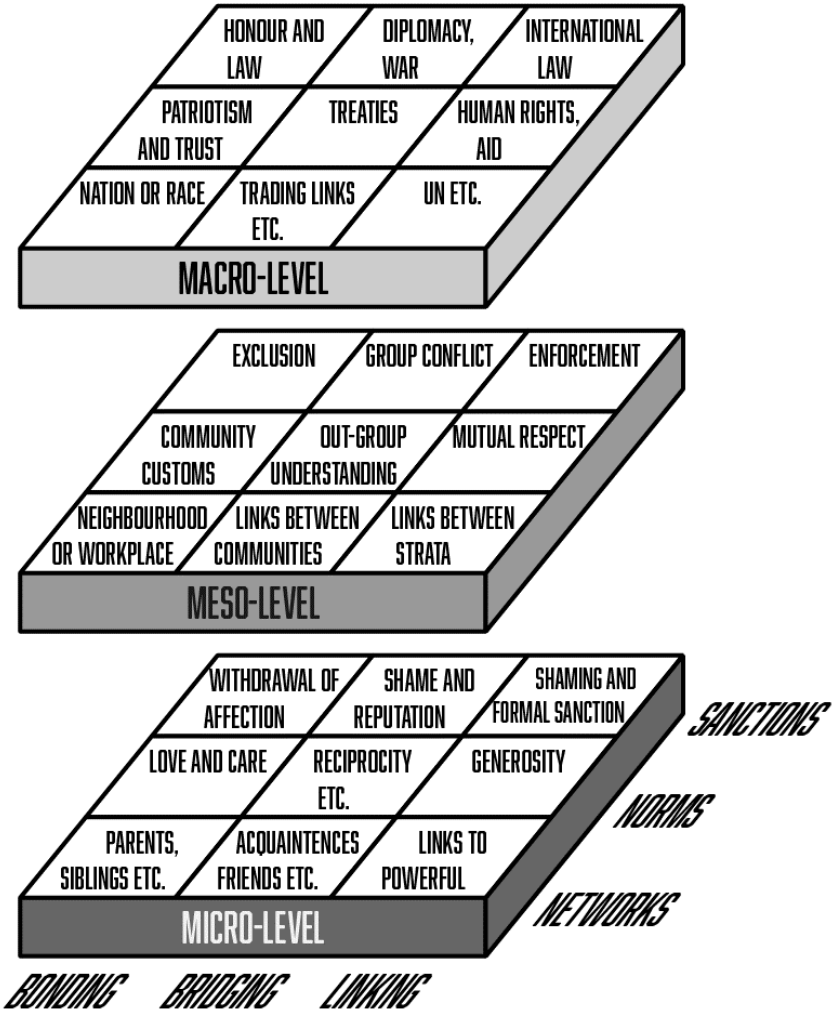

Figure 2 The types of social capital, their structures and how they operate at different levels

anticipate some kind of reciprocation from person B in the future, "this establishes an expectation in A and an obligation on the part of B" (Coleman, 1988, p. 102). Person A must trust that at some point person B will repay the favour or the reciprocity and social capital will be broken. He describes knowledge and information as important part of social relations. Person A might have interest in a subject, but not the resources or desire to learn about it in detail so relies on others within their social circle for information. Norms and sanctions describe the unspoken social rules that exist within a community (norms) and the rewards or punishments (sanctions) that are used to maintain these rules. Figure 1 explains how the different types of social capital operate through the three structures.

Bridging and linking social capital involves more initial risk but can create trusting links between individuals and communities. Social capital is very important the development of a new definition of community. Weak ties that create bridges are essential for building trust. Trust is an essential component in both bridging and linking social capital, it can allow for more access to power and money through stable political representation on every level (Rossetti di Valdalbero & Birnbaum, 2017).Weak ties that provide linking and or bridging social capital to individuals or communities are essential to create resilient, 21st century communities. The challenges we face cannot be solved by being protectionist and inward facing, they are global in nature and a global view must be taken to tackle them. Mass communication can be mobilised to educate, share knowledge and create more empathetic imagined communities. This was demonstrated recently when communities of crafters were mobilised to make and send recovery nests and blankets for animals injured in the Australian bush fires (Paul, 2020). Communities that are open and outward facing must work together to see the wider picture and help one another to bring about change to create a more resilient world.

3.3 Communities of practice

Social capital does not form in just location-based communities. Ties be formed between individuals can be through a specific, deliberately formed community of practice. This is a term used to describe an often informal group that arises based on a shared expertise or practice. These communities "are not defined by place or by personal characteristics, but by people's potential to learn together" (Wenger, White, & Smith, 2009, p. 11). These communities often come together organically through shared desire to improve knowledge of a certain subject. Communities of practice can be seen as a space for an individual to build upon skills and knowledge by connecting to a group with similar goals and practices. Like social capital there is a strong element of reciprocity in communities of practice, people contribute to the pool of knowledge

> "while trusting that at some point, in some form, they will benefit. This kind of reciprocity is neither selflessness not simple tit for tat, but a deeper understanding of mutual value that extends over time." (Wenger, McDermott, & Snyder, 2002, p. 37)

The theory was developed in order to give a name to informal shared learning that develops around a specific interest or activity.

Communities of Practice are incredibly important in the move to a circular economy and the development of a more resilient and sustainable future. As their primary focus is to share knowledge and expertise, they are the ideal places for the development of skills for resilience. For example, to teach people the skills needed to keep products in use for longer, through repair cafes, tool libraries and maker spaces. The knowledge and skills developed through a community of practice has the potential to be disseminated to other communities the members of the community of practice are part of. Passing these skills throughout a network that is wider than the initial community of practice.

The communities referred to in this paper reach beyond communities of practice, as there is a space and a need for many different sorts of communities to engage with and advocate for a circular economy and more sustainable ways of living. Communities of Practice are a useful part of the network of communities referred to, and their purpose and expertise can benefit beyond their community boundary. The linking of communities of practice with other communities shows that their real benefit is as an intrinsic part of the networked nodes.

The next section will look at the circular economy in more detail and explore the need for an emphasis on community when discussing and working towards a CIRCULAR ECONOMY.

4. Circular Economy

There is little denying that human activity is causing the massive climate breakdown we are seeing at the moment (Berners-Lee, 2019; von Weizsäcker & Wijkman, 2018). However, there is a lack of acknowledgement humanities profound effect and that we are all connected (Smith, Kim, & Son, 2017). Despite increased scientific warning there is little strong action on the climate crisis and its causes. This is leading us into a culture of hand wringing and fiddling about the edges, with a push for individual change over corporate change, which leads to companies engaging in greenwashing to allow for business as usual (Hobson, 2019; Hobson & Lynch, 2016; PriceWaterhouseCoopers, 2008). The circular economy is a current trend with serious ambitions. This model and way of shaping the world could have profound effects on delivering a sustainable future. It is promoted as a panacea by academia and business alike, however the term is often used interchangeably with advanced recycling. To engage in a truly circular economy businesses need to fundamentally change the way they view resource consumption, planning for the continual reuse of every part of their product until it can be returned to improve the organic system. Consumers, too, need to be ready to take responsibility for the items they own, by keeping them in good repair and complying with systems of return and repair to keep the resources in use for as long as possible.

The circular economy is an economic model that promotes the constant reuse of resources for as long as they are materially useful before being returned to replenish natural systems. This idea has gained a lot attraction in business and academic circles (Ellen MacArthur Foundation, 2013; Geissdoerfer, Savaget, Bocken, & Hultink, 2017; Kirchherr et al., 2018; Mathews & Tan, 2016), pushed in the UK by the Ellen MacArthur Foundation. However, the adoption and implementation of this system has so far been scattered, with governments slow to follow business and academia's lead. To really make an impact the taking up of the circular economy needs to be full scale, with a consensus across business, politics and academia.

The circular economy will improve resource resilience by advocating for the continuous usage of materials that are already in circulation (Blomsma & Brennan, 2017; Ellen MacArthur Foundation, 2013; Gallaud & Laperche, 2016). It will improve natural resilience through the regeneration of our natural resources (Ellen MacArthur Foundation, 2019; Principato, Ruini, Guidi, & Secondi, 2019; Slorach, Jeswani, Cuéllar-Franca, & Azapagic, 2019), and it can improve community resilience by providing skills and localised employment to keep possessions in good working order and in use for longer (Morgan & Mitchell, 2015; Rossetti di Valdalbero & Birnbaum, 2017; Wijkman & Skånberg, 2015). It encourages a slower repair and share culture over the fast turn over, buy and discard one we currently have. The circular economy can encourage to us see objects we own as having the potential to outlive us and to develop and relearn skills our grandparents had in order to become stewards of our possessions (Robins, 2019). This is where the developing and nurturing of communities is important. By making people aware of their responsibilities towards consumerism we can build resilience to resource shortages and other future shocks.

Designers have a crucial role to play at every stage of the circular economy from the products we use to the systems those products enter into and applying our skills to make the transition to the circular economy smoother (De Los Rios et al., 2017; Lofthouse & Prendeville, 2018; Sumter, de Koning, Bakker, & Balkenende, 2019). The current focus on the circular economy is on the mechanical implementation, this risks the value of human life to the circular economy being pushed aside. Walter Stahel (2010), one of the early pioneers of circular thinking, places a lot of value on human energy as a crucial part of the circular economy. Humans are the ones to repair and maintain the products and systems, as well as develop technologies that make it easier to close the loop.

The next section will detail an early stage research project undertaken by the authors that aims to explore the role of community in circular economy organisations.

5. Research

The research being undertaken by the authors aims to take a deep look at the networks and communities used by a small number of organisations working in the circular economy. The research takes a mixed methods case study approach, using interviews, document analysis,

and social network analysis to create a comprehensive map of the communities and organisations the subjects are involved with. This will create a detailed picture of how these communities are used by circular economy focused organisations. The authors aim to map the networks of circular economy organisations based in North West England in order to make them "*visible and tangible*" (Manzini, 2015, p. 121), to reveal how these organisations are just a small part of the larger circular economy system. By focusing on a small number of organisations the research has time to look deeply into these connections, revealing any points of interest and creating new pathways of enquiry. The organisations looked at range from large multinationals to small start-ups, this is to give an idea of the challenges faced at different levels and to show how different sized organisations activate their communities and networks to engage with the circular economy.

By examining networked communities as part of the circular economy the research aims to reveal the intrinsic value of these nodal communities to the adoption and implementation of a circular economy. By exposing the way that communities are linked the authors hope to make these links more tangible and promote the use of these links within organisations and different types of community.

The analysis is ongoing and here we can offer a tentative look at one example of the results. Figure 3 shows a map created by one of the interview subjects of the connections their

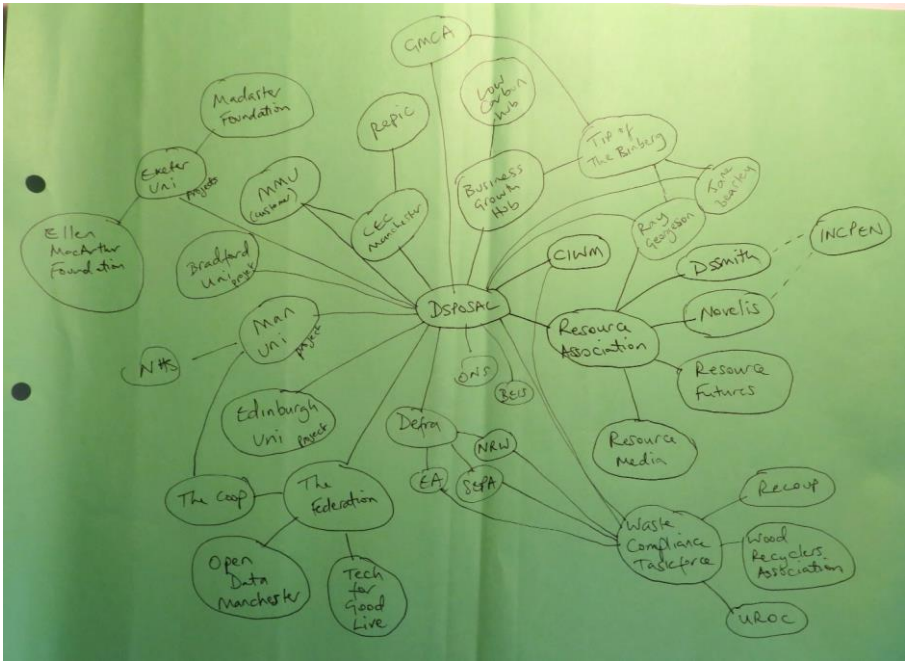

Figure 3: Rough map of interview subject's circular economy connections

business is involved with. For the analysis this map has been built upon with interview data and document analysis to create a fuller picture of the communities that the organisations are connected to (Figure 4). In this case study example, the map reveals many meso, or community level connections (purple links). These connections are made through a strong

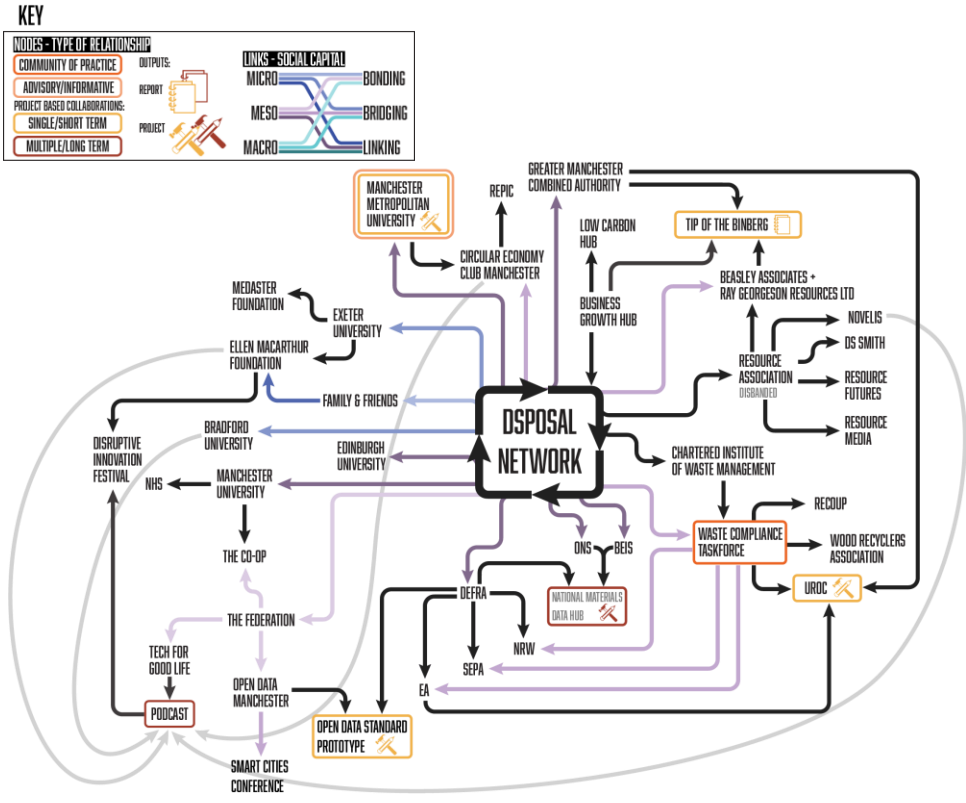

Figure 4: Social network analysis map of a case study organisation's network

push by the organisation to get their name out and create links with different people and organisations. The blue links indicate a personal or micro-level connection which is also prominent in the map, these links are used to create connections to new audiences and are actively pursued by the case study organisation. There is only one Community of Practice listed (in orange), but it provides opportunities for the organisation to link with areas of government that they wouldn't have otherwise had access to. This organisation, along with all the other case study organisations put a lot of emphasis on education and knowledge sharing through their networks. This can be aimed at other sectors, their industry peers, or through engaging the public with their organisation and using education as outreach.

Though each or the organisations studied in the research are based in different areas and are of different sizes, collaboration and engagement with wider audiences is highly important to each of them. Through providing engagement through their specific area they can open up the conversation to include wider concepts of circular economy with niche communities. The ongoing research hopes to create a body of evidence that demonstrates the need to put greater emphasis on building and establishing communities to further the circular economy agenda. This aims to ensure community becomes a more important focus and is included in the design of circular systems at every stage. These are the initial discussion points that have been raised from the data, further analysis is to be conducted before any concrete conclusions can be drawn.

6. Conclusion

Community is a structure that is deliberately designed, although, not necessarily by the current members. To ensure the continuation of the community members must take it upon themselves to reinforce the signs and symbols and boundaries of that community. Community can be viewed as a web of links and connections that we as designers should work towards revealing in order to strengthen these ties and create new ones. By making the web of an individual organisation's community connections tangible and visible, we can show just how actions, decisions and activities have the potential to ripple through the network. The circular economy as a whole is a complex web of networks that serve to loop resources around the system. The skills and knowledge locked within different communities need to be drawn upon to ensure success of circular economy implementation and uptake. The role of design within the circular economy is to establish bridges through the communities, explicitly exposing the links and realising the connections. Nothing happens in isolation so designers should be exposing these links and using them to create a truly circular economy.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing resilience. Design dealing with communities

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Abstract | Design - intended as a simplification toolkit for problem setting (therefore problem solving) - offers a methodology for resilience within communities in crisis (natural, economic, social). Communities which are involved in participated design dynamics: from Modena surrounding areas hit by earthquake (2012), to redesigned industrial areas such as airport cities (Bologna, 2013-2015), moreover from collective ecosystems (Distretto Popolare Evoluto, 2017), to public health interventions for entire neighbourhood (Gorla, Milan, 2019).

KEYWORDS | ONE, TWO, THREE, FOUR, FIVE

1. Design

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The use of the word design has widened. If in origin, it was heavily based on its function of generating products, the focus today is on services, on social structures, on community dynamics. Design is an enabling tool (rather than a discipline), in the sense of the famous phrase "Good design enables, bad design disables" by Paul Hogan. It is a flexible methodology (Moura Guedes, 2008) that can be used in any context, because suspended between opposites. In fact, design is both strategic (acts on long-term policies) and tactical (it must adapt to the occasions). It is theoretical and practical (you have to think before you design, but there is no design without a final artifact, product or service); abstract and contextual; systemic and creative.

Design builds up relationships, more than creating objects or services. Even when working on physical products, the real goal is to build a behavioral system that connects artefacts to the physical and cultural dimension of mankind. So it works on material culture, renewing behaviors rather than technical solutions, with an extensive anthropological approach. Design research is in fact an analysis of behaviors, an expression of needs, an invention of solutions to be addressed to users. This fact is particularly relevant in participatory design operations, to share the typical approach worldwide celebrated as design thinking: to propose an innovative and transversal logic in the solution of problems, summarized by the question: “what if?” (Brown, 2009).

2. Communities

This approach assumes relevance when design is facing problems related to the modification of the cultural and behavioral structure of our society, characterized by a constant and rapid change. First of all, it’s crucial in terms of responsibility - the social responsibility of the designer - as far as he works on people's real needs (Steiner, 1978). But above all it implicates the possibility of generating new models of relationship, consumption, economy. Today working for communities is for designers today an occupation that no longer concerns only the possibility of innovating local production - that is a very useful and consolidated activity; but that of reinterpreting the logic through which the same dominant economy imposed by the western world is facing the global crisis of an entire model of production and consumption (that means: development).

The economic and social model revisions in its applications (food, mobility, energy ...) are the subject of holistic design approaches (Thackara, 2017), which move easily among ideas related to bioregions (Sale, 1985), cities in transition (Hopkins, 2009), de-growth (Latouche, 2011). On a deeper, avowedly anthropological level, the "Palaeolithic turn" (Meschiari, Corrado, Gori, 2015) launches the hypothesis of a “hunture” opposed to a culture: to signify

the relevance of a human model of hunter and gatherer. This model was prominent before the invention of agriculture, and underlines the prevalence of transitory, nomadic, portable forms, showing a strong similarity with absolutely contemporary features. For example, the triumph of design versus architecture, the authors say. We can also add that it works in community management: as in transitional communities (Bauman, 2001), in "local mind" (La Cecla, 1995), in TAZ Temporary Autonomous Zone (Bey, 2007).

3. Resilience

Therefore, designing community resilience, from a design oriented point of view, means taking into account a state of crisis that can be felt as temporary in the event of a disaster; but in reality managing conditions of perpetual uncertainty, in the collapse of an economic and cultural model, still so deeply rooted as to appear without any alternative; since the alternatives could be multiple, partial and combinable. In this scenario, design can favor and optimize that invention of the day by day life (De Certeau, 2001) which in reality represents the true behavior, spontaneous and irreverent, towards hegemonies, operated by "people". Designers, taking advantage of users' skills, and interpreting his role as a facilitator, in a context in which everyone, nevertheless, designs: their daily life, their holidays, their shopping list (Manzini, 2015). The term "facilitator" is not accidental. On one hand it designates an activity practiced by graphic designer (and also, useful for design procedures) as visual facilitation, which takes indirectly the mental maps created by the psychologist Tony Buzan (Buzan, 1996). On the other hand, it refers precisely to psychology practices of a much longer tradition (Lewin, 1949) that indicates the possibility of managing and balancing individual dynamics in a group mind. These activities can become fundamental in team building operations, when dealing with temporary communities built on participants with different backgrounds, who must however be quickly put in a position to collaborate (Branzaglia, 2016).

The possibility of working on metaphors draws very close to the tools related to design for communities, and indirectly, to the more conscious coaching practices. A design oriented approach has the ease of constructing situations through tools and techniques, which make the working methodologies easily practicable. The role of experience is also part of this kind of "design anthropology": because designers build up experiences, and because any project is based on common experiences. Therefore, it is not difficult to think of a figure of "community designer". It resembles the idea of "municipal graphic designer" jokingly hypothesized by Massimo Dolcini in the 80s, inspired by the figure of the municipal doctor. And it fits with the brand new role of "territorial activator", that is the one who gives birth to community networks on Commons - the common goods. Also the architecture field has many experiences of participatory approaches, related precisely to the issues of resilience: the cases of Shigeru Bahn or Alejandro Aravena.

4. Practice(s)

By the way, Design for Communities is the name of a project created for a technical case of resilience: the 2012 earthquake, in the province of Modena, Northern Italy. The project was carried out by ADI, the Italian Industrial Design Association, through its Emilia Romagna Delegation. ADI is a unique association, as it gathers not only designers but also companies, distributors, journalists, professors…: the complete system that makes Italian design so particular. ADI has been particularly interested in the latest years in investigating the role of design among SMEs, that are the economic engine of European industry, and maintain a strong relationship between economy and society because of their local involvement.

The damage caused by the earthquake on housing and production activities risked the disruption of the community network, especially for teenagers, those most sensitive to change. The school became the center of the project, together with a series of sub-themes enucleated in participatory workshops with public organizations and citizen associations gathered around the Town Council of San Possidonio (a very small town) and the Parents and Teachers Association (spontaneous) of the primary school in the town of San Felice sul Panaro. Four university-level educational institutions in the design sector of the region (Academy of Fine Arts Bologna, Faculty of Architecture University of Ferrara, Faculty of Architecture University of Bologna, ISIA Faenza), plus one from Rome (IED Istituto Europeo di Design Roma) and two high schools (BUS Pascal of Reggio Emilia and Venturi Art Institute of Modena) were invited to organize concept design processes developing the issue coming out the participated activities through practical solutions, but above all throughout possible scenarios and symbolic gestures that could easily engage the communities.

In this case, the immediate need to carry out a resilient project arose from the difficulty of the situation and from the awareness of the actors. The problem setting phase did not require special techniques to develop citizens' collaboration. In other cases, it was absolutely necessary to use pragmatic activities and contextual metaphors to build a work group - a temporary community - and push it to cooperate. The three projects developed under the Calderara Creative Community brand (C3) from 2011 to 2015 (under the auspices of DMC Design Management Center) needed to establish communities capable of supporting the production of guidelines for public administration, and of actively collaborating with it.

That meant activating citizens on participation through the role of the various social and cultural associations that were operating on the territory; and creating a high level of consciousness about participative policies among the town council employees and managers, first and before all the ones involved in direct relationship with citizens. On the basis of this process it was possible to design a series of strategic guidelines to identify objectives that have been transformed from time to time into actual projects, financed by various national and EU calls.

The case of Bargellino - a huge industrial area on the outskirts of Bologna, very close to the airport (half of which on the territory of the Calderara Town Council) - was particularly

significant. Economic crisis and previous abandon had turned the area into a problematic place. The involvement of managers and companies' owners in a workshop that could imagine the future of Bargellino led to an effective collaboration plan with the Town Council through the creation of an association between companies intended to protect and develop the area. That plan won an UE call devoted to masterplan for Smart Cities: the only one that was won by an industrial area. A series of structural interventions were made thanks to other national and European Call.

The role of sport as a healthy and commune activity was crucial for the C3 project, as it was for the No Filter social district, a former factory regenerated by the association Planimetrie Culturali in Bologna. Planimetrie Culturali became the main partner of DMC (together with Studio Performa architecture and Antigone network for democracy) for the development of Advanced Social District, a platform for planning management, governance and regeneration in abandoned places to create a "horizontal economy" (even more than a circular one): in essence a place to exchange resources and not money, to help people and groups in difficulty. The basic idea was that regeneration is more than redevelopment on urban scale: it concerns urban planning, social communities, educational programs, services for people and so on. The platform became the occasion for several speeches, conferences, lessons in many locations: but the absence of a policy by the local government of Bologna (even if promised) did not allow it to be practically adopted.

The last case concerned totally the role of communities in health promotion. The Agency for Health Promotion of Milan metropolitan area asked in terms of concept design to the in Graphic Design Master Program of IED Istituto Europeo Design Milano to develop a communication strategy regarding heath for healthy people. The goal was to engage people to take care of their heart before getting sick, in a neighbourhood (used like a test area) of 150.000 inhabitants, called Gorla. Urban Health (the name of the project) started from an investigation of the area, the involvement of associations and public services, the identification of functions and places to activate them. Social media were used to promote a series of opportunities and to suggest people in interacting with their environment, using it like a sort of spontaneous "open air gym". 3M Design Center cooperated with the project supplying materials to indicate or to enlighten common objects such as tools for sport activities. Although it was developed as a concept, the Agency purchased one of the final projects, in order to use it in a larger scale thanks to the collaboration with a national popular sport association.

If design is a matter of providing solution through an innovative approach, that can change the point of view on a specific problem, these cases are nothing more than examples of a design methodology (let's call it design thinking). They can demonstrate that the role of design is vital for transforming ideas in practical actions and for making strategy dialogues with tactic. Of course, both side of this last couple has to be aware of their role. And, in particular, who handles strategy can't think that resilience is the unique solution for solving problems permanently.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing Resilience. Mapping Singapore's Sustainable Fashion Movements

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Abstract | Design has produced a world in which designers are presented with opportunities to alter, augment, intervene, and change existing conditions by imagining future possibilities. Many of the challenges facing the world today extend into a range of complex, societal issues that involve human actions within the natural world, resulting in a call towards sustainability. The role of design has undergone a shift from integrating systematic methods in the production of artifacts and information towards a focus on designing for more meaningful interactions. Design now requires new ways of thinking and doing through modifications, iterations and reflections to explore alternative models for education and practice. This leads to the development of new innovations and inclusive perspectives, forming social ecosystems to continually learn and evolve as a discipline for positive social change.

This research positions design as a force of change with a particular focus on sustainable fashion practices in Singapore. Design is capable of reconditioning existing knowledge against ecological concerns for methods of conservation and sustainability. It is foreseen that designing and capturing a map of Singapore's slow fashion movements will provide models and frameworks for other practices that are centred on issues of social innovation, social enterprise design, and social economies. This project presents the need to define the social ecosystem of Singapore's sustainable fashion, formalising existing industry practices towards a new paradigm for Asian design.

KEYWORDS | SLOW FASHION, SUSTAINABILITY, CULTURAL PRODUCTION, SUSTAINABLE FASHION, FASHION SYSTEM

1. Introduction

Fashion transcends time and space to communicate both individual and collective practices of the everyday within a complex system of designers, producers, distributors, marketers, and consumers. The fashion industry has shifted towards designing meaningfully, signifying a need to understand how sustainable practices can challenge and change future ways of thinking, making, organising, categorising, and sharing knowledge. This research outlines how fashion establishes a common, shared language through an examination of design initiatives and businesses to identify key perspectives, concepts, and theories supporting the symbolic communication of material culture. Taking the context of Singapore and its emerging sustainable design practices, this research examines current practices to provide a foundation upon which future models and frameworks can be developed.

The main discussion of this paper collects, organises, and evaluates the existing sustainable fashion movements of Singapore. These businesses, organisations, and design groups are categorised by scale, scope, and impact: *sustainable modes of production, second-life initiatives through reuse and recycling, circular and sharing economies, inclusive models, and education.* This paper presents three key sections to present a comprehensive overview of the fashion landscape of Singapore:

1. An introduction of theoretical perspectives to frame the discussion of how fashion, as a social practice, leads to cultural production through the adoption of sustainable movements.
2. A presentation of the sustainable landscape of fashion through an examination of current practices in Singapore, identifying five core themes of sustainable fashion.
3. A mapping of slow fashion and its future implications.

2. Theoretical Perspectives

Sustainability extends beyond conscious activities relating to the environment to involve the complexities of human relationships against the dynamics of ecological, economical, sociopolitical, global and local dimensions (Annamma et al., 2015). Fashion businesses are becoming increasingly concerned with producing value through new definitions of aesthetics and quality, as sustainable practices begin to establish new norms within the industry. This section provides an overview of how fashion acts as a social phenomenon to develop common values for the production and contribution to various expressions of culture. The review of these theoretical perspectives will lead to a discussion of how the fashion industry is shifting towards the widespread adoption of sustainability.

2.1 Fashion as a Social Practice and Means for Cultural Production

Fashion produces a world in which the dressed body presents a situated practice across varying degrees of social interaction (Entwistle, 2000). Individual identity is visually represented through bodily expressions to actively produce experiences, communicate shared values, and develop socially constructed practices. Influenced by social and experiential dimensions, the dressed body creates embodied spaces upon which durability and resilience are established through emotional values and meanings (Fletcher, 2012). Changes in style and aesthetics require active participation to form collective representations and preferences, defining the social nature of fashion.

The phenomenon of fashion contributes to new and significant symbolic values to impact consumption through cultural dissemination and material culture, resulting in cultural production (Crane & Bovone, 2006). As a social practice, the collective adoption of fashion produces new cultural currencies as an extension of cultural practices and values. Rocamora (2002) argues that the fashion system has become fragmented as a result of globalisation, which has led to an increase of stakeholders to reevaluate the temporality of fashion objects, proposing new patterns of production and consumption. Fashion is in need of a new vision that challenges the historical notion that fashion is driven exclusively by newness and change (Reily and De Long, 2011).

2.2 Fashion Sustainability

Sustainability is a concept that requires a different approach to former ways of doing, presenting a new standard based on values that include basic human rights such as justice, liberty and dignity (Ehrenfeld, 1999). There are a few other critical influences that affect business models, from the translation of sustainability principles to the form of the value proposition. Taking into consideration the different strategies required, from start of the supply chain to the end, there are a few reasons for fashion businesses to look towards adopting a sustainability agenda.

In a period where information is readily available and easily accessible, all stakeholders have greater access to education and global exposure. People, whether consumers or business owners, are more aware of the impact of their decisions and the consequences of their actions set against external levels of change. This allows them the capabilities to act more intentionally, strategically and creatively in response to the things around, whether it be a focus on community or the environment. In this sense, such consumer mentality reaps relevant business benefits to adopt environmentally friendly materials, ethical production processes, and other socially conscious decisions.

The adoption of sustainability also requires resources for education. The benefit of championing a sustainable agenda draws like-minded consumers and businesses together to form a coalition of influence to leverage degrees of power and foster collaborations and engagements between members. Often, the main causes and underlying philosophies expand beyond the nature of the business and its immediate industry, leading to potential opportunities to broaden the playing field. As people resonate with values and beliefs that are close to them, consumer education focusing on the potential benefits behind a sustainable agenda can be a first step towards changing existing practices and norms.

Due to the production of excess and wastage in the industry, another opportunity that aims to curb the situation is the development of service based business models that reduce stock or operate without a need for production. This shifts the idea of consuming fashion through means that move away from acquiring new fashion products, introducing ways to reinvent or restyle existing products (Todeschini at el., 2017). These services comprise consulting, after sale services to help consumers maintain and recycle goods, and garment subscription schemes. This section has outlined examples, of which there are many others, that pose opportunities to incentivise fashion towards the adoption of a sustainability agenda.

3. Theoretical Perspectives

The fashion landscape of Singapore was examined and categorised based on modes of production, rhythms of consumption and use, forming communities of practice, establishing consciousness and social awareness through design, and contributions to education. The categories of sustainable fashion have been further organised into the five areas of production, second-life initiatives, circular and sharing economy, inclusive models, and education.

Production

Despite a growing number of fashion brands and businesses adopting buzzwords such as “sustainable” or “responsible” as a means for differentiation and a form of marketing, there is a broadly accepted and understood definition that sustainable production involves ethically and ecologically-sourced materials, fair wages for workers within favourable conditions, transparent information and environmentally conscious approaches.

Second-Life Initiatives

These initiatives provide closed-loop systems adopting ecological practices by encouraging consumer participation and engagement, reducing fashion and textile waste. As users are given access to more products, regardless of time and geographical constraints, these initiatives tackle socioeconomic and cultural barriers.

Circular and Sharing Economy

As a direct response to the current internet culture of showing and discarding, these businesses address issues of compulsive purchase behaviours, patterns of excess, and waste by offering platforms for sharing, swapping, and renting. The platforms provide a sense of community between merchants and groups of consumers, developing new cultures of consumption and product use.

Inclusive Models

The term "inclusivity" has been widely adopted by the fashion industry, where business models provide opportunities and financial resources for communities in need through charities, social enterprises, collaborations through co-designing, and initiatives supporting sociocultural needs.

Education

Knowledge plays a key role in sharing and communicating the stories, narratives, traditions, and consumer responsibilities in fashion. The educational models of fashion businesses teach consumers the importance of sustainability through events and panel discussions to set new policies governing conscious practices in fashion.

Table 1. Classification of Slow Fashion in Singapore

CLASSIFICATION OF SLOW FASHION		
AREA OF FOCUS	**ORGANISATION**	**ACTIVITIES**
PRODUCTION	August Society	*Produces seasonless and reversible swimwear made by fair wage workers in Indonesia using recycled materials*
	Esse	*Garments are ethically sourced using environmentally-friendly materials such as Tencel and organic cotton. The production processes are shared openly on their website.*
	Matter Prints	*The brand works with artisans from across the world to develop unique prints for garments, giving credit to artisans by conveying the stories and cultural significance of the prints to consumers.*
	Source Collections	*The brand uses sustainable fabrics, such as Tencel and Lyocel, and produces garments in factories owned by certified WorldWide Responsible Accredited Production (WRAP) individuals.*
	Terie	*Focuses on the empowerment of women by producing bralettes for all sizes with eco-friendly bamboo material..*

	Terra by Qlothe	*The brand uses Tencel, among other sustainable materials, for their garments and works with the Indonesian Prime Minister on the "Buy a Piece, Plant a Tree" program to help restore degraded peatlands and create a sustainable livelihood for native communities. They work with Noissue as part of their eco-packaging alliance, contributing to global reforestation.*
SECOND-LIFE INITIATIVE	Carousell	*Carousell is a user-based platform where transactions can be made to sell preloved items.*
	The Fifth Collection	*The Fifth Collection is a digital platform to sell/rent second-hand luxury products on a consignment basis.*
	The Kint Story	*An online store that sells preloved garments, primarily targeting teenagers and young adults. Its founders give talks in schools to educate the public about sustainability.*
	On the List	*A space dedicated to the clearance of past-season items from luxury brands through online and offline platforms.*
	New2U	*A thrift store where proceeds from sales go to helping victims of domestic abuse from the Singapore Council of Women's Organisation (SCWO). The store also hires women to train them for future employability.*
	PraiseHaven Thrift Store	*Helps underprivileged families and beneficiaries under The Salvation Army.*
	Refash	*Buys and sells second-hand fashion through online and physical channels.*
CIRCULAR & SHARING ECONOMY	Closet Share	*An online platform to rent occasionwear, bags and dailywear on a subscription basis.*
	Covetella	*A platform to rent gowns for formal occasions.*
	The Fashion Pulpit	*A thrift store concept that promotes sustainable fashion by screening documentaries and hosting swapping events/talks. Its founder, Raye Padit, is known for hosting talks on how to lead a more sustainable lifestyle.*
	Green & Gorgeous Fashion Swap	*An organisation that hosts events allowing consumers to swap their fashion items.*
	Long n Loose Singapore	*An organisation that organises clothes swapping events. They support modest fashion and makes swapping more accessible for Muslim women who want to be eco-concious.*
	MADThread	*A platform to rent gowns for formal occasions.*

	Rentadella	*A platform to rent gowns for formal occasions.*
	Style Lease / Ivory	*A platform to rent gowns for formal occasions.*
	Style Theory	*A platform that sells subscriptions to rent clothing and bags for daily wear and/or special functions. The brand holds warehouse sales to clear products that are worn out.*
	Swapaholic	*A platform that promotes clothes swapping among members. Members can swap their preloved clothes at swapping events.*
	Your Clothes Friend Swap	*For a small fee, participants are invited to swap their unwanted clothes that are in good condition for other items that are on offer.*
INCLUSIVE MODEL	Abry	*Hires elderly women and supports underprivileged women by helping them find employment through upskilling.*
	Artisan and Fox	*A sustainable, transparent brand that sells accessories made by artisans from impoverished communities. Artisans are guaranteed 50% of all gross profits from each item. Micro-loans are provided, as well as pay for raw materials in advance, and the company helps to open bank accounts when the need arises.*
	Baliza Shop	*A resort-wear brand that focuses on ethically made clothing. The products use unique methods such as block-printing, beading and embroidery, which are performed by women and children living in poverty. They are committed to developing new skills for their artisans and sourcing for sustainable materials.*
	Covenant Jewellery	*The products are made by silversmiths and jewellers in Phnom Penh, Cambodia. The gems are ethically sourced from a family-run factory in India working with conflict-free diamonds.*
	Eden + Elie	*The brand produces handmade jewellery with artisans with ethically-sourced materials.*
	Ma Te Sai	*Works with artisans in Laos to produce accessories, with proceeds helping the communities.*
	Will and Well	*Designs garments for persons with disabilities to allow them to be more independent and comfortable when taking part in daily activities.*

EDUCATION	Connected Threads Asia	*Brings together fashion designers, manufacturers, suppliers, and consumers to start conversations on how to transform the industry into one with a conscience. They aim to promote sustainable fashion in Asia.*
	Fashion Revolution	*Unites people and organisations to work together towards radically changing the way clothes are sourced, produced, and consumed in a safe, clean, and fair way. Encourages and creates a more ethical and sustainable future for the fashion industry.*
	The Good in Fashion	*TGIF is a student-led, non-profit campaign that aims to reduce textile waste by encouraging Singaporeans aged 21-29 to donate, resell, swap and buy second-hand clothes.*
	Green is the New Black	*An organisation committed to promoting sustainable ways of living through producing articles on fashion, travel and lifestyle, promoting their causes through collaborations and events.*
	Textiles and Fashion Federation (TaFF)	*The official association for the textile and fashion industry in Singapore, TaFF plays an active role in the development of the industry from retail to manufacturing. Working closely with the Singapore government, TaFF is working to position Singapore as an innovative fashion hub in SEA.*
	Zerrin	*An online platform that guides consumers on the latest sustainable design talent — from clothing and jewellery to skincare and accessories. A resource for the latest happenings in the emerging sustainable fashion and beauty industry.*

According to Henninger et al. (2016), the attributes of sustainable fashion should consider sourcing and production processes as well as transparency and traceability. Sourcing and production involve all activities from the use of eco-friendly raw materials to demonstrating a sensitivity towards the social aspects of fashion production, whereas transparency and traceability work towards building trust and relationships with consumers. Table 1. provides a classification of sustainable fashion initiatives in Singapore, in which the organisations are separated according to the 5 overarching principles of sustainable production, second-life initiatives, circular and sharing economy, inclusive models and education. The classification of existing fashion practices in Singapore signifies a growing interest in the region for change and progress towards slow fashion movements, where the underlying philosophy of sustainability is defined by ethical values, environmental and social sensitivity, and moving towards awareness and change.

4. Mapping of Sustainability

The previous section presented a table demonstrating that sustainability cannot be narrowly defined and should be expressed through more descriptive categories to align activities and clarify the objectives for more sustainable practices in fashion. Clark (2008) argues that slow fashion movements, which adopt the underlying principles of sustainable practice, involve different perspectives. Designers and businesses need to develop awareness of local resources and economies, creating economic value for the communities and societies with and within which they operate. Transparent production systems communicate clarity across the supply chain, providing a connection between producers and consumers. Sustainable products embed narratives and cultural heritage through processes of making, producing meaningfulness for end users.

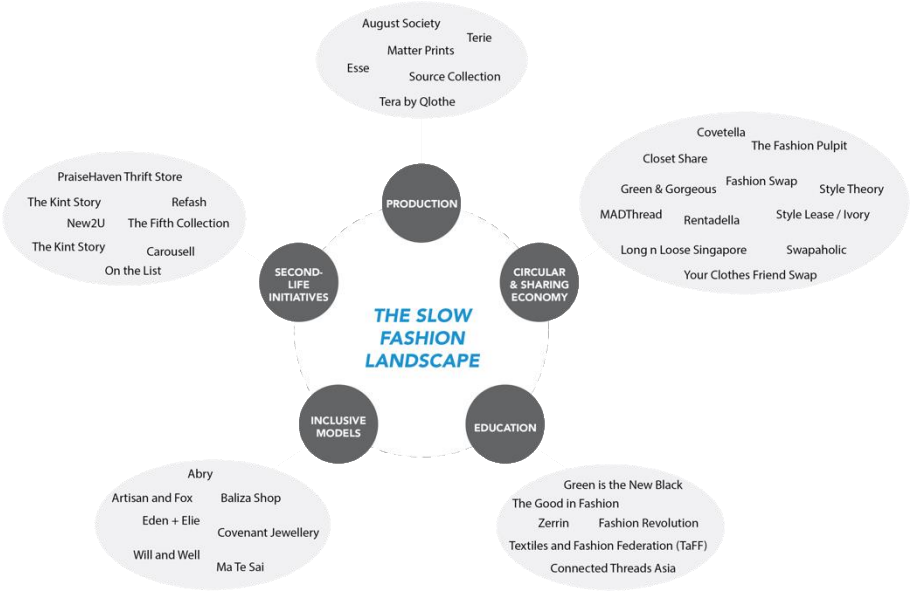

Figure 1. A Mapping of the Slow Fashion Landscape of Singapore

The shift towards slow fashion indicates a need to identify the broader scope of sustainability and question issues of governance and agency in the relationship between designers, producers and consumers. Slow culture focuses on small-scale production, traditions and culture rooted in craft techniques, an appreciation for local materials and markets, challenging the more widely adopted definition of fashion as relying on mass production and globalised style adoption (Fletcher, 2010).

Figure 1 visually articulates the various sustainable initiatives of fashion movements, platforms, organisations and communities in Singapore to present a mapping of the slow fashion landscape. The mapping shows the density of slow fashion initiatives adopting renting and swapping services as part of the circular and sharing economy, providing an alternative lifestyle for satisfying the cyclical nature of fashion that relies on the temporal rhythms of newness and change. In response to the market saturation within this space, it is foreseen that these business models will inform future practices that directly involve users through community-level interactions and communication. The mapping provides an holistic overview of how sustainable initiatives and philosophies are developing and functioning within the field of fashion, providing evidence of a growing slow movement through the cultural production of symbolic value.

5. Future Directions

This paper has presented an overview of the necessary shift for the fashion industry towards more sustainable practices. Through an examination of current and emerging slow fashion initiatives in Singapore, the landscape of sustainability begins to shape new models and frameworks through the evaluation of best practices. The mapping informs current categorisations of slow fashion while suggesting future research directions in the form of detailed case-study analysis and developing replicable frameworks for moving towards a more sustainable industry.

New rhythms of production emerge as designers and producers realign activities around the concept of care, developing new values throughout the supply chain for all involved stakeholders. This pushes for a radical change in the fashion industry and its larger system of operation, reevaluating and redefining the conditions of future models and processes of development. The philosophy of slow fashion begins with addressing stakeholders' needs and considers the larger impact of how various levels of sustainable activities inform new cultures of design, production and consumption.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designing Sustainable Product-Service Systems applied to Distributed Economies in Water-Energy-Food Nexus approach

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Abstract | With the rapid growth in economies, consumption patterns and populations, sustainable access to water, energy and food resources is under increasing pressure. The Water-Energy-Food Nexus has been widely proposed and accepted as one approach to address the challenges. This paper combines the Sustainable Product-Service System (S.PSS) and Distributed Economies (DE) two promising and interwoven offer models coupling environmental and social with economic sustainability with the Water-Energy-Food (WEF) Nexus approach. Furthermore, develop twelve dimensions characterizing to explore the characteristics of designing S.PSS applied to DE in WEF Nexus approach with the analytical conceptual research approach. Finally, critical features and challenges are summarized during the process of analyzing the three cases from India, Africa and Singapore, that focus on different S.PSS solutions applied to DE in WEF nexus approach.

KEYWORDS | SUSTAINABLE PRODUCT-SERVICE SYSTEMS (S.PSS), DISTRIBUTED ECONOMIES (DE), WATER-ENERGY-FOOD (WEF) NEXUS, DESIGN FOR SUSTAINABILITY, RESILIENCE

1. Introduction

In the transition towards to a sustainable society for all (Sanneh,2018; Lambert et al., 2020), the resource challenges of water, energy and food in turning society to a more sustainable direction are tremendous and urgent (Chang et al. 2016). Many people around the world do not have enough water, energy and food: 2.2 billion people do not have safely managed drinking water services (WHO&UNICEF, 2019); 770 million people without electricity access and over 2.6 billion people still do not have access to clean cooking (IEA, 2020); and 2 billion people experienced hunger or did not have regular access to nutritious and sufficient food in 2019(FAO, 2020). With the global population expected to grow to 9.7 billion by 2050 (United Nations, 2019), accompanied by increased in incomes, industrialization, economic change, and globalization will result in the global demand for water, energy, and food growing beyond the carrying capacity of the earth (de Andrade Guerra et al. 2020; Abulibdeh & Zaidan, 2020). Meanwhile, the three elements of water, energy and food are interdependent and closely related. Water is needed to produce energy, energy is needed to extract, distribute and treat water, also food production requires both water and energy. The global demand for energy and food is estimated to increase by 50% and 60% respectively (EIA, 2020; FAO, 2020), also that time around 52% of the world's population living in water-stressed regions (Kölbe et al., 2018). Growing scarcity can worsen access to basic needs and threaten the integrity of ecosystems, the integrated resources management, or better still a system design approach to water, energy and food supply, have the potential to address and halt these trends. It has been highlighted in decision-making process due to the complexity of relationships among these three elements (Bazilian et al., 2011; Howells et al., 2013), i.e., to adopt a system approach to the nexus design, development and management. The approach to provide integrative interconnections with which to encompasses some of the most critical problems compromising the livelihoods of current and, even more so, future generation, have been referred to as the Water-Energy-Food (WEF) Nexus (Bazilian et al., 2011; Keairns et al., 2016; Kurian, 2017; Leck, et al., 2015; Weitz et al., 2017; Namany et al., 2019). The Water-Energy-Food (WEF) Nexus has become central to discussions regarding the development and subsequent monitoring of the SDGs, which across Goal 6 (clean water for all), Goal 7(energy for all) and Goal 2(food security for all). A well-coordinated nexus system approach could be the first step in realizing these goals (Obersteiner et al. 2016; Mercure, et al. 2019; Simpson et al. 2019).

In recent years, WEF nexus have been developing rapidly in academic and scientific research as a novel approach to understand complex interactions among multiple resource systems (Mabrey et al., 2018; Liu et al., 2017; Endo et al., 2017; Albrecht et al., 2018). However, specific models, frameworks and approaches to addressing WEF nexus issues applying the systematic analytical thinking remain limited to date. Under the study within the LeNSin project-the International Learning Network of networks on Sustainability (EU Erasmus +, 2015-2019), two promising and interwoven offer models coupling environmental and social with economic sustainability have been proposed, practiced and validated by a large number

of case studies and design experience applied in different contexts around the world (especially the low/middle-income contexts); these models are the Sustainable Product-Service System (S.PSS) and the Distributed Economies (DE), that have been referred to a win-win sustainable opportunity for all (Vezzoli et al., 2014, 2017; Kohtala, 2015; Emili et al., 2016; Petrulaityte et al., 2017).

This paper aims at filling the knowledge gap regarding the combination of these three models. More specifically, the goal is to define, characterize and give the first outcomes of the research hypothesis of a key role in designing S.PSS applied to DE focused on WEF Nexus. In particular, the research questions tackled in this paper are:

- What are the characteristics and models of S.PSS applied to DE in WEF Nexus approach, especially in low and middle-income contexts?
- What are the applications of these models to promote sustainability for all?
- What are the critical factors and challenges to characterize the S.PSS applied to DE in WEF Nexus approach?

2. Methodology

1. Literature review. Drawing from literature review on the definition, characteristics, and sustainability analysis of S.PSS, DE, SPSS applied to DE and WEF Nexus from previous scientific research works and LeNSin project activities, to establish the internal relationship among them.

2. Theory-building. The identification of designing S.PSS applied to DE in WEF Nexus approach characterizing was carried out using the analytical conceptual research approach (Meredith, 1993; Wacker, 1998). This approach focuses on building new insights through logically developing relationships between defined concepts, in this case the S.PSS, DE, SPSS applied to DE and WEF Nexus concepts and dimensions analysis.

3. Case study analysis. According to the identification of dimensions characterizing designing S.PSS applied to DE in WEF Nexus approach to select and analyse cases through descriptive analysis, that have been published by respectful nongovernmental organizations such as UN, and FAO. In order to gain an understanding of characteristics of existing models, and to confirm and extend S.PSS applied to DE in WEF Nexus approach dimensions and variables.

4. Reflection. Retrospective analysis of the study and specified the main research findings, as well as critical factors, challenges, limits and recommendation for further researches.

3. Sustainability Potential Models

3.1 Sustainable Product-Service System & Distributed Economies

The concept of Sustainable Product-Service System (S.PSS) has been studied since the end of the 90th as one of the most promising models for innovation based on the shift from traditional product or service sales to a combination of products and services to address specific customer demand (Goedkoop et al., 1999; Cooper and Evans, 2000; Mont, 2001; UNEP, 2002; Tukker and Tischner, 2006; Baines et al., 2007). When PSS re-orient unsustainable production and consumption patterns, and reduces the environmental impact of the "satisfaction unit", it is referred as Eco-Efficient Product-Service System (Manzini & Vezzoli, 2003); in the case sustainable benefits are also related to the socio-ethical dimension, it is referred to Sustainable Product-Service System (Vezzoli et al., 2015). Among other definitions, S.PSS refers to "offer model providing an integrated mix of products and services that are together able to fulfil a particular customer demand (to deliver a "unit of satisfaction"), based on innovative interactions between the stakeholders of the value production system (satisfaction system), where the ownership of the product/s and/or the life cycle services costs/responsibilities remain by the provider/s, so that the same provider/s, for economic interest, continuously seeks environmentally and socio-ethically beneficial new solutions" (Vezzoli et al., 2018).

Distributed Economies (DE) is a concept that has been developed as a response to the current industrial production systems that promotes the development of small-scale, decentralized, flexible units that are synergistically connected with each other and make use of local resources (Johansson, et al, 2005). Also, DE strives for innovative regional sustainable development strategies. In this context, "regions" are defined (IIIEE, 2009) as small network entities integrated into the network, providing the advantage of being more flexible and resilient to change. Within the LeNSin project, DE has been referred as a paradigm shift from centralized large production unit and distribution system to small scale locally-based production units empowering end-user control on essential activities and eventually peer-to-peer network-structured to optimise production and consumption by sharing resources and/or goods and/or information/knowledge. The definition has been so far reorganised as follow (LeNSin, 2019):

> "Distributed Economies are small-scale production units, shifting the control on essential activities towards or by the end-user, whether individuals, entrepreneurs or organisations, i.e., there are no intermediaries, or the producers are the same end-users. The production unit could be standalone or network-structured with other DE units to share various forms of products, semi-finished products, resources and/or services, i.e., they become a Distributed Economy Network (DEN), which may in turn be connected with similar networks.
>
> If properly designed they are promising to promote locally-based sustainability, i.e., Sustainable Distributed Economies (S.DE)."

The S.PSS and the DE models, or better still their combination, have been considered as promising methods to simultaneously tackle economic, environmental and socio-ethical issues in low/middle-income (all) contexts (Vezzoli, Kohtala, Srinivasan, 2014). The S.PSS applied to DE i.e. the design of Systems of Products and Services applied to Distributed Economy artefacts. That can reduces/cuts both the initial (capital) cost of DE hardware purchasing (that may be unaffordable) and the running cost for maintenance, repair, upgrade, etc. of such a DE hardware (that may cause the interruption of use), while increasing local employment and related skills, as well as fostering for economic interest of the producer/provider to design low environmentally impacting DE production unit and products, resulting in a key leverage for a sustainable development process aiming at democratizing the access to resources, goods and services (LeNSin proposal, 2015-2019) (Figure 1).

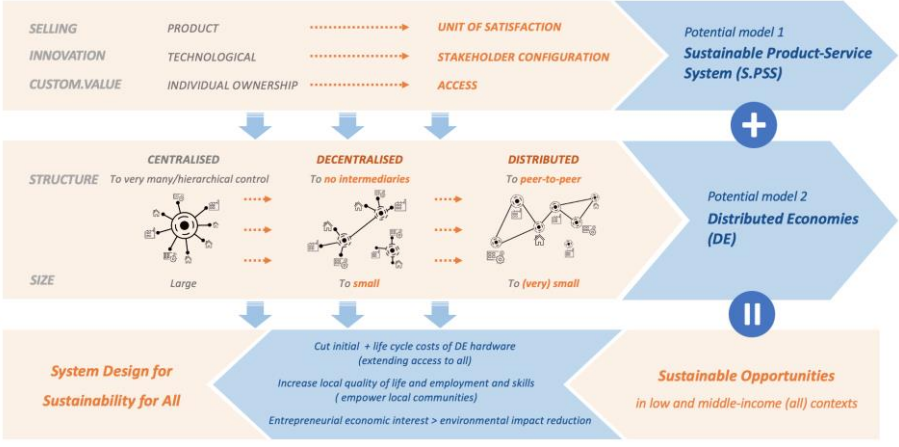

Figure 1. The analysis of sustainability potential of S.PSS&DE models.

3.2 The WEF Nexus

The Water–Energy–Food (WEF) nexus constitutes a framework for analyzing the dynamic interactions between water, energy and food resources flows and stakeholder interaction with systems approach and developing very effective strategies for sustainable development, increasingly recognized by international organizations, academics, policy analysts and other stakeholders (Liu et al., 2017; Endo et al., 2017). The germination of WEF Nexus concept can be traced back to the 1970s in the book of “the growth extremely limited", which is a preliminary exploration of supply, demand, and security issues between population, economy, and WEF (Meadows et al., 1972). Then the academics and related organizations in United States, Japan, India and other countries, successively carried out the studies of food-energy, and food-water (Levison et al., 1977; Allan, 2003; Qadir et al., 2007).

However, the WEF nexus framework first being proposed was in the World Economic Forum (2011), which frames the WEF nexus as a major global risk for economic and social development while the framework developed by Hoff (2011) for the Nexus conference in Bonn is centred around the availability of water resources – taking into account global trends and potential fields of action. The eco-system-based framework from International Institute for Sustainable Development (2013) followed, which considers the access and availability dimensions of water, energy and food and embeds the WEF nexus in the natural, built, institutional and governance systems. The FAO framework concentrated on the links between the human and natural systems for fostering sustainable development based on a resource-focused published in 2014. The above research on WEF nexus framework mainly focuses on the whole process of nexus from concept to action in a macro perspective, including not only the core correlation of resource system but also the peripheral influencing factors and action path. Meanwhile, several other frameworks concerned the key issues in water, energy and food have been published, including the one from Stein(2014), which illustrated how the different water-energy-food nexus domains and associated actor networks are interconnected and Biggs et al. (2015), who proposed a framework that inclusively accounts for livelihoods within the water–energy–food nexus to enhance water, energy and food security at local livelihood level.

At present, despite the WEF Nexus still has not formed a definitive definition influenced by the multiple research scale and relatively short development period, the understanding of WEF nexus can be summarized as the combination of core system and peripheral system (Figure 2). The core WEF Nexus system illustrates the inside-relevance of the three elements water, energy and food, that reflects the interdependence and mutual restriction relationship between water, energy and food resources, for example, the storage, extraction, transportation, treatment and utilization of water resources require energy consumption; the food production requires water and energy consumption from irrigation to processing and distribution; while the production of food and energy requires a large amount of water, which may disrupt the transformation process of water resources and cause water resource pollution. The peripheral WEF Nexus system refers to the outside-relevance, presents the complex influence of the factors such as climate change, population growth, globalization, urbanization, technology, economy and etc. involved in environment systems, economy systems, and society systems on inside-relevance. It is worth emphasizing that it needs a more broadly inclusive understanding of the WEF Nexus, the essence of WEF Nexus is the nexus thinking, which refers to optimize WFE Nexus synergistic benefits considered both the core system and peripheral system to ensure the lower environment, economy and society impacts i.e. reliable resource security, affordable and equal access, Less waste, minimize losses, higher efficiency, stable development, sustainable adaptability and etc.

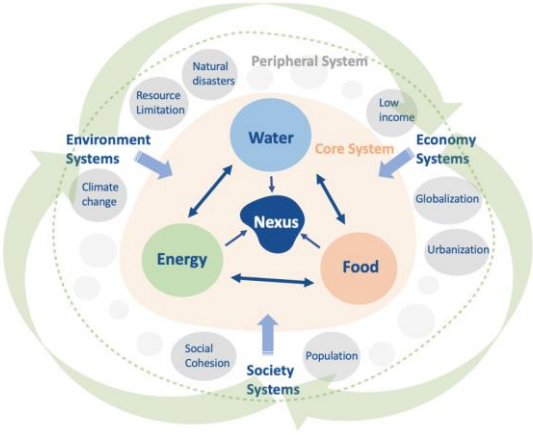

*Figure 2. The WEF nexus syste*m combination of core system and peripheral system.

4. Characteristics analysis

The characteristics analysis and research that integrates the contribution of S.PSS to DE with WEF Nexus could be studied through the definition of characterising dimensions of the three models. Dimensions refers to variations of properties that give specificity and range to certain concepts (Corbin & Strauss, 2014). The literature review of WEF nexus in 3.2 highlighted the need of a more broadly inclusive and systematical understanding of the WEF Nexus both the core system and peripheral system. As a fact, six dimensions are here (Figure *3*) be summarized and defined to characterise the WEF nexus through the system thinking.

The first dimension is the spatial scale, indicates the geographic level of applicability for the nexus. It is essential to clearly define the WEF issues in each scale like global, region, community, household (Garcia et al., 2016), as well as how they relate to and affect each other. Meanwhile, the quantity and quality of water, energy and food resources are influenced by time factors and fluctuate within different temporal scales of weeks, months, years, etc. A key dimension used for describing WEF nexus models is system breadth, i.e., the scope of the nexus and/or resources included. Due to the inextricable linkages among the WEF nexus system and their external resource and ecological environments, the nexus can evolve to embrace more resources or factors, like the livelihoods (Biggs et al., 2015), climate (Beck et al., 2013), land (Ringler et al., 2013) and so on. Another important dimension considered in the nexus is the stakeholder. It refers to the roles involved in the system related to supply chain, also the regulators and policymakers. The appropriate consideration and application of the objectives of each stakeholder in nexus system are classified as multiple objectives dimension. Different hierarchy of stakeholders (individual, enterprise, manufacturers, governments, etc.) have various sustainability priorities.

Industries and agricultural producers are primarily concerned with income and prices, households are concerned with financial security and health, and government are concerned with financial policy, environmental and social factors (Garcia, 2019). Finally, the events or activities that have a significant adverse impact on the WEF nexus system have been considered as the key indicators for assessing system risk and achieving sustainability (Abulibdeh et al., 2020), defined as risk assessment dimension.

WEF Nexus Dimension	Description	Details
Spatial scale	The geographic level of applicability for the nexus. Each scale has its own supply chain of the water, energy and food, also, each scale is connected to the other.	Global, region, community, household (Garcia et al., 2016); International, regional, national, urban areas, rural areas, and household scales (Abulibdeh et al., 2020); etc.
Temporal scale	The quantitative and qualitative of water, energy, and food resources fluctuate both hourly, and over scales of weeks, months, and years. Meanwhile with the increase or decrease of the spatial scale, the temporal scales can be affected by the activities of resource interaction and transfer.	Households purchase and consume water, energy, and food products, which can be on the order of hours to days, with exceptions for appliances. Regional or global suppliers must plan, design, and operate water, energy, and food supply chains, which can be fixed for years (Garcia et al., 2016).
System breadth	The scope of the nexus and resources included. Due to the inextricable linkages among the WEF nexus system and their external resource and ecological environments, the nexus can evolve to embrace more resources or factors.	Water, energy, food; Water, energy, land, food (Ringler et al., 2013); Water, energy, climate, food (Beck et al., 2013); Ecosystem, water, food, energy (Karabulut et al., 2016); etc.
Stakeholder	It refers to the roles involved in the system related to supply chain, also the regulators and policymakers.	Energy enterprise, food manufacturer, water supplier, biofuels company, agriculture producer, industry producer, etc.
Multiple objectives	It refers to the consideration and application appropriately of objectives of each stakeholder in the system.	Resource demand, consumption, profit, cost, product quality, social welfare, etc.
Risk assessment	It refers to the events or activities that have a significant adverse impact on the inside-relevance and outside-relevance of the WEF Nexus system.	Population growth, economic risk, extreme weather, conflicts, agriculture, technology, policy, etc.(Hoff, 2011; Lawford et al., 2013; Abulibdeh et al., 2020)

Figure 3. The description and details of dimensions characterizing WEF Nexus.

On the other hand, the S.PSS dimensions are identified as value proposition (payment structure), product ownership, product operation, provider/customer relationship (from product-oriented to result-oriented), sustainability potential (both economic interests and environmentally and socio-ethically benefits), and are slightly revised from the five dimensions of PSS models studied by Gaiardelli et al. (2014). The DE Dimensions through the practices and research works of LeNSin project can be described to eight, value proposition, system structure, resource type, capital financing (governmental subsidies, donations, private loans, micro-finance institution, etc.), system ownership, organizational form (public, NGO, community, PPP/hybrid, private), system operation and target customer.

In reference to the DE dimension of system structure and resource type, further clarification can be made. To better illustrate the complex system relationship related to multiple scales

and levels interactions from centralized, to decentralized and distributed, it has defined the four main sub-structures: stand-alone, network, network of networks, and centralized connected structures, totally 13 archetypal configurations to indicate the system structure dimension (Figure 4) (i.e. the distributed network structure, it refers to the private or household products/services with sharing or connecting the products/services to the local community/neighbour/etc.). Also, the type of resource involved in the services and/or products of the DE system, has been divided into hardware/resource-based (energy, food, water, manufacturing, etc.) and knowledge/information-based (software development, knowledge generation, design and etc)

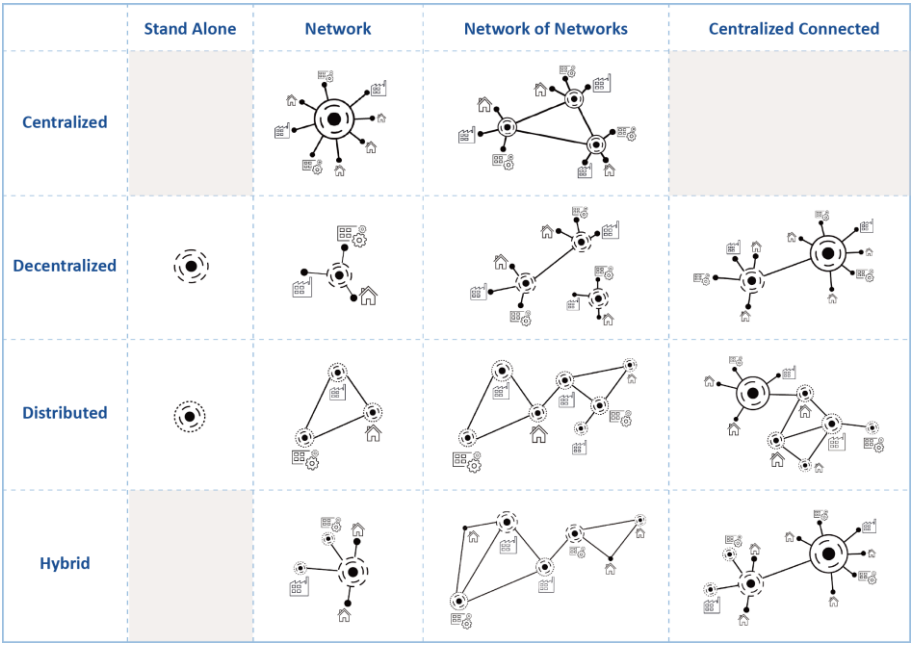

Figure 4. The 13 archetypal configurations to indicate the system structure dimension.

The combination of S.PSS and DE and WEF nexus dimensions led to the twelve dimensions characterizing in designing S.PSS applied to DE in WEF Nexus approach (Figure 5 and Figure 6). The Dimension 1 means what is the value proposition delivered in the system solutions, in general, it refers the target customer how to pay the solutions provider for water, energy, food production/service or other related service. Meanwhile it is essential to indicate which of the transaction-based and relationship-based is the nature of interaction between the provider and target customer in the dimension 9, that can reflect the sustainability potential of system solutions (Gaiardelli et al., 2014). From the dimension 5 to 8, we could identify clearly the roles and nature of stakeholders in the system solutions, who own, provide, operate and use the water, energy and food installations/services. Different participants in

the system have different needs and sustainable requirements, which we can clearly define and describe them in dimension 10, it is conducive to the better implementation of decision-making and management of trade-offs in the Nexus system. Also, it is necessary to consider who/how to provide the capital financing supporting (dimension 4) in the system, cause the capital issues is one of the critical factors in low and middle-income contexts, which related to the system economic benefits in dimension 11. The system scale dimension determines the water, energy, and food supply unit supporting networks (nearby, local, regional network, etc.), that is effective to define the research scope of system and identify interactions of various hierarchical structures, allowing for more accurate and efficient planning, decision-making, implementation, monitoring, and evaluation of the system solutions. During the characteristics describing of S.PSS applied to DE in WEF nexus approach, the system breadth not only includes water-energy-food, but also other factors or resources nexus such as WEF-climate, WEF-land, WEF-Livelihood or which are related to or play a key role in system solutions. Finally, we can excavate and describe the sustainable potential of the system from three aspects of economic, environmental and social benefits (dimension 11), at the same time, it is desirable to predict or identify the risk factors that affect the progress of designing S.PSS applied to DE within the WEF nexus system (dimension 12).

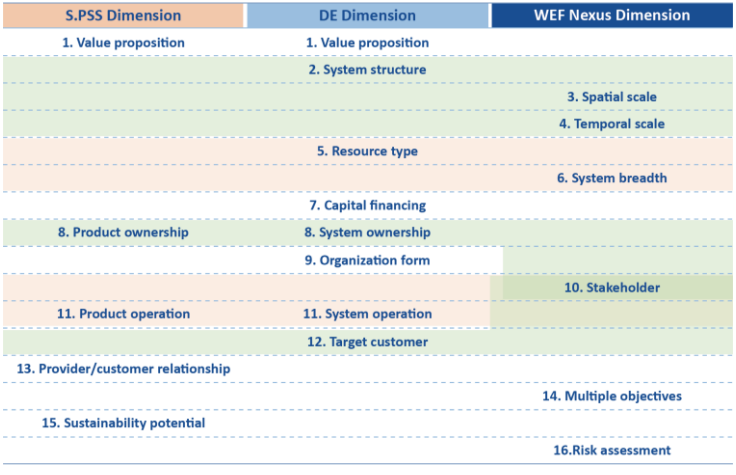

Figure 5. The dimensions characterizing S.PSS and DE and WEF Nexus, identified through literature review.

Dimensions Characterizing S.PSS applied to DE in WEF Nexus approach.

Dimension	Description	Details
1. Value proposition	It refers to the value offered to target customer, the payment structure in the WEF nexus system.	Pay-to-purchase (product-related service; advice; training;consultancy;additional services); Pay to lease; pay to rent/sharing/pooling; Pay-per-period; Pay-per-time; Pay-per-use; In-kind conctibution; Hybrid peyment; etc.
2. System scale	It could be characterized to summarize the interaction between stakeholders in WEF nexus system belongs to which hierarchical structure, to offer, transfer or gain the water, energy, food production/supply.	Decentralized WEF nexus; Distributed WEF nexus network ; Distributed WEF nexus network of networks; Hybrid WEF nexus network; etc. (13 archetypal system configurations in figure 4)
3. System breadth	The scope of the nexus and resources included. Due to the inextricable linkages among the WEF nexus system and their external resource and ecological environments, the nexus can evolve to embrace more resources or factors.	Water, energy, food; Water, energy, land, food; Water, energy, climate, food; Ecosystem, water, food, energy; etc.
4. Capital financing	Represents the means and/or organiztions of capital providing and related cost recoverying and revenue supporting for WEF nexus system.	Governmental subsidies, donations, private loans, micro-finance institution, etc.
5. Ownership	It referred to who owns the services and/or products of the WEF nexus system strictly related to the value proposition.	Customer or Provider
6. Organization form	The nature of the organization providing the WEF nexus system solution.	Public sector-based, utility, NGO, community, PPP/hybrid, private sector-based, etc.
7. System operation	It referred to who operates and manage the system.	Customer or Provider
8. Target customer	The nature of the end user.	Household, private company, community, or other productive activities.
9. Provider/customer relationship	Refers to the nature and intensity of interaction between the two actors in the nexus system and varies from transaction-based (product- orient-ed) to relationship-based (ues-oriented and result- oriented) depending on the responsibili-ties and activities performed on the product and/or service.	Transaction-based: product- oriented; Relationship-based: ues-oriented; result- oriented.
10. Multiple objectives	It refers to the consideration and application appropriately of objectives of each stakeholder in the system.	Resource demand, consumption, profit, cost, product quality, social welfare, etc.
11. Sustainability potential	The system solutions capable of creating the value decoupling it from resources consumption and environmental impact increase while extending access to low and middle-income people enhancing social equity and cohesion.	Economic benefits:cut initial/life cycle costs of water, energy, and food production/supply; Envionmental benefits: resource sharing and reducing resource cost; less waste; improve resource security; prolonging life cycle; Social-ethical benefits: improve customer fideli-ty; improve strategic positioning; increase opportunities in lower and middle-income contexts; etc.
12.Risk assessment	It refers to the events or activities that have a significant adverse impact on designing S.PSS applied to DE within the WEF nexus system.	Population growth, economic risk, extreme weather, conflicts, agriculture, technology, policy, etc.

Figure 6. The description and details of dimensions characterizing S.PSS applied to DE in WEF Nexus approach.

5. Case studies and analysis

In this section we selected three projects on the conditions of S.PSS applied to DE highlighted the interactions of water, energy, and food. The first case is providing solar Irrigation service to smallholder farmer and rural village in Ganga Basin, achieve the sustainable and affordable access to energy for pumping water with solar irrigation promotion, to increase irrigated area for more crops (figure 7). The second case promotes and facilitates the cisterns for rainwater harvesting and storage for vulnerable communities in Africa, to enable safe drinking water access and enhance family agricultural production and food nutrition security (figure 8). The last is vertical urban agriculture farm in Singapore, used rainwater to collect and reuse, plant waste to generate clean energy, and fish-vegetative hydroponics to experiment the WEF nexus solution (figure 9). All case analysis is based on the theoretical model i.e., the twelve dimensions characterizing S.PSS applied to DE in WEF Nexus approach, to verify the accuracy and completeness of the characteristic description.

CASE 1. Solar Irrigation Service Providers in Ganga Basin, India

Value proposition	Offering solar pumps with service related training, installation and maintenance. Customer pay per use or credit instalments.
System structure	Distributed solar network
System breadth	Water-energy-food (Solar energy, irrigation and underground water, crops)
Capital financing	Governmental subsidies
Ownership	Provider
Organization form	Private enterprise (young entrepreneurial farmer)
System operation	Customer
Target customer	Individual household
Provider/customer relationship	Relationship-based (ues-oriented product-service WEF solutions)
Multiple objectives	Village-sustainable management of solar irrigation; Smallholder farmers-less and low-cost energy consumption for irrigation, easy and affordable access to energy and water; Solar entrepreneurs-Irrigation services quality and quantity and income.
Sustainability potential	Environmentally: Scurtail carbon-footprint of irrigation; Reduce surface flooding by curtailing rejected recharge; Expand irrigated area, promote intensification and diversification of farming; Improve utilization of solar pump capital; Saving of diesel consumption. Economically: Quickly expand quality irrigation to the poor at affordable cost; Create 6-15 full time jobs/village; Incentivize solar irrigation service entrepreneurs to contribute to capital investment; Increasing net incomes for farmers and solar entrepreneurs. Socio-ethically: Improve water-energy-food security; Increase employment; Capacity building; Agricultural development.
Risk assessment	Irregular rainfall and climatic shocks; Irrigation management techniques; low-efficiency energy transfer; Diversity of crop cultivation.

Africa and parts of South Asia where the fortunes of millions of poor farmers continue to depend heavily on rain fed agriculture. The challenge is to expand irrigation access to the largest number of poor while keeping its costs affordable, without threatening resource sustainability and minimizing its environmental footprint. The arrival of solar pumps has opened up a new and attractive possibility. Solar Irrigation Service Providers driven village water markets will rapidly expand pro-poor irrigation, secure farming against climate shocks, promote sustainable intensification and diversification, improve utilization factor of solar pump capital, reduce carbon footprint of tubewell irrigation.





Figure 7. The analysis of the Case 1. Solar Irrigation Service Providers in Ganga Basin based on the dimensions characterizing S.PSS applied to DE in WEF Nexus approach.

CASE 2. One million cisterns for the Sahel, Africa		
Value proposition	Providing the water service with the training of construction, using, maintenance of cisterns. Customer get clean water and training pay-per-use.	The ambition of the programme "One million cisterns for the Sahel" is to promote and facilitate the introduction of rainwater harvesting and storage systems for vulnerable communities, especially women. The objective is to enable millions of people in the Sahel access safe drinking water, have a surplus to enhance their family agricultural production, improve their food and nutrition security and strengthen their resilience. To ensure better access to clean water during the dry season, these harvesting and storage systems are aimed to collect water during the rainy season-June to October-for its use during the dry season-November to May.
System structure	Distributed cisterns network	
System breadth	Water-food-climate (Rain water, vegetable production)	
Capital financing	Governmental subsidies	
Ownership	Customer	
Organization form	Local Community	
System operation	Customer	
Target customer	Individuals (Smallholder farmers,rural women)	
Provider/customer relationship	Relationship-based (ues-oriented product-service WEF solutions)	
Multiple objectives	Rural vulnerable communities-sustainable management of water resources; Smallholder farmers-clean water and climate-smart agriculture; Training for the empowerment of communities and local partners; Specific attention to gender(for rural women).	
Sustainability potential	Environmentally: Small-scale irrigation and agricultural water management as a whole are now essential to strengthen their resilience to the increased climate variability; Promoting the using of local materials.	
	Economically: Vegetable production is used for self-consumption and sales; Communities participate in the construction of cisterns through cash-for-work activities; Enable income diversification and improved housing conditions through construction sill training .	
	Socio-ethically: Improve their food and nutrition security; Enhance community cohesion; Promote the gender equality, Capacity building	
Risk assessment	Irregular rainfall and climatic shocks; Water management techniques; Agroecological inputs; Food diversity and clean energy for water	



Figure 8. The analysis of the Case 2. One million cisterns for the Sahel based on the dimensions characterizing S.PSS applied to DE in WEF Nexus approach.

CASE 3. Home farming project of spark architects, Singapore		
Value proposition	Offering the access of related plan, irrigations, energy generation products and services including the training and maintenance. Pay-per-period.	Home Farming is an example of responsing to the current aging population and the heavy reliance on imported food in Singapore. A high-density garden is designed combine the vertical urban agriculture on a vegetable farm by Spark Architecture, used rainwater to collect and reuse, plant waste to generate clean energy, and fish-vegetative hydroponics. Other means to solve the problems of urban population aging, food security, and energy-food resource connection sustainability, provide a comfortable living care environment for the elderly, and achieve a coordinated treatment of aging society and food safety issues.
System structure	Distributed network of networks	
System breadth	Water-energy-food (Irrigation water, food, bioflues)	
Capital financing	Private loans and Governmental subsidies	
Ownership	Provider	
Organization form	Community & Cooperative enterprise	
System operation	Customer	
Target customer	Individual household	
Provider/customer relationship	Relationship-based (ues-oriented product-service WEF solutions)	
Multiple objectives	Communities-sustainable management of WEF resources and living conditions; Individuals-clean and safety WEF, better living environment; Enterprise-sustainable business model; Specific attention to the elderly and aging society.	
Sustainability potential	Environmentally: Promoting the reusing of waste plant and water, Sustaiable energy transfer ways; Reduce transportation and packaging; None carbon dioxide emissions; Maintenance and repair service sextend the product-service system life.	
	Economically: Food production is used for self-consumption and sharing; Creating more economic benefits with less land resources; New opportunities and markets for the promotion of bioflues; All-inclusive services improve the fidelity of the customer.	
	Socio-ethically: Achieve a coordinated treatment of aging society and food safety issues.; Capacity building.	
Risk assessment	High costs for hardwares/equipments; Farm management; Uncompleted recycling service.	



Figure 9. The analysis of the Case 3. Home farming project of spark architects based on the dimensions characterizing S.PSS applied to DE in WEF Nexus approach.

After the analyzing of the case studies, we can conclude three main characteristics in the applications of S.PSS applied to DE in WEF Nexus approach:

- The WEF system solutions shift from high-cost and centralized product ownership to the access to sustainable affordable and nearby WEF supply service network under the application of S.PSS and DE models, which transfer from the product-based offer model of water, energy and food (e.g. irrigation, planting, pumping, power generation equipment) to product-service even service-based sustainable offer model of WEF nexus system (e.g. reducing/avoiding initial investment, providing life-cycle service and cut related cost, community network and individual capacity building).
- Identified the synergies of water, energy and food, rather than the separation of them, is conductive to the multi-objective decision making of the nexus system, leading to more comprehensive and sustainable design, management and implementation of WEF nexus system.
- The practical results of the case reflect the promising potential of S.PSS applied to DE in the WEF nexus approach is a win-win strategy for its environmentally, socially and economically sustainable diffusion to all, especially in low and middle-income contexts (case 1 and 2).

Additionally, the challenges of applying the twelve dimensions characterizing to the case studies are exposed in the process of analysis, that can be summarized briefly as flowing:

Completeness of analysis. The all twelve dimensions basically cover the value, stakeholders, interactions, system potential and risk. However, the specific interactions of all stakeholders involved in the nexus system have not been well defined in the dimensions, and the relevant information analysis of the material, information, labour and finance flow in the system has been neglected.

Accuracy of description and ease of using the dimensions characterizing. The method is based on qualitative analysis without the visual and quantitative description guidance, which will affect the accuracy of case description and increase the difficulty of analysis. The description of the system scale is not as impressive and easy to understand as the graphic display (dimension 2). It is difficult to compare the degree of sustainability between cases from the existing description of sustainability potential (dimension 11). And for the characteristics of risk assessment (dimension 12) are given in generalities, lack of specific directions and guidance of expression.

6. Conclusion

In this paper, we draw support from the experiences of designing S.PSS applied to DE in the LeNSin project, and give the first outcomes of the research hypothesis of a key role in designing S.PSS applied to DE focused on the WEF nexus, by identifying and characterizing

S.PSS applied to DE in WEF Nexus approach. We stress that the approaching of water, energy and food not separately, but as a nexus approach, i.e., as a system to be designed, implemented and managed is extremely promising in terms of sustainability. And characterizing the S.PSS applied to DE in WEF Nexus approach have been developed and presented by twelve dimensions description, based on the exploration, analysis and summary of the key issues and features among the S.PSS, DE and WEF nexus models. The selected cases involved in the WEF nexus solutions have been analyzed with the twelve dimensions, to help verify the completeness and accuracy of characteristics description, also exposed the challenges in characterizing the S.PSS applied to DE in WEF Nexus approach. All that will make progress on the further work to explore and develop WEF Nexus oriented concepts, design strategies and tools to support for companies, practitioners and designers on how to manage trade-offs and build synergies in designing the resilient and sustainable WEF Nexus system to achieve the sustainable access to clean water, energy and enough food for all, finally to effectively contribute to the transition towards a sustainable society for all.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Discovering Design Values in the Chinese Pre-Qin Classics

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Abstract | Based on facts and historical observations, this paper puts forward the hypothesis that Chinese culture, especially pre-Qin classics (先秦经典), contains the wisdom of sustainable development. Through the study on representative pre-Qin classics, the author summarizes the thoughts on the world outlook, outlook on life and sustainable way of life in the pre-Qin classics: Tao generating all things (道生万物), the unity of universe and human (天人合一), and following the law of universe and earth (法天则地). Then author proposes design implications on sustainability with three aspects: design ethics, principles, and the dialectical relationship between man and nature. Three design proposals is also reported as tentative applications of relevant discussion. These exploration and tentative opinions may help to view sustainable design in the perspective of Chinese traditional culture and provide support to enrich the theories and reflections on sustainable design.

KEYWORDS | CHINESE CULTURE, PRE-QIN CLASSICS, SUSTAINABLE DESIGN, THE TAO

Design is the conceiving and planning of purposeful creative activities, and it is also one of the important intellectual activities that distinguishes human being from other animals. Design is rooted human civilization and culture, although the history of term "design" is relatively new as a discipline. In last decades, the scope of design has been extending and gone beyond of artifacts, for example, design for social innovation focuses on the change of people's behavior. In this case, beside enabling conditions, the fundamental cause of the behavior change is the change of people's recognition and understanding. To some extent, design also participates in the process of culture construction. Therefore, the essence of design is closely related to the origin and development of human civilization. This article tends to look into the Chinese traditional culture by pre-Qin classics and discover related design values on sustainability.

1. Assumptions on Chinese civilization

As one of four ancient civilizations and the only living one, in the majority period of human history, China had been the world's central empire with authoritative history and profound culture until the modern time, when missing the first industrial revolution, China went to a temporary week in last two hundred years. And very soon it becomes one of leading countries again. History tells us some basic facts: on the one hand, Chinese civilization has superior and high resilience of survival and sustainable development. In the historical period when China has leadership in world, there has been no global order collapse such as two world wars and the collapse of environment and ecosystem on another. Therefore, this paper puts forward a first hypothesis: Chinese civilization and culture contains the wisdom of sustainable development, and discovering and understanding it may contribute to the common future of entire human society.

There have been a large number of studies on China, Chinese people and Chinese culture, both by Chinese scholars and by non-Chinese ones. While most studies focus on phenomena whether in contemporary or history of China, especially in the field of social sciences. the study of current and historical phenomena about China and Chinese people is a relatively easy path to understand China and Chinese civilization. However, the fragmentation and complication of phenomena, together with the limitations of researchers, make the conclusions intricate and even misunderstanding. Hence, history also tells us some further basic facts: in the terms of social form and moral level, the degree of social civilization and well being in ancient times were very high: China had been great harmony society in the period of the Three Primordial Sovereigns(三皇时期) and the Five Emperors(五帝时期). It was a well-off society in the period of the Three Kings(三代三王). Afterward, the dynasties changed continuously after the Spring and Autumn Period and the Warring States Period. Then the cycles of dynasties became shorter and shorter. Therefore, the second hypothesis is put forward: in the viewpoint of culture, the history of Chinese civilization is a process of

degradation instead of advancement. It means that trying to understand the essence of Chinese culture must trace back and discover the source of Chinese civilization, which are the Chinese pre-Qin classics, such as Dao De Jing: The Classic of the Virtue of the Tao(道德经), The Book of Changes (易经), Inner Canon of the Yellow Emperor (黄帝内经) and Huang Di Yin Fu Jing (黄帝阴符经).

2. Tracing Chinese Culture in pre-Qin classics

2.1 Tao generating everything, a complete view of the universe

Where does everything in the universe come from? How does it work? What drives it? The answers to these basic questions constitute different forms of civilization and culture. With advancement of human understanding, current scientific cosmology has been the latest, getting rid of various versions of obscurantism, and also the common understanding of academic community internationally in principle. However, the scientific cosmology does not answer the question on the first cause of the universe. The scientific theoretical system couldn't reach self-consistency and completeness both at the same time. Hence the scientific explanation of the universe is constantly updated and seemingly endless.

In the pre-Qin classics, the Chinese ancients put forward the "Tao (道)", "Tao generates one, one generates two, two generates three, and three give birth to all things. (道生一、一生二、二生三，三生万物。万物负阴而抱阳，冲气以为和)"(Dao De Jing-chapter 42) . Lao Zi holds that the source of all things and the universe is the Tao, which gives birth to the Qi of Hongmeng (鸿蒙之气), and then gives birth to the two Qi of Yin and Yang, and combines them into third. All things in the universe are formed by the combination of the two Qi of Yin and Yang and the that of Hongmeng. "Tao is independent and constant, circulating without ending. It is the mother of the world (有物混成，先天地生。寂兮寥兮，独立而不改，周行而不殆，可以为天下母)" (Dao DE Jing, chapter 25), although the Tao continuously generates, evolves all things, but the Tao itself is constant without lose and end. In short, the Tao is fundamental to the formation, movement and evolution of everything, but everything has no influence on Tao itself. At the same time, "the so called Tao that can be described is not constant Tao, and the so called Ming that can be named, is not constant Ming (道可道，非常道；名可名，非常名)"(Dao De Jing chapter 1)," I do not know its name, but give a word of Tao, reluctantly name it as Big. (吾不知其名，字之曰道，强为之名曰大) " (Dao De Jing chapter 25), it pointed out that Tao can't be described in nature, of course, which doesn't mean unknowable. "Tao is something imperceptible (道之为物，惟恍惟惚)" (Dao De Jing, chapter 21). Lao Zi believed that being "to the extreme of emptiness and to the extreme of tranquility (至虚极，守静笃) " (Dao De Jing, chapter 16), one could feel and identify Tao. This means that at least very few people who can be called Zhenren (真人) or Shengren (圣人) are able to experience and

comprehend the Tao. The classics are the true words of them, so that ordinary people and readers can learn the Tao through them.

2.2 The unity of human and universe, a forward outlook on life

In addition to the question of the origin of the universe, Plato then posed three ultimate questions: who am I? Where do I come from? Where am I going to? The various answers in history also constitute different paths of western civilization. From the perspective of Chinese pre-Qin classics, these are not the ultimate questions and the answers are also simple: I am the “son” of universe and earth. I come from universe and earth and will go back to there. Since everything and the universe are created, formed and evolved by Tao, man is either no exception. "Human is generated by the Qi of universe and earth with the law of four seasons. (人以天地之气生，四时之法成)"(The Inner Canon of the Yellow Emperor-Preserving life). Specifically, Tao generates universe and earth, and universe and earth generate all things, including human. Therefore, man is a part of the universe, which is governed by Tao and the universe. It is meaningless to talk about life and value without the premise of universe and earth.

Although universe and earth are a whole one and human is a part of it, human is also a special part. "covered by universe, loaded by earth, all things are around and nothing is more precious than man (天覆地载，万物悉备，莫贵于人)" (the Inner Canon of the Yellow Emperor -preserving life). Man is the most noble part of all things. "The Tao is great, the universe is great, the earth is great, and so is the human. There are four great beings, and human is the one of them. (故道大，天大，地大，人亦大。域中有四大，而人居其一焉)" (Dao De Jing, chapter 25). Why is human one of the great four? On the one hand, compared with other things born in universe and earth, human being have the ability to know the Tao and understand the world; On the other hand, in order to adapt to the survival and development, human beings have the ability to transform or resist the nature and create something new. Therefore Classics not only acknowledge that man is a part of the nature of universe and earth, but also emphasizes the uniqueness of man.

2.3 Following the law of the universe, a normal way of living

After understanding the world and human ourselves, how can human beings produce, live and reproduce? "human, earth, universe and the Tao, they follow the law of the next one after another (人法地，地法天，天法道，道法自然)" (Dao De Jing-chapter 25). human is generated by universe and earth and governed by the laws of them. On this basis, the idea of "the isomorphism and correspondence between universe and human (天人同构、天人感应)" is further derived, which holds that universe and human have the same structure in different scales, therefore they are both organic parts of the same one, a large living body. In the same level of structure, they are communicating and corresponding. This is also a core idea of Chinese medicine represented by *Inner Canon of the Yellow Emperor (黄帝内径)*.

Universe and earth generate all things and human. human and the universe are part of the same one. so all things and human can be only in a state of normal when they follow the law of universe and earth. In nature, all living things follow the law of universe unconsciously exception for human being who have intelligence and stand out of the nature, at the same time they have ability of cognition and judgment on universe and all things. So that to following the law of universe becomes a conscious behavior. Whether following well the law of universe and earth or not will directly result in different results, and will also affect the state of universe and earth to some extent, but it can't change the law of universe and earth and the way of effect on human, which is so called "universe and earth are nothing kind and they regarding everything as mere nothing (天地不仁，以万物为刍狗)" (Dao De Jing-chapter 5). Tao is constant and in the view of human, the movement of universe (celestial bodies) is almost constant as well. Therefore, anchoring the universe and following the law of it means to a normal and sustainable way of live of human and human society.

How did the ancient Chinese follow the law of universe in practice? The first sentence of the *Huang Di Ying Fu Jing (黄帝阴符经)* says: "Observe the law of universe, and follow it. That's all. (观天之道，执天之行，尽已)" In the ancient farming society, it refers to astronomical observation and calculation to make a calendar, so that people can work on agricultural production and everyday life according to the calendar. Therefore, to some extent, astronomical observation is the origin of Chinese civilization, and following the law of universe and earth is also the core of Chinese culture.

3. Implications on sustainable design

3.1 The Tao generating all things and universe being constant: towards design ethics.

According to the thought that Tao generating all things (道生万物) and the unity of universe and human (天人合一), human beings, as a part of the universe, is under the law of it. For human, the law of the universe and movement of celestial bodies in space is almost constant. So it provides the fundamental criterion of sustainable development for human society. In other words, anchoring the universe, the optimal state of all things and mankind is definite and unique. When they are in full compliance with the law of universe, they can remain normal and sustainable way of being and complete the natural life cycle. On the contrary, when they are not in accordance with the law of universe, they go out of normal, causing morbidity and damaging the life cycle. Therefore, the universe being constant (天道有常) enriches design ethics of sustainable development. The design conforming to the universe is good design and promotes sustainable development, while the design that does not conform to the universe is bad design and causes unsustainable development. For example, the current increasingly serious plastic waste and their wide pollution, against the law of universe and nature, causes damage of the natural environment. It is worth pointing

out that there is only one best sustainable state for things since the universe is constant, while there could be many different kinds and degrees of unsustainable states.

3.2 The unity of universe and human and following the law of universe: towards design principles.

The constant universe forms the fundamental criterion and design ethics of sustainable development, hence following the law of universe is a basic principle of sustainable design. Only the design obeying the law of universe can promote people's sustainable way of being and doing. Taking agriculture as an example, it is a typical production by law of universe and earth, otherwise the quantity and quality of harvest would be affected. On the contrary, if the design violates the laws of the universe, it would lead to unsustainable way of living and producing. For example, when it is cold in winter, clothes help us to keep warm. If wearing a designed clothes with bare skin, people may catch cold and get sick. In a word, everything and human must follow the law of universe and earth in order to be healthy, normal and sustainable. Therefore, following the law of universe and earth is a basic principle of sustainable design. The law of man is the law of universe and earth, imitates the creation of universe and earth, embodies the simple beauty of objects, and also constitutes the aesthetic standard of sustainable design.

3.3 People-oriented, and universe-rooted concept: towards a dialectical relationship between human and nature.

Human is the most intelligent part of all creatures, and it’s one of four great together with universe and earth. The fundamental purpose of all human activities is the survival and development of ourselves, so sustainable design is also based on the people-oriented concept, but because of the unity of universe and the law of universe, the precondition of people-oriented is to anchor universe and earth. Without anchoring universe and earth, it is easy to violate the law of universe when we design in a people-oriented approach. so as to guide an unsustainable result. For example, simple standing the human’s needs point of view, it appears the phenomenon of mass exploitation of natural resources, mass production and consumption of products and services, to meet the material consumption in the short term, but damaged the ecology and environment, which will eventually harm the sustainable development of people. In other words, it’s necessary to build a harmonious relationship between human and nature. On the one hand, the ultimate purpose of design is for human, but man and all things in nature are one. Anchoring the universe, following its law and protecting nature is fundamental to pretest ourselves now and future. Furthermore, to each individual, physical health is the foundation of sustainable development, with the idea of "the isomorphism and correspondence of universe and human", to conform to the laws of the universe is essential to keep the normal of health of individual as well, in which, the precondition is the nature and environment is normal and healthy. Otherwise, there will be a gap to obeying the law of universe, so as to damage people's health eventually.

4. Tentative design applications

The design implications above of Chinese culture in pre-Qin classics provide new intentions and opportunities on sustainable design. While those design ethics, principles and dialectical relationship are still quite abstract understanding. How to apply them to concrete design solutions and create value for everyday life? It's another challenge that we have explored. Following design works are tentative applications of previous discussion and finding on design ethics and principles, toward situations of reality today.

4.1 A Chinese calendar with local season foods

Chinese calendar was for agriculture in history while today people mainly use it for agenda management with west solar calendar, which indicates that human have been divorced from the universe seriously. This design proposal aims to increase user's awareness of local and season foods and enable them to have better food plan, as shown in Fig. 1 and Fig. 2, in order to reconnect the human and the university by food towards a healthy and sustainable lifestyle.



Figure 1. A Chinese calendar with local season foods.



Figure 2. Illustrations of local season foods on Chinese calendar.

4.2 A set of home furniture for Chinese Zheng Sitting

Zheng Sitting (正坐) is a normal way of sitting without chairs before Han dynasty in China, which conforms to the unity of universe and human, while it has disappeared for a long time although it can be regarded a best way of sitting with significant advantage of health. This design proposal is a set of home furniture for Zheng Sitting in average apartment, as shown in Fig. 3 and Fig. 4.



Figure 3. A scenario of home furniture set for Chinese Zheng Sitting.



Figure 4. A set of home furniture for Chinese Zheng Sitting.

4.3 An office chair for Chinese Zheng Sitting

Spinal disease is popular among white collars for long time sitting. Zheng Sitting exercise is a best way to recover or keep health as the attribute of unity of human and universe while It's not optional to change office furniture and way of working. How to make it possible to exercise Zheng Sitting in average office. As shown in Fig. 5 and Fig. 6, this proposal creates a minimum change that an office chair can be adapted for two sitting postures of both Zheng Sitting and Hu Sitting(胡坐).

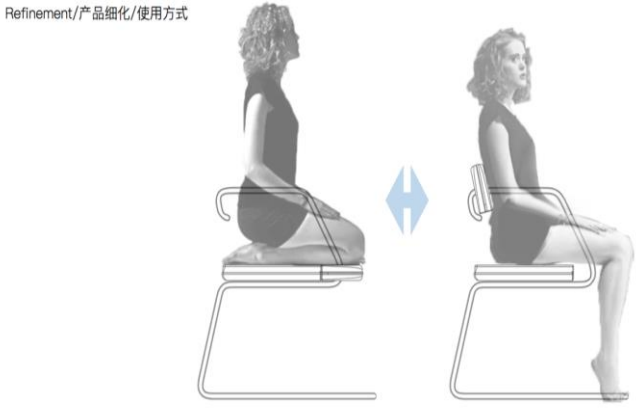

Figure 5. An office chair for Chinese Zheng Sitting.



Figure 6. Posters of an office chair for Chinese Zheng Sitting.

5. Conclusions

This paper is an attempt to trace the roots of Chinese culture in a perspective of design and discover the wisdom of pre-Qin classics, especially for the values on sustainable design. These thoughts and ideas of the pre-Qin classics enable us to treat the challenges of survival crisis and sustainable development in a holistic and dialectical perspective, and put forward more effective design theory, principles and methods on sustainability, towards a more resilient and sustainable society in the future. Admittedly, our understanding of pre-Qin culture is still very limited on the one hand, and our theories and methods of sustainable design are still far from meeting the challenges and demands of sustainable development on another. Therefore, there is a lot to be done, among which one thing is clear: new design cultures and reflections are necessary for the common future of human society.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Eco-lab-orating.
Insights from an ongoing intervention with design school faculty

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Abstract | The paper presents an intervention with faculty members at a college of design, aimed at exploring the potential of design and design education to serve as meaningful forces for social and environmental change. The intervention has taken the form of an ongoing Action Research group, in which the members' main practice is to exchange diverse 'materials' amongst themselves and to artistically respond to them. In this manner the group engages in 'autopoiesis'; e.g., acts as an organ that creates itself while interacting with and influencing its surroundings. The project is philosophically rooted in deep ecology and systems theory. Its outcome has been to create a new social space that has had a transformative effect on the group members as artists and professionals, trickling into the teaching atmosphere of the college and leading to fruitful collaborations outside it as well.

KEYWORDS | DESIGN EDUCATION, ACTION RESEARCH, DEEP ECOLOGY, SYSTEM THINKING, AUTOPOIESIS

1 *and out of nowhere*
it dawns on you
that blossoms are fruit

Melissa Allen, 2015

1. Introduction

This article presents an ongoing Action Research project with faculty at an Israeli college for design. The group comprises 12 faculty members who began, in early 2017, to experiment with alternative modes of collective and artistic action in response to the challenges of the environmental crisis.

The design world is a primary leader of aesthetic, practical, communicative, and artistic trends, and wields a powerful influence in contemporary culture and on the management of human affairs. At the same time, coping with environmental challenges is difficult for designers, whose professional activities are usually subservient to industrial and economic interests. In addition to the powerful hand of the market, the design world also suffers from an excessive deference to disciplinary divisions, which limits fruitful dialogue between design, social science, and environmental concerns (Latour, 1993; Lefebvre, 1991; Rabinowitz, 2009). At the Shenkar Design College, for example, environmental considerations are often seen as an intrusion that complicates the aesthetic beauty and joy of design. When issues of sustainability do enter the curriculum, as they have been increasingly over the past decade, they appear as a mainly technical affair, divorced from mainstream studio courses. This sends an unfortunate double message — that environmental concerns exist, but somewhere set apart from and secondary to 'real' design values.

The Action Research project, presented here, sought to disturb this conceptual dichotomy within the context of the academic field of design education. The intellectual underpinnings of the project draw from the philosophy of 'deep ecology' and from Action Research methodology, particularly as articulated by Keiny (2002), a biologist who translated elements of ecology and system thinking into explicit principles for Action Research. The group modells itself metaphorically and practically as an 'ecosystem,' in which the members, as 'organisms,' interact in a manner that is both collaborative and indeterminate. The key practice in the group is the exchange of 'materials' between the members, where members individually 'metabolize' these same materials and produce artistic responses to them.

2. Theoretical background

Deep ecology is an environmental philosophy that critiques the domination and exploitation of nature by human beings. It calls on us to recognize our species as part of a web that

sustains all life on the planet, and in which nature has inherent value independent of its instrumentalization by humans (Capra, 1996; Capra & Luisi, 2014; Naess, 1986; Orr, 1994). In a similar critique, Merchant (1980) has argued that in the West, to understand nature almost necessarily means to rule it. This understanding is often calculative and is driven by a belief in infinite growth and inevitable technological progress, while devaluing the forces of compassion, imagination, memory, and non-scientific knowledge. Similarly, Capra (1995), a physicist and system theorist, argued that amending relations between humans and nature requires a re-evaluation of the traditional epistemic hierarchies between rational versus intuitive, reductionist versus holistic, and linear versus non-linear thinking (Capra, 1995). He referred to this as a shift to "system thinking," and paralleled it with the paradigmatic change over the 20th century from the mechanistic to the ecological view of nature. I.e., while the mechanistic approach treats natural phenomena as discreet working parts, the ecological view is more holistic, treating nature as a multitude of systems constantly interacting with and influencing each other, and in which a change in any part of the system can affect every other part (Capra, 1996; Maturana & Varela, 1980).

'Action research' is a collaborative research practice in which researchers and participants mutually produce academic knowledge, in the course of practical action in the world (Levin, 1999). There is no 'one size fits all' method for doing Action Research, but variants on this research tradition all share the view that valuable knowledge pre-exists the researcher, and should be recruited collaboratively with participants, towards the goals of social change and improving lived reality (Greenwood & Levin, 2006).

Shoshana Keiny was a biologist and educator who was deeply influenced by modern ecology, particularly the idea that humans should be seen as part of the systems they study. She articulated eight principles of 'ecological thinking' that could be applied in experiential science education and that are consonant with the spirit of Action Research (Keiny, 2002; 2006). They are: *Holism* — the group cannot exist without its constituent 'parts,' yet always constitutes something greater; *Self-organization* — complex systems are assumed to organize themselves from within, based on the qualities of interactions between components; *Interaction* — analysis should focus more on what happens between components, than the components themselves; *Contextuality* — phenomena must be understood in relation to the particular time and place where they occur — in other words, all phenomena are inseparable from their environment; *Causality* — phenomena in the system do not have a distinct start or end point, thus 'causes' and 'effects' cannot be attributed with certainty, but are always interchangeable; *Subjectivity* — reality is constructed by the observer who is also part of the ecosystem, and multiple interpretations are always possible; *Reflexivity* — subjects can and should reflect on their reality and act to change it; and finally, *Indeterminism* — outcomes of group interactions cannot be controlled or predicted in advance.

In her approach, Keiny compared Action Research to an ecological system, paying attention to interactions within the system, much in the way that communities of organisms are

studied in modern ecology (Odum, 1953). She called the central tenet of her approach *reciprocity*, the idea that humans have a double role in the system: Both as actors and observers, they shape the system and are shaped by it.

3. Context

Design holds a highly ambivalent and contradictory role in the national culture of Israel. On one hand, Israeli culture promoted the Romantic legacy of emotional connection to nature, as a vehicle for national revival (De Shalit, 2000). The ethos of modernist and utilitarian design was also highly influential on the state's founders and early leaders. At the same time, environmental and aesthetic concerns are usually devalued as trivial occupations, compared to the existential concerns of immigrant absorption, settlement, and national security (Sela-Sheffy, 2011).

The Action Research project was carried out at the leading design college in the country, serving about 1,500 students and enjoying an international reputation. It speaks a language of 'professionalism', 'excellence', prioritizing clear 'goals', and 'efficiency'. The discourse of sustainability is still a relative newcomer at the college, and environmental considerations are not yet merged into the core design curriculum. As is often the case in design education, students are encouraged to solve problems efficiently and beautifully, given strict parameters, but without disturbing the infrastructures or meta-discourses in which a design product will take its place. This problem is not exclusive to the college but reflects the paradoxical relationship that exists between design and social research more generally (Albrecht, Lupton & Holt, 2000; Irwin, 2015; Ventura, 2014).

4. Method

Prior to establishing the group, I carried out an exploratory study to flesh out how people at the college relate to environmental topics and what sustainability means to them. In the exploratory stage I interviewed about 30 faculty members, students, and department heads whose work touched on social-environmental concerns. The interview materials were rich but a bit dissatisfying. I thought — 'We're designers, let's create something relating to the environment instead of just talking about it.'

The Action Research group included five men and seven women (including myself) of diverse ages, both junior and senior faculty, representing all six departments in the college (fashion, textiles, visual communication, industrial design, building & environment design, and jewellery). The group is ongoing, meeting bimonthly since early 2017 through the present.

The first meeting began with an explanation introducing the Action Research, and a summary and reflection on the personal interviews that had been conducted ahead of the meeting. In the first few meetings, the priority was to provide a space for each member to

bring their professional interests and sustainability personal standpoint to the table, while establishing a culture of transparency and trust that would enable the group to work as a community. Following each group meeting, I sent a summary and reflections to all the members.

Over three years, the most important working principle for the group has been to acknowledge the inherent value of each member, without judging or sanctioning any member's particular 'design' contribution or mode of participating in the group. In many respects the group manifests Keiny's (2002; 2006) principles of 'ecological thinking': Decisions are reached organically, through mutual conversation, and everyone is listened to and treated as an equal member. The group engages in frequent *reflection*; its activities prioritize *indeterminacy* and *interaction* among members over discreet products and finite results. Most critically, the group evidence *self-organization*, acting as a complex system that creates itself through interaction between the different parts. The principle of self-organization represents a culmination of the elements of ecological thinking.

5. Group Metabolism

In *The System View of Life*, Capra and Luisi define a living organism as characterized by two processes. One is the ability to absorb external materials, which it uses to build itself and to determine its molecular identity; and the other is having an internal metabolic system which allows the living organism to continuously create, repair, and renew itself (Capra & Luisi, 2014). Building on the concept of "self-making" (or "autopoiesis"; Maturana & Varela, 1980), they hold that self-generation is the defining characteristic of living networks:

> "Living systems continually create or recreate themselves by transforming or replacing their components. In this way they undergo continual structural changes while preserving their web-like patterns of organization,"

creating a "coexistence of stability and change" (Capra, 2018). Organisms constantly respond to their environment, but these interactions cannot precisely determine and direct their influence on the living organism, its interior state or response to change. Picking up from these ideas, the group sought to model itself as an analogous kind of living entity, to embody an 'ecosystem' in which members — 'organisms' — interact and create in a shared space of 'metabolizing' materials.

The first task the group came up with was to exchange 'gift materials' among the members. The purpose was to trigger dialogue and to jumpstart the group's creative activity. The plan was as follows:

> "Each person is requested to give and to receive 'gift material' to someone and from someone else in the group. Each person will respond personally, in a visual, artistic, physical, active way to the material received from the other person. For the purposes of this task – 'material' can be anything having substance and definite

> properties. Concrete palpable material perceivable through the five senses, or conceptual material such as a text or memory."

The members were also encouraged to document the process — coming up with an idea of what to give as a gift, how to present it to the receiver, and any sketches, decisions, data processing or other stages in developing their work in response to the gift that was received. The idea was that each person work on something that interests them, triggered by someone and something external to them — together and apart at the same time.

Here I will trace some examples of material gifts and responses, to help characterize the collaborative, distributed and indeterminate character of the group's activity. This mode of operation was highly unusual for faculty, who are generally used to working in isolation, following strictly defined goals and parameters for their design projects.

An industrial designer was interested in relationships between natural and synthetic materials. Among other projects, she created hybrid objects that represent functional and morphological dependence between sweet potatoes and water containers, which she designed and printed using a 3D printer. She called them "vases that are like infusions for sweet potatoes." For example, in one of the designs, the plastic container includes a straw that penetrates into the sweet potato, providing it with water, while the sweet potato serves as a leg that stabilizes the plastic object and keeps it from falling down. The two aspects, the potato and the plastic, cannot exist separately; if they are separated, the container will fall, the water will spill, and the sweet potato will dry out. These experiments led to a necklace-like object featuring the sweet potato roots, which she passed on as a 'material gift' to the architect.

This awoke in the architect an interest in root growth, and in associations with family roots and genealogical tables. In his studio, his eyes stopped on a gift he had received on completing his architectural studies — a book on the city of his birth, La Plata, Argentina. The city of La Plata was planned on modernistic ideals, on a grid and diagonals, and its map resembled, to his mind, the shape of seed-starting trays. The similarity between the two forms, the municipal grid of La Plata and the seed tray, led to the creation of a hybrid image of roots with a sketch of a map of the city. He then examined the hybrid image through the lens of 'Space Syntax' — a research field, popularized in the 1970s, for examining interrelations between the design of structures and their social use patterns. The architect's aim was to explore the correlation between the planning data and the urban logic of the city, versus the spread of roots, as a possibility for urban research inspired by botanical forms (see Figure 1).



Figure 1. Root studies.

Another industrial designer, who keeps a personal collection of mousetraps, presented one from his collection to a fashion designer. For the industrial designer, the mouse traps represent a deeply felt conflict between ethical purpose and professional success ("Build a better mousetrap, and the world will beat a path to your door"). The receiver saw the gift as a symbol of her being "trapped" in fashion consumption. Responding to the mousetrap, she experimented with the deconstruction of used denim and created prototypes of jackets and other one-of-a-kind apparel made from second-hand material. She was able to connect with a fashion company that collects and repairs used jeans from its clients, and which kept a large stock of used denim. About ten more prototypes followed. Ultimately, the fashion designer partnered with an NGO that supports women coming out of the cycle of sex work, providing personal supporting and professional training as seamstresses.

The output in the group was fascinating and strange, blending familiar and recognizable forms in new ways. An architect presented a jewellery designer with a large, living palm leaf, who approached it as one would diamonds or gold, polishing and neutralizing its morphological history and extracting from it a small, jewel-like object — the remainder designated as 'waste.' A textile artist presented a graphic designer with a specially prepared scrapbook of used, bound paper (wrapping paper, toilet paper, old receipts, and so on). The receiver, who has a theoretical interest in skin, used this opportunity to do things to the paper "that are done on skin, to peel, to tattoo, to scar." Other 'gifts' took the shape of a task, such as visiting the beach, a botanical garden or a leather importer. Not all gift materials succeeded in triggering an ongoing process of iteration and response among the participants; some led to a limited dialogue or opened a possibility for future conversation that has not concluded. Figure 2, below, provides a taste of the array of material gifts and responses that came about in the group.



Figure 2. Array of gift materials and responses by the Action Research group.

The matrix of 'gift material,' which began as a preliminary exercise to set the group in motion, gave rise to a style of interaction that defined the social space of the group as a whole. It nurtured mutuality and dialogue between faculty who did not previously know each other, and fostered commitment to the group. Over time, another ritual developed in addition to gift-giving: sharing knowledge worlds and research activities, in the form of a short personal lecture at the beginning of each meeting by a different group member. These lectures sparked discussions that also became, in themselves, part of the group's agenda for the meetings.

6. Outcomes

Two years into the life of the group, I conducted 2-hour, semi-structured interviews with each member to assess their evaluations of the group.

Evaluations were generally highly positive. Words like "trust," "freedom," "support," "belonging," and "empowerment" recurred in the interviews. For example, one participant said that the group "allows each person to feel that it belongs to them, and that they are a part of it." Another reflected: "The freedom and the value accorded to each person, the opportunity to communicate and interact and share your personal process, is empowering."

The features that group members found most challenging in the Action Research project were its indeterminacy, the absence of explicit instructions or direct control over outcomes. The male group members, especially, bristled that the group did not provide a structured work plan. For example: "I didn't think the model would work… I was suspicious that without a definite goal, the group would fall apart." Another said: "I need the security of knowing where things are headed, but I was willing to let go since [the group] wasn't my sole responsibility." However, for most participants, these same aspects were the most rewarding: "I learned a different style of management… [treating] flexibility as part of the agenda… allowing things to be articulated as you go along." Another said: "I have always looked for yes/no answers and it always led me to a dead end… The surprising and meaningful benefit for me was that… environmental questions are complex and there is more than one language to speak them." A third added: "Usually I am super in control. I like to label information, and here I can experience things without knowing where they will lead."

Another cluster of responses within these assessments, related to the influence of the project on the members' teaching. Overall, the members noted that experiences in the group had a positive impact, inspiring their teaching, providing ideas for assignments and affecting their relationships as instructors. Interestingly, several members used the word "sub-conscious" to describe these effects: "Subconsciously, I insert it into everything that I teach," said one member. "I feel that it subconsciously impacts my interpersonal experiences as an instructor," said another.

Design education is usually competitive and goal-oriented. The group provides an opportunity to take cues from natural systems that don't have a prescribed leader or goal, but rather to experience relations that are non-hierarchical, indeterminate and mutual. The activities of reflection, giving each other strange 'gifts', and being vulnerable in a professional setting are markedly unconventional activities in the context of the classical training or 'socialization' of design professionals. These activities force colleagues to explore alternatives styles of relating to one another, and by extension, to the shared natural environment.

The gift-giving practice was a central methodological axis for this process. Some members experienced the gift-giving act as a 'test' which they might fail as a giver or receiver (if the gift did not motivate or inspire creativity, for example). Gift-giving required each member to acknowledge and be aware of how the receiver thinks, what will interest or move them, as well as relinquished their full control over the creative process, which will be initiated by others. Design typically worships the vision and genius of the individual designer; here, the act requires designers to operate in relation to other people, to cede control to the group and be vulnerable. Moreover some members felt defensive or distant from the group, or struggled to find an effective role in it. The activities thus illuminate some potential costs of changing our relationship as humans and designers to planetary sustainability: discomfort,

dependence, unpleasant novelty, role confusion, disappointment, and creative frustration, can be expected at least to some degree.

The gifts also spurred specific critiques and experiments relating to sustainability and design. The example of the 'better mousetrap' interrogates the kinds of relationships that common designs foster between humans and other living beings. The example of the palm-leaf caricatures the implicit manner that aesthetics encourage us to instrumentalize natural resources while disregarding subsequent waste. In the examples of the 'roots' series, the participants critiqued the prevailing design ethos that usually trains us to erase nature or dominate it. This was demonstrated in an extreme form (the vegetable roots completely constrained into synthetic shapes). The participants then reversed the power relationship, which they explored by allowing the roots to guide their creations, rather than the reverse.

In the three years since its founding, no one has left the group; and, in an interesting nod to the guiding principle of 'holism,' there has never been a meeting in which every member attended. Over time, as the initiator of the group, I have been able to release control and trust in its continued existence. Also, the members have come to take more responsibility for its continuation. However, I am still expected to manage the scheduling and logistical arrangements. Perhaps this also suggests the difficulty in our culture of fostering capacities for collective action. Most recently, the group was invited to present its work in a group show at the national Biennale. In the course of this exhibit, the audience will also be invited to create and interact with the group's work, and in this sense also to become part of it.

7. Conclusion

The aim of this ongoing Action Research project has been to awaken opportunities for interaction, reflection and change within design and design education. The working model that came about in the group was inspired by 'ecological thinking,' an approach that celebrates the uniqueness and visibility of each participant, and at the same time creates a space for dialectical connection. The group activity that I have described had a transformative effect on its members as professionals and teachers, and a surprising outcome was that the methodology of Action Research also became, for the participants, an end unto itself. Following Maturana and Varela (1980), in my analysis the research group exemplifies a case of 'autopoiesis,' i.e., an organ that both creates itself while interacting with and influencing its surroundings. That is, the group does not only discuss issues of environment and sustainability in a detached, intellectual way, but manifests them in the body of the group and the research process itself. This is reflected in the fostering of collegial reciprocity and dialogue in an institution which is typically competitive and individualistic, in collaborations across disciplines, and in reflections on the group's impact at the two-year point since its founding. Transformation was also felt in ecological ripples outside the group, for example via partnerships with the business sector and with NGOs. All these trickled down directly and indirectly into the teaching atmosphere of the institution.

As an applied art, design penetrates every aspect of our everyday lives. Objects, infrastructures, and images are an inseparable part of human existence and it is easy to overlook, as Willis (2006) stated, that "We design our world, while our world acts back on us and designs us." The impacts of design can be catastrophic and obvious, as in environmental and social crises, or they can be more subtle, faintly cementing mental habits and the conditions for human behaviour (Fry, 1999; Lopes, 2017). Calvelli (2009) argued that there is a powerful correlation between how we perceive the history of design, and how we teach design to the next generation. A 'bad ecology' will have as its outcome nothing more than the production of objects. For a 'good ecology' to exist, design schools must encourage dialogical engagement with existential problems and promote more openness of thought (d'Anjou, 2007). The research described here is not supposed to directly resolve the myriad ecological problems and conflicts that face our planet, but it does perceive an urgent need to respond to them by expanding relationships between disciplines and between theory and practice, and sees the tools of art and design as natural leaders in this process.

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Acknowledgements: I thank all the group members who are taking part in this special project for their willingness to march together into the unknown. Colleagues, who became research partners, and especially friends, and from them I learn every day a little more about the world and about myself.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Educating Designers for the Circular Economy: Innovative Digital Resources, Collaborative Learning and Synergic Actions

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Abstract | This paper will discuss the role of the designer and the importance of design education and digital resources required in order to find a new vision with regards to the problems created by man himself. Design is at present going through a great change from the linear system towards the circular economy and requires new actions, attitudes and resources when interacting with this change, in addition to harnessing the opportunity to "redesign the world." Sustainability has proven to be a continuous process of learning and adaptation, the present day digital transformation can offer great opportunities for designers to influence with the concept of Green UX, both as a tool to visualize and communicate in a straightforward manner wicked problems and convert major players in the commercial world into future users and promoters of circular design. Research shows that innovative digital platforms can offer alternative teaching methodologies for collective learning.

KEYWORDS | CIRCULAR ECONOMY, CIRCULAR DESIGN, INNOVATIVE DIGITAL PLATFORMS, SUSTAINABLE CONNECTIVITY, COLLECTIVE LEARNING, DIGITAL TRANSFORMATION.

1. Design education and digital resources for an ethical, sustainable and digital transformation

Sustainability has proven to be a continuous process of learning and adaptation, preparation for a new economic model puts the responsibility on and highlights the importance of specific education for a circular economy using new models. This paper will discuss the role of the designer and the importance of design education and digital resources for the ethical, sustainable and digital transformation that is required in order to find a new vision with regards to the problems created by man himself.

Design is at present going through a transition from the linear system towards the circular economy (CE) and requires from the designer new actions, attitudes and resources when interacting with this change. Research to promote a circular and sustainable economy aided by design is underway, such as the research project to identify the tools required by Portuguese companies and designers, in order to overcome barriers and be able to align design projects with European policies (Camocho, Ferreira, & Vicente, 2018).

However, formal design education has fallen behind, the preference of students is changing since they are generations adapted to technology with a greater facility in digital learning, an example being the use of mobile phones in teaching, such as social networking tools and media experiences that have impacted on education and student learning (Tynan, 2011). It is worth noting that these generations (Willian, 2011) show that technologies are changing not only the way of learning and teaching, but also academic structures and practices. Simon McIntyre (2014) comments that teaching is connected with society and work practice, which implies an advance in the use of technologies and in the way of learning and collaborating.

Informal disruptive methods respond better to present day needs, and in particular with regards to complex evolutionary topics required to prepare students for future alternative economic models. Sustainable curricula first appeared in higher education at the turn of the 21st century with the DIS Design and Innovation for Sustainability carried out by Carlos Vezzoli and Ezio Manzini in the design department of the Politecnico di Milano (Vezzoli, 2006). In 2010 the Aalto University's Creative Sustainability masters programme was created with a cross-disciplinary character between the art, design, business and technology faculties. It's focus is related to the Finnish national design plan focused on implementing sustainable design education for a future society (Hyvönen, Saarela, & Mattila, 2014). In past years the situation in design education has not evolved as desired, and in 2020 still only a limited number of institutions fully incorporate CE in their design studies.

Digital resources are advancing at an exponential rate, becoming accessible to all and enabling an acceleration in the dissemination of knowledge, leading to new ways of sharing and collaboration, informal education models have exploited this opportunity providing

contents that are urgently needed addressing, as is the case of sustainability in design education. During this period of recent digital acceleration the concept of User Experience (UX) design has gained prominence as our day to day existence moves online. Here UX design provides the perfect scenario for designers to work with complex topics to simplify the existing excess of data, give users a voice, and allow brands to showcase their sustainability.

An ethical, sustainable and digital transformation can now be achieved and future designers must be prepared to "redesign the world," this in turn will require training and guidance from formal educators "to respond to crises and challenges that humanity faces in the 21st century social innovation needs to be viewed in a systemic and open dimension to achieve long-lasting and positive impact" (Ferreira, Souleles, & Savva, 2020, p.37).

2. Online resources for design teaching of the circular economy

Many online resources for design teaching of this new economical model have emerged in recent years, the following provide quality open source material: the Circular Design Guide (Ellen Macarthur Foundation & IDEO, 2017) is a website for designers with methods, mindsets, stories and resources created by Ellen MacArthur Foundation and IDEO design studio in 2017, and The Circular Classroom (Arcaroglu, 2018) with material for students and educators to start their own CE classroom was launched by Leyla Acaroglu's UnSchool of Disruptive Design in 2018. Both provide guidance for designers and non designers to understand and apply circular methods to lifestyles and work, however both are somewhat behind the times in terms of their resources and UX.

Other online platforms –offering general circular economy contents– with updated material tend to act as repositories accumulating an abundance of data impossible to digest. Three have been studied: the Sustainability Map, the European Circular Economy Stakeholder Platform and the Circular Economy Learning Hub. Each was chosen for promoting CE at a European level, offering different perspectives in accordance with their stakeholders, all providing intrinsically a listing of generic data, standards, regulations, case studies, news and projects, however all are lacking specific material of interest to the designer. It is also unclear the manner in which each receives, regulates and certifies content, making it difficult to trace or evaluate the information to the original source which would enable findings to be applied to the design field, nor do they recognise the potential of design in the circular economy.

The Sustainability Map has various European and American aid and economic entities as sponsors, with a variety of users: producers, processors, buyers, organizations, experts and academia, working to "provide scalable tools, technical assistance and advisory services for every stage of the value chain, from micro, small and medium sized enterprises in developing countries to retailers and brands in developed markets" (International trade

Center) With content on standards, community, network and trends, aimed at enterprises, international buyers, public-sector and academia (generally in the field of environmental economics).

The European Circular Economy Stakeholder Platform (ECESP) is an initiative created by the European Commission and the European Economic and Social Committee (EESC), impulsed as part of the part of 2005 EU Action Plan for the Circular Economy to engage with stakeholders and support the exchange of future good practices. It functions as a "network of networks", it plans to go beyond sectoral activities and highlights cross-sector opportunities, to share and scale up effective solutions and address specific challenges, for example: funding sources, proposing measurement tools or policy guidelines. In 2015 a two year research collaboration with the Ellen MacArthur Foundation and Granta Design resulted in the Circularity Indicators Project, aimed at business, policy makers, academia and consumers it is designed to measure the extent to which the material flows of a product or company are restorative. According to Janine Borg, ECESP platform coordinator and EESC Secretariat, recommendations for improvement have been made to concentrate actions thematically, establish clear timeframes and define purpose, objectives and desired outcomes of these actions, the current structure and content being considered most helpful for those already in the know. Future plans also include greater attention to education in order to guide, not simply check how circular you are but to redirect actions, and support the creation of other platforms at a national level, Italy already has its own platform and Austria is in the process.

The Circular Economy Learning Hub (Ellen MacArthur Foundation, july 28, 2019) is the most useful for the design community, devised by the Ellen MacArthur Foundation who considers that design is the heart of the circular economy. It requires us to redesign everything and enjoys a close relationship with the IDEO global design company. This recently launched learning hub is part of the foundation's ongoing initiative to increase education efforts, with work focusing on six areas: learning; business, institutions, governments and cities; insight and analysis; systemic initiatives; and communications.

3. A profound transformation: we are all designers

We know that designers use their creativity and their way of designing to unite fantasy with invention (Munari, 1997). They also have the ability to solve problems in a variety of ways by associating existing ideas from areas that are initially disparate (Amabile, 2000). According to Manzini, we are all designers (Manzini, 2015). This statement permits us to see the profound transformation that has occurred in the designer's intervention with the world. Capra (2002) talks of creativity, continuous learning, moving and development with basic elements in living systems. Another theory by Capra (2002) suggests that the living systems of nature have the capacity to organize themselves, promoting a new order. However the same does not occur with man-made systems,

these are increasingly more complex, and according to the author, cover all aspects of our lives, whether in the productive model, communication systems, among others, and require a profound change in order to become sustainable.

We live in a context in which even wicked problems (Buchanan, 1992) have become super wicked problems where "time is running out; those who cause the problem also seek to provide a solution; the central authority needed to address it is weak or non-existent; and, partly as a result, policy responses discount the future irrationally" (Levin, Cashore, Bernstein, & Auld, 2012). We know that many agents from all sectors of society are needed, industry, businesses, NGOs, citizens, experts, the state and its laws, which in collaboration can contribute knowledge, creativity and innovation to solve these problems and provide a new order.

The present day digital transformation offers opportunities for designers to influence with the concept of Green UX (Morrissey, 2019), which serves both as a tool to visualize and communicate in a straightforward manner these complex issues designers are now facing and to convert major players in the commercial world (Google, Apple) into future users and promoters of circular design.

One of the keys to solving the problem is connectivity as Capra (2002) already pointed out at the beginning of the 21st century, change will happen through connectivity and communication between various areas of knowledge, because society, according to his findings, maintains a rigorous separability between the areas of knowledge and society. The challenge of our times will be the connectedness of scientists, people, communities, and need to be organized in such a way that they do not impair the ability of nature to sustain life on the planet. Transferring this necessary connectivity to Manzini's theory that we are all designers, allows an understanding of the profound transformation that has occurred in the designer's behaviour.

Connectivity is the key for the new order, in this context an organizational system can be observed with innovative digital resources, collaborative learning and synergic actions, in this scenario the designer is the aggregating element that creates the mechanisms and tools for collaborations and processes to be executed, in addition to being the nucleus of circular design according to the Ellen MacArthur Foundation. Given the current climate emergency, organizations such as education, government, companies, among others, are unable to respond, the most recent example being the environment summit "COP Chile - Madrid 2019" that failed to advance in global agreements. This is unfortunate as other organizational paths, where several agents from different sectors share their knowledge and exchange information and concerns, have more success, an example is the Disruptive Innovation Festival (DIF), which encourages collaborative learning.

The Disruptive Innovation Festival is a digital platform that aims to change the mentality of designers and business in order to inspire action towards a circular economy, a regenerative system in which the flow of resources and waste, emission and energy losses are minimized. An online festival that proposes to identify new ideas by asking: "What if we could redesign everything?" Curated by the Ellen MacArthur Foundation, during a three week period annually where innovative projects are presented and debated in both the professional and academic field.

Informal design education responds better to the present day society's needs as it can be both lean and agile, it enables people to be in contact and implement disruptive methods. Whereas regulated design teaching shows that "… sustainable development is not yet at the top of design curricula. It exists in most cases as an isolated component of something optional, that could be chosen –or not– to integrate into the design idealization and creation phase" (Ferreira, Souleles, & Savva S.,2019). It is important to highlight that academia knows that a change in the way of doing and thinking is needed as is demonstrated with the Sustainable Disruptions Report by the danish Design School Kolding, which has as its motto for change and disruption the Albert Einstein phrase: "We cannot solve our problems with the same thinking we used to create them." (Bohl, 2015, p. 8)

New methods and tools to help designers make circular material choices exist, for example the Circular Design Guide (CDG) created to encourage synergy and collaboration, breaking with the traditional modus operandi, using worksheets and case studies, which make it possible for the work to be fluid, dynamic and creative. Collaboration between universities on the theme, such as the LeNSin (International Learning Network of networks on Sustainability) organized during 2015-18 and developed with Erasmus+ finance includes 36 worldwide universities and offers a platform for the exchange of good practices to contribute to a transition towards a sustainable society, taking into account the different contexts of each region. Both the CDG and LeNSin can be considered examples of information exchange and working methods on society impact.

The Circular Classroom (Arcaroglu,2018), is a collaborative learning project that incorporates the experience of other educational centres and synergic actions by adding specialists from different areas, initiated by the designer Leyla Acaroglu (also sustainability innovator and educator), the government of Finland, other teachers and students. This methodology is used in Finland's high schools to help change linear thinking towards the circular, supporting this transition equipping all with a new way of thinking, necessary design tools and a common language for this to happen. Structured in three modules (sustainability, design systems and creativity) it is an interactive resource platform, offering teaching material, classroom activities, teachers kit based on

communication and design to generate change, a method that activates collaborative and experimental learning.

4. The digital transformation offers great opportunities

The European Commission has updated this year it's 2005 Circular Economy Plan alerting that although the circular economy is here to stay it is far from being implemented globally or to the desired scale, as many stakeholders are still without an action plan (EC, 2019): "The circular economy is now an irreversible, global mega trend. Yet, much is still needed to scale up action at EU level and globally, fully close the loop and reap the competitive advantage it brings to EU businesses. Interaction with stakeholders suggests that areas not covered by the action plan could be investigated to complete the circular agenda" (EC report on the implementation of the Circular Economy Action Plan, 2019).

The importance of specific education for a circular economy using new models, be it disruptive, online, informal, is now a priority for the design sector. Here the potential of UX in relation to environmental issues has derived in the concept of Green UX. This concept is defined as having two aspects; first as a tool, making visible the complexities and problems of the CE, offering a new communication with the daily experiences that affect the management of resources and second in its application, where the fast growing unsustainable digital sector is committed to implementing the principles of a circular economy, adopting a new sustainable and inclusive model.

Optimization of digital resources to create a *design for all* adopting lean or agile style workflows, designing for greater usability, minimizing the use of excessive data by ethically managing servers, without forgetting the high consumption of the screens, wi-fi technology and the effectiveness of the Internet of Things (IoT). Designing for *Mobile-first*, that is, to begin designing for small screens and scale upwards, this method provides greater performance, and guarantees an excellent experience with fast loading websites for users accessing through mobile networks.

There are now many projects implementing Green UX, such as the British government website. It is a perfect example of easy, clear and inclusive usability. Its Head of Design Ben Terrett explains: " 'People come to GOV.UK to do something and then move on with their lives. No one comes to look at graphic design. We believe that the form follows the function and that from this comes a visual elegance.' It is more than just the design of a website; what they designed is the complete digital interaction between citizens and the government, including transactions. All information follows a simple structure, aesthetics is not striking, the design is based solely on typography and at all times allows interaction at various levels (surveys), with the support of AbilityNet for people with specific accessibility needs..." (Hurst, 2013, 17 april)

5. We need to start living the data we possess

The world has suffered too long an excess of factoids that have made it immune to the problems of sustainability, and now the time has come to handle ecological knowledge in a more genuine manner, we need to start living the data we possess (Morton, 2017). At present we are witnessing a public outcry for climate change action, where a schoolgirl from Stockholm –Greta Thunberg– has united thousands of people in over 300 cities in March 2019 on the first ever global climate strike (350.org., 2019, 15 may). In response to critics who encouraged her to abandon her Friday strikes, since 2018, to return to school and become a scientist working towards climate change, she reminds us: “But the climate crisis has already been solved. We already have all the facts and solutions. All we have to do is to wake up and change.” (Thunberg, 2019).

The circular economy and circular design are complex concepts to implement. According to the Ellen MacArthur Foundation “A circular economy is based on the principles of designing out waste and pollution, keeping products and materials in use, and regenerating natural systems.”(Ellen MacArthur Foundation. Concept. What is a circular economy? A framework for an economy that is restorative and regenerative by design) This *circularity* is the basis of many sustainable theories and methods (Cradle to Cradle, laws of ecology, looped economy, regenerative design, industrial ecology, biomimicry, Life Cycle Assessment and Blue Economy) and provides an alternative to existing wasteful linear production and use.

The idea of an economy in loops is not new, first appearing in the European Commission report “The Potential for Substituting Manpower for Energy” (Stahel & Reday, 1982) in 1976, later the concept of a circular economy based on non-linear systems was outlined by the environmental economists David W. Pearce and R. Kerry Turner (1989), and in 2013 the authors of the Cradle to Cradle concept (of special interest to designers) McDonough and Braungart, updated their concept with the publication of “The Upcycle: Beyond Sustainability - Designing for Abundance”(McDonough & Braungart, 2013), proposing that instead of limiting sustainability to protecting the planet from human impact, we have the opportunity to improve the planet by producing beneficial projects.

The CE offers a positive continuous development cycle which preserves and increases natural capital, optimizing the yields of the resources and minimizes the system risks, managing finite stocks and renewable flows, and works effectively at any scale. Design has immense opportunities for action in this field, however it requires its professionals and in particular the new generations of designers first to be aware of the concept, then have in place the data, tools, certifications and methodologies in order to be able to design products and services that are truly circular. And this is where innovative digital platforms offering alternative teaching methodologies will play an important part in

preparing the future generations of designers to overcome the complexity of the issue, to start living the data we already possess and applying it to their projects.

6. In Conclusion

Research to date identifies the need for innovative digital platforms to offer alternative teaching methodologies to educate all together. Here the capacity of the designer to create the tools, methodologies, and teams to visualize the complexities of the circular models will be crucial, but will only occur once more emphasis is placed on educating the designer towards the circular economy.

The digital transformation and the evolution of the Green UX concept is providing valuable support, while the digital sector serves to visualize experiences and implement a sustainable agenda, it is also becoming aware of the potential of CE thus offering the end user a responsible digital product or service, easy to use and designed with total accessibility.

In the new context of CE the designer attains a new protagonist, becoming a key element of the design process it allows for the creation of new tools so that synergies and communication between different parts of society can occur.

The actual complexity and super wicked problems faced result in a change towards a more collaborative and open structure where collective creation uses open source methods as the future for CE education, for example, the Open Education at Creative Commons. Working to eliminate barriers, train and educate using open licenses to offer an Open Education.

Initiatives of collaborative networks between universities like LeNSin, government policies of applying the CE to classrooms like the Danish use of the Circular Classroom platform, uniting faculties for cross-disciplinary actions like the Aalto's Creative Sustainability Masters or the recent launch of the Circular Economy Learning Hub are positive actions for education to prepare future generations of designers. By using the digital resources available and thus put the circular economy in action, making the most of a designer's capacity to create tools and resources to visualise the complex issue, to catalogue and preserve correctly the knowledge obtained from the experience of each project, offering up to date insights and leading the much needed multi-disciplinary teams.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Evolving the conventional curriculum: innovative learning interventions to enhance learning competencies

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Abstract | Singapore, having received the status of a "Creative City of Design" by UNESCO, has identified creativity as a key strategy for social and cultural development. Traditional perceptions of Singapore as a conservative island nation are changing, as industry sectors embrace design-led processes of planning and implementation to produce and facilitate new innovations in cultural production. This paper discusses the importance of design education to adapt to the changing environment and equip students with more holistic approaches to design. The research considers the growing impact of design citizenry through community engagement and the underlying philosophies supporting the design of future markets, against the rapidly changing context of Singapore. This study presents a 3-week long, immersive workshop for final year design research students. Through documentation of the workshop delivery and reflective journals of students, the piloting of a "Markets" track of research is analysed and discussed to define the ability of future designers to influence cultures of change through new approaches to address the macro and microeconomic shifts framing design practice. This paper examines how the potential of design impact can be measured, evaluated and scaled through flexible curriculum design in design education.

KEYWORDS | DESIGN EDUCATION, DESIGN PEDAGOGY, CURRICULUM DESIGN, INNOVATIVE LEARNING

1. Introduction

Digital disruption is not only changing the landscape of businesses and the workforce but pushing learning and teaching approaches to re-evaluate how educators motivate new modes of learning in a digital world. This confronts design education with challenges to restructure and redefine the role of future designers to establish deeper understandings of customer experience and more meaningful engagements with communities to support design impact. One key area facing significant change is the space of markets. As citizens contribute to new sharing and circular modes of production, dissemination and use, traditional notions of the market are being replaced with new conceptions and ideas of social, economic and sustainable design practice.

In tertiary education, educators are working towards preparing learners with emerging 21st-century competencies. Singapore's Ministry of Education produced a framework that lists Global Awareness, Cross-Cultural Skills, and Critical and Inventive Thinking as competencies that will enable youth to find new opportunities within the digital age (Ministry of Education). Against the design education landscape, there is a push towards infusing a wider appreciation of design in curricula within the institutes of higher learning to meet changing job scopes and rising demands for design skills (Ang, 2019).

This paper provides an overview of the higher education landscape of Singapore and presents a bottom-up curriculum design that addresses the alignment of pedagogical approaches that respond to the needs of the environment. The testing of a pilot study is presented, discussed and analysed to propose a mapping of curriculum design that considers agility and flexibility for learning and teaching. This paper concludes with the identification of design literacies that equip students with broader competencies while enabling programmes to continually evolve and adjust to the changing needs of the macro-environment.

2. Preparing 21st-Century Leaders and Change-Makers

The 2025 design masterplan vision for Singapore sets out to develop a thriving, innovation-driven economy that is strengthened by design through higher education strategies and design-led, creative thinking skills (Design Singapore Council, 2019). While these plans will contribute to the growth of the economy, knowledge building activities and exposure to design disciplines is crucial. Design-led thinking within interdisciplinary environments, where collaboration occurs, would allow students to integrate and transfer knowledge across various design disciplines and methods to operate in non-design contexts.

Design should establish itself as a discipline that engages through experience-making, builds with business strategies, and integrates user experience. However, the term "*design*" has taken on a new meaning with less emphasis on how things look and more on how things should work (Ang, 2019). As disciplines like engineering, business and media begin to

provide more opportunities for those with design-led skills, the value of design produces significance through ways of thinking, processing, and innovating ideas for effective solutions. Across the disciplines, collaborations involving designers are increasingly in demand as government bodies, NGOs and local communities enlist designers to develop creative strategies. This further emphasises the need for design education to adapt and embrace the changing demands of the market.

The design curriculum needs to evolve and develop changes that meet the expectations of students, which are demonstrated by the 21st Century competencies of adaptive learning, critical thinking and digital experience. According to Ang (2020), education systems need to acknowledge the impact of digital influence and equip students with skills and values to navigate the digital world. This enables them to not only take part in a technologically connected world but build resilience against the uncertain and unpredictable future of the job market. It is important for design education to acknowledge the convergence between social media and lifelong learning skills, which act as a conduit for new cultures of learning and knowledge production.

Papanek (1985) stated that designers should "design for people's needs rather than their wants" (p. 219), reinforcing the responsibility of designers in influencing markets and assuming agency over all activities in the creation of meaningful experiences. Design develops significance when its research and solutions extend beyond singular issues and consider the systemic complexities where design skills produce value through innovative solutions. This signifies the demand for design education to address human-centric perspectives to frame the interrelatedness and interdisciplinary nature of design problems, developing transferable skills through critical thinking, idea scaling and evaluation, and systemic approaches to design.

3. Case-Study: Immersive Workshop

Digital transformation influences various industries through changes in how businesses function, create, and thrive against competition. These changes affect students and the culture of research, evidenced through growing interests in topical issues concerning social media, social responsibility, and the geography of design. In order to address the broad knowledge needed to facilitate the expanding design interests of students in the School of Design Communication at LASALLE College of the Arts, three research pathways were created to support practical applications through the designing of experiences, objects or systems:

- **CULTURE:** focuses on the value of design research through the perspectives of sociology and cultural anthropology.
- **MARKETS:** emphasises the relationship between consumers and economies in driving design as an important discipline and profession.

- **TECHNE:** rooted in the study of material culture to link the historical development of graphic art to contemporary studies in visual communication and communication design.

The "Markets" track categorises broad media, marketing, and communication research. As traditional notions of the market are being replaced with new conceptions and ideas of social, economic and sustainable design practice, there is a growing need to create more effective social services through inclusive design methods to innovate and respond to external challenges. To introduce the research track to final year Design Communication students, a 3-week immersive workshop was developed to communicate core research methods, explore the various skill sets informed through research, and produce practical outcomes through a creative design process.

3.1 Piloting of the Workshop

Influenced by macro-level changes, resulting in social and cultural shifts, inform the design activities of the current student population of "Generation Z" who are highly entrepreneurial, innovative, socially aware and undeniably political (Mootee & Smith, 2017: 11). Responding directly to the profiling of this new generation of designers, the immersive workshop challenged students to define how businesses, economies, and design innovation function against the landscape of digital content and marketing, service design, and experience design. The three weeks of the workshop comprised the following:

1. **Introduction to Markets**: Students were challenged to develop curiosity about the world and how design can be applied through creativity, problem-solving, social processes, and learning experiences. Acknowledging the marketplace as a system of institutions, within which procedures are developed in the exchange of goods and services between people and organisations, broad definitions of markets were explored in relation to how culture links economies to politics and governing policies.
2. **The Digital World**: Introduced key concepts such as the function of social media, role of digital marketing and digital objects, and utilising artificial intelligence and technology in the creative industries. This session focused on aligning student research to an awareness for building tools of production.
3. **The World of Experiences**: Presented how to create meaningful experiences for people through user experience and interface design, service design, and human-centred design. The definition of experience was broadly discussed with a focus on users to engage in the creative processes of design improvements, innovations and speculations for daily life.

The immersive workshop was documented through a reflective journal that recorded the activities involved in producing outcomes throughout the creative process. Although critiques and peer evaluations engage learners with new abilities to assess and formulate critical feedback (Davis, 2017), the reflective journal allows for self-assessment to inform

individual research and practice. Table 1 presents the timeline of activities and methods of learning. These insights were summarised from the reflective journals of students, leading to the identification of effective teaching tools, methods and approaches.

Table 1. Insights on Workshop Delivery

REFLECTIVE JOURNAL INSIGHTS		
Timeline (Stages)	Methods of Learning	Approaches toward Change
WORKSHOP 1 Introduction to Markets Design Road Mapping - Design research methods - In-class assignment	Designerly way of Knowing: The designerly way of knowing is not only embodied in the process of designing but, equally, the products of design carry knowledge. (Cross, 2007) Triangulation: Triangulation is the means by which an alternate perspective is used to validate, challenge or extend existing findings. (Turner and Turner, 2009)	• Moving away from the comfort zone • Realisation of what needs to be done to speed up work progress • Other topical discussions of concepts indirectly affecting or impacting economy, business and innovation developments
WORKSHOP 2 The Digital World Content Generation - Content planning method - Group critique	Critical Thinking: The three main stages of critical thinking for designers: Observe, Question, and Answer. (Elmansy, 2017) Feedforward: Feedforward consists of providing future-oriented options or solutions. It asks, 'What further improvements need to be made to advance my progress?' (Hattie & Timperley, 2007)	• The event of realisation is a creative leap - creativity as the occurrence of a significant event in the design process. (Dorst & Cross, 2001) • Students indicated how a sudden insight, which most recognised as a learning event, was significant to the process.

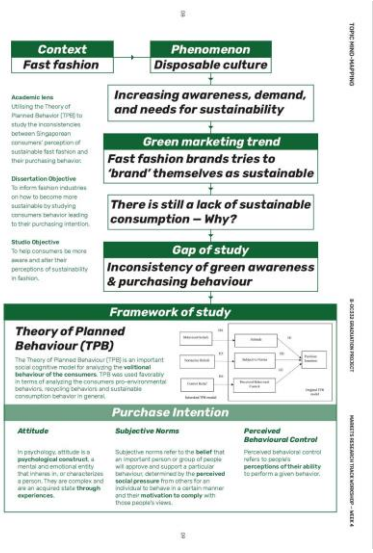
Workshop 3 The World of Experiences Digital Design Experience - User experience - Group critique	Small-Group Critiques: "…under this strategy, students talk about work in greater depth and are more critical than in the public settings of a full class critique." (Davis 2017: 136)	• Building different perspectives of design responsibilities and how that might engage design through communication. • Heller notes what the late Milton Glaser expressed, "The key is to ask questions, for the answers will result in responsible decisions. Without responsibility, talent is too easily wasted on waste" (Vienne and Heller, 2003), as why designers must produce honest design that acknowledges the truth rather than manipulates intended audiences with false impressions.

3.2 Holistic Approaches to Teaching

Curriculum design requires an understanding of the needs and expectations of learning within a given cohort. This requires teaching activities that develop opportunities through empathy to produce dialogue, as the '"ability to empathise changes not only how we see and respond to people but also how they respond to and see us…" (Jiwa, 2017: 93). Empathy, in design, is a quality with which practitioners can access the needs, wants and values of users. In that same sense, educators should adopt holistic perspectives through empathy to identify the intellectual, emotional, social and creative potential of students. This directly influences the research topics and themes of student research, which consider the role of design in changing cultures of production and consumption through growing awareness of designing for social awareness and sustainable practice.

Table 2. Selected Outcomes

SELECTED OUTCOMES OF THE "MARKETS" RESEARCH TRACK		
Student Name	Designed outcome:	Synopsis of work

Janice Yap	 A3 poster	**A3 Poster:** The study of Singaporean fashion consumers' green awareness and purchasing behaviour - utilising the theory of planned behaviour to study the inconsistencies between the perception of sustainable fast fashion and purchasing behaviour.
Aretha Cheong	 IG Page	**Social Media - Instagram Page:** The Culture of Erroneous Identity: A study on consumer culture and its impact on the psychological development of self in Singaporean children aged 6-1.4 The Instagram page, *"Kumonforfeelings*" was created to raise awareness on authentic forms of emotional security. Primarily targeted towards parents to educate them on the dangers of consumerism in children, followed by raising the awareness of emotional stability and security, and how it can be carried out to best support their kids emotionally to reduce the risk of relying on consumer culture.

Joshua Yeo	 Editorial Design	**A3 Publication:** A study of 'greenwashing' in Corporate Social Responsibility (CSR and how Food and Beverage brands can engage the Singaporean Cosmopolitan Millennial Consumer by addressing the ageing workforce through brand messaging. The publication features a study of the current forms of CSR in the different industries through a visual study to properly understand the trend of old forms of CSR as a trend.

Design education trains future designers to develop cultural and social sensitivity and responsibility. The resulting outcomes of the 3-week immersive workshop demonstrate the key issues, research themes and design articulations are presented in Table 2. Each of the 3 projects presented above demonstrates a clear application of the immersive workshop by questioning the current market practices, speculating towards design-led futures, and proposing feasible strategies by translating theory through research. The projects present evidence of students developing the ability to tackle large and complex systemic issues through design-led research and creative practice.

4. A Mapping of Future Research in Design Communication

Effective education requires the cultivation of enthusiastic learning, which considers students experience by providing a diverse curriculum that supports methods of teaching and assessment to motivate learning (Robinson, 2016: 231). The key characteristics of a

design communicator comprise awareness and the ability to rethink societal changes and developments. Brock & Hundley (2016: 147) state that the learning process is dynamic and should value mistakes and setbacks to cultivate growth and development. As designers are positioned against complex and problematic situations, intuitive and reflective practices are instrumental to dealing with uncertainties (Schon, 1983).

The piloting of the research tracks provided key insights into the types of topics and research areas that interest current students, indicating the trends for future research tracks and pillars to consider as sources of knowledge production. Markets, as a research area containing relationships between producers and consumers, frames all design activities as it considers the roles of culture and society in the creation of design outcomes. The key terms, insights, themes and concepts from the 3-week immersive workshop were compiled and reorganised to produce a mapping of future areas for student research in the field of Design Communication.

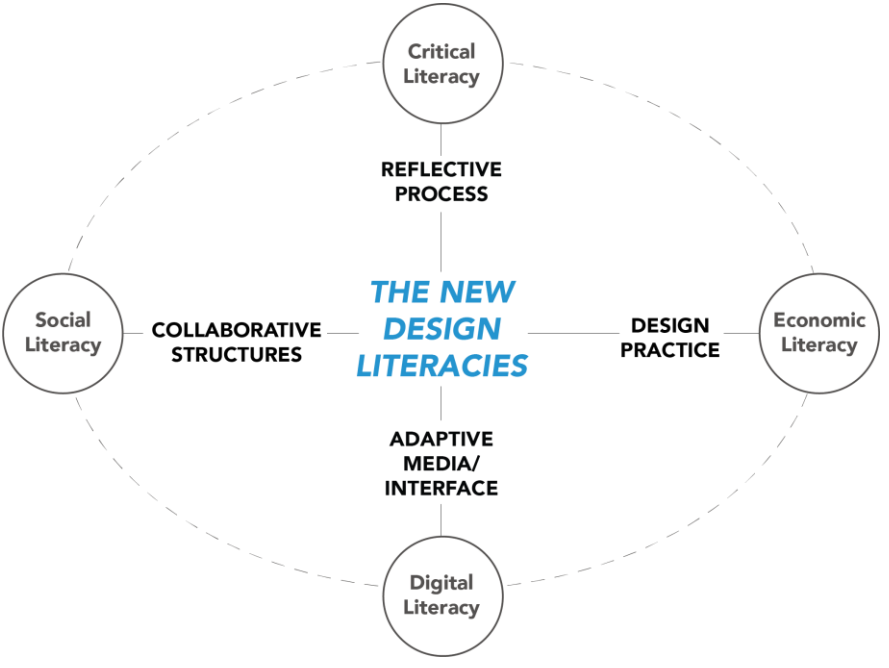


Figure 1. Design Literacies through Flexible Curriculum Design

The mapping of design literacies in Figure 1 outlines how the piloting of the immersive workshop, within the research stream of "Markets", has led to the identification of 4 new literacies for students in the School of Design Communication. The 3 stages of the workshop were developed in direct response to the macro-level changes to the industries requiring specific design skills and activities were organised to expose students to experience through

media, development through critical processes, knowledge production through collaborations, and tangible outcomes through design practice.

THE NEW DESIGN LITERACIES		
ACTIVITY	MODE OF DELIVERY	LITERACY/COMPETENCY
ADAPTIVE MEDIA & INTERFACE	*Experience & integration of communication tools*	DIGITAL LITERACY as a key ability for designers to gather, organise and present information through various forms of technology
REFLECTIVE PRACTICE	*Design development through thinking & writing*	CRITICAL LITERACY is necessary for designers to analyse and evaluate the sociocultural dimensions of design
COLLABORATIVE STRUCTURES	*Group critiques & design evaluation*	SOCIAL LITERACY is the ability of designers to translate social interactions into processes of knowledge exchange
DESIGN PRACTICE	*Translation of research into practical outcomes*	ECONOMIC LITERACY defines the role and function of designers and design activities to produce value

Figure 3. Identification of Design Literacies

As the systems of the world become increasingly complex, it is important for design education to identify clear competencies and skills for future designers to produce impact through the design practice. Digital literacy enables designers to navigate through rapid changes in technology, media channels and interfaces to generate new forms and methods of communication design. Critical literacy positions designers against the broader dimensions of social, cultural, political, ecological and economical changes in the external world, requiring designers to adopt critical perspectives that inform all future actions. Social literacy acknowledges the privileged position of designers to effect impactful change through collaboration, generating robust knowledge through the levels of social interaction and exchange. Economic literacy, within the context of “Markets”, challenges designers to measure, scale and evaluate how design outcomes and skills can produce new currency and value.

Table 3 presents how the workshop has produced a pedagogical framework that informs new literacies and future areas for design research within the programme. Through the introduction of an immersive workshop, students were exposed to new ways of thinking and learning to effectively produce design outcomes addressing the challenges and complexities of the macroenvironment. Equipping students with new design literacies prepares them with a more comprehensive knowledge base that can be transferred across different disciplines, contexts and applications.

5. Conclusion

The piloting of a 3-week immersive workshop demonstrated that cultivating research as part of design education relies on flexible and adaptable approaches to develop an inclusive curriculum. Teaching activities need to present direct connections between key theories and design methodologies for effective student learning experiences. As design competencies continue to evolve and develop, design education needs to quickly adapt to the changing needs of the institutions, industries and markets governing design practice. This paper has demonstrated that developing design literacy, through practical applications, produces new transferrable skills that engage students in the forms of self-directed learning, active engagement, planning and critical awareness for utilising and transforming design towards new innovations.

Design literacies change and evolve in relation to the shifting forces of the environment, requiring design education to develop agility and quickly respond through pedagogical interventions. The case-study discussed in this paper provides an example of how curricular activities and programme structures can integrate different approaches to foster more dynamic studio culture through learning. This enables the design curriculum to maintain relevance and resilience to inform future research areas and contribute to the knowledge base of design.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Fashion Futuring. Rethinking sustainable fashion design.

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Abstract | The paper investigates the possibility to re-imagine fashion design in a sustainable direction and to conceive alternatives to the current unsustainable growth of which fashion has been a carrier in recent decades. The paper relies on the emerging design-theory-based concept of "futuring", which concerns ecology, sustainability, and social innovation. It sets a methodological framework that develops eco-fashion beyond environmental sustainability, and slow fashion beyond the critique of the acceleration of fashion production and consumption. The proposed framework leads into the four directives of Do it Yourself; Future Artisans; Digital Manufacturing; and Industrial Experimentation and allows to encompass initiatives ranging from circular economies to participatory design models and open design. Future research on Italian case studies will test the validity of this framework. The research hypothesis is that there is an Italian design laboratory in fashion, able to prefigure new material cultures and shape the ways we live and interact.

KEYWORDS | FASHION DESIGN, LABORATORY ITALY, FUTURING, ECOLOGY, SUSTAINABILITY

1. Introduction

A *merceria* (haberdashery) in Siena has re-imagined its function and extended its work to co-design accessories with its clients. People can choose patterns, fabrics, trimmings and have a personalised bag, basket, headscarf, t-shirt handmade in no time. A tailor learned his trade from the family business in Sicily. At one point, he decides to experiment with different ways of patternmaking, attends training at a makerspace, and starts using open-source software that allows him to create patterns using parametric designs. In Trentino Alto Adige, a group of young engineers has asked what to do with the leftovers from winemaking. The answer is a design process that recycles grape skins and stalks into a new textile. Meanwhile, in Piemonte, an almost 200 years old manufacturer produces high-quality yarns sold to designers for the luxury market. These four vignettes introduce this paper's theme: which are the main directions emerging in fashion and textile design in Italy in relation to sustainability? We present here the ideas that prompted our research, which is still at its initial stages.

It is believed that fashion does not have moral obligations toward the future. However, the seduction of bio textiles, the zero waste lifecycle and the use of new technologies in the garment industry are just some examples of the forward-looking agenda of 21st-century fashion. Nowadays, the association between fashion and a sustainable future is acquiring more relevance and communicative strength. In 2019, the French fashion designer Marine Serre defined her designs as "Future wear", combining techno-sportswear styles and environmental concerns in an "Eco futuristic" line made of end-of-cycle products. In 2015 the United Nations established seventeen Sustainable Development Goals (SDGs) under the title of *Transforming our world: the 2030 Agenda for Sustainable Development*. The SDGs' 169 targets address a wide range of issues related to sustainability and economic security. Following this agenda, the international non-profit association Forum for the Future and the Centre for Sustainable Fashion (London College of Fashion) have published *Fashion Futures 2030*, a global scenario for sustainable fashion conceived to help industries and people "to think differently about the future for fashion" (William et al., n.d.).

Students and climate activists organised the campaign Friday for Future which became a global movement in 2019. The slogan "no future" has been adopted by the global environmental movement Extinction Rebellion to warn about the un-sustainability of the present ways of living. Through the campaign #BoycottFashion, the movement has asked supporters not to buy new clothes for a year and repair and up-cycle, share and swap, rescue and repurpose clothes, and establish a new ecologically friendly relationship with them. In the context of a growing demand for a better future and increasing anxiety for the future generations, fashion should play a crucial role in encouraging a critical change, stimulating radical visions and pervasive action, from large-scale industrial systems to individual experiences. Finally, in the field of fashion studies, the discussions about the end of fashion as a broken system have inevitably raised a parallel debate on its future, involving the redefinition of fashion itself (Steele 2019).

In opposition to the dystopian visions of unsustainable growth of which fast fashion has been a carrier in recent decades (Payne, 2019), this paper outlines possible research directions. It presents a methodological framework articulated along two axes: 1) short-long supply chain and 2) handmade and techno-oriented. These two axes create four areas: Do It Yourself, Future Artisans (*Futuro artigiano*), Digital Manufacturing, and Industrial Experimentation.

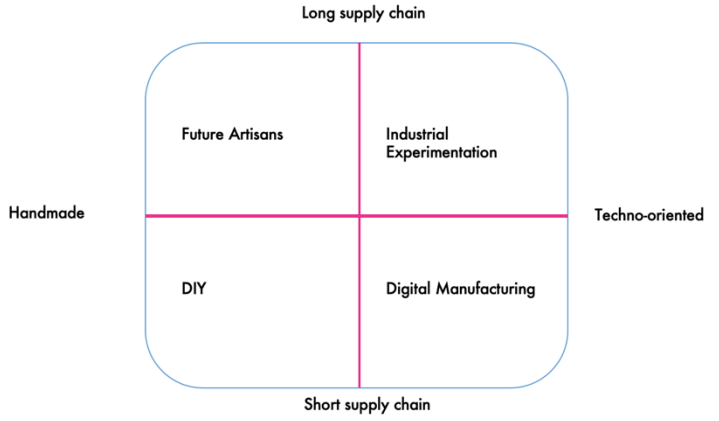

Figure 1. Fashion futuring methodological framework.

Future research on Italian case studies will test the validity of this framework. The research hypothesis is that an Italian design laboratory in fashion can prefigure new material cultures. In the next two sections, we provide the context of this design laboratory's experimental and prefigurative character, outlining the main points in two intersecting debates: one on fashion futuring and the other on "laboratory Italy" (Hardt, 1996).

2. Fashion Futuring and Sustainability Debate

The concept of design futuring stems from the work of design theorist Tony Fry, who has argued for the need for new directions (redirecting) in design to respond to a world that has become unsustainable. Re-directive practices facilitate knowledge exchange; politically contest the unsustainable status quo; promote the transformation of knowledge into action; and shape communities of change working towards a common goal. Importantly, as Fry emphasized, re-directive practices break away from established ways of thinking, working

and making, and producing new designed objects and new design cultures, practices, and designers (Fry 2009, 2014).

"Futuring" is becoming an essential concept in fashion, thanks to the sustainability scholar (Alice Payne, 2019). Payne understands futuring as a dynamic process able to negotiate between two opposing interpretations of sustainability. The first interpretation sees futuring an optimistic and gradual technological evolution towards a cleaner industry. The second endorses a more prudent approach to freeing fashion from the imperative of unsustainable growth of capitalism.

The concept of fashion futuring allows overcoming the exclusivity of some of the proposed sustainable solutions to fashion. These positions include, for instance, "eco-fashion" beyond environmental sustainability (Scaturro, 2008; Brown, 2010); "slow fashion" as a critique of the acceleration of fashion production and consumption (Fletcher 2007, 2010; Clark 2008); and the ancient Greek philosophical concept of "beautiful and good" (Frisa & Ricchetti 2011), which combines ethics and aesthetics. These approaches reaffirm fashion as an elitist concept that exclusively entails the linkage between slow and expensive, innovation and luxury. On the contrary, fashion futuring is a new approach to the debate on sustainable fashion that emphasises initiatives ranging from the creation of circular economies (Smith, Baille & McHattie 2017) to participatory design models (Hirscher, Fuad-Luke 2013) and open design (Romano 2015). All these initiatives have in common the quest for a more holistic approach to fashion design, manufacture, and consumption. For instance, it entails DIY practices and innovation supported by the free circulation of ideas and skills.

3. Fashion Futuring the "Laboratory Italy"

Italy represents an interesting case study because big brands, emerging designers and a plurality of artisans coexist in its territory. Each has its narrative, stressing respectively, marketing, creativity, and manual work's intellectual character (d'Ovidio, 2015). Together, these dimensions show how fashion in Italy is a multifaceted and a complex phenomenon, defined by positive tensions between traditional techniques and new technologies.

This research project is part of a network of studies investigating fashion in an interdisciplinary key and its complex relationships with capitalism’s history. The project moves from the idea of "Laboratory Italy" as theorised by Michael Hardt as a political experimentation model in which theory and practice go hand in hand. In Hardt's words:

"The relationship between theory and practice remains an open problematic, a kind of laboratory for testing the effects of new ideas, strategies, and organisations. Revolution can be nothing other than this continually open process of experimentation." (Hardt, 1996, p.2)

In recent years, "Laboratory Italy" has gained new momentum and new meaning. A new momentum, because it has been seen as a paradigmatic concept to rethink Made in Italy as a “cultural counter-hegemony in an international market dominated by the United States”

(Balicco, 2018, p. 39). A new meaning, because it has been expanded from political philosophy to the rich cultural pluralism of Italian design, and tested in the fields of fashion, architecture, and visual and performative arts (Bolgherini, et al., 2018).

The research thus adopts an approach that combines the two theoretical debates around "Futuring fashion" and "Laboratory Italy", to identify, map and analyse emerging re-directive and experimental practices in the field of design, production and communication of fashion in Italy. A result is a theoretical tool for investigating new areas of contact between creative practices in the field of fashion and forms of activism (Vanni, 2020).

We identified futuring practices and Italian laboratory in fashion in the intersections of the following four directives: Do it Yourself; future artisans, digital manufacturing, and industrial experimentation.

4. Fashion futuring: a methodological framework

This section expands the methodological framework we outlined in our introduction. This framework is a mapping instrument built in two dimensions: the practice and knowledge axis, that moves from the handmade to the techno-oriented, and the production and distribution axis, that moves from short to long supply chain. These two directions intersect to form four quadrants, and each of these quadrants includes design practices, theory, and artefacts. This framework is a methodological tool to think through emerging design practices that we will map in the next stage of our research. As it often happens when methodological frameworks are tested in fieldwork, the framework itself may change.

4.1 Do It Yourself (short supply chain + handmade)

The 2000s has seen the revival of self-production practices in clothing, from knitwear circles to cutting and sewing courses. These practices point to the desire to escape classic production and consumption mechanisms and re-evaluate individual creative abilities. Feminist perspectives recovered knitting, crochet, embroidery, and other domestic crafts as examples of creativity and unpaid female labour (Greer, 2013; Hackney, 2013: Rosner, 1018). More recently these crafts have expanded through the use of web 2.0 (Gauntlett, 2011), for examples with websites dedicated to particular techniques, with platforms that enable short supply chains (Etsy) and with visual social media (Pinterest and Instagram).

Handmade, craft and DIY are labels that often recover creative, minorities practices, following feminist studies on the politics of making activities and the historical omissions of women's crafts (Parker & Pollock, 1981; Greer, 2013; Hackney, 2013). As signs of personal creativity, these DIY practices mobilise an imaginary of individuality, economic resilience, reinvention of traditions, a more democratic fashion and forms of "quiet activism" (Hackney, 2013). DIY also appeals to an appetite for new frugality (von Busch, 2014). Finally, making or buying from makers are also acts of micro resistance and material disobedience to the many

ethical and environmental issues surrounding fast fashion. Artisanal and handmade products appeal to a quest for authenticity, uniqueness and added value against the ubiquity of fast and high street fashion (Micelli, 2011). With regard to Italy, a case in point taken into consideration during the initial stage of the research is Talking Hands, a permanent workshop of fashion design and social innovation established in Treviso in 2016. It involves migrant workers from developing countries and adopts manual activity as a form of narration of their lives and dreams (Franzo, 2020).

4.2 Future artisans (long supply chain + handmade)

Futuro artigiano is the title of the book (2011) by Stefano Micelli dedicated to hand made artisan cultures and practices, which the author places at the centre of the concept of Made in Italy. Micelli maintains that it is precisely the skills of "knowing how to make artisans" (Sennett 2008), both in small and large companies, that make Italian manufacturing attractive at a global level. Handmade becomes a meeting point between local and global. An example is how small fashion independent brands as Ijo' Design, funded in 2001 by Annalisa Surace, have revived the Apulian traditional weaving on olive wood looms. It has gained an international profile and has been selling its designs through The Lobby, an experimental concept retail born in 2018 in Stockholm to offer short contracts to niche brands, providing them with small in-store spaces for the presentation of their collections to the public and the buyers. Another enlightening example is the Italian textile company Bonotto, which has contributed to promote the “slow factory” model against industrial standardisation and low-cost mass production. As the company website explains, in the Bonotto firm, industrial production processes "are entrusted to mechanical machines with no automation rather than to electronic machines. Old, discarded, and neglected looms, precisely because they are 'slow'" (Bonotto 2020).

4.3 Digital manufacturing (short supply chain + techno-oriented)

The advent of a new culture of making (maker culture) coincides with the desire to re-imagine production and consumption in the direction of sustainable futures, and the capacity to blur distinctions between producer and consumer. The spread of digital technologies such as laser cutters associated with open source software has generated new ways of thinking fashion design and new design processes. In the field of fashion, digital manufacturing is not limited to the production of new objects. Instead, digital manufacturing includes the reinvention of a 0 km fashion chain and the creation of new designers capable of integrating artisan know-how with digital knowledge. It also includes the invention of new technology or the hacking of existing tools. For example, the Milanese makerspace We Make runs Digital Fashion training programs that use open source technologies and remixes specific fashion design with digital technology knowledge and practices. For instance, pattern making draws both on 'traditional' fashion design methods and the possibilities of parametric patternmaking software (Seamly2) that enables the designer to change specific parameters to alter sizes without producing new patterns for each different size. Similarly,

1980s knitting machines have been updated with a shield and an Arduino microcontroller, used in combination with open-source graphic software to produce innovative patterns (Vanni, 2020). Files with patterns, designs and hacks can be circulated online and made locally (in maker spaces, or other spaces equipped with technologies), and artefacts can be sold through online platforms, such as Etsy. In 2020, the digital manufacturing has shown its potential to transform the fashion industry, overcoming some of the limitations imposed by the anti-Covid-19 measures. To date, the research has explored the four Italian cases of Inversion; Sense – Immaterial Reality; IL3X and Barbara Bologna (Vaccari, Franzo & Tonucci, 2020).

4.4 Industrial experimentation (long supply chain + techno-oriented)

Sustainability has acquired central importance at an environmental, socio-cultural and economic level. The logic of 'Reduce, Reuse, and Recycle' informs a rich pool of experiments. This is the case of the invention of new fabrics made of living materials such as mushrooms (Mycotex by Neffa), or waste milk (QMilk), algae (Algae Apparel), and agricultural residues (Crop à Porter). The latter is mainly developed in Italy, where the local agri-food production has plenty of raw materials to experiment with and to sustain a circular economy based on waste transformation. Orange Fiber is a Sicilian company that turns citrus peels into textiles. The apple skin leather Frumat and the wine waste leather Vegea are manufactured by other two Italian companies specialised in vegan and eco-friendly materials. The initial phase of our research has highlighted how these sustainable and innovative examples (Franzo, Vaccari, Vanni & forthcoming) can contribute to radically transform the textile and leather industries, which in the 20th century have been the cornerstones of the Made in Italy.

5. Discussion

Fashion futuring theoretical framework intends to highlight new areas of contact between fashion design and forms of activism; traditional craft skills and technological innovation culture; and small scale high-quality productions and digital manufacturing. Also, it aims to contribute to rethinking the cultural, environmental and socio-economic implications of the role of the fashion designer, from their working conditions to their weltanschauung (Vaccari, 2012). Building on "Laboratory Italy", this research intends to overcome the traditional interpretation of Italian fashion inherited by the late 20th century and built upon the opposition between the mass politicisation of Italian culture in the 1960s and 1970s and the hedonism of the 1980s and the following decades, epitomised by fashion. The research highlights the role that Italian fashion could play in the 21st century when fashion and fashion design can contribute to generating forms of resistance and resilience to global climate change.

The research combines fashion studies, design theory, historical research, field research, and qualitative analysis on the methodological level. On a territorial and national scale, this

research relates to independent fashion designers, start-ups, small and medium enterprises, sustainability departments of luxury groups, independent fairs dedicated to craft and sustainable fashion such as Venice Fashion Week, international associations such as Fashion Revolution and the Fab-Lab network.

This research has the main theoretical objective of conceptualising an Italian theory of fashion and study the new material cultures generated by fashion futuring. The research also aims to support sustainable futures, helping to face the current climate and environmental emergency through disseminating and enhancing practices aimed at redirecting fashion design as a product and re-imagining it both at an individual level and as a collaborative practice.

Conclusion

Fashion for the future is an emerging theme, able to catch the interest of global brands, small-medium scale firms, and independent designers. The fashion futuring research project is part of a network of studies that investigates fashion in an interdisciplinary key and in its complex relationships with the history of capitalism on the one hand, and, on the other hand, the literature on sustainability. This preliminary study has identified "futuring" practices in fashion design in the intersections of four directives: Do it Yourself; Future artisans; Digital manufacturing; and Industrial experimentation. This framework could help to enhance the understanding of fashion sustainability, by offering a tool for mapping it and putting in relation the broad spectrum of experiments found in Italy today.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

FASHIONABLE FAÇADE: textile waste innovations for the built environment.

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Abstract | A groundswell of designers, small-scale entrepreneurs and consumers are redefining waste - seeing it as a resource and imprinting new marks on our lived cultures by turning to circular supply systems. This paper investigates regenerated materials made from textile waste for use as 'new' products in the built environment. The study finds that while innovations from waste-based products are growing rapidly, their adoption seems obstructed behind walls of limited communication and economic risk aversion. The promising news is that some small and micro factories are taking on the challenge of commercialising new innovations - and succeeding. Designers are building value through the adoption of regenerated products within the larger creative economy. However, even this apparently more sustainable route has its pitfalls. Through an exploratory approach, this study illuminates some of the steps still required for systems change towards full circularity in the production and adoption of textile waste as a resource for the built environment.

KEYWORDS | TEXTILE WASTE, CIRCULAR ECONOMY, RECYCLED BUILDING PRODUCTS, MICRO-FACTORIES, DIFFUSION OF INNOVATIONS

1. Introduction

Consumers were shocked to hear that common practice among fashion brands is to regularly incinerate deadstock (unsold garments) (Lieber, 2018). Burning is one of several textile waste management strategies implemented in the absence of viable recycling schemes (Malinauskaite et al., 2017). Yet the application of effective recycling schemes has become an imperative as global textile waste is a significant social, economic and environmental issue amounting to around 100 million tonnes of garments disposed of per year (Redress, 2017). Approximately 25% of textile waste is recycled in the second-hand clothing market but as little as 1% is currently regenerated into new materials (Morlet et al., 2017). This leaves around 75% degenerating in landfill or releasing toxic chemicals via incineration (Wang, 2006). Little of the 1% of recovered materials are respun into yarn for garments, instead they are processed into nonwovens (Tonevitskaya, 2019), destined for markets other than the textile industry. These fibres are channelled into the automotive, aerospace and marine fit-out industries, cleaning, paper, bedding, defence, roadworks and building materials. Still an escalation in the recovery and recycling of materials is essential to circumvent needless land fill and reduce the strain on finite natural resources, in order to ultimately balance environmental and social impacts (Amaral et al., 2018).

Calls to shift from a linear supply chain to a closed loop model are echoing through the design industries in increasing intensity (Gwilt, 2012; Kortmann & Piller, 2016). The circular economy model means virgin resources are processed into materials for products that can be recycled and regenerated (ideally) indefinitely (WornAgain, 2020). In this model, products are designed in such a way that they last longer in the first place. For example, by designing for disassembly, garments can be recycled at the end of each use phase (Goldsworthy, 2014). This represents the 'high value' end of the waste spectrum. Other examples of valuable recycling include polyester reprocessing for yarns to make runners (NilkeInnovation, 2020), cotton reduced with enzymes, re-spun and blended with virgin fibres for strength to make new fabrics (Soper, 2019), and pre-production cotton off-cuts reprocessed for wadding. However, at some point, the fibres become too unstable or contaminated for use in textile products and move to a 'lower value' middle phase. It is at this point that fibres can be used as composites for building materials such as bricks (Binici, Gemci, Aksogan, & Kaplan, 2010; Rubino, Liuzzi, Martellotta, & Stefanizzi, 2018), concrete slabs, screeds and renders (Topsfield, 2018; TPM, 2019), surface coverings, sheeting, and insulation. The final phase is incineration – where some claim that this is still a recycling of the carbon energy, for example for industrial heating (Malinauskaite et al., 2017).

Building materials consume 50% of the world's virgin resources (Baker-Brown, 2019). However, the majority of the unrenewable reserves destined for the construction industry could be spared if more recycled materials were used. Yet the use of building materials made from recycled materials, let alone textile waste has found limited acceptance (Munn & Soebarto, 2004). Although various regenerated textile waste building materials have been developed and tested for almost two decades (Binici et al., 2010; Rubino et al., 2018), it

appears that designers are unaware of all the innovative products available to them. Furthermore, the benefits of the products are not widely marketed; they are perceived as more expensive and/or clients are not willing to pay the price; they are considered less desirable; they are difficult to obtain because innovations are emerging at an accelerated pace and not converting adequately to viable commercial outputs; they are not manufactured to scale; they are not accessible world-wide and they are subject to local codes and restrictions which inhibit their use (Hawley, 2006; Munn & Soebarto, 2004).Yet if 75% of the textile waste remaining from other forms of recycling were channelled into reprocessed materials for the built environment alone, close to 100% of textile waste discarded into landfill could be avoided, while substantially reducing the drain on natural resources. In this way, "the building sector has the largest potential for delivering long-term, significant and cost-effective greenhouse gas emissions"(UNEP, 2009, p. 9). This study argues that a stronger drive for the dissemination and adoption of innovations in textile recycling for building materials is called for.

Enthusiastic media accounts have masked the challenges of diffusion and adoption of innovative building materials with the assumption that innovations are easily accessible once developed and presented (Rogers 1997, 2002). Certainly, the model for commercialising new products through intermediary bodies such as trade fairs, wholesalers and agencies already has a lengthy history. Furthermore, the speed and complexity of new innovations is breaking down the ties between intermediaries – that is, cutting out the 'middleman' through disintermediation, allowing direct innovation-to-consumer pathways to emerge. In some cases, disintermediation has led to more agile markets and quicker adoption of innovations as well as new value creation. For example, disrupted business models based on resource sharing and crowd sourcing services such as Rent the Runway, Fiverr and Kickstarter have become popular, but models based on product (re-)manufacture have been less successful as they require 'scale'. That is, they are not feasible until products have been tested for various parameters, checked for ethical compliance, cleared and covered by copyright, investigated for political impact, certified, delivered in large quantities, marketed and commercialised economically. This represents significant investment into the costly demands of time, expertise and risk (Peter Oluwole Akadiri, 2015). Nonetheless, entrepreneurial teams as well as scientific organisations are taking on the challenge of creating new materials from waste in small quantities and succeeding in bringing them to market. The question is, what are the conditions that lead to small-scale success, and can these conditions or this methodology be reproduced so that many more inventions are commercialised, utilised and ultimately do good, whether at a small or large scale? In linking to the specific case of textile waste for regenerated building material the contribution of this paper lies in probing the interdisciplinary discourse between scientists, engineers, fashion industry participants, building industry stakeholders, distributors and alternative business model start-ups in these sectors.

This study finds that cross disciplinary barriers are an inhibiting factor to the viable development, dissemination and adoption of new products. As a result, new groups of

stakeholders have emerged within the circular economy including eco-consultancies, cross-disciplinary teams and technology driven start-ups. Unsurprisingly new tensions between stakeholders have also arisen and currently remain unresolved, thus also halting innovations transfer. Contrastingly, the lines are gradually blurring between industry specialists such as innovators, start-ups, designers, entrepreneurs, collaborators, promoters and users. This investigation does not propose to untangle the different roles of stakeholders. On the contrary, it proposes to discover how the flow of interactions is redirected in the process of adoption. Potentially the new value creation emerging from these interactions will drive major changes in sustainable design culture for the creative economy of the future.

2. Methodology

In order to understand the flow of ideas and the diffusion of innovations within the complexities of specifically identified sectors of the circular economy, this study uses an exploratory approach to investigate the adoption of innovative, textile waste-based building materials. Importantly it foregrounds the role of the built environment designer, detailing the opportunities and challenges that may arise during the sourcing and specification stage of design. For the purposes of this study, built environment designers are defined as architects, interior designers, landscape designers, industrial designers, product developers and other stakeholders involved in the design process of building construction. The study tables 20 stakeholder firms presenting innovations across textile waste, materials engineering, micro factories (Desai, 2020), social enterprise start-ups, research facilities, design organisations, educational institutions, materials marketing, consultancy firms and media commentators, found through text-based searching strategies (Sikarskie, 2019). A world view is taken for this initial study as these innovations are rarely found in local regions, and at the time of writing, only a handful of applications appear to exist globally. Web research was undertaken because this simulates the most likely initial steps that a designer would undertake in sourcing and specifying new products. That is not to say that designers do not rely on other means for sourcing products, and these are acknowledged as they arise. Information on the scale of the innovations companies is noted if available to provide data for future research. This may become a discriminatory factor informing investigations on more localised organisations in the future. The information also identifies the limitations of innovations currently available within this sector, again providing data for future research.

Importantly my role as fashion designer is also a methodological factor in this investigation. As such I have specialist knowledge on various facets of the fashion industry including textile supply chains and design specification and manufacturing processes but little understanding of materials disposal, materials regeneration or details of the building design and construction processes – beyond the similarities I can guess at through my own work as fashion designer. Once again, this simulates the positions many designers find themselves in.

That is, willing to participate in the circular economy, but at a loss as to how to proceed and communicate across disciplines. But this is precisely the point. As a fashion designer I am interested in the proper disposal of pre and postproduction waste, as well as post use waste and potential associations across industries. I am therefore intentionally investigating an area outside of my discipline to demonstrate an instance of 'cross-disciplinary' communication and investigation, analysing the conditions and processes to uncover challenges and solutions that may occur.

3. Innovations in textile waste for building materials

Sustainability encompasses many facets including the use of environmentally friendly materials as well as the adoption of the circular economy, that is, one in which materials loop back into the production system. Providing a systems model for change, the circular economy serves to arrest the dependence on finite resources and assists the reduction of environmental damage. Within this system, waste, once seen as an unwanted substance, is increasingly viewed as a recurring resource (O'Sullivan, Card, & Fisher, 2019). There are several mainstays in the closed loop system including upcycling, repurposing, reselling and so on. These procedures have been researched and developed over the last decades with materials capture and recycling emerging with promising innovations (Boiten, Li-Chou Han, & Tyler, 2017).

Textiles for recycling are retrieved from two primary high value sources. Pre-consumer textile waste is derived from offcuts and residue of yarn and fabric manufacture, as well as the post-industrial scrap textiles from garment manufacture and other industries. The second source is post-consumer waste, which includes used garments, end of life upholstery and soft furnishings (e.g. curtains, carpets) and expended domestic and commercial manchester. A reason why only around 1% of used fibres are regenerated for use in the garment industry lies in the several complexities in textile waste reprocessing. Many first-phase textiles are made from blended fibres, for example cotton (natural) fibres are often combined in one garment or textile product with polyester (synthetic) filaments. This is a significant deterrent as blended fibres first need to be separated if they are to be regenerating into new yarns. Furthermore, although encouraging innovations in the fibre separation field are underway (Navone et al., 2020), when biodegradable fibres (such as cotton, other cellulose-based fibres, or wool) are mixed with non-biodegradable fibres (such as polyester, acrylic, nylon, or elastane), the resulting yarn is no longer biodegradable (Morlet et al., 2017). Difficulties with removing dyes, additives, processing agents, bio hazards and other contaminants from textile materials often requires further processing steps and additional chemicals to attain satisfactory material parameters (WornAgain, 2020). Recycled fibres are subject to yellowing, degradation, and loss of mechanical properties such as strength and flexibility. Regenerated fibres are often blended with virgin fibres to ensure

the quality required, but the maximum recycled content in the final products is limited (Goldsworthy, 2014). Therefore, the majority of mixed content textile waste is channelled away from the fashion industry to the middle value sector of the waste spectrum, for use in other industries. Fibre not suitable for re-weaving can be reprocessed for non-woven products such as wadding or felts. Once cleaned and spun, fibres can be compressed for use in mattress production for example. Textiles which are sent to the flocking industry are used to produce filling material for furniture padding, panel linings, loudspeaker cones, surface casings and car insulation. Other products regenerated from textile recycling include industrial rags, polishing and cleaning cloths. Polyester chips regenerated from clean garment waste (as distinct from soiled food wrappings for example) are emerging as a high demand resource. They can be liquefied and used to create new fibres for use in regenerated polyester fabrics, fibre for insulation products and fibreboard. Regenerated polyester can also be used for geofabrics, for instance as excavation reinforcement netting (Broda et al., 2019) or injection moulding for playground equipment, park benches, shipping pallets and so on. Ironically climate change has increased the demand for protective, textile-based shade coverings for agriculture. Cellulose (from fabrics such as rayon, viscose, Tencel, bamboo etc) also has a range of uses in its regenerated form. It can be converted back to viscose through wet spinning and can be used in the adhesives and the resin industry (AFC, 2019).

Some of the innovations developed for building products include light weight wall panels from cellulose (cotton), wall and ceiling panel insulation from denim and textile reinforced concrete from mixed fibres. Some of the materials even have distinct advantages over the traditional materials – but this usually comes with a higher cost (Reis, 2009). However, regenerated materials also have disadvantages over virgin materials such as the need for collection, separation, sanitising, anti-fungal and other treatments. Others still are less performative than traditional materials, for example the cellulose fibre in denim insulation is water absorbent and therefore requires better encasing than glass fibre (Fischer, 2015). To be clear, textile waste is not the only source of feedstock for recycled built environment materials. For example, innovations with biomass (such as agricultural cellulose refuse) and used building materials also form part of the circular economy picture in the construction industries (Asdrubali, D'Alessandro, & Schiavoni, 2015). Below is a table of innovations currently available specifically using textile waste in products engineered for use in the built environment:

Table 1. Heim, H. 2020. Innovative building materials and properties - generated from textile waste.

Application	Material/ Product name	Notes
		COMERCIAL PRODUCT
Wall and Ceiling insulation	'Ultratouch'	The denim and cotton fabric is shredded and treated with boric acid to make it flame retardant, and insect, pest, and mildew resistant; no formaldehyde is used; it is twice as expensive as fibreglass; UltraTouch contains no chemical irritants and requires no warning labels. UltraTouch™ Denim Insulation contains 80% post-consumer recycled natural fibres. https://www.bondedlogic.com/ultratouch-denim-insulation/
Hempcrete	'Hempcrete'	Hempcrete is a generic term for a mix of lime, hemp & water; Unlike concrete or masonry, hempcrete does not crack severely under movement. Hence its suitability to be used in earthquake areas. It is also about the seventh of the weight of concrete. Hempcrete consists of hemp shiv, a short length hemp stalk by-product, and lime-based binder. Hempcrete's 'INSULIME' is a proprietary binder to form HLC (Hemp Lime Composite) or Hempcrete (a mixture of an approved lime-based binder and 'INSULCORE' https://hempcrete.com.au/
Floor coverings	'Vilsco' Floor coverings	Vilsco wax fabric printers Using textile misprints, Simone Post's products were first presented to audiences during the Dutch Design Week 2015 and will now be developed together with Label/Breed to produce them industrially and on a bigger scale. https://materialdistrict.com/article/vlisco-the-beauty-of-leftover-materials/
Coatings; Acoustic wall coverings	'Denimtex'	Discarded clothes and jeans fibres are bonded with a bio-based glue. Decorative effects are created by blending multicoloured fibres. The mixture is directly applied to the wall. https://www.denimtex.nl/ https://materialdistrict.com/material/recycled-jeans-and-textile-on-the-wall/
		FUNDED RESEARCH
Insulating panels	'INPAT'	The INPAT project has developed insulating panels for the construction industry. The panels made only from textile

		waste perform better than products currently on the market, both in terms of noise insulation and stability. In addition, they offer good thermal properties and are easy to install. The production process uses high temperatures and pressure to produce a substance like felt which can then be coated to form panels. http://inpat.aitex.net/overview
Wall coverings		UNSW's Centre for Sustainable Materials Research and Technology (SMaRT) has created various building products, panels and tiles from textile waste in their 'Micro-Factory'. https://newsroom.unsw.edu.au/news/science-tech/turning-old-clothes-high-end-building-materials
Panels		Researchers at the School of Architecture at Universidad Politécnica de Madrid (UPM) have developed a lightweight panel made from waste textile fibres. Lighter in weight and providing better acoustic and thermal performance, the used fibres do not require any special treatment before use. The researchers chose to use a binder made from natural hydraulic lime to make the panels. See Material District: https://materialdistrict.com/article/lightweight-wall-panels-waste-textile-fibres/
		MEDIA REPORT
Plastic road surfaces	'Plastiphalt'	Contains plastic bags, glass bottles and toner from used printer cartridges mixed with asphalt. Also used for playgrounds, carpark curbs, speed humps, park tables and benches. https://www.smh.com.au/environment/sustainability/plastic-and-glass-road-that-could-help-solve-australia-s-waste-crisis-20180802-p4zv10.html
		RESEARCH LABORATORY
Bricks		Binici et al. (2010) have created clay bricks mixed with cotton and textile ash to create a lighter weight product (Binici et al., 2010). Agrawal et al. (2013) used four different combinations of polyester, viscose and cotton, in clay bricks showing a higher than average compression value (Agrawal, Watile, Mohata, & Makwana, 2013).
Gypsum board		Melo et al. studied the thermal performances of a gypsum board made with an ethylene-vinyl acetate material derived from the cuttings of expended sheets in the shoe industry.

	The results showed that the material had improved thermal insulation qualities compared to conventional materials (Melo, da Silva, Coutinho, Sousa, & Perazzo, 2012).
Sheeting	Binici et al (2010) found the thermal performance of chipboard improved when lightweight composite materials in which a mixture of fly ash, cotton waste and barite was applied between two chipboards (Binici et al., 2010).
Polymer concrete	Pichardo, P. P., G. Martínez-Barrera, M. Martínez-López, F. Ureña-Núñez and L. I. Ávila-Córdoba (2017). Waste and Recycled Textiles as Reinforcements of Building Materials. Natural and Artificial Fiber-Reinforced Composites as Renewable Sources, IntechOpen London: 89-104.
Plaster screed	Barbero-Barrera et al. (2016) developed mortar by mixing textile waste and lime paste with different lime-water ratios. The authors found textile fibers increase the mechanical properties of plaster mortars (del Mar Barbero-Barrera, Pombo, & de los Angeles Navacerrada, 2016).
Mortar	Kalkan et al. (2016) experimented with denim powder fibers as a new type of mortar reinforcement. The team tested several perlite and pumice mixtures with different denim waste content. The result showed improved mechanical properties and flexibility (Kalkan & Gündüz, 2016).

4. Designing with sustainable materials

One of the most problematic barriers to the use of recycled building products by architects according to Munn and Soebarto (2004) is a lack of knowledge and understanding of recycled materials, and their value and application in the building design process. This implies that more education, trans-disciplinary communication, active promotion and coordination is needed (Peter O Akadiri & Olomolaiye, 2012). First, accurate information and guidelines developed between textile mills, recyclers, materials engineers, building designers and suppliers are needed to create alignment on the best use of fibres for new textile and clothing production that include options for recycling downstream. For example, Fashion Positive's PLUS programme is asking brands, designers, and suppliers to work together on circular fashion outcomes (Morlet et al., 2017). Second, further recommendations are needed once the textile product is used. For example, consultancies such as Circle Economy, along with collectors, sorters, and recycling experts, is running the Fibersort project, which is resulting in data on the volumes of clothing collected in Europe and their different material blends (CircleEconomy, 2019). The Trash-2-Cash research programme is developing

processes for indefinite chemical recycling of textiles. The project involves designers and material scientists at an early stage to ensure the most effective use of the materials recycled (Tubito et al., 2019). Blocktexx is a dedicated textiles waste collector and separator regenerating textile waste feedstock (Powell, 2019).

Another obstacle to using regenerated materials arises from the regulators and standards organisations which are notoriously slow at adopting change. This is understandable as the products created from polymer-based materials (PBMs) such as polyester, elastane and latex may continue to leach chemicals into the environment particularly if subject to weathering processes (Lambert, Sinclair, & Boxall, 2014). Therefore, steps to capture and avoid chemical and micro particle escape must be part of the project design consideration when using recycled materials. A more agile/interim approach that partially addresses the slow approvals challenge is seen in the growth of certification organisations. The Global Recycled Standard (GRS), managed by Textile Exchange, is increasing confidence in recycled materials, by certifying the integrity of products as having been recycled according to International Standards Organisation (ISO) norms (Morlet et al., 2017). Although this does not constitute automatic acceptance by building regulators, it may shorten the time taken by officials to adopt transformation, while increasing confidence and demand from end users.

Standards organisations are not alone in their sluggish uptake of systems transformation. Although the fashion sector is known for its rapid pursuit of trends, it is paradoxically slow in adopting new innovations. According to Vezzoli and Manzini (2008) product or industrial design is a discipline far ahead of fashion design and manufacturing where sustainability and social innovation are concerned. Designing for sustainability in the product design field has "progressively expanded from a technical and product-centric focus towards large scale system level changes in which sustainability is understood as a socio-technical challenge" according to Ceschin and Gaziulusoy (2016, p. 118). Seeing textile waste conversion as a systems issue may facilitate its uptake in the future. A systems issue can be addressed through education along with new business models.

5. Start-ups, micro-factories and dissemination

The inventions developed in research programs and/or by entrepreneurial individuals and organisations often find their way to the start-up world. Start-ups are business model propositions usually built around addressing a problem through the implementation of a new innovation. Programs and events surrounding the start-up ecosystem facilitate the progression from invention to adoption – or at least that is the intention. The workshops and pitch sessions of start-up events provide a nexus point not only for investors but for potential users. Unfortunately, while start-up convenors and participants tend to pitch to financial investors, they may be overlooking large groups of stakeholders such as designers and end users that could promote and accelerate the use of their products. Admittedly some

start-up solutions are not yet developed for scale, but partnerships, dialogue and long-term interest can be established early in the entrepreneurial cycle.

One benefit of the start-up world is its recognition of 'small-scale'. It is inherent in start-up philosophy that small is good, agile, has potential, embodies latent value, and is likely to flourish under the right conditions. This means that even small-scale inventions or prototypes are acceptable in the marketplace. For example, the start-up Miniwiz has set up a portable pop-up store in Sardinia (it has also appeared at London and Milan design festivals) which presents the Trashpresso recycling machines that clean and dry waste that customers bring to the store. The separated recyclables are turned into small flakes. These are combined and heated, then moulded into new shapes which can be used for interior design accessories – such as lampshades and tiles. The entire production process takes less than five minutes, from waste to new product (Pownall, 2019). The retail pop-up shop model has provided an immediate try-before-you-buy model of dissemination for the company's innovations.

The start-up world is not the only arena for dissemination of innovations. Some small-scale entrepreneurs and researchers are actively presenting innovations through the media and digital marketplaces (O'Sullivan et al., 2019). Crowd sourcing and funding websites which present new products directly to consumers such as Kickstarter and Pozzible are building 'direct-to-market' relationships. Industry media and design blogs like Dezeen present innovations but these mostly represent prototypes and the chasm to product specification is not easily bridged. Next-generation 'matchmaking' platforms as well as trade fairs, conventions, online marketplaces and conferences such as Waste Build Amsterdam (WasteBuild, 2019) and Fashion Tech Berlin (FashionTechBerlin, 2020) can inform the designer as well as the end user. They provide a platform for exchange, often blurring the lines between innovators, start-ups and end users, as all are encouraged to contribute to the co-creation economy. By educating, testing and publicising new innovations simultaneously, these trade-fair-cum-symposia are quickening the path to market viability.

Dissemination mechanisms generate the pull required to develop demand and economies of scale, thus adding further value. For example the Excess Materials Exchange platform (EME, 2020) that brings together suppliers and buyers of recycled materials sees waste as a secondary income stream. Similarly, Circle Market, an online trading platform that connects the supply and demand of excess textiles, aimed at the materials engineering industry rather than direct use by the designer, is currently piloting its services with a number of firms globally (CircleMarket, 2020; hollandcircularhotspot, 2019). In another example, Cotton Converts claim to connect the solutions with the problems and accelerate collaborations across brands, charities, government and the consumer (CottonConverts, 2020). It is important to note that during the online research for this project, although media 'hype' was prevalent, it was extremely difficult to find commercially available building materials made from textile (or indeed any other) waste. Furthermore, of the anticipated 20 products researched, only 4 were commercialised, another 12 originated from funded research labs,

university research projects, or media reports but did not appear to have been commercialised. The snapshot in Table 1 demonstrates the current disproportionate uptake of recycling innovations in the building industry.

Micro factories emerging from research centres provide another example of acceptable innovation on a small scale. The team at the university of New South Wales' (UNSW) Centre for Sustainable Materials Research and Technology (SMaRT) has developed high-end composite products from textile waste that can have a wood veneer look or a ceramic-style finish. The products have been lab tested for fire and water resistance, flexibility, acoustic and load-bearing capabilities. Green micro-factories can not only produce high performance materials and products, they eliminate the necessity of expensive machinery (Sahajawalla, 2018).

The jump from university research laboratory to full-scale uptake by designers still presents challenges. At this point, cross-value chain collaboration is needed for innovation to reach scale, but few practitioners venture beyond the borders of their expertise for fear of appearing uninformed or unaccomplished. Construction firms like Urban Art Projects (UAP) provide an excellent example of the collaborative courage required here. Rather than waiting for university laboratory discoveries to reach the market, the company takes the reverse approach, openly conceding their need for new knowledge and call on university research centres (and their expertise and resources) to collaborate and find solutions for materials experiments and applications. The parametrically designed façade for the new W Hotel complex in Brisbane is an example of just such a collaboration (UAP, 2020). Fortunately, those more open to (and perhaps accustomed to) collaborators are comfortable enough with their knowledge requirements to experiment and contribute their vision when cooperating across disciplines. However, this still leaves the research lab in a passive position. For materials to move beyond lab testing and into the marketplace more affirmative action and less risk aversion is also required on the part of the technicians/scientists/engineers and their administrators, not to mention educators.

6. The consumer and market demand

Economic value creation is rapidly giving way to the triple bottom line (3BL) of simultaneously achieving commercial, social and environmental goals (Peter O Akadiri, Chinyio, & Olomolaiye, 2012). However, while economic goals fuelled by fashion overproduction are still dominant, the 100M tonnes of textile waste that is generated annually around the world represents a staggering loss of more than USD 100 billion (GFA, 2019). Importantly Crang, et al (2013) note that global supply chain networks and flows of waste, work not by adding value but by changing the value in the commodity, that is, taking a low value product and transforming it to high value. This is already seen in the transformation of waste plastics. Claimed to be the 'new gold' (Linnenkoper, 2019), clean, recycled plastic is in 'short supply' and therefore has become a high value feedstock product,

with an estimated growth potential of 6% (Locock, 2017). This demonstrates how partnerships and shared investment opportunities between innovators, brands, and manufacturers are leading to solutions that bring recycled materials into the mainstream. This could be augmented by cross-disciplinary firms building trust through longer-term relationships and potentially co-investing in textile waste technologies (Soper, 2019).

The fashion industry, albeit sporadically, is also arising as an innovator and activator in the struggle for supply chain balance (GFA, 2020). That is, many initiatives, campaigns and critiques have been levelled at the fashion industry which have led to a rise in awareness, demand by the consumer for more sustainable practice and change for the better. Despite a slight turn away from fast fashion consumption, the consumer demands alternative approaches from brands that show they are reducing their social and environmental impact (Fletcher & Grose, 2012; Gwilt, 2012). While the consumer market holds the designer accountable, designers are re-defining their approaches to sourcing sustainable materials. Coupled with fashion consumer awareness and the demand for sustainability, the potential for designers and consumers to drive change remains high. The practice of specifying products with higher recycled content by fashion designers is perceived by the consumer as an effective way to meet sustainability targets (Thorpe, 2019).

It is one thing for building designers to understand the value of using recycled materials, but another to understand how value can be created through encouraging the end user to prioritise sustainable materials in their projects. The marketing story of a project should not be underestimated here. Consumers are more likely to buy products from companies who support the causes they care about (Fromm, Lindell, & Decker, 2011), therefore, it is important that building designers are informed of the issues involved and potential solutions, thus placing them in a position to better advise their clients. Foregrounding the circular story represents not only a values shift, but an augmentation of the role from designer to facilitator of sustainable practice. Indeed, some organisations and marketing agencies are understanding the power behind these stories. For example Levis has developed jeans recycling for wall insulation, thereby adding value to the brand itself (Danigelis, 2019). A way to satisfy demand in this latent market is for a building design team to reset the parameters favouring recycled and eco-efficient materials and encourage open dialogue with the contractor/end user on specific options for their project. Granted, consumers in the building trades, where discounts and purchasing incentives operate - are not always the people who make decisions on materials procurement. This also implies, as Munn and Sebarto (2004) suggest that the education and support of built environment designers is essential, as is the acknowledgement by the profession of the imperative of sustainable approaches and of the impact design choices have on the environment. This represents a change in supply chain flows.

Beyond the media and internet exchanges already cited, consumer demand can also be influenced by government agencies' best practice purchasing models (Sweett, 2009). Procurement guidelines that provide organisational buyers with the information needed to

favour recycled materials and circular criteria in their sourcing decisions and public construction tenders can drive demand towards a greater uptake of recycled materials through large-scale public works (Morlet et al., 2017; WasteBuild, 2019). Admittedly, beyond driving demand through government procurement, regulators also need to address the facilitation and potentially incentivise the adoption of recycled materials within building regulations with greater urgency (Mehta, 2019).

Although design for disassembly and the use of recycled materials is well researched (Baker-Brown, 2019; Crowther, 2014), the specifics of materials provenance and their benefits is less well understood. Educational institutions have the opportunity to embed not only the use of, but the prioritisation of specifying recycled and regenerated materials into the curriculum. Improved design education mandates a more discerning approach to design decisions, beyond the aesthetic and structural, ensuring graduates emerge with the potential to positively impact the future. This may require re-evaluation of the teaching of this topic in some design schools around the globe. In some cases, this means 'designing out design' – that is, rather than focusing on the aestheticized result, prioritise the use of and rationale for regenerated materials.

7. Conclusion

This preliminary research into textile waste for building materials has brought to light some of the levers that are currently driving both nascent circular economy activities and sustainable building practice. It appears that some large apparel organisations such as Levis, Nike and Worn Again Technologies are seeing textile waste as a new value resource and successfully developing innovative materials for use in other industries such as the built environment. Smaller companies are also seeing some success in developing textile waste materials. However, a gap remains between innovation and implementation despite the willingness of some early adopters.

The study finds that four significant stakeholder groups need to work in concert for the dissemination and adoption of innovations to occur seamlessly: the innovators (scientists, technicians) the enterprises that adopt and bring the innovations to market (start-ups), the designers (built environment architects) who order or specify the product and the end consumer (builder, public works contractor, owner) who value its use. Regardless of the innovations, many projects are stalled before the commercialisation phase. Industries have an opportunity to combine their efforts through information-sharing to build a comprehensive picture of the materials used throughout various industrial systems and implement them effectively (Morlet et al., 2017).

This paper posed the questions: How might designers source innovative regenerated textile products for use in the built environment? How might the innovators disseminate their ideas, have their technology commercialised, and how can entrepreneurs/start-ups better connect with designers? There are few regulatory initiatives to jumpstart the transfer,

therefore it is up to the various industry stakeholders to make the first moves. This study proposes that the designer is to take greater responsibility when seeking out the supplier, and that the scientist actively promote their work, potentially through collaboration with entrepreneurial start-ups, facing designers. In this way, many new inventions may reach the market and drive change more quickly for the better. A fundamental shift in prioritising social, environmental and entrepreneurial values coupled with responsible design practice will push the circular economy forward, thus imprinting new marks on our lived cultures.

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Acknowledgements: I thank my friends, associates and colleagues who are designers for the built environment and candidly shared their insights on their understandings of materials derived from textile waste.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Food Cycles. Processes and products

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Abstract | This paper illustrates an on-going research project, Creative Food Cycles, that addresses the topic of food as a cross-cutting factor and powerful accelerator towards co-designing sustainability in cities. In this direction, the activities of the two-year-span interdisciplinary project explore new ways, not only of targeting food as an industrial product, but also trying to move the levers of cultural innovation. This culture-based approach to food cycles can provide a deeper understanding of and practical tools to enhance a circular economy in everyday life and become a driver for positive change. The multidisciplinary platform, booted with the project, simultaneously displays a recursive set of thematic actions in three cities, such as workshops, art-installations and itinerant exhibitions, following three phases: from production to distribution on the intersection of digital technologies and scattered food production. Distribution to consumption explores cultural experiences with special focus on new models of distributing, processing and consuming food. Lastly, that from consumption to disposal highlights new ways of recycling food waste as a resource for new materials and prototypes.

KEYWORDS | FOOD CYCLE, FOOD WASTE, CREATIVITY, CIRCULAR ECONOMY, RESILIENCE.

1. Introduction

Food is an essential constituent to guarantee life on the planet, it is our energy and fuel for nourishment, it is needed for growth, and is a key element of most economic, anthropic and cultural systems of every territory and as such it deserves special attention from the design world (Fagnoni, 2019). This is even more evident when one considers how the food industry has conditioned our daily routine in an increasingly intrusive way as postmodernity progresses. From the wheat bread revolution to the invention of refrigeration, and the food globalisation process, culminating in our times, food has turned out to be an industrial product strongly subject to profit and to an unceasing process aiming at better productivity. The invention of refrigeration, in the mid-nineteenth century, provoked a radical and unstoppable change: the delocalisation of food tastes, or food globalisation (FAO, 2004), that is culminating in our time. It is a widespread system, which after the disruptive crisis of the beginning of this century has become ever more a new land of conquest of speculative capital (Liberti, 2016), as a product for mass consumption, that requires the design of its entire lifecycle. (Di Lucchio, 2010).

World population growth, together with diet change in developing countries and land scarcity, makes investment in the sector particularly attractive. It is nothing new, as the food industry has developed over time a fool proof way to subvert the relationship between food, territory and people, and it has progressively and systematically designed the products that support the distribution and consumption of goods in our daily lives. Design cultures today have begun to rethink and question new production, distribution and recycling models of food cycles. The ways of producing, distributing, transforming and consuming it must be reviewed in order to achieve the goals of the UN Agenda by 2030 (UN, 2015). Food provides the opportunity to address the hottest issues of sustainability in our contemporary society, because with its several life-cycle phases it is the common thread that unites almost all the 17 Sustainable Development Goals. As researchers, sustainability issues about food as an industrial product have to be integrated in every design action related to it, and above all it must be taken into account that at a general level people still have some difficulties in understanding the sustainable values of the projects related to this topic. Subsequently, even if they recognise the ones for their own lives, they tend to overlook those for the planet. This must force us to push more strongly sustainable values while developing, communicating, disseminating and practicing our research and actions in order to develop, at the users' side, a sense of responsibility towards every single action dealing with food and to be able to translate inputs from virtuous projects into everyday life practices.

The question that emerges at this point is: can we use food as an accelerator of the disruptive change towards co-designing sustainability in our cities and implement it in our everyday lives? This research project starts from the idea that food is a powerful medium because it has the "ability to work on the functions of the emotional process, which is closely linked to the cognitive process, or rather to the aesthetic emotion that objects trigger" (Di Lucchio, 2010). In particular, taking a step back from the importance and urgency of the

theme, the project addresses creativity about food as a lever of innovation, redesigning food cycles, from production to disposal, trying to anticipate what will happen in the short term, but, above all, to subvert what we are used to and raise awareness as much as possible.

To do this, we must refer to the circular economy cycle for food as a natural system of regeneration in which waste does not exist, but instead is a new resource. From a linear to a circular one, our food system has to be changed with a wide range of actions that can address climate change, create healthy cities, and rebuild biodiversity, because they have come at an enormous cost to society and the environment. There are three main aims in the opportunity to change the global food system that the Ellen Mc Arthur Foundation summarises as follows: "Sourcing food grown regeneratively, and locally where appropriate. Designing and marketing healthier food products. Making the most of food" (2019). These three goals highlight the catalytic role of cities and the necessity to involve local communities, stakeholders and active urban society, developing a cultural and holistic approach, joining all the aspects of food cycles. This also means stimulating with an open and inclusive approach a deeper interconnection of all the disciplines dealing with the urban environment. Starting from the way we build our environment, exploring the potential for cities to act as food production hubs, developing resilient food supplies that rely on a diverse set of local, regional and global sources, according to where food types grow best, reconnecting city dwellers with food and the farmers who grow it, and in the end, of course reducing food waste and co-designing a new concept of waste itself.

2. A call to action

Creativity and food can turn out to be major driving forces in the current cultural and societal field to address this challenge. In recent years, the limits of sectorial policy programmes and academic research have become obvious in addressing the topic of food cycles as a main field of change. In particular, if we refer to the fact that technologies and the availability of ways of production, distribution, consumption and disposal of food are already within our reach, but always and in any case not widespread or adopted for various reasons, including not least, economic viability.

The project Creative Food Cycles (CFC), co-funded by the Creative Europe Programme 2018-20 of the UE, wants to empower cultural actors, accustomed to creative processes, such as architects, product and communication designers and artists, to assume a more proactive attitude, regarding food and its expressive capacity, as a cultural vehicle of identity, innovation and social integration. Even though technological progress allows the availability of new products and techniques, these are not sufficient for the necessary radical change without creativity as a means of diffusion and a call to action. The mandatory radical change for the pursuit of these goals requires a positive and creative attitude to reinterpret the reality that surrounds us and the objects of everyday life. Food is a fertile field both for experimenting, and for full understanding of the relationship between ethical elements and the way we produce, consume and recycle it in our cities. Even more because this topic is an

interesting field of investigation for design which has a “reparative role” (Antonelli, 2019, p.18) in respect of these kinds of environmental and social issues in which the system at a general level and the choices of individual consumers are intimately intertwined.

“Designers and artists are able to formulate, through artifacts and concepts, urgent political questions that cannot rely solely on regular processes to enter public discourse. With regard to the environment and all associated concerns, in particular, state policy is driven to make reforms by the priorities that researchers, designers, activists, scientists, architects and citizens set forth.” (Antonelli, 2018).

3. Food Cycles

This project, according to the sense of urgency, is therefore aimed at creating an international multidisciplinary platform that simultaneously displays a recursive set of thematic actions connected with creativity such as workshops, installations and itinerant exhibitions.

The proposed activities are based on a holistic approach, able to join all the aspects of food cycles through the interlinking of phases curated by the three partners: from production to distribution, from distribution to consumption and from consumption to disposal. Addressing different competences and disciplinary fields, the project aims at transforming three European cities into laboratories of creative food cycles — boosted by the combination of the partners’ competences in advanced information and communication technologies from by IAAC in Barcelona, urban resilience strategies from LUH in Hannover, and inclusive citizen participation and co-creation from DAD UNIGE in Genoa, the designers’ unit.

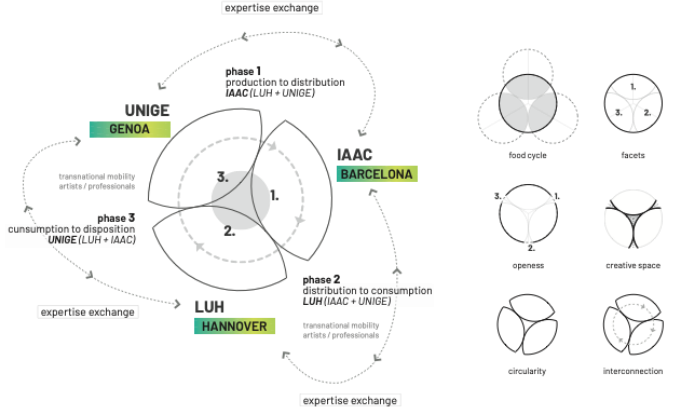

Figure 1. Common methodology of the project: the Food-Cycle Phases and roles of the partners in the international exchanges _ Image: LUH Regionales Bauen und Siedlungsplanung.

The activities start with Food interactions, a co-design activity to edit an open access state of the art catalogue of best practices, including innovative, actualised and implemented projects, combined on a creative attitude basis. The catalogue expresses and materialises sustainable food cycles that emerge from digitalisation, advanced technological implementation, digital manufacturing, sharing and informal economies, innovative participatory processes, increased awareness of climate change and advanced strategies for urban and territorial resilience.

The Food Crossover phase follows in the research activity by proposing three creative workshops, one in each partner city, meant as co-creation open labs to empower thematic skills and to engage diverse audiences. The outputs are collected and illustrated in Food Cycles in action, co-produced art installations and place-making events in the three cities and arranged as an itinerant exhibition travelling to other venues, to end up with an academic symposium to evaluate outcomes, and the final festival at the end of 2020 to present prototypes and proof of concepts to target groups and stakeholders. Every single action of the project is conducted spreading open calls to action and for projects in order to allow a wider participation of professionals and foster local organisations to widen their audiences and to experience international exchange at the same time. Calls for projects are meant as essential tools to collect ideas on the topic of food, but also to allow the creation of a network of proposals, (Fassi & Sedini, 2017) with a high innovation level that can be spread at a larger scale.

From production to **distribution.** How can food cycles enhance the transformation of cities and territories? In this phase the aim is to demonstrate how the use of technology can help to produce food in urban environments, or in close proximity, and enhance city resilience. Urban agriculture has the potential to make healthy and not expensive food available for citizens. Thanks to the use of digital fabrication and control interfaces, CFC shows different ways to produce food to citizens, architects, product and event designers, building self-sufficient cultivations. The use of digital fabrication allows the building of customised design gardens and the use of sensors helps to check performances. If soil cultivation may not be practicable in many urban conditions, especially in dense city cores, a different kind of cultivation can become a practical solution where the lack of space or farming knowledge are the main limitations. The prototypes developed explore these solutions for the cultivation of alternative food, also as new building structures for the urban environment.



Figure 2. Food Shakers | Food Remakers Workshop, Genoa, 17–21 June 2019, was about food waste as new material, from organic food waste to the creation of new industrial materials, or food waste and packaging for new products, from organic food waste to real products for consumers. Workshop participants had the opportunity to showcase the designed prototypes at the 2019 SUQ Intercultural Food, Art and Craft, and Music Festival in Genoa.

Distribution to consumption. How can we imagine a new conviviality through food cycles? The concept of this phase is to focus on new models of distributing, marketing and processing – as well as cooking, displaying, sharing – food in a collective place-making effect. The activities aim to create an urban food hotspot characterised by a multipurpose stage able to connect people, best practices, trends and movements through action. This is made possible bringing together sensorial experiences, digital technologies, storytelling and creativity, offering interactive ways to participate in an experience connected to food, addressing the extended audience who usually shops, consumes and interacts in our urban foodscapes (McKendrick, 2014).

Consumption to disposal. The process from consumption to disposal offers not only options for new uses of discarded food products, which can be transformed from waste to resources - but also focuses on defining new potential meanings of the concept of waste, because waste does not exist in nature and this is a word we have to erase especially if we talk about food. The Unige unit wants to answer the question of how to configure new design and creative experiences related to food and food waste, engaging a wide public to design by and for themselves (Brown, 2009), making sustainable habits and behaviours more compelling and attractive (Mau, 2009). Product design Unige researchers, students and local

urban activists have presented and implemented different activities, in which design has a role as a form of culture and major driving force for the envisioning and realisation of processes of social innovation towards resilience where people change their behaviour and act collaboratively (Manzini, 2015).
The main research outcomes include the development and prototyping of new materials and products obtained from food waste, which demonstrate the multiple aesthetic and ethical possibilities that considering food waste as a resource brings with it. At the same time these projects always work with the main idea of making the population aware of recycling, looking for easy to reproduce procedures and daily use of the products made, but also trying to inspire through the creation of evocative installations.

4. Food Shakers | Food Remakers

Currently, a third of all food produced globally is thrown away each year. Food loss and waste represents one of the most significant environmental and economic issues and it is generally recognised that, if waste were a country, it would be the third-largest greenhouse gas emitter, behind China and the United States (EFC, 2016). It is a well-known issue which also fully involves European and Italian cities, that have to take an active role by making the most of food by redistributing surplus edible food, while turning the remaining inedible by-products into new products, ranging from food products, organic fertilisers to biomaterials (BCFN, 2018). Cities and communities have to be seen, rather than as a final destination for food, as places and environments where food by-products are transformed, through emerging technologies and innovations, into a broad array of valuable materials. A philosophy that is contextualised within a circular economy, using the material energy of food, but also its conceptual one, for a better safeguarding of resources.

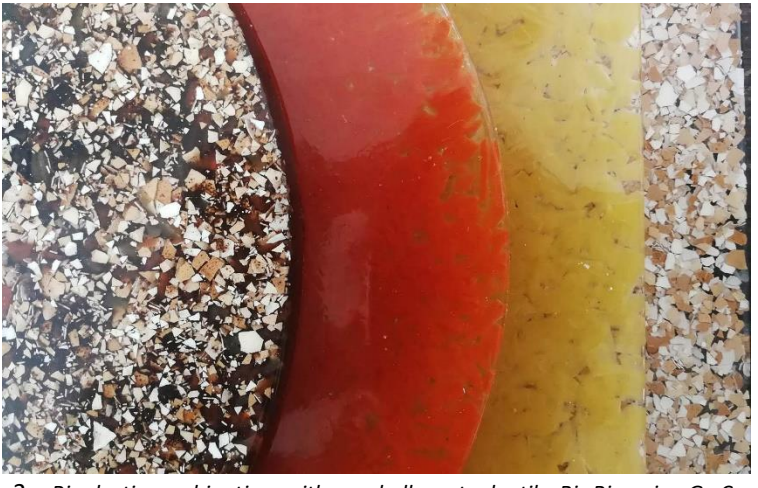

Figure 3. *Bioplastic combination with eggshell, pasta, lentils. Bis Bioresina G. Centineo, M. Lequio, Li Changrui, Shi Xinran. Ph. M. Paolillo*

To investigate the after-consumption phase of food cycles in the *Food Shakers | Food Remakers* workshop and installation of the Unige research team, exploring the concept of food waste as a new material, addresses stakeholders related to design culture such as designers, architects and cultural organisations and to the world of education of all levels.

The project follows a clear public engagement strategy, that starts by mapping the stakeholders, dividing them into categories of interest, and involving them in the action at each stage. A strategy of events is the means to connect CFC to the local relevant citizenship initiatives, aiming to explore the needs and wishes of the communities and their potential, together with the spread of different calls for projects to local stakeholders, to engage them in co-designing activities.

An innovative component is the constant use of public performances - live music, theatre, cooking-shows, etc. - as a common element of the installations that accompany the activities during the project life. These events work as prototyping actions (Fassi & Sedini, 2017), where products and spaces are shown, while people are interacting and experiencing actions connected with the general goals.

From organic food waste to the creation of new industrial materials, to food packaging for new products, or even to real products to eat or to wear for consumers, this process displays materials and products that can permanently change our perception of waste. From the project a strategy could be extrapolated that brings together collections of best practices, co-creation workshops, and installations open to the public that involve different levels of education. Putting together best practices with co-designing activities has proved in the activities carried out to be very effective in raising people's awareness and involving them directly in the creative and realization phase, allowing them to come¬ into contact with food waste as a material that takes on new meaning. In addition, the many prototypes coming out of the project activities of the workshops also have value at the level of innovative proposals, which should be explored and evaluated separately. The involvement of young architects and designers in the design processes of food waste allowed the research teams us to introduce new ideas and generate a high rate of innovation.

Once properly transformed, waste becomes a new resource both for industrial products and for applications in urban installations, following a development model that is anything but new, which takes advantage of new technical opportunities to recover the ancient culture of reuse that produced no waste whatsoever.

This two - years span investigation into the recycling of food waste, developed with product design students and designers under the Creative Program advocacy, makes use of a diversity of media, such as installations, videos and stage performances, to address the topic from multiple perspectives. The goal is to offer a platform for reflection and analysis on the meaning of a new use of materials, on their pervasive DIY production and how design could be an important agent in developing a more responsible use of resources. The results of the research can be measured through the number of prototypes developed, the people

physically involved in the activities and the knowledge produced and disseminated through the online channels. In the end the project is also become an itinerant exhibition that circulates, spreading its message in cities related to the CFC network, and at a digital level it is a website - www.creativefoodcycles.org - conceived as an open platform where every single action that has been produced can be viewed and therefore replicated by using the tools, i.e., workshops, calls to action, calls for projects, webinars and DIY recipes, to generate new ideas and approaches.



Figure 4 Leibniz Universität Hannover, CFC "PorTable". Pop-Up Installation to raise civic actions and people awareness to create more attractive space in cities for food consumption - October 2019. Credits: A. Pape, J. Arfsten for CFC.

This sharing of experiments also follows the concept of a return to materiality as resistance to the prevailing impositions of the digital world: an invitation to return to concrete sensations, such as smelling, feeling and touching, as a privileged space in which to rediscover contact with material reality, without digital intermediation (Han, 2019). Design cultures are in this sense lined up in an activity with strong ethical implications, offering products that aspire to the industrial scale, but in a creative way exploring what our choices may be in the near future, working on our common feelings in relation to food cycles.

5. Conclusions

A design culture-based approach to food cycles i.e., production, consumption and disposal, can provide a deeper understanding, as well as new models, and practical tools to enhance a circular economy in everyday life and become a driver for positive change (Schröder, 2019). Resilient food cycles can be key factors for strategical challenges and opportunities related to urban qualities, cultural values, informal practices, education, economic development, ecological targets and social integration. From the creation of feasible prototypes to the setting up of events, triggered by the three CFC project partners, the research deploys resources to dive into the priority issue of food, that has become increasingly more important as an industrial product, subject to the logic of economic exploitation. Although

unable to affect the system at the level of the economic macro system, the culture of design can provoke a radical change in behaviours, opening up to dialogue with as many people as possible and proposing feasible solutions.

In this direction, the CFC project, particularly with the work of the UNIGE team on reducing waste generation through recycling and reuse in everyday life, aims, on one hand, to test within the academic design community new products and materials derived from food waste, and, on the other hand, to organize creative events to raise awareness of the impact of food cycles in our cities.

In this framework, this paper presents the structure of the CFC research, illustrating the different phases and events and describing the materials and methods of the network and its possible implementations, but also opening a possible discussion on awareness campaigns for issues related to food cycles and their impact in our cities.

The engagement and empowerment of creative communities is the main goal of the CFC project to influence the policy agenda and have a positive impact in order to activate resilient processes. The method applied is the exploration of a constellation of ideas, techniques and prototypes that are considered as a priority so that everyone will be able to move definitively to a circular consumption and production system, capable of avoiding waste.

This implies the development of participatory design activities and specific design tools such as events, call for projects and communication strategies addressed to creative communities. In this project the participatory methods displayed are particularly suitable to create and facilitate the creation and accumulation of social capital at different scales about the central topic of resilient and creative food cycles.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

From Objects and Products to Things and Stuff.

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Abstract | Our everyday consumption and interaction with physical artefacts is a major environmental issue. The designers behind most of these artefacts generally refer to them as products or as objects. This status may make conceiving more environmentally relevant solutions difficult. By defining and clarifying the use of these terms in design literature, the different status of artefacts as objects, as products, as things and as stuff are discussed. We also draw on ethnographic studies on longer relations with everyday artefacts in the domestic context. This original research into artefact relations gives insights into the evolving status of possessions as they become domesticated and integrated into daily life patterns. The use of the terms things and stuff rather than objects and products may help reposition design activity (and design education) as not solely concerned with generating new products, something that can be shared with non-designers, encouraging a more responsible approach.

KEYWORDS | THINGS, STUFF, PRODUCT LONGEVITY, PERSON-PRODUCT RELATIONSHIPS, SUSTAINABLE CONSUMPTION

1. Introduction

Our daily consumption and interaction with physical artefacts is a major environmental issue. The designers behind the majority of these artefacts generally refer to them as products or objects. This implied status may make conceiving more environmentally relevant solutions difficult. With emphasis on intentional relations (Jacob, 2019) and essentially visual engagement, terms given for the artefacts around us may need reconsidering, particularly in the disciplines responsible for conceiving them. Whilst objects and products may be the appropriate terms for what is created, artefacts once integrated into our homes and daily lives might be more realistically termed things or stuff.

Findeli (2010) emphasises the need to think of design projects in terms of two main 'moments', the 'conception part' and the 'reception part'. The design act being incomplete "if we do not address what happens to the project's output when it starts its life in the social world". This second stage of artefact experience is increasingly relevant in the context of evolutions towards refusing and reducing more ephemeral consumption and prolonging, where possible, material product relations. Two of the 'Ten Golden Rules of Design for Sustainability' proposed by leading researcher in sustainability and the circular economy, Conny Bakker, (2019) illustrate this. One rule questions how "design can intervene in everyday life to shape and support sustainable lifestyles for (groups of) people and communities". A second rule advocates "design for long use and reuse… creating products that last and that can be loved and cherished, maintained, repaired, reused, upgraded, adapted, personalised, refilled and repurposed for as long as possible." Both rules encourage design for everyday life behaviour and "living with" artefacts over acquisition.

The focus of this research is the second moment of product lives in relation to design process. In the context of longer product lifetimes and the circular economy how might design methodology need to evolve? We question whether the common language vocabulary associated with the conception of everyday artefacts is relevant to current environmental imperatives. In both design education and industry, are the terms used for the artefacts we create relevant to the relations and behaviour we should be encouraging? In the case of physical artefacts, should we still be thinking in terms of products and objects?

2. Limitations

The question of vocabulary best suited to everyday object relations is potentially a very wide subject. Rather than attempting an exhaustive coverage of the question, our aim is to initiate discussions that may be useful for design activity and education. The scope of this discussion is further limited by the design research standpoint; within design process the emphasis is not only on artefacts, but on the human relations and interactions with these artefacts in context (Love, 2002).

Design activity today encompasses experiences and services, concerning both tangible and intangible relations. Nevertheless, in relation to the environmental issues underpinning this research, the studies here will concern relations with physical artefacts, in everyday life, following for example Ben Highmore (2009), for whom design culture concerns the ordinary, the ubiquitous rather than "the extraordinary"

An additional limitation concerns language. Words used for physical artefacts cannot be considered as having direct equivalents in different languages. This article mainly concerns English language terminology. It should be noted that we will mainly discuss four common language terms: objects, products, things and stuff. The word 'artefact' is used as a neutral (and less common language term) for the physical entities discussed in this research.

3. Methodology

The discussion of appropriate terminology for current artefact relations is based on both a literature review and original ethnographic research. Literature from design research and related fields such as anthropology, archaeology, sociology and philosophy illustrates uses of the terms objects, products, things and stuff in the context of artefact relations. The use of these terms gives insights into the relative status implied by these terms for artefacts.

The status and scope of each word is discussed in relation to findings on the nature of longer everyday artefact relations. The findings discussed here are part of wider research into longer relations with everyday objects (Green, 2019b).

The methods used here to gain better understanding of longer everyday artefact relations are situated in the common ground between design research and ethnography. These focus on empathic, collaborative approaches (Lee, 2014) rather than observation alone. Other key aspects of this research, which illustrate the proximity between design research and ethnography/anthropology, are the emphasis on exploration rather than hypothesis testing (Miller, 2010) and situating, rather than separating, observation and description (Ingold, 2011). All the studies cited here relate to research carried out with design students as part of study modules addressing product relations/sustainability.

One study involved detailed descriptions of one everyday artefact relation. Participants commented an everyday artefact they cared about, wanted to keep and made an effort not to lose or damage. 282 useable transcriptions were collected via semi-structured interviews (cohort: 9 to 82 years old, 169 females for 113 males). These were subsequently coded using an iterative process to identify and regroup recurring themes.

Two further studies with cohorts of design students, in years 1, 2, 4 and 5, aimed to generate insights about a wider range of everyday artefact relationships. In the first study 36 students in all were asked to think of, illustrate and comment on ten everyday objects that mattered to them. In the second study, 26 students noted every object they touched over a 12 to 24 hour period and then illustrated this collection, highlighting the objects that mattered more

to them. This second protocol was inspired by the research by Paula Zucotti (2015). These two studies in the form of self-reporting (Author, 2019) inventories taken together highlight the differences between the objects that can be easily thought of at a distance, and those actually encountered and touched *in-situ*.

In introductions to participants these studies the word “object”. was used. While the word “object” possibly orients replies towards ‘objectified’ artefacts (see section 3.2 below), this seemed to be a relatively natural choice for common language expression.

These studies on object relations focused on the domestic context. Clothing was not the main focus, but was not excluded from replies. Over 200 different kinds of objects were commented on covering a range of categories from kitchen appliances, bags and luggage, writing equipment to portable audio and hair/beauty related accessories.

4. Findings

4.1 Artefact terms in (design research) literature

Markosian (2009) mentions that a six year old can give examples of physical objects, demonstrating that these are the most familiar type of object. While being an obvious common-language term for artefact, objects are also non-physical entities, including categories like numbers, sets, universals, propositions, possible worlds, events, facts, minds and souls (Markosian, 2009) In different human and social sciences, objects mean different things. In (Freudian) psycho-analysis an object is likely to be an abstract entity linked to desires or drives (Blandin, 2010). The philosophical object is likely to be simply that which is opposed to the subject, and exterior to the self (Blandin, 2010).

Markosian (2000) suggests differentiating physical and non-physical objects by existence in both time and space. While all objects exist in time, only the ones which also have spatial locations count as physical objects. Closer to the design field, the Theory of Objects project by Dunne & Raby (2015), plays on Meinong’s theory that non-existent or impossible objects should be included in taxonomies of objects if they can be thought of or imagined. The term ‘object’ permits blurred boundaries between the physical and non-physical, but relates to a person/‘subject’ and the notion of thought. The film “Objectified” (Hustwitt, 2009) and forty’s “Objects of Desire” (1992), two key commentaries on the design industry, use ‘object’ to refer to something objectified and remarked. Objects appear to be artefacts distinguished from their surroundings, singularised or even sacralised (Kopytoff, 1986). “An object is that which has been worked by the subject” according to Dagognet (1989), but this “work” can be simply that of contemplating the object.

The word object also appears to be used in the case of artefacts with meaning, such as the *Significant Objects* project imagined by Walker & Glenn (2012). Stuart Walker also uses the

term object when describing artefacts with deep spiritual significance with enduring or sustainable potential. (Walker, 2004)

Objects may have a superior status and a link with personal meaning. Cupchik (2017), uses the expression 'products-as-objects' to describe entities with which people have emotional attachments, and differentiates between 'design products' and 'personally meaningful objects'.

In design education, the term 'object' is perhaps less common than 'product' to describe the activity but is nevertheless quite widely used. The Product design department at the ENS AAMA, (Ecole Nationale Supérieur d'Arts Appliqués et Métiers d'Art) in Paris, has recently been re-baptised Object design. The word object-designer is used by Parsons (2018), professor of the Designed Objects Programs at the School of the Art Institute of Chicago in a short video questioning "What is Object Design?" Here the term 'object' appears to be used to leave open the definition of the activity, (Green, 2019a). The term object may be better suited than the term 'product' for design treating both tangible and intangible solutions

'Product' remains the commonly used term in design literature, reflecting the evident link between design and production. The term product is widely used in artefact experience and interaction (Schifferstein & Hekkert, 2008; Jordan, 2000). Literature proposing design strategies for longer artefact lives generally refers to products (Mugge, 2008, Haug, 2016, Haines-Gadd, Chapman, Lloyd, Mason & Aliakseyeu, 2017). But in the case of the concept of "Emotionally Durable Design" (Chapman, 2005) the term object, and subject-object relationships (Chapman 2010) are also referred to. Related artefact relations are product attachment (Schifferstein & Zwartkruis-Pelgrim, 2008) and product love (Whang, Allen, Savoury & Zhang, 2004). These concepts refer to relationships with specific, singularised artefacts, and their potential for seduction. Artefacts with the potential to seduce or enchant are also referred to as "objects", for example in the case of the (smart) Enchanted Objects described by David Rose (2014).

> "Enchanted objects start as ordinary things - a pen, a wallet, a shoe, a lightbulb, a table. The ordinary thing is then augmented and enhanced through the use of emerging technologies… so that it becomes extraordinary." (Rose, 2014, p47)

This example highlights that the terms 'product' and 'object' may be interchangeable, but that 'things' have a different and lesser status. A 'thing' can be something exterior to the (human) subject unnoticed by him/her (Blandin, 2010), whereas the object emerges from the environment. The term thing seems better suited to the domestic context. Seminal texts on artefact relations, The Comfort of Things (Miller, 2008) and The Meaning of Things, Domestic Symbols and the Self (Csikszentmihalyi & Rochberg-Halton, 1981) refer to relations once artefacts are integrated into the home environment. The things referred to have meanings and significance, but are part of groups, and are not specific individual entities. The word 'thing' itself (or *Ding*) originally referred to a form of archaic assembly (Latour, 2004). Latour suggests that whereas objects (Gegenstände) are matters-of-fact, things are matters-of-concern. 'Things' are perhaps more open to discussion and evolution. Highmore

(2008, p3) suggests that "design studies needs objects, needs things. What it doesn't need, however, is the sense of a design item as a *finished* product that is either adopted and adapted by users, or not."

Things simply exist - and are simply engaged within the responsive, instantaneous 'time' of the everyday (Rinkinen, Jalas & Shove, 2015, quoting Highmore (2002)). They are part of constellations, actions and practices (Shove, 2016). Thomas (2006) confirms the idea, following Heidegger, that physical things are not just objects in consciousness: they are always embedded in a complex network of relations between people and things. Ian Hodder (2016) has written extensively about entanglements between humans and things, how humans and things are linked by dependence, but also how humans are deeply entangled in the vitality of things and the assemblages of their relations.

As well as being part of assemblages and networks, physical 'things' endure over time and undergo change (Thomas, 2020). Odom, Pierce, Stolterman and Blevis (2009) refer to 'things' in their study of why people conserve certain artefacts and not others. In studying care and repair behaviour, Fulton-Suri (2009) also refers to 'things', confirming the link to durability and evolution.

Things can be unobtrusive and have a certain humility (Miller, 2010) that objects and products do not, but they nevertheless influence behaviour. They work by being invisible and being unremarked upon (Miller, 2010) They can be present but 'hiding in plain sight', they can also fade into and emerge from the background (Thomas, 2020).

Even more undefined is 'stuff'. Miller (2010) describes stuff as "ubiquitous and problematic", but also encourages having an attitude towards stuff that doesn't involve opposing ourselves to it. The attitude Miller advocates is one where we face up to and acknowledge stuff, at the same time accepting our own materiality. In The Right Stuff, Markosian proposes a distinction between things and stuff,

> "Stuff, as I understand it, is what things are made of. Think for example of a solid, homogeneous sphere. That's a thing. Now think of the region occupied by the sphere. That region is filled with stuff… In general, stuff fills various regions of space, and some portions of stuff *constitute* things" (Markosian, 2015, p2).

In common language, 'stuff' is both the material that things are made of, but also the things that fill up various regions of space that might be our homes, our cupboards or our backpacks. Stuff is undeniably material. Importantly, stuff, like clutter, can be seen as unstable, volatile and is the opposite of design history's objects with clean lines and meaning-making (Baker, 1995).

Representing the materiality of things, but also unwanted or unmanageable materiality, stuff is probably something design should address. From this short discussion, the advantages of 'things' are also apparent. Things are what inhabit our domestic environment, and are part of ensembles, multiples and entanglements. They are less defined but more durable entities.

While objects are mentioned in literature related to longer artefact relations, 'objects' belong to types of relation where meaning, (self) narrative and significance are generally present. Objects are what is drawn out of the background of everyday experience, and are named. The terms and labels attached to them may endure beyond the physical presence of the artefact. Objects can be things without physical reality. Products share some common ground with objects, and are clearly linked to the first phase of the artefact's lifecycle, and are particularly present in design and marketing literature. Products are also more linked to production and less to the domestic context and relate less to everyday relations.

In the following section, certain qualities and components identified in lasting everyday artefact relationships are discussed. These qualities can be considered in relation to the nature of artefacts as objects, products, things and stuff.

4.2 Artefacts in longer everyday relations

A key insight that emerged from the first extensive collection of data on longer object relations was the lack of references to artefact appearance. Moreover, longitudinal analysis carried out on a sample of 44 detailed replies showed that the presence of visual aspects as a component of lasting relationships diminished over time. This matches existing research by Fenko, Schifferstein and Hekkert (2009) showing a rapid drop in the importance of vision in artefact relations in the first months of possession. Also, despite the fact that two out of three studies mentioned here are based on cohorts of design students, there was a clear absence of comments relating to visual properties, even in the case of artefacts with notable visual details. Positive lasting artefact relations may involve progressive invisibility.

Our studies revealed another kind of artefact invisibility. In the study where the cohort were asked to think of, note and comment 10 objects mattering to them at a distance, they could initially only think of one or two things. It appeared to be difficult for the student cohort to imagine 10 objects that they made an effort to keep, or hoped to continue using, despite the fact that subsequent studies showed that similar cohorts touched between 50 and 100 non-disposable artefacts per day. On average, the cohort (n = 35) were able to list 7.66 artefacts. In addition, it is notable that despite the protocol specifying actual individual artefacts, over 20% (n.=57) of all the artefacts noted (total n.= 268) were categories rather than specific things (pens, bobby pins, sneakers). A further 10% were groups of things (old clothes, personal library, calligraphy material). This suggests these unremarkable everyday artefacts perhaps had blurred status and boundaries.

The study based on the 'Everything we touch' protocol (Zucotti, 2015) gave an insight confirming the uncertain status of material artefacts encountered in daily life. The number of short-life artefacts noted by the cohort ranged from just 3 in some inventories, to over 3O, despite being a reasonably homogenous group (product/service design students aged 18 - 25). It seems unlikely that the number of short-life objects touched (for example tubes of

toothpaste, kitchen sponges, but not single use items) was as different as the results suggest. In follow-up discussions, the cohort mentioned their difficulties paying attention to everything touched. The majority of material artefacts encountered do not particularly stand out.

The notable differences in numbers of short-life artefacts noted can also be an indication of the very personal, idiosyncratic nature of everyday artefact relations. This insight was confirmed by the variety of objects chosen as mattering by participants. An analysis of objects chosen by participants aged between 17 and 26 shows surprising variety, see Table 1 below. Despite probably consuming similar products, the participants in our studies keep and notice very different things in their homes.

Table 1. Variety of objects chosen, cohort aged between 17 - 26 years

study	no.of participants	no. objects per person	total no. of objects	no. of different types	no. of objects chosen only once
one everyday object relation	90	1	90	58	22
10-object inventory	35	5 - 10 (average 7.66)	268	139	72

The multi-faceted nature of longer relations revealed in the initial study (based on open coding of 282 written transcriptions of semi-structured interviews) was confirmed in subsequent studies. While self-related relationship components were present as reasons given for longer relations, they were one of five major components identified (Green 2019b). These five components are provisionally named Using/doing, Feeling on me, Appreciating time, experiencing pleasure and remembering self. These findings suggest that longer artefact relations should not only be thought of in terms of “personally meaningful” objects.

A final insight that seems to confirm the relevance of thinking in terms of stuff is the presence of material related commentary in longer artefact relations. While as a whole, the studies revealed that artefact materiality appears to go unnoticed in everyday interactions, one of the key components in longer relations was an awareness of artefact materiality. Artefacts that mattered were commented in terms of their weight, their capacity or volume, and also the materials they were made of. In many cases longer lasting artefact relations appear to concern things where stuff is noticed.

4.3 Discussion

The selection of findings above relate to a certain type of artefact relation that could be considered environmentally beneficial. While only representing a small part of artefact interactions, they highlight aspects of everyday life relations, when things are kept and cared for and helped to have longer lives. The findings suggest everyday artefact relations better match the terms things and stuff, and even the artefacts that matter are perhaps more "things" than products or objects.

The problems that object and product based terminology may generate have already been discussed in areas related to designing. In the Design Culture Reader, Highmore (2009, p3-4) states that if the everyday material environment is to be considered as an active field of engagements and entanglements, "…this means finding other words to describe the active environment of design rather than 'product', 'status', 'identity' and the like." Encouraging thinking beyond the idea of products, Highmore writes "the way to get to the ordinary, to get to the everydayness of design, requires an approach to design that isn't overawed by novelty".

Rinkinen, Jalas and Shove (2015) writing about understanding material culture and day-to-day practices cite Ingold who proposes that we should:

> "…focus less on the 'objectness' of things and more on the material flows and formative processes through which they come into being … on things in use, recognising that usefulness is always in flux, that it depends on how objects relate to each other, and how they are integrated into one or more practices"

Products and objects are not the best terms for thinking of things in complex bundles; as things in flux and everyday practices. They may relate too much to newness and isolated, noticed artefacts.

Tim Parsons (2018) proposes that "how someone chooses to define design says much about their views on the subject and how they choose to practice it". In the same way, words used for the artefacts that designers work on may influence the way they approach them.

Although this article has mostly focussed on artefact words in the English language, the differences of meaning and the impact of these differences are likely to be present in other languages. This can be illustrated by the example of the words *mono-tsukuri* and *koto-tsukuri* in Japanese:

(物物造り / もの造り) and (事造り / コト造り)

These terms are a combination of *mono/koto* (thing) and *tsukuri* (making) where *mono-tsukuri* can be translated as conscientious manufacturing and *koto-tsukuri* can be translated

as making things happen (Toyota-global.com.) Widely used in relation to designed artefacts, and particularly in automotive design, both '*koto*' and '*mono*' are closer to 'thing' than object in meaning. The two words nevertheless indicate different levels of tangibility, with *mono* being closer to thing in the sense of physical object, or material, and *koto* more likely to be used to describe an event or concept (Fukushima, 2017).

In the same way as 'artefact' words such as products and things can be differentiated by temporality, *mono-tsukuri* can be understood as a means to producing, whereas *koto-tsukuri* can be seen as the event or phenomena it brings about. Ashigawa and Sakuragi (2019) present a simple table measuring common use expressions, with everyday verbs in relation to *mono* and *koto* to clarify their meaning (a *mono* can be eaten, a *koto* cannot). This (subjective) classification exercise (see Table 2.), through common use verbs, can also help to illustrate the physical context, temporality, tangibility and inferred status of the words in our study.

Table 2. "Doing" verbs to differentiate objects/products and things/stuff.

	object/product	thing/stuff
(to) design	X	
(to) purchase	X	X
(to) use	X	X
(to) wash up		X
(to) tidy		X
(to) repair		X
(to) cherish	X	
(to) replace	X	
(to) throw away		X

5. Conclusion/Implications

Certain qualities found in longer everyday artefact relations better match the scope and status of things/stuff, rather than objects/products. Our research establishes that things and stuff better evoke artefact relations after the sales moment, and are equated with the second moment in artefact life-cycles. This second moment being more idiosyncratic and

less ‘product-like’. Things/stuff fit better with end-user implication in the decisions related to the physical artefacts they interact with. Things/stuff are in context and in networks, less related to appearance but present as material/tactile experiences.

While we cannot advocate using the terms thing or stuff in direct replacement for product or object in descriptions of design as an area of study or a professional activity, we can warn against exclusive use of these terms, and hopefully raise awareness of the bias they may create. The aim of this paper is to raise awareness of the need to re-assess artefact-related vocabulary in the design domain.

For design activity and design education to effectively adapt to necessary evolutions in material artefact relations, the way we name these artefacts needs to be questioned and may need to evolve. Changing the vocabulary of design can help in rethinking interactions with materials in everyday life.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Green infrastructures and satellite images: the case study of Munich.

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Abstract | Although being the main driver of economic growth, cities have simultaneously contributed to the most serious increase of environmental degradation, being simultaneously targeted by Climate Change effects. In this scenario, decision makers are called to identify the best actions for mitigation and adaptation of urban spaces, exploiting innovative Information and Communication Technologies (ICT) resources and approaches. Based on the City Sensing approach, the aim of this paper is to present a case study that demonstrates how the application of integrated ICT frameworks - including free Copernicus satellites data, big data sources and cognitive techniques – to urban regeneration practices such as green infrastructures can support decision makers and citizens in order to create a knowledge community which is aware about air pollutants and carbon emissions of its neighbourhood. Making risk visible and shared will contribute to the modelling of a resilient, inclusive and sustainable city.

KEYWORDS | CLIMATE CHANGE, POLLUTION, SATELLITE, MOSS MAT

1. Introduction

Rapid urbanization and economic growth unveil how cities are the centre of economies, attracting an increased number of people which is expected to reach the 70% of the world's population by 2050 (UNDESA, 2013). Nevertheless, because of their crucial role in driving world economies, cities are mainly responsible for environmental degradation since 1990s (World Bank and Institute for Health Metrics and Evaluation, 2016), with energy and transportation sectors being the most anthropogenic activities responsible for Greenhouse Gas (GHG) emissions and air pollution (FAO, 2016). As a result, the high population density and the proliferation of economic activities have exposed cities to great aggregate risks, with negative impacts in terms of quality of life, environmental security and economic loss (ITU, 2015). This framework unveils a wide spectrum of Climate Change effects, ranging from natural disaster and environmental degradation to diseases, whose uncertainty in terms of climate impacts determines also uncertainty of response.

Urban centres, in fact, are characterized by a distinct capacity and legitimacy to define policies and allocate resources, which is crucial in order to trigger effective interventions (Hunt&Watkiss, 2011). Nevertheless, when speaking of climate change, decision-making process lacks of a full picture of the nature and magnitude of risks as well as of the potential impacts and trends. In order to give legitimacy and authority back to policy-makers, it is necessary to make climate-change risks "visible" (Global Commission on Adaptation, 2019).

2. Research methodology

2.1 Research objectives

The aim of this research is presenting an innovative approach of city planning based on City Sensing which can simultaneously free cities from the burden of air pollution and climate change effects and trigger urban and social regenerative intervention.
The application of integrated technologies, in fact, can contribute to the definition of new approaches to support urban planners in:

- understanding the co-existence of several variables of Climate Change;
- inclusively engaging and connecting researchers, policy-makers, citizens into the decision-making process;
- creating a knowledge and practice community of resiliency (ITU, 2015).

Due to the capacity of regulating urban microclimate of green infrastructures – in particular green roofs made with moss mat covering abandoned public building – the application of innovative technology can develop a reliable measuring system to detect atmospheric pollution which is scalable and allows urban and economic regeneration of abandoned areas

of the city. The United Nation Report on Extreme Poverty and Human Rights shed lights on the possible scenario of a 'climate apartheid' "where the wealthy pay to escape overheating, hunger, and conflict while the rest of the world is left to suffer" (United Nations Human Rights, Office of the High Commissioner, 2019).
Starting from this terrible forecast, the study will propose a sustainable financially and environmentally alternative which empowers the adaptive capacity especially of vulnerable areas and groups.

2.2 Research methodology

City Sensing is a widespread and pervasive approach of city knowledge aimed at supporting urban planning and monitoring and share such a knowledge with key stakeholders in order to trigger a participative city modelling process. Such an interactive, streamlined but comprehensive decision-making is facilitated by the integration of ICT which, on the one hand, improves city resilience and its adaptive capacity thanks to the creation of an informed network of people. On the other, it enables territorial governance through the systematic dissemination and communication between all relevant stakeholders (ITU, 2015; Condotta&Borga, 2012; Borga, 2011).

In particular, heterogeneous quantitative data that have been gathered during this research derive from two different sources: all Open-Source satellites of the Copernicus Mission and on-site surveys and official EUMETSAT[1] databases providing information about pollution levels.

As far as satellites, even if Earth Observation is not systematically used at local level for monitoring atmospheric pollution yet, its accurate resolution guarantees analysis consolidation potential on a continental scale. In particular, the 5P satellite can be widely applied in order to monitor urban air pollution and estimate green areas' sequestration capacity, through the TROPOMI[2] sensor which measure tropospheric pollution.

With the aim of creating a city map, we first developed Sentinel-5P level 2 products to maintain a single grid per orbit (level 3 –L3). The conversion was carried out in a second phase, combining the different data in a single call. They were then merged with the Copernicus atmosphere monitoring service (CAMS) data. Finally, a map of samples was created on a normal spatial lat / lon grid with related product variables. All data have been geometrically corrected and compared with the near real-time data of the ECMWF[3] Integrated Forecasting System (IFS) which assimilate the IASI[4] and MOPITT[5] observations of carbon monoxide (CO) (Inness et al., 2015), provided by the CAMS.

[1] European Organisation for the Exploitation of Meteorological Satellites.
[2] TROPOspheric Monitoring Instrument.
[3] European Centre for Medium-Range Weather Forecasts ECVs Essential Climate Variables.
[4] Infrared Atmospheric Sounding Interferometer.
[5] Measurement of Pollution in the Troposphere.

Data analysis has been carried out on ozone (O^3), carbon monoxide (CO), nitrogen dioxide (NO^2), sulphur dioxide (SO^2) and methane (CH^4). Here we only present data related to CO. The interpolation of CAMS data with the time and position of the single TROPOMI measurement allowed to analyse the average density of the air column, taking into account the sensitivity to the vertical recovery of the TROPOMI sensor.

All the processing tools are Open-source. SNAP[6] libraries have been used for the processing of satellite images. Instead, the control and validation of data is carried out within the Python libraries (TensorFlow, Scikit-Learn, Numpy, Keras etc.) in order to guarantee low-cost services and wider accessibility.

However, the orbit model has some variations. Every day the satellite's orbit moves slightly further east, so even two images of the same position for consecutive days have slightly different ground cover. After 16 days, the satellite passes back to exactly the same geographical point on the ground, restarting the orbit sequence. To solve this problem, we resampled the data on a normal spatial pixel grid. Data fusion was performed using multiple linear regression and its residual spatial interpolation (residual kriging). The results were verified by cross-validation (i.e. the interpolation calculated repeatedly, each time leaving out a sequence of satellite data).

3. A Service Design approach for the city of Munich

In the study case of Munich, the underlying theme is the pollution of urban areas. This project tackles the problem of pollution and urban decay in a holistic way, that is, treating a specific part of the city as an "ecosystem" that includes buildings and people, with the possibility of identifying possible advantageous variables of urban requalification with benefits in terms of environmental well-being by inserting, when possible, economic facilitating devices. The technological solution here developed provides a suite of services for different stakeholders; this solution, if properly connected, selects an integrated and synergistic use of technological, methodological, economic and social resources.

The taken approach is that of Service Design whose concept is linked to the economic financial discipline and indicates an activity of integration and organization of different types of resources, including communication artifacts and materials pertaining to a specific service, aimed at improving the relationship between supplier and end user. In other words, Service Design can be seen as an interdisciplinary approach to the design of a service in which User-centered Design assumes a central importance in giving the service greater usability, desirability, accessibility and attractiveness and is recently described by some research (Prestes Joly, et al, 2019) as a key factor in service innovation.

[6] Stanford Network Analysis Platform.

One of the substantial elements of the approach is for example the use of satellite data. Salinas, et al (2014) show that they use digital tools and georeferenced data, combined with a co-design approach, interactively connecting between citizens, stakeholders and decision makers in the approach to urban problems as it provides a common and shared information base and efficient methods of communication and exchange of information between the various subjects. Salinas, et al, (2014) underline among the main vulnerabilities, the frequent and well-known difficulty of making the most technical aspects of the processes and the very different actors understandable.

The approach to Service Design is applicable on many aspects, however a rather well-known aspect but less applied on a large scale, is certainly linked to the reliability and quality of the information that feed the digital strategies; in this regard, the idea that the blockchain can make a substantial contribution is very widespread and shared, however the examples of application of this technology are still rare. In the future prospects of evolution of this research, the blockchain has a central function in Service Design as it plans to automate the process that guarantees the origin of the information generated from data processing provided by satellite platforms, whose reliability and quality is consolidated.
When satellite data are attributed an economic value, the need for a transfer register is evident, generating related costs and impacts on the service economy; alternatively, a self-certified blockchain-based tracking system that is practically cost-free can be used. The same technological platform, in addition to the structured register, must also perform the important function of a meeting place between sellers and buyers of carbon credits by developing a market in which financial resources of the real market are introduced.

The foregoing lays the foundations for the development of a process in which a subject owning a property to be redeveloped is convenient to carry out a "green intervention" thanks to the guarantees of return on short investment times, as well as bringing an environmental benefit to ensure community.

3.1 Data driven sustainability model for city resilience

The City Sensing approach is specifically oriented towards detailed knowledge of phenomena characterized by high temporal resolution and a medium-large spatial context; for this reason, it is also particularly suitable for this project where the topic of urban sustainability is central. As well known, the concept of sustainability is often characterized by different aspects interconnected with each other, in fact, sustainability understood almost always from an environmental point of view is highly dependent on the economic one and / or related to the social dimension.

In this research, it is developed a cognitive and interpretative model of urban complexity supported by a system of digital data and information whose main objective is to provide a certain and reliable quantification of phenomena and dynamics usually considered unnecessary or not useful. It is possible therefore to speak of a "Data-Driven Sustainability Model" referring to a technological system of monitoring and evaluation of phenomena on

an urban scale that allows to develop real economies aimed at reducing negative impacts and improving the environmental quality and urban space.

4. A project for the city of Munich

4.1 Application of moss mats on abandoned buildings' rooftops

Urban regeneration, known as the installation of different forms of vegetation within the city, including street trees, hanging gardens, green roofs, green walls, etc. represents a strategic approach if supported by enabling technologies. Green infrastructures, in fact, can greatly reduce the level of concentration of particulates and CO^2 through the sequestration capacity of the soil and plants related to photosynthesis and the regulation of the urban microclimate, contrasting the increase in temperature with the evapotranspiration of the leaves (Rete degli orti botanici della Lombardia, 2009; Rete Rurale Nazionale, 2012). Since '90s, green infrastructures and their different applications (green roofs, green walls, vertical gardens) became very popular elements to counter-balance urban pollution's effects and regenerate given areas (Bassan, 2014) through the implantation of some species into the city. A crucial role in sequestrating CO^2 and particulate matter is played in particular by moss which is usually applied to cover roofs and walls of buildings through the creation of a "mat" (Directive 2000/60/CE).

Our case study refers to the city of Munich (Germany) taking as a reference period from February 2019 to August 2019 with the processing of satellite images classified on a monthly average. Munich is Germany's third largest city with the highest population density and the capital of Bavaria, one of the most competitive industrial regions in Europe. Within the project, we processed information from the sentinel 5P satellite, the first mission dedicated to monitoring our atmosphere. Operating in synchronous orbit with the sun, the satellite maps a multitude of air pollutants around the world. The latter, in combination with the auxiliary input data, allowed to elaborate the concentration of each atmospheric gas and to model it on the basis of its absorption characteristics at specific wavelengths of light.
The data we have analysed refer to the air column and not to specific points of the city, this allows us to analyse the problem of air pollution with a different view from the normal ground-based control units[7]. In this study we do not take into account the winds and possible variables that could interfere with our results.

Therefore, the preliminary phase of the study was to identify the surfaces and buildings suitable for hosting garden roofs, green areas. We understood that all buildings cannot accommodate garden roofs or walkable green areas. In particular, the city of Munich has a building architecture mainly characterized by pitched roofs or roofs that are not suitable for

[7] Of course, it must be emphasized that atmospheric central units have much more precise data than satellite data.

extra weights. To solve this problem, we identified our solution in absorbent moss panels. These panels solve numerous problems, first of all the moss does not grow like a classic vertical plant but remains flat and can be installed both on pitched roofs and on all roofs that already house solar panels or external bodies.
Moss is an inexpensive material for insulating homes. It is characterized by environmental compatibility, antiseptic properties, resistance to deformation. Furthermore, moss is characterized by being adaptable to almost all temperatures, in fact it needs little water due to its capacity of capturing it from the air humidity and natural precipitations. For this reason, it is able to remain dry for long periods by changing its color and then greening up as soon as it absorbs water. This guarantees a wider scalability of the solution as the moss mat can be used both in southern and northern Europe.



. Figure 1. Moss installations in Stockholm, Sweden. 2017. Source: © Anselmo Lepore.

Due to the low maintenance needs of the musk carpet, we have studied the effects of its installation on public and abandoned buildings and industrial areas. We have chosen this type of buildings because, on the one hand their large size guarantees a greater surface available to plant the moss. On the other hand, being public buildings, the interlocutor is in most cases a public administration, so it should be simpler finding agreements addressing community benefits. Furthermore, public and industrial buildings are homogeneously located throughout the city.
Authors of many studies from North America and Europe have made strong economic arguments in favour of adaptive reuse of old public buildings, claiming that rehabilitation projects cost around 30 % less than comparable new construction, with possibility to access to tax credits and incentives to offset the high cost of rehabilitation (Rypkema, 1994).
Abandoned buildings are often cataloged as a problem, but with the installation of mosses and green areas they play a double function. The first one is purely aesthetic, the second one is tied to the environment: abandoned buildings may turn into "sponge" buildings, literally buildings with the qualities of absorption of polluting substances.

4.2 Study results

To better define and locate the areas with the highest pollution, Monaco has been divided into 5 areas used as a classification tool for statistical surveys. The 5 areas are very different from each other. For example, area 3 is the historic center, area 1 is mainly industrial, area 4 and 5 are residential and industrial, finally area 2 is a residential area with a strong presence of greenery.

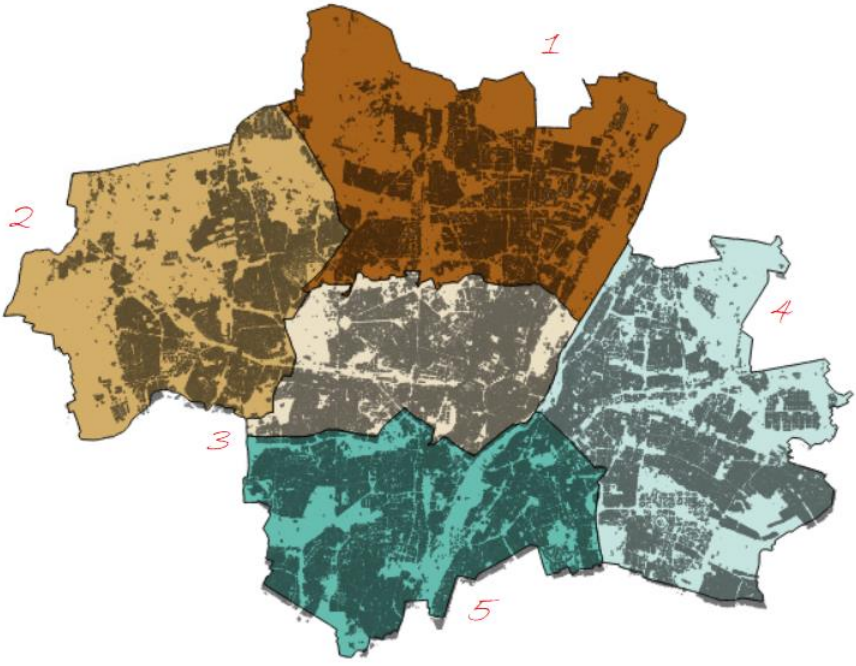


Figure 2. Portioning of Munich in five study areas.

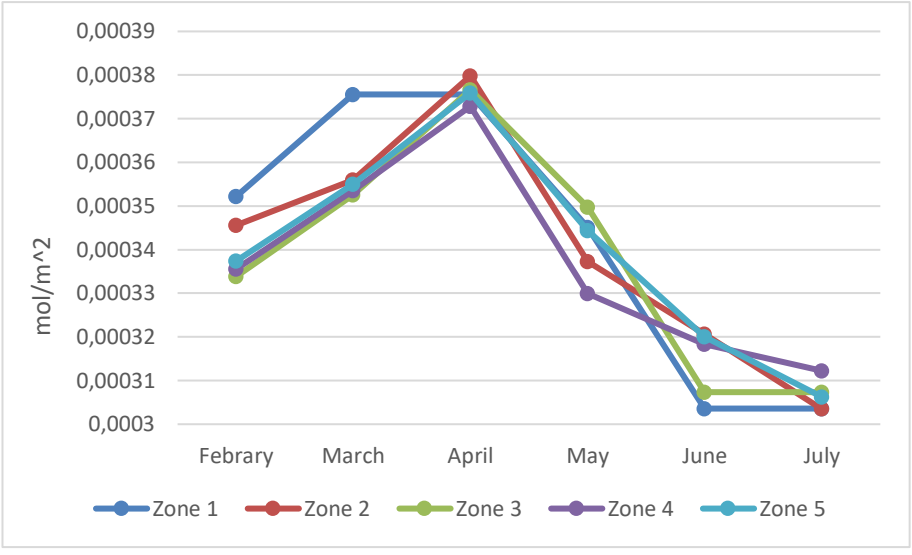
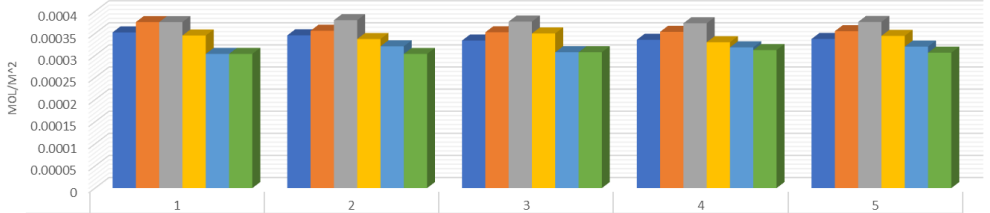


Figure 3. Distribution of Carbon Monoxide within the 5 study areas in Munich expressed in mol/m² (at variable temperature and pressure) – Monthly Average

The reference data used in this document derive from the monthly average of 2/3 images per day.



	1	2	3	4	5
Febrary	0.035222314	0.03455661	0.033378471	0.033555491	0.033732511
March	0.0375561238	0.0356000816	0.0352516741	0.0353476042	0.0355006869
April	0.0375561238	0.0379806592	0.0376653137	0.0372852848	0.0375902414
May	0.0345133831	0.0337207270	0.0349783028	0.0329945953	0.0344368009
June	0.0303587835	0.0320696740	0.0307343296	0.0318326571	0.0319992890
July	0.0303587835	0.0303479003	0.0307343296	0.0312243217	0.0306260238

Figure 4. Distribution of Methane within the 5 study areas in Munich expressed in mol/m²– Monthly Average

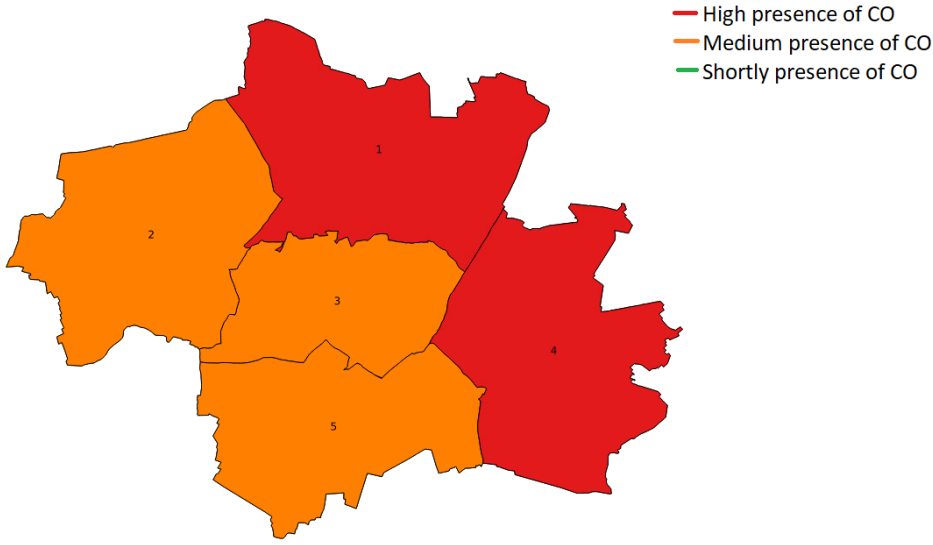


Figure 5. Distribution of Carbon Monoxide within the 5 study areas in Munich expressed in mol/m²– Monthly Average

The figures showed the density values of the vertically integrated CO column. The major polluted areas are 1 and 4. In Figure 3, the influence of weather and climatic conditions on the concentration of pollutants in the atmosphere is noted with precision. In particular, we note that in June and July on average weather was rainier than in March and April, contributing to "cleaning up" the atmosphere. Figure 4, on the other hand, highlights the values of the monthly averages, which show the highest values and therefore a higher concentration of CO in these two areas compared to others. After carefully calculating the aerial columns of the whole city for a period of 6 months, for the purpose of our work we had to detect with certainty the available buildings and their shape. Carbon monoxide (CO) data are calculated using the measurement of the terrestrial radiance of the clear sky and the cloudy sky in the spectral range of 2.3 µm of the short-wave infrared part (SWIR) of the solar spectrum. TROPOMI's clear sky observations provide total CO columns with sensitivity to the tropospheric boundary layer. For cloudy atmospheres, the sensitivity of the column changes according to the path of the light.

Although Sentinel-2 data has a resolution of 10 m, we preferred to use it anyway to make a comparison with the available Open Street Map (OSM) DATA. Therefore, Sentinel-2 images have been classified into a Pixel segmentation and objects like clouds are removed. The

validation led to the division of the territory (August 2019) with the assignment of the respective use (e.g. School, hospital etc.).

Sponge buildings were identified in zones 1 and 4: 65 public buildings with a total area of 175,156 m² were selected. The identification took place using the Google Maps geocoding tool, which allowed us to georefer on a map the addresses of all the public bodies of Monaco, only later through a classification of objects and OSM data we extrapolated the geometry of the building.



Figure 6. Selected "sponge" buildings located in area 1 and 4 of Munich

Finally, a georeferenced file was prepared for the city of Munich. The data on the concentration of air quality have been attributed to the respective geometry of the buildings on a semi-annual and seasonal scale. The data on the half-yearly average concentration were interpolated and then compared with the CAMS monitoring data. From the geometry we extrapolated the surface taking into account the frames and unsuitable areas for

installing the moss. The 65 buildings with their extension could reduce the presence of CO by 15% per month in the two selected areas. The data were calculated taking into account the fact that moss has a storage capacity of 2,500 Ug / m^2 per hour of carbon monoxide and 2,000 Ug / m^2 of methane per hour (Forest Inventory and Analysis Database, 2018). Finally, in addition to the storage of pollutants, the same moss could capture 35 kg m^2 of carbon per year, which can be sold on the voluntary carbon market (Voluntary emission reductions - VER) through the blockchain. Below we show the advantages of the 65 buildings for the two polluted areas of Monaco: the proximity to these green infrastructures is a non-trivial condition to guarantee the highest level of removal of pollutants. With a 1 km buffer that uses Geographic Information System (GIS) tools, we made a projection of the potential benefits of these sponge buildings onto the city. The areas within the green line will benefit most from the presence of green roofs and walls in terms of the effect of mitigating air pollution.

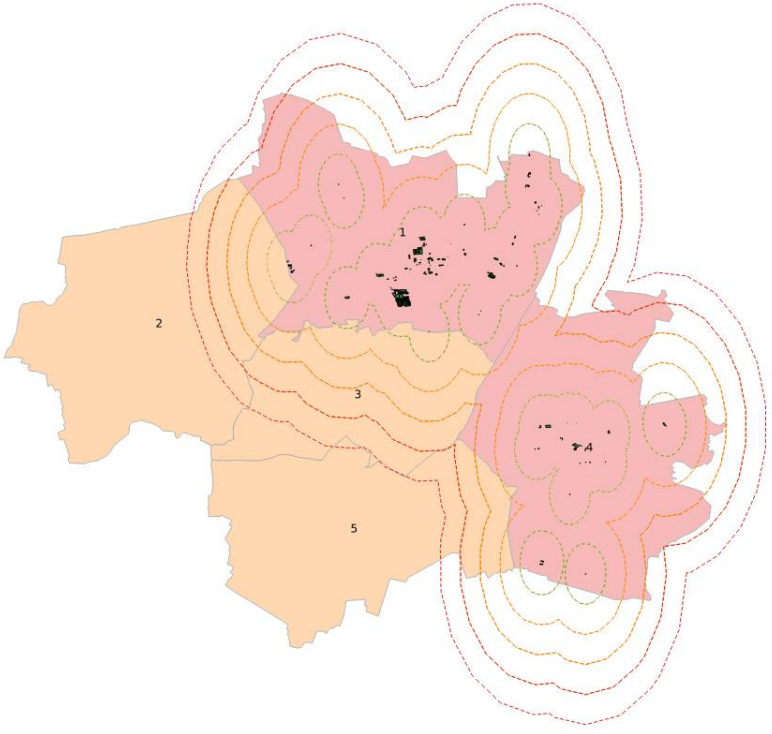


Figure 7. Mitigation effects of sponge buildings in the area 1 and 4 of Munich

5. Conclusions

Main results from the case study of Munich unveil that the extensive use ICT integrated with urban greening and applied in a small reference area can represent a key mitigation and adaptation strategy, expecting therefore higher benefits if applied to the whole city of Munich.

The great advantage of the presented integrated approach is that not only it mitigates climate change effect by monitoring and absorbing carbon emissions, but it also enhances adaptative actions related to the creation of green infrastructures and, in a future, a community-scale business model.

Besides from being the new city lungs, future perspectives are here introduced for green walls through the integration of another technology – blockchain – whose tokenization system can contribute to the transformation of moss mat as net carbon sinks that can generate carbon credits to be sold in the carbon credit market. In this way, we demonstrated here that there is still time to work to build urban resilience and reduce climate risks at all scales with a price which is much cheaper than recovery and rebuilding: building on resilience, we prospect a scalable project which even can take profit from its source of deterioration.

Moreover, the reintroduction of these green infrastructures not only contributes to inner city and suburban recovery, recognizing the importance of recycling old and underutilized buildings in terms of urban requalification, but this also discloses full social opportunities such as the re-acquisition of a sense of community intended as responsibility and obligations for one's place and its residents, which is usually lost when deteriorated vacant buildings appear (Stas, 2007) or gentrification practices are implemented.

Environmental degradation increases everyone's vulnerability to climate change recalling on choral effort in order to empower resilience capacity. Making effects of climate change visible, however, helps integrating this variable into urban planning decisions: the integration of several technologies can therefore trigger experiential learning and participatory planning within communities. Based on City Sensing approach, in fact, our solution gives back decision-making power, especially to most vulnerable groups, allowing the development of shared goals and coordinated actions (Global Commission on Adaptation, 2019).

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

‘I Don't Want to Feel Outdated’. The dissonance between product attachment and contemporary relevance.

Malene Pilgaard Harsaae

Abstract | Product attachment presents one aspect towards more sustainable clothing consumption. However, empirical research and narratives from several mature Danish women reveal that product attachment runs parallel to their desire to radiate contemporary relevance. This desire challenges product attachment as a path towards more sustainable clothing consumption. Based on this research, the article presents four small narratives, each revealing product attachment working alongside the desire to radiate contemporary relevance. The findings emerging from the narratives are discussed and reveal that a strong product attachment appears to increase the number of times a specific clothing product is used. However, a strong product attachment does not automatically prevent replacement or complementary consumption. The article does not present any solutions to the challenge of creating sustainable consumption but draws attention to the need of redefining what it means ‘to be in fashion’ and thus promoting a paradigm shift within fashion.

KEYWORDS | CLOTHES, FASHION, SUSTAINABILITY, PRODUCT ATTACHMENT, CONTEMPORARY RELEVANCE

1. Introduction

It is incontestable that our current production, consumption, and disposal of clothing has a significant impact on and devastating consequences for the environment. The 2017 report "A new textiles economy: redesigning fashion's future" by Ellen MacArthur Foundation estimates an approximate doubling of the clothing production between 2000 and 2015 (Ellen MacArthur Foundation, 2017, p. 18). The report also draws attention to the under-utilization of clothing.

> "Clothing is massively underused. Worldwide, clothing utilisation – the average number of times a garment is worn before it ceases to be used – has decreased by 36% compared to 15 years ago". (Ellen MacArthur Foundation, 2017, p. 19).

Two main reasons for the underutilization of clothes are discernible. One is the actual nature of the physical product, the way it is manufactured and the materials chosen for the production. Many contemporary clothing products materialize as pure commodities and are not designed and produced with the intention of creating products that last. This approach has consequences in relation to the number of times a piece of clothing can be used either by the original purchaser or in relation to prolonging the useful life of a piece of clothing with a new owner through e.g. second-hand purchase.

The second reason for the underutilization of clothes relates to the users' experiences and satisfaction with the clothing items and the significance of clothes in the construction of identity. Products and consumption in general are repeatedly emphasized as elements by which the individual formats and constructs identity (Giddens, 1997, Baumann, 2000). Clothing products and choices provide a very visible form of consumption and "… performs a major role in the construction of social identity" (Crane, 2000, p. 1). Clothing choices are influenced by cultures and norms, by changing times and fashions, and by the desire to radiate contemporary relevance, "… the desire to be 'in fashion' that promotes consumption". (Entwistle, [2000] 2015, p. xiv).

Overall, the development of the current fast fashion business model focusing on fastest to the market, low prices, an ever faster change of fashion trends, and the increasing speed of new products available on the market have contributed to an upswing in the consumption of fashion / clothing products. These factors have created a consumer culture paradigm of product detachment and short-term satisfaction, leading to underutilization of clothing as product selection does not encourage repair and maintenance of clothing, but fast replacement and early disposal. (Armstrong et al. 2016, Lang et al. 2016, Niinimäki and Hassi, 2011, Clark, 2008, Birtwistle and Moore 2007).

2. Background

One approach to address the underutilization of clothing and to reverse the current downward trend of average times a piece of clothing is used, is an increased focus on designing and producing long-lasting products with a deep product attachment. Product attachment is highlighted as a potential improvement towards more sustainable consumption of products, including clothing. (Mugge et al., 2010, Niinimäki and Hassi, 2011, Niinimäki and Armstrong, 2013, Lang et al., 2016). Designing clothes with the intention of fostering product attachment is however fraught with complexity. "Unfortunately", product attachment arises not only through an optimization of the nature of the products, good fit, long lasting materials, and durable manufacturing. These are all tangible elements that can be addressed and improved though an intensified focus on the design and production of clothing with the intention of making garments that last. Despite disrupting the current dominant fast fashion paradigm, designing and producing clothing that lasts is physically possible. However, creating garments that last in terms of material and manufacture are not the sole factors that contribute to creating a potential product attachment. "Making clothes last is very different from making long-lasting clothes". (Fletcher, 2012, p. 227).

Intangible mechanisms like those of experiences and satisfaction related to situational use and memories related to personal experiences and feelings simultaneously influence product attachments. (Mugge et al., 2010, Niinimäki and Hassi, 2011, Niinimäki and Armstrong, 2013). These are experiences that are uncontrollable for designers.

Additionally, a deep product attachment does not replace the individual's drive to keep up with time and to radiate contemporary relevance by following current fashion trends and changing aesthetics.

> "Rarely does a new item better protect our bodies physically or offer enhanced functionality; rather we buy afresh to make visible our identity both as an individual and part of larger social groups within a particular place and time". (Fletcher, 2012, p. 225).

Not often do consumers thus buy clothes based on physical needs but they are caught in a paradigm of constant change, newness, and planned obsolescence, the paradigm of fashion. "Most clothing purchases are driven by a need to fulfil emotional desires or vanity needs rather than a real need for new clothing" (Niinimäki and Armstrong, 2013, p. 191).

Research among mature Danish women supports the notion of clothing purchases driven by psychological needs rather than by physical needs. (Harsaae, 2020).Based on findings from my research, this article aims to present and discuss some perspectives on product attachment. In this context, the findings are presented as four small narratives, which are excerpts from larger and more in-depth narratives presented in the final PhD thesis. The narratives illustrate how the desire to radiate contemporary relevance runs parallel to

product attachment, thus challenging product attachment as a path to sustainable consumption.

3. Narratives of product attachment and contemporary relevance.

From 2016 to 2019, I conducted an empirically-based study of mature Danish women's construction of style through clothes. The study consisted of a questionnaire (n= 293) and semi-structured interviews (n=113) among Danish women born 1940 – 2000 and wardrobe inspired (Fletcher, Klepp, 2018) in-depths interviews (n=4) with women born 1941 - 1965. The research design focused on addressing ordinary women's engagement with clothes. The respondents represent a fairly average group of Danish women with respect to education, income and lifestyle.
The data collection formed the basis of narrative analysis to specifically identify mature (50+) Danish women's interaction with and relationship to clothes. The analysis focused on identifying how each women's clothing culture "… speaks itself through an individual story" (Riessman, 1993:5) and aimed to detect similarities and differences among the women's style narratives as a framework for their individual style (Harsaae, 2020). The point of departure for the conceptualization of style narrative is based on Tulloch's (2010) introduction of the concept;

> "I see the styling practices of a layperson's articulation of everyday life through their styled body as equally valid. For me this is part of the process of self-telling, that is, to expound an aspect of autobiography of oneself through the clothing choices an individual makes — what I have come to call style narratives." (Tulloch, 2010, p. 276)

In connection with the research and subsequent analyses, a number of perspectives emerged, including product attachment, which was not included as such in the original frame of inquiry. However, product attachment arose spontaneously in the conversations with the women.
The data strands revealed that several mature Danish women possess – and use – clothes they have bought 15, 20, even 40 years ago. This notion indicates a strong product attachment to specific clothing items, arising through usability, experiences, and memories.

> "Niinimäki and Koskinen (2011) identified a number of determinants of emotional attachment to clothing and other textile products. However, these meaningful garments most often represent a certain memory and may no longer be in active use." (Niinimäki and Armstrong, 2013, p. 191)

Contrary to the findings of Niinimäki and Armstrong (2013) my respondents predominantly emphasize attachment to old products, which are still in active use. This does not exclude that the same women keep and own clothes for nostalgic reasons which are no longer in active use. However, these women generally appeared more inclined to narrate about the clothes they still actively use. *"I have clothes from the last 40 years, but I wear **all** of it."* (Margrethe, born 1947). As product attachment related to clothes in active use was brought

forward spontaneously by the women themselves and appeared significant for them, the perspective on product attachment to clothes not in active use was not pursued.
Short extracts from four selected narratives illustrate some of the dominating and different perspectives on the emotional/psychological mechanisms governing the drive to radiate contemporary relevance operating alongside a strong product attachment.

3.1 "I still wear my 40-year-old velvet dress" - Margrethe, born 1947

Margrethe is a retired doctor born in 1947, she is married and has two grown-up daughters. She is a very petite woman meaning that she sometimes has to browse teenage or children departments for clothes matching her petite size. She has a classic contemporary style consisting of basic garments mainly in monochrome classic colors as black and navy; in the summertime she adds some brighter colors and a few patterns. She does not express any particular interest in fashion as such but valuates her appearance. *"Every morning I carefully consider what to wear".* Financially, she has the means to engage with expensive clothes and invests in exclusive pieces of outerwear, e.g. a mink coat, and a dress for a special occasion. Garments, which she uses for decades. However, she renews her daily wear wardrobe regularly through the purchase of basic t-shirts and other jersey products like short tight-fitting skirts and dresses, which she mainly buys at the supermarket. She feels that a higher price does not guarantee her a better quality and the low supermarket prices justify that she replaces her basic items frequently, when they start to look worn out or outdated. *"My dream style is too expensive, I can afford it, but I will simply not buy it out of principle. I don't want to pay a higher price for better quality, fit, and manufacturing. After all, price is not related to design and trend".* Her main reason for acquiring new clothing product relates to her daughters' opinion about her appearance. *"I want my daughters to think I look smart".*

3.2 "I want to be part of the time" - Jette, born 1950

Jette is born in 1950 and is a retired pedagogue. Her style consists of tight-fitting jeans, Doc Martens inspired boots, colourful knits and printed shirts. She loves shopping and buys, returns, and changes her garments multiple times a month almost exclusively at second-hand shops. *"I have a fast replacement of clothes. It is my hobby to browse for good bargains in second-hand shops and the low prices allow me to take chances. I just give it back for reuse if it is not right"*. Despite her fast replacement of clothing items, she nevertheless presents several items which she will "*… never part with*." E.g. a short patchwork jacket from the 80's and a black leather skirt that was a hand-me-down from her sister and which has been a part of Jette's wardrobe since the late 90's. *"I think it's so cool. It's worn, there is patina on it, and I feel comfortable in it. I inherited it from my sister, and she used it for 10 years before I got it; that is something I like"*. She hunts for the low prices and predominantly buys fast fashion brands like H & M and Bestseller. She takes a great interest in trends and fashion and wants to appear fashionable and ageless. She emphasizes the importance of being part of the time by constantly adding, removing, and replacing styles in her wardrobe and wants her clothes to radiate contemporary relevance as an indicator of her ability to

avoid appearing old, physically as well as psychologically. *"I think it is fun to be part of time. In this way, I feel that my heyday wasn't 10 years ago".*

3.3 "I don't want to feel outdated" - Anne, born 1953

Anne is a professor in psychology and is still working full time. She has a Scandinavian minimalistic style with an emphasis on skirts and dresses. Black is the dominating color, which she combines with simple graphic prints in strong colors. She valuates clothes with *"… comfort, mobility, good quality, it must last several seasons. It must not be too extreme, it must be usable over time*," and she presents 12-15-year-old dresses and blazers that she still frequently uses. She expresses an increasing awareness of the consequences of her own consumption habits but still buys clothes every second month. *"In the last years, I only buy what I need, and I value the philosophy behind. By buying a little less, I show my position and attitude towards child labor and the environment".* Anne takes a great interest in clothes and buys high-end products. She enjoys shopping and prioritizes the effort to find the 'right' garments. Her purchases are characterized by conscious selection, and the few times she has given in to a sudden impulse have been her worst buys. She likes clothing concepts with alternative approaches, e.g. attending events where you pay half of the price upfront and waits eight weeks for delivery and final payments. She never buys from supermarkets or fast fashion chains. Her clothing choices supports her feeling of self and she emphasizes the importance of radiating contemporary relevance as a part of her identity. *"Trends are important. I don't want to feel outdated, to look old fashioned"*

3.4 "I don't want to look like a 70's relict" - Susanne, born 1959

Susanne is currently unemployed; she has an education as pattern maker and is born in 1959. She has a 70's and 80's inspired style with lots of tunics, loose pants and overall patterns inspired by both decades. Her colour choices consist of black and white as the basics combined with strong 80's colours like cobalt and cerise.
Susanne presents a pair of 20-year-old black pants which she loves and still uses because of *"… the comfort, the material, and the fit; they are made for women"*. She has repaired and even enlarged the pants with a white insert in the side seams in order to be able to keep on using the pants despite her changed body. Her wardrobe contains more examples of beloved items and long-lasting items, yet at the same time she buys new items every third month to renew her wardrobe. She buys medium-priced products from recognized Danish designer brands and from time to time makes a good find in second-hand shops. She is interested in clothes and fashion as a part of her appearance and the well-being connected to fitting in to the occasion and situation. She enjoys reading fashion magazines and following online fashion shows to stay informed and updated about fashion both from a personal and a professional perspective. *"Trends are not important as such, but I do not want to be labelled as a 70's relict so I do follow them"*

3.5 Findings

Each of the women reveals a narrative as well as a strong product attachment to several products with life spans from 10 to 40 years thus extending the average times a specific

product is used. However, they still purchase new items with a regularity between a fortnight and every three months. Thus, they are participating in and contributing to driving the wheels of fashion forward and thereby contributing to minimizing the average times of use for products in general. The women concurrently express their agreement on how the need to appear updated and radiate contemporary relevance drive their continuous consumption and acquisition of new clothing items. This corresponds to the findings posited by Evans and Cooper (2010) and cited by Fletcher (2012):

> "Sian Evans and Tim Cooper note, "attachment doesn't necessarily lead to lifespan optimizing behaviour" (2010: 334). Simply because users have formed a bond with a piece, does not mean it will be used or replacement consumption prevented". (Fletcher, 2012, p. 228/229)

These women present clothes still frequently in use and which form a kind of stationarity in their wardrobe. Parallel to 'replacement consumption' prompted by items kept by emotional bonds and not in use, the consumption behaviour of these women appeared to be equally characterized as constant complementary consumption. These women agree on the importance of radiating contemporary relevance through their selection of clothing that follow current fashion trends. This stimulates them to continuously update and complement their wardrobe with new garments of contemporary relevance.

4. Discussion and reflections

The small extracts of the narratives show the presence of product attachment to various garments still in active use. Product attachment is thus a unifying factor in the four women's clothing narratives. The women also unanimously express the importance of appearing updated and radiating contemporary relevance through their clothing choices. Their stories thus all contain the oxymoron between product attachment as a path to sustainability, and the desire to radiate contemporary relevance as a driver for consumption and as such an obstruction for product attachment as a path towards sustainability. Although the oxymoron is present in all four stories, there are still significant differences in the women's clothing and consumption culture. Weekly consumption and replacement of clothes to satisfy the joy of getting something new, being part of the times, and making the good finds that Jette achieves by browsing second-hand stores. Margrethe maintains a stationarity in her wardrobe predominantly consisting of expensive outerwear, e.g. fur coats and beloved dresses. However, she still replaces basic items every second month through purchases in supermarkets, so she appears well-dressed and smart for her daughters. Susanne supplements her wardrobe with the new fashion, predominantly from high-streets brands approximately every third month to appear updated. Though she emphasizes longer-lasting products, Anne buys high-end brands every third month as she does not want to appear outdated.

They all submit to the mechanisms of fashion and the current paradigm of consumption of clothing products as a substantial constituent in their constant construction of identity. The questionnaire (n=293) does not reveal any significant difference in the consumption frequency between the various age cohorts. Based solely on their age, mature women possess better possibilities of exercising engagement with long-lasting products. However,

the desire to express their identity through their clothing selection and purchase of new products of contemporary relevance, does not appear to be remarkably lesser than the younger women as expressed by their consumption behavior. Gilleard and Higgs (2000) similarly emphasize how mature and older individuals continuously construct their identity through consumption; "… the identity that the individual constructs to express and interpret their own aging". (Gilleard and Higgs, 2000 p: 23).
These women emphasize the tangible properties of the specific product as well as intangible feelings related to experiences and memories of use as foundation for their product attachment thus, articulating and supporting Fletcher's differentiation between products that last and long-lasting products.

> "But for fashion clothes, which already endure physically long past their period of use, putting resources and effort into enhancing the physical durability of seams and fabrics is worth little if it is aesthetics or social preferences—or even changing waistlines—not material robustness that determines a piece's lifespan". (Fletcher, 2012, p. 227)

In the past, it was a matter of course that products were produced to last a long time. The materials were durable and processing slow, hence clothing was relatively expensive and therefore clothes were maintained and repaired, and it was not uncommon for clothes to be inherited from generation to generation. The practice knowledge is still possible to include in the current production of clothes, provided we are able to change the current business models of fast fashion with focus on quantity and escalating newness to alternative business models with focus on quality and consideration in relation to the production of clothes. Creating products that last is a factor, though not the solely determining one, in the occurrence of product attachment and furthermore a prerequisite for the possibility of re-use and recycling. Products that last thus accommodate the potential of improving the average times a specific product is used.
The intangible elements related to individual experiences and memories are more complex to address but the more knowledge we obtain about users and their preferences, the more plausible it is that we can also design long-lasting products in terms of product attachment and in this way create longer lasting products.

> "[ ] a "prior to production" approach, where the philosophy behind the product is linked to the user at an early stage with the aim of creating products that have a longer life cycle thereby postponing the disposal of the product". (Harsaae & Terkildsen, 2016, p. 452)

An increased focus on the development and production process of clothes on products that last as well as long-lasting products may provide the foundation for a strong product attachment as a path towards a more sustainable use of clothes and an improvement in the numbers for the current under-utilization of clothes (Ellen MacArthur Foundation, 2017, p.19). But the approach is strongly challenged by the current consumption culture. However, there are changes in consumption culture as posited by e.g. Clark already in 2008;

> "[ ] the slow approach is introduced and presented as something more than a literal opposite to fast fashion. The term is used to identify sustainable fashion solutions,

> based on the repositioning of strategies of design, production, consumption, use, and reuse, which are **emerging** along side the global fashion system, and are posing a potential challenge to it". (Clark, 2008, p. 428, my emphasize)

The potential challenges for the global fashion system emphasized by Clark have further advanced since 2008 with the increasing attention and concerns bestowed on the climate changes, e.g. Towards the Circular Economy (Ellen MacArthur Foundation, 2013), The 17 Sustainable Development Goals (United Nations, 2015), and Doughnut Economics (Raworth, 2017). Within the fashion system changes have predominantly focused on materials, though new business models do emerge as well.

The critical system thinker Donella Meadows accentuates paradigm shifts as the most influential in improvement of systems. (Meadows, 2008). Several researchers within the realm of fashion similarly advocate a paradigm shift in consumption behavior as necessary for improvement of the fashion industry's devastating impact on the environment. (E.g. Clark, 2008, Fletcher, 2012, 2019, Skjold, 2019, Klepp, 2019, Author, 2016).

5. Concluding remarks

The "right" fit, good lasting manufacturing, durable materials, or materials aging gracefully, are definitely elements that are initial prerequisites for the creation of product attachment. These elements are all possible to address even if they are not dominant in the current business models prevailing within the fashion industry. Though the creating of products that last not necessarily prevent replacement (Fletcher, 2012) or complementary consumption for the individual, products that last have the potential to increase the times a specific garments is used through wear and use by multiple users from hand-me-downs to second-hand bargains.
The emotional attachment obtained through experiences, memories, and usability is equally significant for the creation of product attachment. This aspect of product attachment is more complex to orchestrate and even when it occurs, it does not appear to prevent further consumption. The desire to express identity through the use of clothing products, to radiate contemporary relevance by following new and upcoming fashion trends, to follow fashion through consumption are still strong drivers.
Maybe we need a completely new definition of what it means 'to be in fashion' to drive the necessary paradigm shift in consumption that can truly improve the global fashion industry's currently devastating impact on the environment.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Innovation through circular economy: Tool development for multidisciplinary approach to product-service-system Design

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Abstract | Visualization is one of the key elements for problem analysis and characterization. Designers are key players in the entire process of the product-service chain and are relevant actors in the linear economy model of consumption. The growing unsustainability of this model of production and consumption challenges the design methodology to deal with the new environmental, social and economic reality, that promote the need of holistic approaches to problem-solving, for a more sustainable production-consumption paradigm. To support the transition towards Circular Economy (CE), designers have the opportunity to act in this field where the value of products, materials and resources is maintained as long as possible in the system. By using tools and strategies they can help multidisciplinary approaches to support the development of more holistic solutions. The CE Journey tool promotes project-based learning and it has been tested with students from various fields of training, professionals and companies from various sectors of transformation. Based on a canvas approach it allows visualization of the flows (of goods and information), touchpoints and interactions of materials, partners, producers and users, it helps to analyse and optimize scenarios throughout the product lifecycle (uphill, tophill and downhill).
This document will provide comments on the several testing phases and optimization, reporting on the integration of CE in project development. The main focus of this approach is the development of educational content and tools to support the CE. However, a holistic approach can provide a closer relation to the real context, increasing the applicability of the

tool and thus, the proximity with industrial and business partners. The CE Journey tool intends to promote direct contact between the various actors involved in decision making for product-service development. Through a visual representation of the journey, it aims to identify the touchpoints between the factors identified: materials, producers, stakeholders and users, providing a model for analysis and identification of opportunities to optimize the journey and to enhance the closing of the loops to present a more circular solution. The expected result is a visual matrix that allows the players visualize journey and stakeholders' interactions to optimize the journey and closing of the loops.

KEYWORDS | DESIGN FOR CIRCULAR ECONOMY, TOOLS, CO-CREATION, VISUALIZATION

1. Framework introduction

With the need to act in complex scenarios and fluid modernity [1], project methodologies need new holistic approaches as well as new resources or design tools. The principles of Ferdinand Saussure [2] - the sign, the meaning and the signifier - are considered relevant, in terms of what and how people communicate. In this case, visualization is understood as one major aspect to clarify what the various stakeholders are talking about.

For the last decades, we have seen the consolidation of a linear consumption model supported by an economic model that emphasizes this reality and brings new social, economic and environmental challenges. Promoting a circular model, in one hand, fosters how waste and production systems are designed to enhance the reduction of virgin resources and on the other hand, products and materials are kept in use and values sustained for as long as possible - lowering the stress on natural systems [3].
Designers can impact in the entire process of the product-service chain and are relevant actors in the linear economy model of consumption. To do so, it is important to support and promote skills and multidisciplinary competences towards design for circular economy [4].

The European Katch_e project (Knowledge Alliance on Product-Service Development towards Circular Economy and Sustainability in Higher Education), develops several training materials on CE, including both theoretical background materials and tools for practical implementation of CE solutions in organizations. Katch_e aims at addressing the challenge of reinforcing skills and competences in the field of product-service development for Circular Economy and sustainability, with a particular focus on the construction and furniture sectors. A previous analysis of the implementation of CE showed that the interviewed students, mostly industrial design engineering students, indicated that CE was not taught in a specific way but was included horizontally within other disciplines related to environmental science and sustainability. Some indicated that they had not received any related training, and all agreed that the received training was insufficient. According to the analysis of needs and the interview results, a set of specific contents on CE has been proposed in Katch_e (Figure 1). These materials (eight modules and seven tools) meant to be used in academic teachings, in-classroom context, as well as in companies. They address how to define new business models, how to develop products and processes and the assessment and communication of the circularity. This paper describes de development of one of this seven tools and how it was tested.

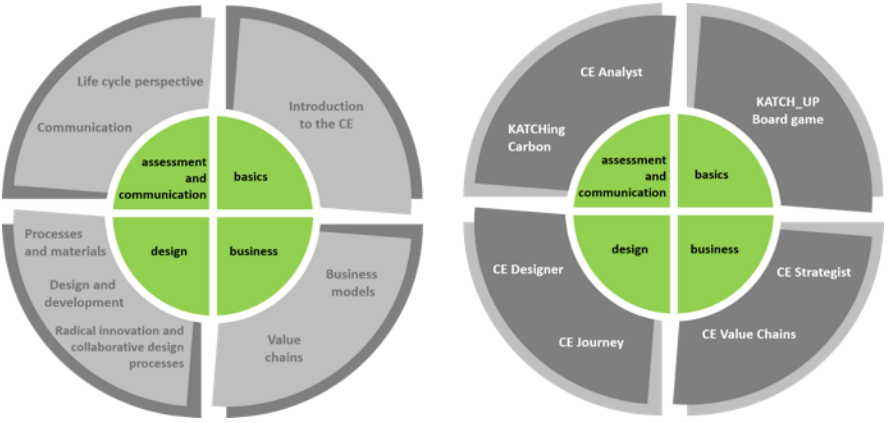

Figure 1. Modules and tools developed in Katch_e project.

1.1 The power of visualization

The implementation of design processes to new contexts of action and the involvement of new actors requires consideration in the choice and definition of the procedural approach. The relevance of the procedural model increases when we act in complex scenarios and when we have to support the transition from more traditional approaches to contemporary approaches [5], as well as in the articulation of different languages characteristic of multidisciplinary teams [6]. To enhance positive and effective results, resulting from the elaborated work, a taxonomic analysis of models [7] [6] and procedural design approaches [8] [9] [10] was developed. This analysis allowed us to assess the importance of two main issues. The first, that the power of visualizing knowledge in problem-solving is considered remarkable as a means of communication and support for generating, analysing and synthesizing information, as well as facilitating dialogue between actors and revealing data, relationships and fields of exploration and construction solutions [11]. In other words, the visualization of knowledge emerges as support for the definition of a real context (to understand) and to enhance an approach to the abstract (to deconstruct). An analogous approach to the process of characterizing what (*what is*) and the consequent abstract deconstruction (*exploratory and constructive*) of possible scenarios (*what could be*) [11].

The visualization can act as an enhancer of projectual fluidity, an accelerator of convergence and understanding of the different team elements, as well as reducing the possibility of divergent forms of interpretation [12].

As a complementary form of this conceptual framework and the principles of Ferdinand Saussure [2] - the sign, the meaning and the signifier - are presented as relevant. The first two are bases that are potentially interpreted stably, according to specific codes and social contexts, and the last assumes a personal dimension, a unique interpretation and relative to

the individual experiences of the person. This reflects the material and sensory side represented or visually idealized, which is understood as a possible point of divergence between people through its particular characterization. In this way, we assume the relevance of the resources or tools used, as supports that promote clarification, inter- and intra-group dialogue and eminently visual representation. Finally, we resort to an approach centred on the positive core [10], as an initial starting point, intending to enhance the identification of opportunities instead of the identification of problems. By adopting a gradual strategy is considered useful in facilitating communication between people who seek to: stimulate understanding between and within groups, through the development of a common language; and facilitate the introduction and use of visual resources, initially based on spelling that is gradually being contaminated by the graphic aspect;

2. Circular Economy Journey Canvas - Tool goals and development

The main focus of this approach is the development of educational content and tools to support Circular Economy. However, a holistic approach can provide a closer relation to the real context, increasing the applicability of the tool and thus, the proximity with industrial and business partners. The Circular Economy Journey Canvas tool intends to promote direct contact between the various actors involved in decision making for product-service development. Considering this, the tool was designed based on three distinct but interconnected moments, which encourage the analysis of *materials*, *partners*, *producers* and *users*, constituting a tool for validation or exploration of the product-service lifecycle. The first two moment of CE Journey tool were inspired by IDEO Circular Joint Venture Workshop. They aim to clarify the *Superpowers* (meaning the roles and assets) and the *Challenges* (regarding activities, barriers and motivations) of the various actors/factors that are involved in the product-service already defined. These serve to create a common understanding between the parties of which role, motivations, added value and difficulties they may have when confronted during the project. These two moments described are materialized with specific cards that must be distributed and analysed, fostering reflection upon the superpowers and challenges. This can be particularly helpful for multidisciplinary teams, for it implies to be invested in those actors/factor's specific role. After these first two moments it was defined the need to produce some visual support were the several stakeholders could see all the interactions, flows and touchpoints of *materials*, *partners*, *producers* and *users.* This task must be fulfill in group and using a canvas that was grounded in the customer journey concept.

The tool was intended for testing with different audiences: not only students but also professionals already working in product-service development. It should be made available for free, easy to be download and printed.

2.1 Tool description

The CE Journey is a tool that through a visual representation of a product/service journey, it aims to identify the touchpoints between several identified factors: materials, producers, partners and users, providing a model for analysis and identification of opportunities to optimize the journey and to enhance the closing of loops to present a more circular solution. It promotes an exploratory and visual assessment, which allows the representation of an overall Product / Service / System journey, in the three stages (uphill, top hill and downhill). After a clear problem or challenge definition, it promotes two analysis tasks that allows the player to reflect on their roles and challenges toward a circular and sustainable solution. As a consequence of this previous tasks, in group, the players can develop an overall journey and explore possible strategic solutions to further develop possible future ideas and improvement opportunities can be identified. The analysis of this creativity session induced the design and development team to define and explore new opportunities, that will be further developed. With the results, the project team can demonstrate where and how the problem or circular opportunity can be address.

The application of the tool is composed of 3 tasks:

1st Superpowers (30 minutes);

2nd Challenges (30 Minutes);

3rd CE Journey Canvas (60 minutes)

Target Group: The tool targets product developers and designers which aim to integrate circular design approaches in the development of new products and services – both professionals and students in related fields alike.

Prerequisites: The users should clearly define a problem and have group of participants with a good knowledge of the sustainability of a product or service along the life cycle, or be provided with such information, related to the defined problem (in the case of the tool being used in an academic context).

Previous knowledge about CE and Product Service System (PSS) is recommended.

Results:

- A prioritization of roles, assets, challenges, tasks and barriers that can be found as applicable design strategies for a more circular and sustainable product/service;
- A common understanding of the flow of relationships and exchanges between the various solution factors.
- A visual canvas that allows the user to understand the journey and touchpoints of the products, producers, partners and users in order to optimize it and potentiate closing of the loops.

- A visual outcome for one overall analysis of the product or service solution according to the possible PSS proposal;
- Immediate improvement ideas and opportunities, through the reflection and assessment of possible solutions and flows;
- Background information for a brainstorming or other creativity session;
  Limitations:
- This tool was developed for exploratory or assessment purposes, in which there is no quantitative data – that for some stakeholders/professional can be more abstract in terms of circularity and sustainability. By that reason we think this tool can be complemented with a Life-Cycle Analysis tool. Despite of this limitation, the solutions that can be achieved with the tool may be more incremental or more radical, depending on possible creative solutions.

Time of tool application: Up to 2 - 3 hours (with coffee-break)

There are available several types of cards (Figure 2):

Instructions cards that presents What is, goals and how to use it description (3 cards);

Circular Economy Focus Card (1 card) The major focus of this game is to achieve or enhance Circular Economy solutions, so please keep the purple card under your sight!!

Superpowers and Challenges' cards (set of 8 cards each, two for stakeholder/factor) these cards are identified by the order of the task, name (e.g. 1.2 Producer Superpowers, 2.1 Producer Challenges) and colour code (orange -material; blues – producer; green – partner; red: user) related for each role.

Blank cards of each stakeholder/factor (set of 8 cards, two for stakeholder/factor) to be fullfill in order to the trigger question that are presented (10 questions in total per stakeholder)

Stages' cards these 17 cards can aid you to further analyse the potential of each stage when you are developing your path in the canvas. They present trigger questions that might be helpful to think about the specific stage in a circular economy approach.



Figure 2. Set of cards: "0" instructions; "Focus Card" major goals of the activity; "1" Superpower instructions task cards; "2" Challenges instructions task cards; "3" CE Journey Canvas instructions card and trigger questions cards for activities 1st and 2nd activities.

The third task to fulfill in the CE Journey Canvas is essential to outline the journey and identify where the starting point of each stakeholders/factor (it can be in an uphill, top hill or downhill stage) (figure 3). Each actor must identify the journey starting point and sequentially number and fill their tasks and goals, outlining the path (with pins and colour threads). In collaboration, the participants must try to identify their touchpoints. The participants must aim to optimize the solution in its economic, environmental and social dimensions. The CE Journey canvas printable version available is 1200x900mm (figure 3)



Figure 3. Pre-set CE Journey canvas and stage cards organize by color code: blue – uphill; orange – tophill; coral – downhill); pins and color threads.

2.2. Testing and adaptation

As already mentioned, the tool was intended for testing with different audiences: not only students but also professionals already working in product-service development.

2.2.1 TEST WITH STUDENTS

In a preliminary moment, the tool was tested with master's degree students enrolled in a specific Circular Economy curricular unit. The students, from various backgrounds, worked in multidisciplinary groups that were developing furniture pieces applying cork and other materials, such as wood or metal. After the tests and according to the results and feedback obtained, changes were made, simplifying tasks and time reduction of the use of the tool. This was applied by reducing the total number of questions and including most elements on the canvas. The tool was intended to help players and/or stakeholders to assess the overall Product/Service/System journey, in the three stages (uphill, top hill and downhill) and along with the several factors: materials, producers, stakeholders and users. Figures below show the first version tested by students. This session lasted 3 hours.



Figure 4. Master's degree students test sessions.

2.2.2. TEST WITH PROFESSIONALS AND INVESTIGATORS

Validation among professionals and investigators was also taken into account. This took place at two different session: the first together in a consortium meeting staff (figure, involving the different partners in testing activities; the second through testing at a national workshop by inviting national partners (companies/organizations, professionals, teachers, researchers, students).



Figure 5. Consortium partner meeting test sessions.

In the first session, we determined with a national partner (cork company) a challenge related to its production and business area, which was presented together with the instructions and objectives of the tool. During a 1h30 session the tool was tested. Despite the short experimentation time, the considerations were in line with the indications of the first test of students. However, the presentation of a closed and concrete challenge proved to be simpler to use and explore the tool. This same strategy was applied on second session (national Stakeholders where), where we had two groups of 8 persons each testing the tool. After a brief introduction and explanation of the tool, for each group was presented a specific challenge related to national companies/partner. One related to cork industry and another in the business area of production of wood products. In each group there was an element of each company, which facilitated the process of explaining and clarifying of specific challenges or doubts related to the product / service in question. This session lasted 2 hours.



Figure 6. National stakeholders' workshop

Although the majority of the participants made positive comments. It was notorious, like the test with consortium partners, the difficulty in develop conceptual thinking solutions without validation or use of objective data. This difficulty was more evident in professionals related to LCA, although several of them demonstrated an interest in using this tool in parallel with studies or data on product life cycle. Another consensual remark was the lack of time to complete all tasks, highlighting the number of cards as a negative point

2.2.3. ADAPTATION AND IMPROVEMENTS

After the tests and according to the results and feedback obtained, it was clear the need to made changes in order to simplify the tool use. The remarks in both sessions underline the need for the simplification of tasks and time reduction of the use of the tool.

After the tests developed and gauging of the criticisms and suggestions, the tool's improvement proceeded. These had the following objectives:

Number of components - reduction of the number of elements/cards

Clarification of use - Creation of rules and how to use it paper sheet separate from the card strategy; Creation of the problem example and open problem cards, the first presented an example of a possible project opportunity, the second a filling matrix with the various elements for defining a possible project.

Supports - derived from the large format of the canvas, A3 versions were developed, as well as digital versions (PPT) with a pre-defined canvas, such as an open and customizable canvas. This made it possible to add more actors or subjects depending on the number of factors related to the defined scenario.

Relationship between tasks - in order to facilitate its use and relationship between the first two tasks and the canvas. In this sense, the 17 cards initially presented in the first version were reduced to 9 cards. In order two the number of questions we reduce 50% of it, passing from 10 questions to 5. We started to present the questions related to the first two tasks, however, the answer to them was placed on the canvas. In this way, we seek to stimulate the relationship between the three moments of the tool, as well as the centralization of information on the same support (figure 7)

The major modifications reflect on the **reductions of cards** as well in the **relation between cards/questions and canvas**. Also, the reduction of cards was possible by the development of the **foldable instruction paper** as well the text improvements of usage regulation.

Example and open problem cards Present an example of a problem or particular context along with several stakeholders related to it. The open problem card has blanks guide you to define your specific problem before you start using the Circular Economy Journey as showed in figure 7.

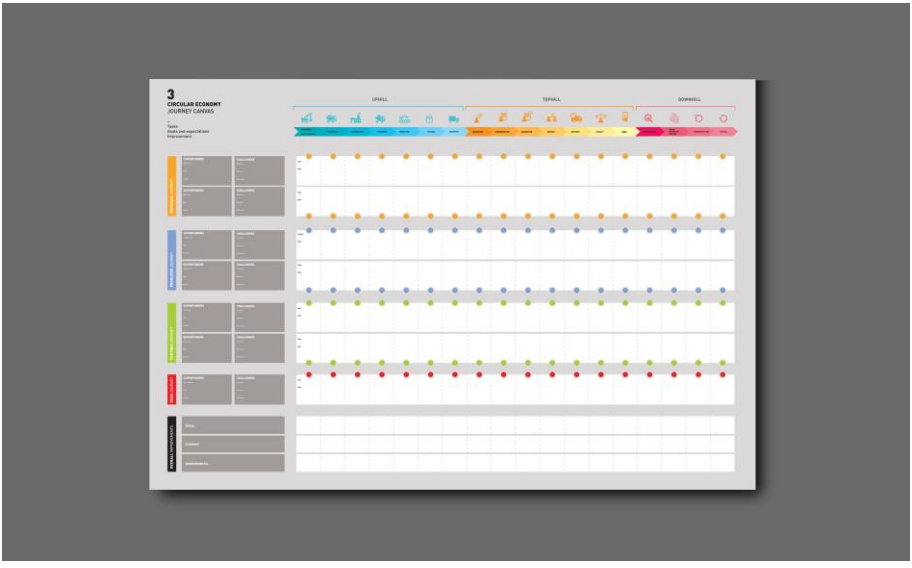



Figure 7. Tool redesign and updates: Canvas (top); instructions (bottom-left) and example card and open problem card (bottom-right)

2.3 FINAL TESTING

The final test was developed in a curricular unit (Ecodesign and sustainable development) of the last year of the industrial design degree. In the project-based discipline, students developed a proposal and after stabilizing the solution, they were asked to analyze the proposal to associate the product with service and define the necessary changes to stimulate the evolution of a design for the circular economy. The tool was presented, and it was notice

that the images facilitate the understanding of the tool and the final outcome of the exercise. They add access to all the files and formats of the tools, and they were allowed to change if they want to. As you can see in the figure bellow, they adapted different strategies and sizes.

To start each task, it was used the time proposed but after completing each task they were allowed to further develop the analysis and solution. The use of the tool was made in three session of 3 hours each. Although they were allowed used the canvas digitally, all of the 42 students, during the first stage/solution preferred to use the analogic version so they could explore it. The only adaptations identified in the canvas were made in order to add or reduce the number of stakeholders.

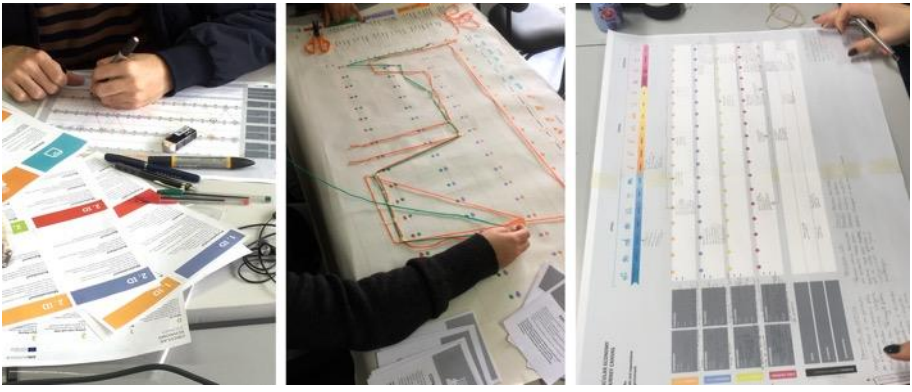

Figure 8. bachelor students using tool in different strategies

In the end they introduce the CE JOURNEY canvas in a poster that was used to present the overall solution. In this final presentation they used a digital version to present the information more clearly. We can consider that the exercise was demanding, since the students need to deal it the overall complexity of a product-service, but they could understand their relevance and impact in term of product design development. The majority of the first product proposals changed to achieve solutions that enhanced circularity by adapting strategies of assembly and disassembly, changing materials or maintenance strategies and services.

3. Conclusions

After testing and consequent development described, some conclusions were possible regarding the final version of the Circular Economy Journey Canvas tool. The tool should help the players and/or stakeholders to assess the overall Product / Service / System journey, in

the three stages (uphill, top hill and downhill) and along with the several factors: materials, producers, stakeholders and users. Through a visual representation of the journey, it aims to identify the touchpoints between the factors identified: materials, producers, stakeholders and users, providing a model for analysis and identification of opportunities to optimize the journey and to enhance the closing of the loops to present a more circular solution. The user should have a specific product/service in a specific context (materials, producers, stakeholders and users) in mind, which is then analyzed further. The expected result is a visual canvas that allows the tool user to see the journey and touchpoints of the products, producers, stakeholders and users in order to optimize the journey and closing of the loops. All the described process made it possible to test the tool with multidisciplinary participants, ensuring it would be fine-tuned in order to minimize efforts to understand and apply the tool, maximizing its possible results.

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Acknowledgements: the support on the research from your colleagues, student's participation, internal or external partners' contribution or funding bodies.

Co-funded by the Erasmus+ Programme of the European Union

ID+ RESEARCH INSTITUTE FOR DESIGN, MEDIA AND CULTURE PORTUGAL

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Lost in transition; Methodologies and tools of Product-Service Systems Design for major life transition.

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Abstract | The research focuses on family caregiving problem, i.e., the care of a family member suddenly suffering from a health condition. Reference is made to the context of Shanghai, but the extent of the problem in China is ubiquitous, given the trend of aging population as a result of the one-child-policy only recently abandoned. Although the government introduced the Healthy China 2030 policy in 2016 to dramatically improve the health of 1.3 billion people, there are no measures to support those who take care of a sick family member. The research, currently underway, proposes methodologies and tools of the Product-Service System Design to reorganize the network of dedicated services already existing on the territory in order to eliminate inefficiencies and strengthen the social fabric. Besides, the concept of unforeseen "change" is investigated according the traditional Chinese Weltanschauung so to reactivate human creativity in the face of adverse events in daily life.

KEYWORDS | FAMILY CAREGIVING, MAJOR LIFE TRANSITION, PSSD, TRANSITION DESIGN, CHANGE, YIJING

1. Introduction

1.1 Area of research

The elderly will reach 33% of the whole population in China by 2050. About 60% of this quota will need daily care because of a range of conditions in most cases not curable or terminal, and requiring regular support (Tang et al., 2013). Providing family caregiving is still very rooted in China, mainly due to the concept of filial piety (Wu et al., 2005). Therefore, the caregiver role is undertaken by family members, often not fully aware of the implied burden and the actual patient's condition.

Becoming a caregiver is a significant life transition since it can dramatically impact family life, especially when the change is unexpected or for the long term. People naturally have different response capabilities to stress management. Caregiving exerts a lot of pressure, and in general those affected find themselves in a difficult position. Lack of support during the transitional stage may originate adverse symptoms: stress, depression, and anxiety reflect decreased life quality in long-term caregivers (Guo & Liu, 2015). Psychological, economic, educational aid should be available through specific governmental policies. At the moment, in China, the actors' ecosystem is poorly managed (Glass et al., 2013), and new sustainable lifestyles for caregivers are in demand to face the staggering numbers.

1.2 Observed problem or paradox

As a matter of fact, due to the psychological burden, the financial toll, and the lack of specialist information (Guo & Liu, 2015) (Hu et al., 2018) (Guo et al., 2015), adequate aid should be available to caregivers also through specific governmental policies. However, although the Chinese Government targets to improve the health of 1.3 billion Chinese by 2020 through the Healthy People 2020 policy, the government has no specific measures to support caregivers; neither does it through the new Healthy China 2030 policy (Tan et al., 2017).

1.3 Research question

The research wants to investigate how Product-Service System Design (PSSD) can stimulate the creation of participated and shared strategies to improve both short and long-term caregivers' lifestyles and resilience.

1.4 Working hypothesis

The authors put forward the working hypothesis that PSSD offers the appropriate methodology and tools to facilitate the integration of services already existing on the territory, to the benefit of family caregivers in the long haul. However, through co-creation

methods, PSSD can help reactivate creativity in times of great stress, to deal with an immediate emergency.

1.5 The aim of the project

The aim of the project is to investigate how PSSD can support family members becoming caregivers. The research focuses on PSSD tools suitable to explore the problem through in-depth interviews and co-creation workshops and to ideate effective support systems for a resilient society.

1.6 The objectives of the project

The overall aim is split into four objectives:

1. It is necessary to investigate whether there are targeted policies or support services currently available for caregivers in Shanghai;
2. Subsequently, the research addresses the private plan of the caregiver patient relationship to understand what facilitates and hinders the creation of temporary and immediate solutions to deal with the emergency;
3. Desk and field research combined with trends' study will generate insights helpful to create long-lasting future visions through scenario building, hence contributing to Transition Design, a research area that advocates "design-led societal transition toward more sustainable futures" (Irwin, 2015);
4. Finally, a workshop prototype in a Chinese multi-stakeholders' context is created.

Overall, the objectives focus on the long-term time frame, with the only exception of second point, which addresses immediate solutions to face the emergency.

2. Desk research

2.1 Caregivers and policies to support family members in Shanghai

From 1979 until 2016, Chinese society has been under the one-child policy, whose aim was to control the rapid population. The regulation beneficially contributed to economic growth and standard living improvement. However, age breakdown and more significant gaps between the different generations followed (Liao, 2013).

President Xi Jinping, in 2016, introduced the Healthy China 2030 policy (HC2030). The "plan gives due recognition and resources to both population-wide approaches and targeting of high-risk patients, focusing specifically on chronic diseases such as heart disease, diabetes, and cancer" (Tan et al., 2017). The policy comprises four dimensions: "health priority; reform and innovation; scientific development, justice, and equity." More than that, the policy

target to benefit patients, children, discriminated individuals, and despite claiming inclusion, it does not emphasize a particular reference to caregivers. However, the high rate of caregivers is a natural consequence of the one-child policy, and the projections should serve as a base for building new plans. Namely, "by 2050 it is predicted that there will be 110.5 million dependent people in China, of whom 66 million (60%) will be at least 60 years old" (World Health Organization 2015, n.d.). Given this, there are some support systems on different dimensions, including:

- Compound Community Support Service aiming to alleviate caregivers' duties by providing the help of professional caregivers, currently available in one Shanghai neighbourhood only (Zhang et al., 2015);
- Non-Governmental Organizations seeking to financially support caregivers and their sick family members (Serious Illness Fundraising Website in China, n.d.);
- Governmental financial support aiming to reduce the treatment and medicine costs for the patient (Caregiver 1 et al., personal communication, December 20, 2019).

2.2 Trends of the aging population in China

The effectiveness of the healthcare system has enormous consequences on caregivers' life. The HC2030 policy is heading toward a system that pushes prevention (Tan et al., 2017) through better lifestyles and early detection symptoms. The plan provides for a more conscious economic development, aware of a high rate of pollution that affects the citizens' health, so it aims at a coordinated development of ecology, health and economy. On the more practical side, the plan includes incentives to improve facilities and services that meet the needs and desires of the new Chinese middle class, mostly formed by those born in the 1990s (PricewaterhouseCoopers, 2010). It is precisely among this young middle class that the trend of a healthy, sustainable life that wants to achieve "personal well-being" is growing (Global Wellness Summit, 2019). Higher education possibilities, higher disposable income, and a more frequent encounter of the Western culture have been shaping a mindset capable of positively react to the new policy. Nonetheless, the significant risk of chronic and non-communicable diseases, which has been a significant cause of death (80%) in China in the last years (Fang et al., 2015) is caused by unbalanced lifestyles, which include alcohol consumption, smoking, unhealthy diet, and inadequate physical activity.

2.3 The Chinese concept of Yi

In addition to retrieving data on the dimension of the family caregiving phenomenon in China and, in particular, in Shanghai, the authors carried out semantic research on the concept of change in Chinese culture. We want to understand how the average affected family most likely would face such an overwhelming fact filtered through the rooted Chinese Weltanschauung.

The term yi in Chinese has multiple meanings, including change. The Yijing (The book of change), one of the cornerstones of Chinese philosophy, probes the concept of yi (Shantena Sabbadini & Ritsema, 2011). The text does not analyze the change that is predictable in natural cycles, such as the circadian rhythm, the seasons' changing, the stars' motion, or the tides' ebb and flow. Instead, yi stands for the irruption of an utterly random fact of nature irreducible to the pre-established order of things. Unimaginable events of a harmful magnitude have a destabilizing effect that has always driven people to search for the meaning to justify their occurrence.

For the modern Western mentality, unpredictable change is often inexplicable. When it is not possible to establish a chain that leads back from the effect to the cause, it is concluded that the fortuitous and unfortunate event is an expression of chance, understood as a lack of meaning. According to Jung (in Wilhelm, 1950), for the ancient Chinese mentality, everything that happens at a given moment is neither the product of causality nor of chance. Instead, everything has its origin in the constant struggle between order and chaos, construction, and destruction. Life can regenerate itself because every form of order is instantly swallowed up by disorder, in a constant alternating flow.

Observing the occurrence of an event is equivalent to taking a snapshot of the field of forces at play in constant mutual subversion. Every small detail bursting onto the scene participates in the forces active at that moment. Nothing is meaningless. On the contrary, every element bears a portion of overall meaning, like the tile of a puzzle. However, one must be able to decipher the overall 'configuration' of the items. Going back to the causes is of no interest at all; the ancient Chinese goes in search of the hidden meaning.

The Yijing was born under the Zhou dynasty (1122-256 B.C.) as an instrument of divination. In practice, three coins are thrown: the random configurations, into which they fall, appropriately decoded with the help of the manual, reveal a message informed by the same meaning of the event under investigation.

Faced with a particularly disconcerting fact, the ancient Chinese formulates a question that is particularly close to his/her heart and uses the method of throwing the three coins to visualize the configuration of the forces in the field concretely. The throwing is random, for there is no intentionality in it; therefore, it is the key to the buried and hidden meaning of things. The configuration that is determined short-circuits every response that the human mind, chained to linear reasoning, would be able to produce. It is then up to the intuitive ability of the interpreter to establish the links of meaning between the configurations obtained and the question asked. The connection belongs to the plane of significance, never to that of cause and effect.

The investigator of the fortuitous event's meaning is similar to a participant observer. In other words, the psyche of the observer and the observed matter are mirroring each other. The uncertainty of the question and the ambiguity of the obtained configuration are symmetrical. Since the latter is a symbolic image, it will return a cloud of semantic content

that cannot be unambiguously circumscribed. The ambiguity of meanings, far from being a source of frustration, is the opportunity for the ancient mentality to project completion of the sense at will outwardly. Projection is the act of interpretation: the applicant throws a dart into the dense cloud of the unconscious mind and pierces a meaning inaccessible to the logical mind. If, due to their ambiguity, the images are universally adaptable to all questions and circumstances, it is the interpretation that leads them back to the question posed Hic et Nunc.

The Yijing is a tool that ancient Chinese people have used over the centuries to navigate and follow the meanders and whirlwinds of life's changes, to open a meaningful dialogue with the shaping forces in the field, instead of being blindly swallowed by them. The material world is endowed with meanings that are always in resonance with the human psyche.

At this point, one might wonder what the usefulness of such a method might be for the contemporary man. First of all, the unforeseeable change in daily life is a constant of mankind, regardless of time and place. The unpredictable occurrence of an unfortunate event has an immediate paralyzing impact which, if not promptly tackled creatively, can lead to a situation of psychological and emotional agony impossible to recover.

According to some studies in the field of neuroscience (Öhman & Mineka, 2003), humans make an illusory correlation between an adverse event and the threatening presence of snakes or reptiles. In other words, there is a cognitive affinity between the vision of a snake and a harmful or dangerous event. In both cases, what scientists call the fear module in the brain is activated: a neural circuit at limbic level, like the amygdala, located in the anterior temporal lobe, which emerged during the evolutionary transition from reptiles to mammals. This module, belonging to the ancient nucleus of the reptilian brain, is much older than the neocortex and is relatively encapsulated from more evolved cognitive functions. It would be activated by the stimulus of a snake (or an accident) and would control the emotional output: the flight or fight behaviour.

The sudden occurrence of a stroke to a family member causes the same freezing fear response as a reptile's vision a few inches away. In such adverse circumstances, the neocortex and more advanced cognitive functions are inaccessible, only the limbic nucleus of the fear module is active. Creativity is not available to seek adaptive strategies for the new situation. The yijing method is a trick to bypass the cognitive block and access a pool of unconscious content that intuition (and not logical thinking) can bring to the light of consciousness. We will see later how this method has been proposed to the workshop participants to tap into the creative intuitive mind and put in place countermeasures to face the sudden unfortunate event.

3. Field research methods

3.1 Workshop

The Lost in Transition workshop was part of the Design for Transition International Conference held on October 24-26, 2019, at Jiangnan University, Wuxi, China. The workshop aimed to designing solutions for caregivers in China. Thirty students of Interior Design and Product Design, besides two professional designers and a Design professor, participated. The plan of the workshop was divided into four phases with related activities:

Discover:

- Ice-break activity;
- Presentation on the caregivers' current situation in China;
- Hints on scenario planning techniques,
- Division in three teams

Define:

- Empathizing with caregiver personas assigned per group;
- Assigning teams different scenarios as a mandatory framework;
- Formulating implicit and explicit needs through user stories;
- Formulating the key question about the challenge to overcome;
- Interrogating the oracle through the yijing;

Develop

- Building a stakeholders' map (Figure 1);
- Concept ideation and selection;
- Future scenario system map;
- Future scenario user storyboard.

Delivery:

- Presentation of the ideation process of future scenarios and the entire design process (Figure 2).



Figure 1. Students working on the stakeholders' map depicting the caregivers and the related actors. "Lost in Transition" Workshop, Design for Transition International Conference, October 24-26 2019, Jiangnan University, Wuxi, China.



Figure 2. A presentation of a design concept, its process and tools followed by the Team N.3

3.2 The formulation of the design challenge

There were developed three personas (Figure 3) illustrating different personality types and having peculiar relationships to the family members in need of care. Age, gender, financial status, and occupations were also detailed. The teams were encouraged to address the caregiver's explicit and implicit needs. Furthermore, to empathize with the caregiver, "Key Questions" cards were distributed to generate a variety of doubts and challenges and finally focus on one. The three caregivers' profiles were designed based on the literature review findings, reporting the challenges on distinct dimensions, including:

- Financial burden: A middle-aged extravert wife in a financially difficult situation.
- Mental Health problem: A single introvert mother struggling with depression.
- Balancing caregiving with the previous lifestyle: A grandson who recently became a caregiver in addition to being a student and sporty person.

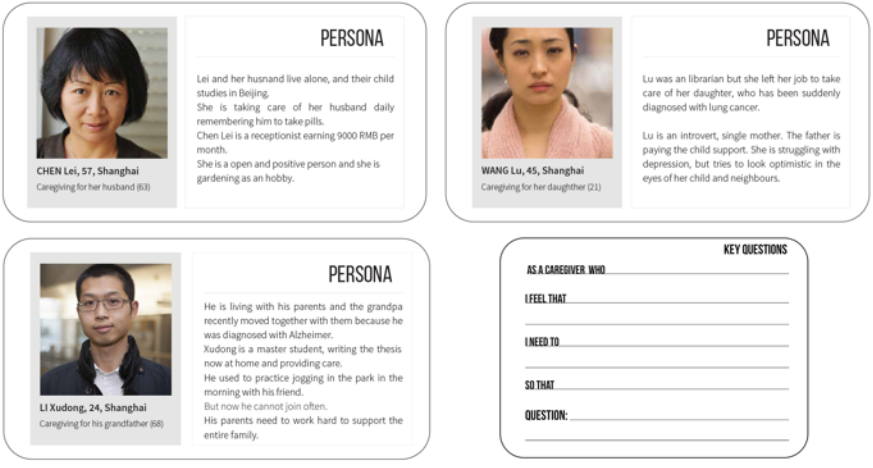

Figure 3. Pre-developed personas and Key Question cards facilitating the teams to create design challenges.

The three teams developed specific design challenges that are illustrated below (Table 1).

Table 1. The characteristics of pre-designed caregivers personas and the teams' ideated design challenges.

Team	Challenge category	Caregiver Persona	Design Challenge
Team N. 1	Financial burden	A middle-aged extravert wife in a financially difficult	How can I find more time to explore my own 'earning'

		situation.	potential while looking after my husband?
Team N. 2	Mental health challenge	A single introvert mother struggling with depression	How can I reinforce my mental health while being a caregiver?
Team N. 3	Balancing caregiving with previous life order	A grandson who recently became a caregiver in addition to being a student and sporty person	How can I balance my personal time to take care of grandpa and me?

3.3 The oracle's question

During the preparation of the workshop, we asked ourselves how to facilitate the groups' empathic understanding of the crippling situation of loneliness, confusion, helplessness, and fear in which the persona finds him/herself after the family member's sickness. We prompted the teams to refine a burning question that the persona turns in their minds obsessively. Being frightened, the personas have no way to use their creative faculties to find a solution; they react by automatically activating the fear module in the reptilian brain. One way of bypassing the cognitive blockage is to throw the three coins according to the yijing procedure, obtaining a suggestion from the oracle, namely from the intuitive faculty of the unconscious mind.

The first team works on a middle-aged wife who has to find extra income to take care of her husband. The oracle suggests hexagram N. 2 mutant to N. 24. Without going into the technical details of what a mutant hexagram is, hexagram N. 2 suggests not to do anything rash, stand still, remain concrete, and with feet on the solid terrain, to begin with. Once the stability is recovered, move on to the suggestion in N. 24: go back to a starting point to retrace your path by correcting it. The group works on a gardening service that the woman offers to her neighbors, rekindling her relationship with them.

The second team deals with a divorced mother who doesn't know how to take care of her mental health when dealing with her teenage daughter's illness. The hexagram obtained is N. 44: mating. After a moment of bewilderment and hilarity, the group worked on the relationship networks of the young mother so that she could find a new understanding and supportive partner and included funny remedies like the "husband pills."

The third team faces an active and sporty student who must take care of his grandpa and does not wants to give to the previous active lifestyle completely. The hexagram retrieved was N. 43: the oracle suggests responding to the new situation with decisiveness, and finding a way to vent the energy after the accumulation of so much tension, like a river

breaking its banks. The group works on innovative VR goggles that allow them to connect with friends both indoors and outdoors, for jogging and workouts together.

3.4 Interviews. Data Collection

We conducted the study in Tongji Hospital in Shanghai, where three caregivers and a doctor, were interviewed, besides one more caregiver, unrelated to the hospital. We used a qualitative design, in-depth interview method (IDI). The general aim was to find similar patterns across caregivers, during their critical periods of caregiving. Moreover, we wanted to discover different perspectives of caregivers within the same family: the second and third caregivers are satisfying this goal. Finally, we aimed to find out an expert's viewpoint on the caregivers' situations, and comments on the challenges from a professional perspective. The criteria to choose the caregivers were age, gender, diseases affecting their family members, financial status, years of caregiving, and family structure. The demographic data and caregivers' responsibilities are described in Table 2.

3.5 Interviews. Procedures

Three interviewed caregivers were met in the emergency hall in the Tongji Hospital in Shanghai. The interviews were conducted in Mandarine Chinese by two trained interviewers, one of which was speaking Chinese and was translating the caregivers' responses to the colleague. Caregivers IDIs encompassed their personal stories of becoming caregivers to a family member, how they learned about the disease, what was their perception, and what were the new responsibilities. The IDI explored how the event had been impacting their personal lives, and how smoothly the new role integrated with their previous habits, what were the facilitating factors. The caregivers were asked to share their strategies of alleviating their states of mind and easing their duties. The IDI of the doctor working in the Hepatobiliary Department of Tongji Hospital tackled the general perceptions of the challenges faced by caregivers for pancreatic and liver cancer patients as well as their duties and finally, the doctors' response to the caregivers' phenomenon they are witnessing.

Table 2. The demographic data about interviewed caregivers and their family members in need of care.

	Caregiver 1	Caregiver 2	Caregiver 3	Caregiver 4
Age	62	49	73	40
Gender	male	female	female	female
Occupation	salesperson	accountant	retired worker in a textile factory	design researcher
Number of family members needing care	1	1	2	1
Relationship to	mother (84)	father (80)	husband (80)	father (72)

the family member in need of care (age)			and son (44)	
Number of years to be caregiver	8	13	13 – for the husband, 5 – for the son	5
Family members' disease	heart problems	Locomotory problems, low immune system	husband: 2 strokes, locomotory issues, weak immune system; son: mental problems	prostate cancer
Type of care provided by the caregiver (arranged by priority)	Physical care, psychological support	Informational and financial aid, mental support, physical care	Physical care, mental support	Informational support, psychological support

3.6 Interviews. Data analysis and results

We summarized significant themes and challenges of the caregivers' experiences.

- Skills needed to become a family caregiver and the implicit changes of the previous life orders;
- Duties and challenges of the new role: fear of uncertainty, fragile mental balance;
- Belief, time for oneself, and social support as factors facilitating regaining emotional equilibrium;
- Caregiving as an opportunity for rethinking the self.

A clear difference emerged between middle-age caregivers and elderly caregivers. The younger caregivers have a higher likelihood of focusing and satisfying their emotional needs by traveling and disclosing their feelings. Some caregivers take the challenge as an opportunity to rethink their values, family relationships, and life.

The interview with the doctor was held last. He confirmed the challenges and also flashed a light on new topics.

1. Chinese cultural beliefs and values:

- The ethical question of hiding the actual diagnosis to the patient;
- The moral virtue of "endurance" as a prerequisite for a Chinese person in a difficult situation;

- Family togetherness in facing the problem;
- The difficult trade-off between investing in a terminal disease treatment and saving money for the future of the family;
- Chinese community and organizational solidarity towards caregiving peers.

2. Unprepared emotional and critical thinking response due to high pressure:

- The refusal to accept the disease of the family member;
- Ignoring symptoms and underestimating the health issues of family members due to a lack of knowledge.

The doctor mentioned the importance of alleviating caregivers' burdens through support systems. However, there is a lack of connections between the caregivers' support structures and the hospitals, on both administrative and medical staff levels.

4. Conclusions

4.1. Research output

The research is currently ongoing; however, the ultimate goal is to present a transformative scenario, evolving on fifteen years, proposing a long-term change at the societal level. The workshop at Jiangnan University generated personal strategies to cope immediately with an unfortunate emergency thanks to the strong presence of technology as a social connector. As researchers in PSSD applied to Social Innovation, we imagine a future less dominated by technology and more oriented towards social relations and resilience of human relations, especially in urban contexts like Shanghai. The following scenario builds on previous research, interviews, and workshop, and it is presented as a tentative output but also as a tool for further open discussion and refinement.

In five years, the current situation will likely have some incremental changes. There will be a slight improvement in health facilities in terms of physical spaces and technological devices. To date, the existing facilities do have limited reception services for caregivers during the permanence of their relatives. At this stage, the high uncertainty of the moment and the disconnection from everyday life increase stress. If the government is willing to help citizens both on the psychological and economic levels, it is necessary to support caregivers in the most acute phases, especially during the hospitalization or treatment changes.

In ten years, the HC2030 objectives should have been partly achieved, especially in terms of facilities and services improvement with refined data synchronization among venues, which currently is still an issue. Such advancement might help equally distributing the number of patients across hospitals. Healthcare would benefit from a spread-out Eco-system that, in turn, would influence how caregivers follow their relative's journey.

In fifteen years, more changes might occur. The young and middle-aged generations are now following more responsible lifestyles. Social innovation initiatives have spread around the city of Shanghai to activate major collaboration and socialization among neighbors. Stronger relationships fabric most likely can relieve local structures supporting caregivers. Community centers provide dedicated functions enriched through a community-based approach. Art and acting activities relieve stress during long-term degenerative diseases (Quinlan & Duggleby, 2009).

4.2 Research outcome

The social sensibility towards the topic is impressive, as confirmed by the interest raised by the workshop and the interviews. Potential ways to alleviate the impact of family caregiving include the connection to beliefs and Weltanschauung, keeping personal life balance, benefiting of community, and organizational support (Caregiver 1 et al., personal communication, December 20, 2019). The Chinese culture preconceptions are prompting these alleviating methods, especially for elderly caregivers. PSSD can offer suitable methodologies and tools to raise social awareness and solidarity by inviting on the stage different actors capable of co-building sustainable, more desirable future scenarios of family caregiving.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Materials Designers. Boosting Talent towards Circular Economies

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Abstract | Materials designers is an emergent professional profile which has its roots in the maker movement and whose role can have a positive impact in the development of a circular economy. As preliminary research for the development of the MaDe (Materials Designers) European project, a qualitative analysis was performed in order to identify the specific needs, opportunities and skill gaps for materials designers training and exposure, as well as for the requirements for enhancing social and industrial awareness towards circular economy issues. Based on the collected data from existing materials-related design projects, educational programs and existing initiatives, a series of recommended key-actions have been developed to define a European project that boosts creative talent towards circular economies.

KEYWORDS | MATERIAL DESIGNERS, CIRCULAR ECONOMY, CIRCULAR DESIGN, DESIGN SKILLS, EUROPEAN PROJECT

1. Introduction

The transition towards a more circular economy ((European Commission, 2015) brings great opportunities for Europe and its citizens. It is closely interlinked with crucial EU priorities on jobs and growth, investments, the social agenda and industrial innovation. The European Commission has promoted an ambitious program on Circular Economy by establishing "a common EU target for recycling 65% of municipal waste by 2030; a common EU target for recycling 75% of packaging waste by 2030; a binding target to reduce landfilling to a maximum of 10% of municipal waste by 2030." To be achieved, these goals require the involvement of civil society in creating new opportunities for materials to be used as resources for local production, and by establishing new supply chains between SMEs and industries at the city and regional levels.

Circular economy starts at the very beginning of a product's life. Both the design phase and production processes have an impact on sourcing, resource use and waste generation throughout a product's life. This circular design approach can make products more durable or more comfortable to repair, upgrade or remanufacture. It can help recyclers to disassemble products in order to recover valuable materials and components. Overall, it can help to save precious resources. Circular Design involves Service Design, Product Design and Materials Design. Most materials have an infinite life cycle. They can be reused, reformed and redesigned with a new purpose. By harnessing the unexplored potential of materials, we can implement social, economic, environmental and political change through a cross-sector approach.

Designers will play a strategic role in this transition. New industrial niche markets are developed, and new multidisciplinary creative professional profiles are spontaneously emerging. Designers and creatives are called for a more responsible role on the advancement of society, and the industry is starting to appreciate the several facets that designers can have thanks to their creative skills: designers are also changing agents, problem solvers, anthropologists, technologists, culture influencers, and environmental agents (World Economic Forum, 2016)). Design is a transversal creative discipline that can dialogue with materials science, information science and social sciences, amongst others, in order to address environmental and societal issues. Design, art and culture are driving forces to bring environmental perspectives to life in an attractive, innovative and human-centred way, such as in the European Green Deal (European commission, 2020).

More specifically, materials and material-driven design (Karana et al., 2015) have emerged as an essential driver in the transition to the circular economy (3). Studies show that more than three out of four decisions influencing the final choice of materials and manufacturing processes are made during the design phase whilst over 80% of the ecological and economic costs are made before the object is created. Design and materials have a pivotal influence on the way that products and services are made and used – they are, therefore, a crucial element in a shift towards more resource-efficient economy (Whicher, 2015).

In a time where there is this need for a more responsible role of design into environmental, technological and social issues, new designers' profiles that are aware and embody their work with the immediate and far-future concerns, emerge. In the last decades, the domain of design materials has been increasingly studied and developed due to technological advances that broadly expanded the capability to operate on the materials and due to more and more attention to sustainability issues. Remarkably, the dissemination of the Maker culture through the FabLabs and the diffusion of the do-it-yourself phenomenon changed the relationship between designers and materials, bringing designers to relate to production processes and materials manipulation. A specific emerging profile is that of materials designer, that merges circular design, materials experimentation, and new creative processes. This specialist material designer evaluates, ideates or develops materials and inspires approaches to manufacture materials for use in products that must meet specialized design and performance specifications. Some sector experts foresee Specialist Material Designers as a job of the future (Brownlee, 2016).

However, in its emerging role, industry and creative industries are not yet fully aware of the existence and potentiality of these new materials designers and how they could boost their adaptation to a circular economy. An analysis of needs, opportunities and skill gaps and the definition of key-actions to boost material designer profiles and social and industrial awareness is needed.

2. Methodology

Data of existing materials-related design projects, educational programs and existing initiatives have been collected at different levels: desk research, field research and expert sessions.

Desk Research: Extensive desk research has been performed under trends research methodologies that allow for the detection of emerging opportunities. Primary and secondary resources have been used: specialist literature (Journals (Ferrara, Rognoli, Arquilla, 2016), (Rognoli, Bianchini, Maffei & Karana, 2015) , Books (Karana, Pedgley, Rognoli, eds., 2014), (Lee, 2015), (Solanki, 2018), Forecasting reports (Viewpoint Magazine), (Wunderman Thompson Intelligence, 2017), (Space10, 2017), Conferences (Chawla, 2017) and European Commission reports (European Commission, 2013), (European Commission, 2009) and existing European projects (Design and Advanced Materials) have been reviewed to provide an accurate analysis of the field and detect barriers, weaknesses and identify needs.

Field research: This desk research information has also been complemented with field research through visits and analysis of various Design Festivals (Dutch Design Week 2017, London Design Festival 2017).

Expert sessions: a co-creation session was performed between the three authors (partners of the MaDe project), counting on their expertise and their privileged position as observers of the reality in the area of new materials, design, and its impact onto the circular economy (The Materials Experience Lab, Elisava Master in Design through New Materials).

The process for analysis follows the Futures Research methodology: collecting the information through the mentioned channels, building the evidence wall, clustering of concepts, and cartographic categorization of results (Raymond, 2010).

3. Analysis

With all this collected and analysed information, the following opportunities and needs have been identified:

Opportunities

- Materials design is a new professional profile and an emerging discipline. Specialist Materials Designer is one of the seven jobs that will grow, according to design leaders at Frog, Ideo, Artefact, Teague, and more (Brownlee, 2016).
- Transversal impact on design disciplines. There is a huge opportunity for materials designers since materials span all the design disciplines with 'physical' production.
- Materials for a circular economy quality label. There is still no specific quality label for materials designers with a focus on the circular economy. There is an opportunity for a quality label such as an Award that contributes to a more responsible purpose of design (e.g. materials for circular economies), creating a label of creative talent, knowledge and positive environmental impact.
- Fostering new alliances. There is an opportunity to create early alliances between designers and material manufacturers or industrial producers to incubate radical design-led technology ideas and start-ups.

Needs

Overall Needs

- New creative revenues. Materials designers need to understand the new economic context and the ways to interact and sell their added value to industry; as well as to understand the alternatives to find new sources of revenue. They could be entrepreneurs, creative forecasters, or materials designers within an existing industry (El Taller Esfèric, in Spain, a materials-based start-up that needs support in understanding what kind of business model they can apply to their creations).

- A common vocabulary needs to be set in place. The different disciplines of design, engineering and materials science all have a different language to describe materials, and processes and this cannot bring together a constructive collaboration. There is an imperative need to develop a mutually understandable vocabulary of definitions and techniques so that they can begin to engage at a deeper level.
- A new creative sensorial approach. Materials have been historically considered from the engineering point of view, which leads to poor communication of their tactility, sensoriality, and creative possibilities. There is a need to communicate the realm of materials and materials design from a more creative and impacting approach. There is an emerging need to create a simplistically complex platform that can bring the nature of new materials in their many processed states to the design community.
- Systems thinking. There is a need to consider local identity, lifecycles and systems thinking, proposing an alternative approach to applying materials, encouraging a positive economic, environmental and social change, revealing the truth of how we live today and might live tomorrow.

Specific needs for creatives and designers

- Skill gaps. Addressing skills gaps appears often highlighted as a challenge in multiple policy papers in the domain of Cultural and Creative Industries (i.e. Design), Key Enabling Technologies (i.e. Advanced materials) or the Circular Economy: COM(2012) 537 final "Promoting cultural and creative sectors for growth and jobs in the EU"; COM(2016) 381 final "Working together to strengthen human capital, employability and competitiveness"; COM(2015) 614 final "Closing the loop - An EU action plan for the Circular Economy"; COM(2014) 446 final. "Green Employment Initiative: Tapping into the job creation potential of the green economy"; SEC(2009)501 final. "Design as a driver of user-centred innovation". The Design Council (UK) has recently published "Designing a future economy. Developing design skills for productivity and innovation" (Design Council, 2017). This report catalogues the skills intricately connected to design and innovation. Design skills are the fusion of creativity with technical ability and interpersonal competencies and will be essential for any economy seeking to maximise the opportunities of technological advancements. Yet with these opportunities come significant challenges. The research, as mentioned earlier, shows that the UK has skills gaps and shortages in design and a narrowing pipeline of young designers who could otherwise fill these roles.

Specific needs for companies and industries

- Future-fit production. The industry is not aware of the existence and potentiality of these new materials-designers and how they could boost their adaptation to a

circular economy. There is a need to evaluate and certify new materials in order to introduce them to the value chain.

- Impacting message. There is a lack of common consensus in the language and opportunities that materials design is and can impact on. The industry is in need of a comprehensible language that they can adopt to be more aware of sustainability issues linked to materials.

Specific needs for Design Stakeholders and General Public

- New perspectives on sustainability. Associations, regional public bodies and NGO need to address from new perspectives the sustainability issue. There is a need to generate more dialogue between these design stakeholders and the designers and companies in order to understand the new context for the circular economy and how materials can address it.
- General awareness. Citizens need to understand how materials are the Trojan horse for sustainable solutions, becoming more aware of their consumer choices.

Skills gaps

These are the identified appropriate skills to become a Specialist Materials Designer:

1. Sectorial Transversality. Understanding the transversality of materials and connecting solutions from different industries.
2. Scientific and creative. Adopting a multidisciplinary view of materials, both from a creative and scientific approach.
3. Sustainability and circular economies. Understanding circular economies in the context of design and materials.
4. Hybrid of traditional and computerised skills. Mastering hybrid skills that bridge traditional craft techniques with technological innovation in the field of materials processing (3D printing; Computer-aided fabrication,…).
5. Locality. Understanding the potentiality of local materials knowledge and culture
6. Business models. Gaining new business models' knowledge that enables materials designers to envision alternative mainstream industry solutions and new sources of revenues.
7. Different production sectors. Understanding the different productive sectors, they can impact with their creations.
8. Hands-on experimentation. Adopting experimental methodologies and DIY techniques from other disciplines and bringing them into the creative ones.
9. Visual communication. Creating an attractive visual project to ensure high communication impact of any experimental creative project.

4. Results

Material Designers (MaDe) is a Creative Europe programme that addresses specific skills needs for designers within the circular economy paradigm. MaDe's approach considers materials design and materials making as a remarkable driving force behind innovation and responds to the question: What if we used creativity to provide better circular economy solutions through the ideation of new materials?

Based on the previous analysis and identification of opportunities, needs and skill gaps, a series of key actions have been defined and are the ones applied in the development of the MaDe project:

Objectives

The objectives of this programme are as follows:

1. To explore and obtain a better understanding on how can materials' design contribute to attain a more circular economy; providing thus tools, strategies, guides, contents, education, in order to enable designers (i.e. fashion, furniture, objects, packaging,...) and new creatives (i.e. materials designers) to connect to the industry.
2. To spot the European materials designers emerging scene in order to identify the most talented and promising creatives in this domain.
3. To provide 120 European students from different creative areas (design, arts, ...) with the appropriate skills to enhance their career as Specialist Materials Designers, which is foreseen 14 as a job of the future in the design industry.
4. To foster the career development and recognition of emerging materials designers through the circulation of their works, awards and professional stages in order to make them gain visibility among the industry, which is keen on incorporating a circular economy approach.
5. To connect new materials with designers and the industry through a digital platform that makes the tactility of materials come to life by enhancing the experience.
6. To ensure the broadest impact for MaDe's educational resources and primary outcomes through public presentation events to European industry (i.e. when main Design Weeks occur) and a proper communication and dissemination program.

Training

Workshop implementation is aimed at addressing Specialist Materials Designers skills gaps by training a selected group of 120 European designers and new creatives; and at generating a new breed of materials designers and 120 materials design projects to be displayed and

promoted. This training action addresses Specialist Materials Designers skills gaps and covers the need to gain a deep understanding of challenges for designers when approaching a more circular economy. In order to promote international cooperation capacity and foster exchange of experiences, the workshops take place in 3 different European cities and have a cooperative scheme with other material network stakeholders.

Material Network and Platform

A MaDe network is necessary to cover some of the identified needs. MaDe gathers two complementary academic partners: ELISAVA from Spain and POLIMI from Italy; and a disruptive design studio from the UK (Ma-tt-er). Partners pool expertise in the area of new materials, design, communication and its impact onto the circular economy with a complementary approach, which derives from the preliminary analysis of needs. Additionally, a network of other associated European design institutions reinforces talent spotting, skill training insights and transnational mobility. Dissemination of results and visualization of material designers towards the industry and the wider public needs the support and engagement in the network of other stakeholders that reach industry and professionals (FAD Spain, ADI Italia to name a few), and a platform that can reach society, such as the Ellen Macarthur Foundation. This platform works to inspire a generation to re-think, re-design and build a positive future circular economy. They have an educational department as well as a dissemination department, which includes the managing of the Disruptive Innovation Festival (DIF), and the generation of publications such as the Circular Design Guide together with IDEO.

An online platform will be key to connect multiple levels of agents and generating engagement from our target audiences and to disseminate the results of the project thus creating awareness regarding the importance of materials in the circular economy. This online platform has to aim at tackling the visual challenges of materials' tactility as well as providing a platform for new sources of revenues for designers.

Quality Label

There is a need to establish a quality label for material design, recognizing excellence. A MaDe Award should be the vehicle for this excellence recognition through each of the following categories: Best start-up potential / Best future vision / Best industry application.

The MaDe Award categories will be:

(A) MaDe Award 1 - Best start-up potential.

(B) MaDe Award 2 - Best future vision.

(C) MaDe Award 3 - Best industry application.

The MaDe Award Jury, from the MaDe network, is a key factor for the dissemination and excellence of the Award. General and specific criteria for excellence of the MaDe Award is defined as follows:

General: Degree of innovation | Degree of creativity | Formal and Technical quality | Self-explanatory quality | Symbolic and emotional content | Number of potential applications, short or long term.

Specific for each category:

(A) A project with a high potential to become, in the short term, a materials-based start-up with a focus on the circular economy.

(B) A speculative materials project with an elevated future impact on society and industry in terms of the circular economy.

(C) A materials project that has a high potential to be applied, in the short term, in industry, initiating the transformation towards circular economy.

The MaDe Award prize consists of a fellowship to perform a stage into a Company or Institution and develop a materials design project.

Fellowships

The MaDe Awards grants the three winners with a unique opportunity to develop a materials design project in a professional environment and mentored by high-skilled tutors. The goals are to raise awareness on industry, companies and organisations for the need of materials designers professionals with a circular economy vision and to boost materials designers professional careers by introducing them to the industry.

The fellowship is a paid internship where each winning designer will develop a project at a different company/organisation and with different objectives depending on the category of the MaDe Award:

(A) MaDe Award 1 - Best start-up potential:

Objective: Stage in a business incubator to develop the final business model of their own company.

(B) MaDe Award 2 - Best future vision:

Objective: Stage in creative industry company or marketing department to develop a communication project that helps raise awareness on the importance of materials in the circular economy.

(C) MaDe Award 3 - Best industry application:

Objective: Stage in a Company to develop a joint capsule collection, promoting circular products in companies.

Exhibition

In order to cover the need to raise awareness among industry and the wider public towards materials design for circular economies and to give important visibility of the MaDe project to a broad audience an exhibition or showcase of the materials design projects is a key action to develop.

Key awareness messages

Another key action is to inform and explain how Specialist Materials Designers can contribute to a better circular economy and to disseminate a clear message for each different audience:

a) For creatives, designers:

- MaDe will provide you with key skills to promote your professional career in the design industry.
- By being present in the MaDe on-line platform, MaDe will help you to improve your visibility and chances for an extra communication channel and/or a future job opportunities.

b) For companies:

- They can be prepared for the future by incorporating materials adapted to a circular economy.
- They can improve the quality of their products thus their competitiveness into the market regarding the systematic use of design and a material-driven design approach.

c) For opinion leaders:

- To get a glimpse on the future of design, acknowledging the most disruptive designers.

d) For wider audiences:

- Design takes responsibility and provides more sustainable futures.

5. Conclusions

MaDe project results aim to provide a platform which recognizes the potential of designers and the material they could create across all creative sectors aiming at creating a circular economy. The combination of key actions such as Training, Network and platforms, Quality label and Awards, Fellowships and Exhibition aims at covering needs and skill gaps for material designers and industrial and societal awareness towards a circular economy. MaDe

project will showcase and demonstrate the positive impact that material designers can have across the industry which will kickstart the futures of those hoping to affect the European material landscape.

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Acknowledgements: We acknowledge support from the Creative Europe programme.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Preparedness and infrastructure design for disaster and emergency situations; the key to a resilient community

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Abstract | Natural disasters appear to be growing in number and intensity due to global warming, population explosion, widespread travel and the overcrowding of cities. We aimed to augment students' knowledge and awareness of disaster situations with a focus on the needs of special populations (e.g., elderly people, people with disabilities, children, pregnant women) to develop the infrastructure needed for improving preparedness and resilience. Design concepts were developed in studios by industrial design and architecture graduate students. Representative design concepts of infrastructures, including designs for shelter and storage facilities and communication and information hubs, solutions for rescuing individuals from fires using smart innovative technologies and design concepts for people with special needs, are presented. We believe that preparedness and the development of infrastructure designs will increase individual and national population resilience, increase trust among the citizens in the municipality and enable people to successfully cope with potential traumatic events, thus leading to a physically and mentally healthy community.

KEYWORDS: DISASTER, EMERGENCY, INFRASTRUCTURE, RESILIENCE, PREPAREDNESS

1. Introduction

Climate change and global warming are expected to be the greatest threats to worldwide health in the 21st century, and together with population explosion, widespread travel, and the overcrowding of cities, they will result in an increased frequency, severity and coverage of natural disasters (Alexander, 2006; Guha-Sapir & Hoyois, 2015). Common natural disasters include earthquakes, tsunamis, storms such as hurricanes and tornadoes, floods, avalanches, epidemics (e.g., SARS, Ebola outbreaks), droughts, and cold and heat waves.

The basic assumption is that thousands of people will be harmed and remain homeless, infrastructures will be damaged or unusable, roads will be blocked for extended periods, and this damage will be followed by economic loss, so the population will need to be able to rebuild (mentally and/or physically) (Norris et al. 2002; Norris et al. 2002). Disasters require a rapid response; this need is currently met by national and international organizations sending medical and humanitarian assistance and support, including food, temporary housing, clothing and more (Alexander, 2006; Bitterman & Zimmer, 2018; Franco et al, 2007; Guha-Sapir et al., 2004).

Past experience has shown that external humanitarian support will arrive a few days after a disaster, but immediately following the disaster, the locally available resources and community (neighbours, friends and family) help people recover. Thus, the by-standers are the immediate responders (Ashkenazi & Hunt, 2019), and they should therefore be supported with the necessary resources.

Moreover, rescue delegations stay for a limited time period, and they mainly address acute situations and direct disaster causalities. The equipment transported is not always suitable for the specific type of disaster, conditions at the disaster location and people's needs and may not last for long-term use (Tierney, 2019). There is no continuity of care for "Day Two" or the treatment of the local citizens (e.g., chronic disease); thus, long-term deleterious effects on the healthcare status and on the resilience of the population occur.

It is therefore the responsibility of the nation and local communities to be prepared for disaster situations, so that they can support citizens with the needed resources and enhance their ability to recover and return to normal everyday life as soon as possible after the event (community resilience) (Kimhi, 2016).

2. Aims

Based on the prevalence and importance of emergency situations following disasters, we have decided to integrate the topic of 'design for emergencies' into the curriculum for design and architecture studies. Specifically, studio sessions were designed to achieve the following goals:

a. To augment students' knowledge and awareness of disaster situations (natural and man-made disasters) with a focus on the needs of special populations (e.g., elderly people; people with motor, cognitive or sensory impairment; children; pregnant women).
b. Be familiar with the principles of exposure to extreme environments (extraordinary physical, psychological, and interpersonal demands that require significant human adaptation for survival and performance).
c. Design products, structures and services to rescue, treat, support, and improve the quality of life of the people affected by disasters based on literature review and market survey, task analysis and applying human factors principles and structured design procedures.

3. Methods

Full semester-long studios that were dedicated to the topic "design for emergencies" were held for graduate students in industrial design and architecture programmes.

The studio/workshop curriculum included lectures on theoretical and practical topics related to disasters and performance in extreme environments, lectures presented by invited speakers, visits to the Civil Protection Centre, short-term and mid-term assignments, and a final project that was completed and presented by the students.

The first assignment was to conduct a literature and web survey based on the following keywords: disaster, rescue, hazard, natural disasters, specific types of disasters (e.g., earthquakes, floods, storms, tsunamis), climate change, and global warming. The search was performed via search engines such as Google Scholar, Scopus, PubMed, Internet sites, the National Geographic website, journalists' reports, TED videos, personal stories of people who experienced disasters, international websites of disaster-related organizations and even movies.

The lecture topics included physiological information, performance in extreme environments (e.g., hypothermia), the physiology of subpopulations (elderly people, people of specific genders, children, people with disabilities), sensory physiology, biomimicry and inspiration from nature, smart innovative technologies (monitoring, sensors, Big Data), human factors and principles of task analysis, data collection and presentation .

The mid-assignments were to select a specific disaster and population at risk, conducted a more focused literature review and market survey, design several concepts that may be selected for the detailed final project.

The final assignment was to design a product or system for designated users in disaster situations according to their needs. The final report contained a detailed report documenting all stages of the work and drawings, a storyboard, an engineering description, the final design concept evaluating the trade-offs, constraints and future directions, a class presentation with a video, 3D models and a poster for the final exhibition.

4. Results

4.1. Overview of natural disasters and people's needs

Natural disasters can be classified as direct or indirect manifestations, as shown in Figure 1. *Direct disasters* are major natural disasters, including earthquakes, storms such as tornadoes and hurricanes, tsunamis, avalanches, floods, droughts, cold waves, heat waves, epidemics, floods, and sandstorms (Figure 1), generally resulting as a direct effect of climate change and global warming. A high level of synergism and interrelations across the different disasters is common, resulting in multidirectional, multifunctional disasters; therefore, people should expect events of multidimensional types of damage.
Indirect disasters (cascading disasters) are those that threaten population health through adverse changes in the air pollution and air quality, diseases (e.g., asthma), water-related contamination, the spread of disease vectors, food insecurity and under-nutrition,

displacement, and mental diseases (Field et al., 2012; Tierney, 2019; Watt et al, 2015; Norris et al., 2002), as shown in Figure 1.

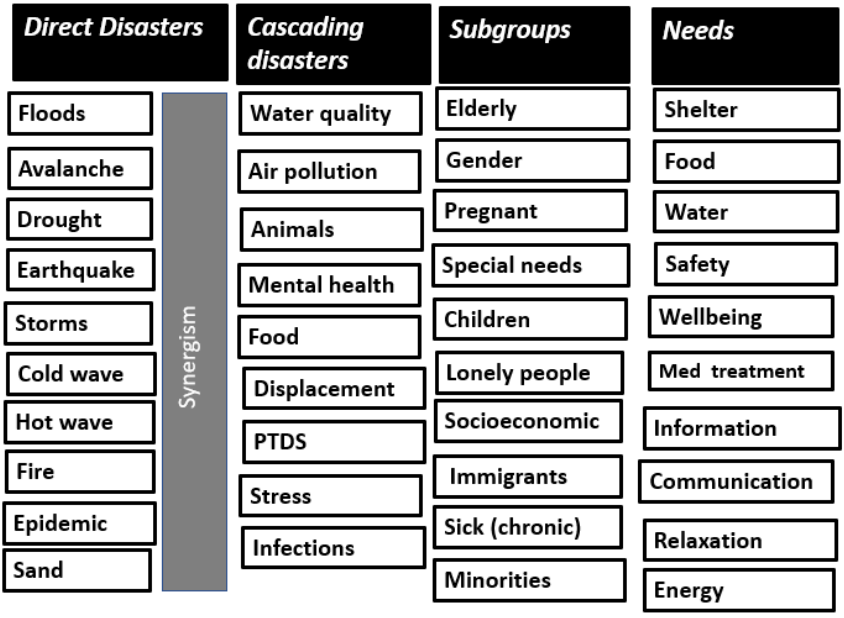


Figure 1. Overview of the natural disasters, subgroups of individuals at risk and specific needs during emergency situations.

The special subgroups of individuals at risk include weakened and vulnerable populations (Figure 1). The ageing population seems to be the greatest challenge of the coming century (Harper, 2014; Eurostat), and in the future, more elderly people will be exposed to emergency situations and their cascading effects. Elderly and specifically lonely people have been reported to be among the most vulnerable individuals who suffer and die in emergency situations (Fernandez et al., 2002; Ngo, 2001; Pekovic, Seff & Rockman, 2008; Tierney, 2019). Other subgroups at risk include females, pregnant women, children, people with special needs and disabilities, minorities, immigrants and people of low socioeconomic classes (Figure 1) (Tierney, 2019).

The needs in disaster situations are basic and immediate physical requirements, including shelter and clothing, food and water, safety, medical treatment, information, communication, relaxation, wellness and energy.

4.2. Student projects

Based on the overview (Figure 1), we identified the main design challenges associated with disaster and emergency situations as the early detection of danger, fast and effective information and communication, locating survivors, a supply of food and water, shelter, clothing and mental health relief, to be supplied on-site immediately after disaster events. The students were asked to select one specific disaster, while considering its synergism with other disasters and its cascading effects. If possible, a specific group of users was identified, and the students were asked to find ways to address to their needs.
Examples of students' work are presented under five categories in the following paragraphs: infrastructures of facilities for shelter and salvage, communication and information hubs, designs for people with special needs, rescue (mainly from wildfires) and a relaxation site for children. All projects presented herein are primary design concepts developed by students and should therefore be regarded accordingly.

Infrastructures of shelters and rescue facilities

Disasters arrive largely unannounced, although some disasters such as storms may have some warning (Tierney, 2019); because there is often little time to prepare for disasters, the autonomous activation of available infrastructures for shelter and rescue is needed.
Figure 2 presents concepts for shelter and rescue facilities that have been designed as integrated parts of the landscape that can be activated autonomously by smart sensors upon the onset of emergency situations. The basic idea is that shelter and rescue systems should be available and accessible in public areas, ready to be activated whenever needed, without interrupting or burdening individuals' daily activities or the landscape appearance (e.g., systems stored below ground, installations that have other functions the absence of disasters, or rescue systems that are embedded and integrated with an exterior public component) or being activated in an unmanned manner.

A B

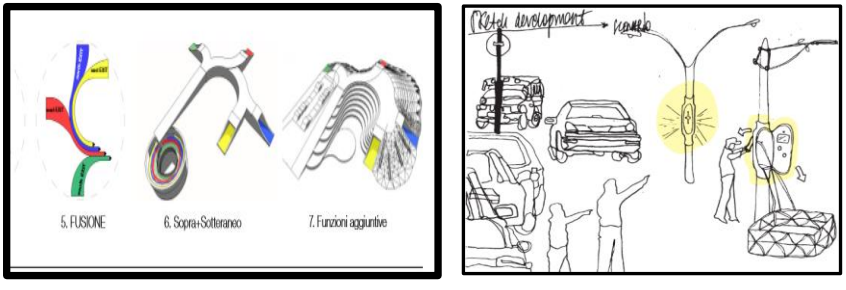


Figure 2A. An underground shelter built as part of a recreation park that is normally closed and opens automatically, unmanned, for citizens use on the onset of storms (e.g. hurricane or

tornado) (Veronika Basova). B. A rescue boat to be released and inflated after floods from light column pillars distributed in the public space containing also first aid equipment (Piazzon Eleonora)

Communication aids and information centres

The needs to communicate and obtain information are among the greatest needs of people in emergency situations, especially because wireless communication and mobile phones are not reliable during disasters and may collapse and power may be down, preventing people from charging their cellular phones. It is therefore essential to guarantee redundancy in transmission options and keep cable (wired) phone and public phone boxes functioning or develop independent local communication nets that are continuously active and functioning. Several projects were developed based on the pop-up principle; temporary information and communication hubs containing solar energy sources for charging cellular phones and storage facilities that are located underground, activated and erected automatically when needed by specific sensors were developed. The facilities were located at central and well recognized places containing necessities for the local people for the first days after a disaster, including water, food, first aid supplies, protective clothing and basic equipment for rescue and the removal of ruins, as it has been shown that bystanders are the first responders after a disaster (Ashkenazi & Hunt, 2019) (Figure 3A).

A B

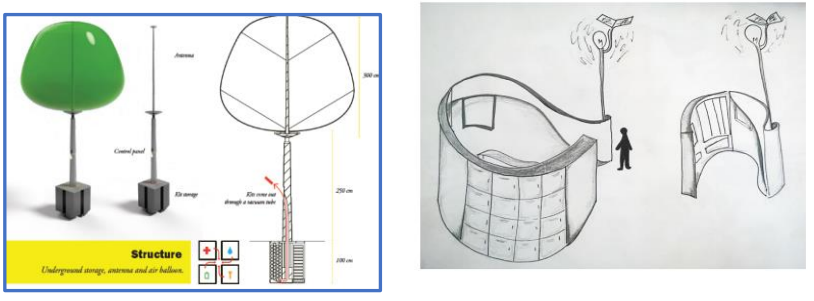
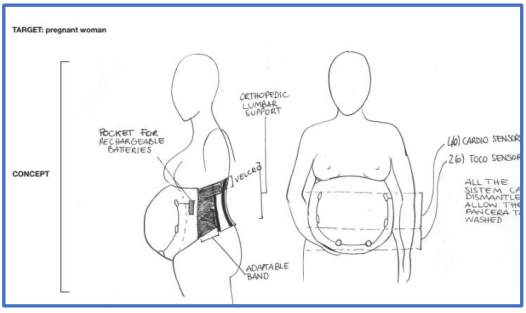


Figure 3. Communication, information and storage infrastructures: A. A meeting hub to be erected automatically after a disaster; it has a green balloon that is inflated to indicate the location of the information and communication centre and emergency kits with medication, water, and food that are stored underground (Marco da Rose). B. An underground storage unit located below bus stations to be erected when needed for the immediate use of locals after an emergency situation; they contain medication, water, food, tools needed for rescue and digging and a power bank for charging mobile phones (Kena Sofia Flores Sierra)

Design solutions for people with special needs

A line of products was designed for people with special needs, who are vulnerable in emergency situations. All products are generally easy to use, foldable or lightweight, made from conventional materials or equipment and have multiple applications, even for non-disaster situations; thus, they are promising, sustainable and cost-effective solutions. Figure 4A presents a kit for pregnant women to be delivered to disaster areas for women who are naturally under stress, cannot contact their doctors and are concerned for their baby. A solution for an elderly and disabled person at risk during earthquake is presented in Figure 4A.

A



B



Figure 4A. A wearable belt with back support for pregnant woman, containing cardiotocograph equipment that is embedded into the adjustable elastic material for follow-up monitoring of foetal movements and heartbeats and the capability to send the data to a medical centre located at a safe remote location (Marzia Bello). 4B. A standard wheelchair for elderly people and people with movement impairment that is equipped with protective elements for falling particles; the protection is normally housed within the wheels and handles and can be erected automatically during an earthquake (Andrea Zamboni)

Additional projects (not presented herein) included a foldable, lightweight, inexpensive "all in one" baby cot for fast, easy air transportation; adaptable, personalized air masks for babies and toddlers during hazardous air pollution conditions; and eye masks equipped with a light source, calming music and audiobooks to provide companionship for elderly people during lonely and stressful periods after disasters.

Infrastructure to rescue individuals from fires

Fires are a global hazard, a primary disaster, and a cascading event accompanying several types of natural and man-made disasters. Numerous fire-related events have recently occurred, and unfortunately, we were unable to save people from the fires, especially those

on high floors in skyscrapers, crowded areas and remote locations, such as forests. The designs developed by students involved smart innovative technologies for the early detection of fires, setting effective alarms, identify trapped people and people with special needs (e.g., disabled and lonely people) and autonomously rescue individuals without risking the lives of firefighters (Figure 5A).

In particular, people with dangerous occupations who are frequently exposed to extreme conditions were considered. Figure 5B presents a concept for a firefighter's uniform including advanced technological aids to ensure the safe monitoring of physiological parameters and environmental conditions. A related design, a protection suit, for healthcare staff and volunteers in areas with highly infective diseases (e.g., Ebola, SARS) and other risky conditions was developed using high-tech accessories and advanced innovative materials for the suit. In addition, the suit is designed to be comfortable to operate in extreme temperatures and easy to don and doff in a safe, unobtrusive manner without being risking infection of the user.

A



B

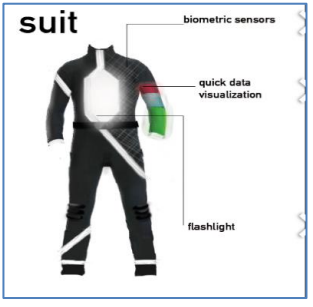


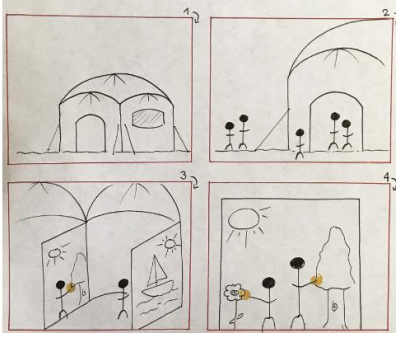
Figure 5A. A concept for a rescue system to be used for people trapped in fires (e.g., in the forest); the system includes automatic/smart sensors to detect trapped people, a system for the autonomous delivery of a protection suit, and important information, and it provides safe, unmanned evacuation (Malia Priola). 5B. A full-body suit for firefighters that provides protection, information display, has a light source embedded in the front of the suit, has shoes that leave behind markers for persons needing to follow the firefighters route and location, and smart wearable display on the sleeve for physiological data and personal warnings (Luigi Leopizzi).

Early treatment for on-site relief and relaxation

Children and elderly people are among the most sensitive age groups, as they have a high chance of being ignored during emergency situations (Tierney, 2019) when the main rescue efforts are focused on searching for people, rescuing them, treating injures, obtaining information about missing people and other tasks. Over the years, studies have shown the

importance of early mental treatment to reduce damage and even prevent post-traumatic stress disorder (PTSD) (Neria, Nandi & Galea, 2008; Lai, 2017). Posttraumatic stress symptoms can occur in children after disaster exposure (Lai at al., 2017). It is important therefore to deliver mental health relief to children at the first line of rescue. However, the human resources needed for immediate on-site mental health help and accessibility to consumable leisure equipment (e.g., games, painting supplies, books, leisure equipment) are limited. Therefore, the concepts that were suggested by students involve unmanned, smart virtual technologies that use non-consumable tools integrated into a portable, flexible structure that can be safely stored until needed or transported with the first support of humanitarian delegations.

A



B

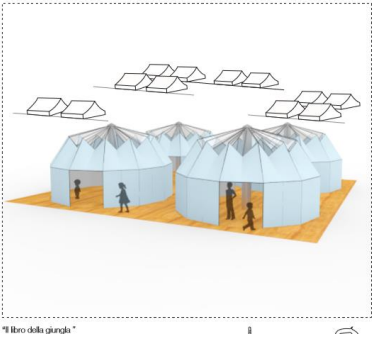


Figure 6A. An interactive display for children that is placed in a shelter structure to induce relaxation and reduce stress; the children can use this display at any time of the day without adults, as it is based on interactive stories and smart electronic virtual technology (e.g., electronic ink) (Edda Zearo). 6B. An overview of an interactive unit for children; a portable, foldable, modular, "all-in-one structure" with a virtual interactive display embedded within the walls (all-in-one installation) .

5. Summary and future directions

Most of the projects developed by the students are based on the concept of planning an infrastructure of shelter facilities, storage units, information and communication hubs and aids to assist people with specific needs (elderly people, children, persons with sensory and motor impairment, pregnant women), who are at risk in emergency situations. The basic principle involves using a variety of sensors and actuators that are dispersed or integrated within the environment to continuously collect follow-up data and allow smart autonomous responses to be elicited when needed in active, pre-prepared infrastructure.
The suggested future directions for the design of infrastructure for emergencies are as follows:

A. Autonomous systems, such as robots and drones, can be used to increase the safety and accessibility of individuals, to overcome the shortage of human resources, and increase extend and abilities of identification and rescue of victims (Murphy et al., 2016).
B. 3-dimensional (3D) building technologies can be used in disaster areas to enable fast and safe construction and repurpose local materials, enabling a personalized, sustainable and cost-effective building tailored to a specific site and the local people's needs (e.g., utilizing the wreckage after an earthquake as a building material using 3D printers).
C. Advanced innovative materials that have multiple qualities and contain embedded smart technologies, such as actuators, illumination, smart sensors that are responsive to different temperatures, and solar panels that supply energy, can be used (McEvoy & Correll, 2015).
D. Buildings can be constructed with air (Airtecture), as using air-inflated fabric structures offers numerous benefits. Air, a natural and no-cost substance, is available everywhere and is universal and sustainable. Air can replace traditional load-bearing components and offer temperature isolation, lightness, ease in shipping, and options for modularity by partial inflation. The benefits are the decreased use of building materials, reduced material waste, and easy re-use of facilities (Kronenburg, 2013).

6. Conclusions

Designing infrastructure for emergency situations is a multidisciplinary challenge that should involve researchers; scientists; professionals in the fields of design, material engineering, psychology, and emergency and military medicine; search and rescue (SAR) teams; and humanitarian organizations. Given the prospect of an increase in disaster situations, both natural and man-made, and city crowding, the need for building infrastructure and preparedness for emergencies is growing. Thus, innovative solutions and redesigns of facilities that allow them to adapt to the various humanitarian needs arising in emergency situations can be developed with the use of advanced and innovative methods and concepts. We believe that this approach will be sustainable and cost effective, will further serve as a beta site for innovation and enterprise, and will contribute to the resilience of society.
We believe that introducing graduate students with multidisciplinary backgrounds to issues of disaster preparedness will increase their awareness on how to incorporate physical infrastructures in their future projects.
Preparedness and the development of designs of infrastructures will increase individual and national resilience, improve the trust of the citizens in the municipality and enable people to successfully cope with potential traumatic events, thus leading to a physically and mentally healthy community.

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Acknowledgements: The work was performed while Noemi Bitterman was a visiting professor in Iuav Venice. We would like to thank all the students for their hard and creative work while being exposed to new topics. Special thanks to Francesco Foti MD for his lectures and his professional contributions. The names of the students whose projects are presented in the pictures are indicated in brackets.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Replicating the Unpredictable: Board Games as Prototypes for Wildfire Evacuations

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Abstract | As the frequency and scale of wildfires grows it is critical that communities in fire prone areas are able to develop and implement effective evacuation procedures. Yet, despite the high degree of danger associated with wildfire evacuations, there are very few chances to explore these types of procedures in a way that are low-risk, iterative, and leverage local knowledge. Very little progress has been made on the way we might "prototype" evacuation events. This paper draws on an expanded notion of prototyping and demonstrates the ways a board game has been used to develop greater understanding of wildfire evacuation procedures. The game supports cross-disciplinary collaboration, insights from the community, and elevated an understanding of a highly complex scenario. The findings suggest a rich potential for the ways games can be used to quickly explore other complex systems with minimal risk in dramatically reduced timeframes.

KEYWORDS | PROTOTYPING, SYSTEMS DESIGN, DISASTER RESPONSE, COMMUNITY RESILIENCE, DESIGN THINKING

1. Introduction

As the increasingly severe impacts of climate change affect communities around the globe, evacuation events are becoming far more common[(1)]. Within this realm, escape from wildfires has proven to be particularly vexing for emergency personnel and community members. The complexity and scale of wildfire evacuations makes it very difficult to explore these types of events in an iterative and low-risk way. The result is that few future evacuees ever get a chance to experience how they might respond, communicate, and make decisions until they are in the midst of a life-threatening situation.

Our team addressed this challenge though the disciplinary lenses of design, public policy, and civil engineering. Our goal was to enhance effective decision-making by community members during wildfire evacuations. As the lead designer on the team, I was responsible for finding ways to prototype evacuation scenarios that would help our team surface knowledge from the local community, uncover nuanced information, and support the generation of new ideas and approaches by a group of diverse stakeholders.

Prior to this project, several members of our team had conducted research on the evacuation from the Camp Fire of 2018 that that resulted in the loss of 86 people in Paradise, California. Although that event had many factors that were unique, the need for safe evacuations is a consistent theme for all communities at risk of natural or human-caused disasters. Our team's goal was to increase the efficacy of evacuations so that communities in wildfire-prone areas could more resilient in the face of this increasing danger.

2. Project Overview

2.1 The Growing Threat of Wildfires

The frequency and size of wildfires in the last several years foreshadows the types of events that we can expect as the effects of human-caused climate change become more prevalent. The swift movement, scale, and unpredictable nature of these disasters make them particularly dangerous for the growing number of people who live in areas that are susceptible to this type of hazard (Radeloff et al, 2018). Wildfire evacuations are particularly challenging because, unlike more foreseeable evacuation triggers like sea level rise, flooding or hurricanes, wildfires arrive with little notice and they grow and change in dramatic and unpredictable ways. Few community members are trained how to act in the event of a wildfire and fewer still get to practice their responses in a low-risk environment. In these scenarios, an evacuee must mobilize quickly, react under pressure, and make decisions with incomplete, changing or conflicting information (Comfort et al, 2020). Given the stakes of this situation, our team has been seeking ways to empower communities to develop

strategies for resilience and communication to when they are affected by these massive events.

2.2 A Community at Risk

As part of this project, our team partnered with the community of Bolinas, California. This unincorporated coastal community of about 1500 people is situated in the beautiful natural setting of Marin County, to the northwest of San Francisco. Although Bolinas is technically not far from more populated areas, the fact that it is only accessible by Highway 1, a two lane road that clings to the dramatic coastline with countless switchbacks, gives the town a sense of seclusion. But the isolation that makes Bolinas an attractive place for its residents also presents challenges during the very likely event of an evacuation. The community is at risk of multiple natural threats. In addition to lying on top of the famous San Andreas Fault, much of Bolinas is in low-lying areas which make it vulnerable to sea level rise and tsunamis. Bolinas is also part of the Wildland-Urban Interface (WUI) which makes it particularly susceptible to wildfires.

While the geography and limited access make Bolinas it a fitting analog for other at-risk communities, Bolinas has a few unique challenges of its own. First, its small population means that it does not have the emergency resources that would be common for a larger municipality. Bolinas has just two full time firefighters so it relies on part time staff and volunteers to operate its two Engines and one Ladder truck. The community does have a "mutual aid" agreement with Marin County whereby any available firefighters would be sent to Bolinas in cases where the Bolinas Fire Fighters needs additional assistance. While this type of agreement may work for localized fires it puts Bolinas at particular risk in regional events when the Marin County firefighters will likely be addressing fires in their own community. [(2)]

Bolinas' geography, infrastructure, and governance means that it has an outsized threat and limited resources. In the event of a large scale wildfire, the community is unlikely to have the luxury of waiting for help from the outside. The only safe course of action will be to get out.

2.3 Evacuation as a Complex System

Evacuation is a deceptively simple term for a series of intersecting systems of communication, behaviors, artifacts, policies, as well as natural and unnatural phenomena. To design an effective evacuation procedure, one must view the system as a whole. Unfortunately, a systems lens often results in meeting complexity with complexity so that a "prototype" in the policy realm is a pilot program that may be years in the making (Kontschieder, 2018).

In the emergency preparedness realm, interventions usually manifest as awareness campaigns or yearly drills. Educational campaigns are relatively inexpensive way to share best practices, but they have few, if any, mechanisms to tap into the knowledge of the

community or learn from the uncertainty that will surely impact any live scenario.[3] Disaster response drills bring people together to create a more embodied experience of an emergency, but the logistics of these events is complex enough that they are usually only yearly events. While these efforts are beneficial, much more needs to be done to adequately prepare community members for these complex events that require rapid decision-making in stressful, high-risk scenarios. With the exception of military, law enforcement and emergency personnel, few people ever get the chance to "practice" how they would respond in these types of events.

2.4 Project Objective

Our goal was to enhance the ability of community members to make effective decisions during wildfire evacuation events. Our team recognized that our combined expertise not be fully sufficient. Any successful intervention would also rely on the specific, local knowledge of the community members. Our broader group of academics, emergency personnel and community members aligned with what Ezio Manzini describes as *expert* and *diffuse* designers (Manzini, 2015). In this sense, the author, in the role of the *expert designer*, sought to develop a prototype which would "feed and support" the community's ability to develop more effective evacuation procedures (Manzini, 2015).

3. Prototyping Complex Systems

In order to achieve this ambitious goal, our team needed to find a way to *quickly explore behaviors during a life-threatening event, with innumerable variables, in way that supports collaboration, idea generation, and understanding between a diverse group of stakeholders?* We did this by utilizing an expanded notion of prototyping that defines the practice as "any intervention that enhances our ability to learn about an aspect of a design challenge with limited risk, investment and time" (Maiorana, 2017). Traditional prototyping definitions which rely on notions of validation and progressive iterations are not possible because the system itself is in flux (Senge, 2006). Furthermore, systemic challenges defy "solving" in a traditional sense as noted by Horst and Rittel in their seminal work on "wicked problems" (Rittel and Webber, 1973). By shifting our understanding of a prototype from an early version of a solution to a tool for exploration, we are able to create more "cycles of learning" in a systems context than would be possible if we think of a prototype in a traditional way (Kelley and Kelley, 2013).

This new approach to prototyping can be summed up in two deceptively simple questions.

1. What do we need to learn?
2. What is the fastest way we can learn it?

The first question helps a team to be more efficient by narrowing the scope. The team only builds what is necessary to support the most critical learning objectives. This approach is

effective for bounded and unbounded design challenges and has been popularized by terms like *Minimum Viable Product* (MVP) from The Lean Start-up (Ries, 2011). A thoughtful answer to this first question requires a team to explore their "solution" in a way that acknowledges all of the potential ways it might fail, and then explore the weakest aspect first[(4)] (Ries, 2011). A team must be willing to take a critical look at their solution from a broad perspective and not simply set out to solve the challenges that fall within the team's core domains.

If the first question establishes the intention of the prototype, the second question is about using creative ways to explore the area of focus as quickly as possible. When addressing this question, a team must relax the typical conception of what constitutes a prototype. In doing so, they can open up new possibilities to uncover meaningful information in dramatically reduced timeframes (Maiorana, 2020).

Our grant proposal articulated the areas we needed to explore in order to develop a more effective approach to evacuations. Simply put, our team needed to more deeply understand how community members would respond in the event of a wildfire evacuation. Within that, we knew that the elements of ***communication***, ***transportation*** and their ***specific strategies*** (where to go and how to get there) would be most critical. With these objectives in mind, we then moved to the next question; What was the fastest way we could learn about the community members' communication, transportation, and strategies during a wildfire event?

Escaping from a wildfire places an evacuee in a situation with more pressure, risk, and ambiguity than they may have ever faced in their lives. As a result, gathering data about these experiences through surveys or interviews will only yield so much data (Beckman and Barry, 2007). Furthermore, many people have never lived through an evacuation so any information gathered purely hypothetical. In addition, while a survey would provide effective data for questions we understood, it wouldn't provide a space for new questions or community knowledge to emerge (Portigal, 2013). We needed a situation which would yield insights about how the community members would interact with the messy, stressful and ambiguous aspects of an evacuation without the associated risks. We did this by creating a board game.

4. Game as a Systems Prototype

A tactile game may seem to be an unlikely way to address something as complicated as a wildfire evacuation scenario, but the simplicity of the platform is actually quite well suited to prototype a system. Although the technology is modest, simple elements like cards and randomized spinners can bring a complex set of scenarios and behaviors to the forefront. The approachability of a board game supports a richer conversation by minimizing the power differentials that are implied by more elaborate offerings (Rettig, 1994). Finally, board games can be played in relatively short periods of time which results in greater learning in a more

compressed timeframe that would be possible with more full scale experiences like evacuation drills.(5)

4.1 Overview of the Game

The game is played around a large table with a 3' x 5' map of Bolinas at the center. There are several types of game pieces including cards, spinners, and tokens that represent fire, people, vehicles, and communication options. Players inhabit one of the three following roles:

- The Fire - *acts like a referee and is played by a single person*
- Emergency Personnel - *an amalgam of police and fire personnel and is played by the professional fire fighters or law enforcement.*
- Community Members - *The remainder of the players occupy this role*

Because the prototype is intended as a tool for learning, it is essential that the Emergency Personnel and Community Members respond as they believe they would in a given scenario. In this regard, the experience is far more akin to design ethnography than it is to a traditional "test" in which one might validate a proposed solution (Beckman and Barry, 2007).

Each type of player has a different motivation. The Emergency Personnel has the goal of getting as many Community Members to safety whereas the Community Members only need to worry about getting themselves and their loved ones. While the person playing The Fire cannot win, their role is critical in maintaining a sense of urgency and persistent threat.

Before we begin playing the facilitator verbally states the rules and goals of the game. The players are reminded that even though this is a game it is also a prototype and a research tool so it is important for them to "play themselves". The game starts by determining the specific time and day of event through the use of analog spinners (Figure 1). Players then place their game pieces on to map to show where they would be at that moment in time. They then select from two modes of communication and choose a "loved ones" tile which signals who they would bring with them. Once the starting locations are established, the location, size and direction of the fire is selected at random and the Emergency Personnel choose to either warn the public or address the fire. Community Members only get to move once the Emergency Personnel issue a communication through the alert system. The Community Members then choose a vehicle that they will use for their evacuation.

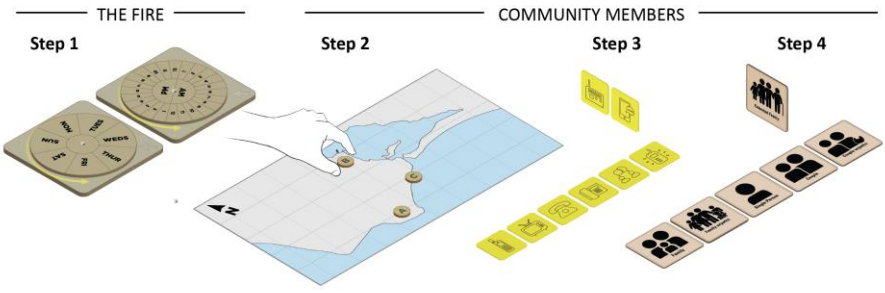

Figure 1. During the set up for the game, time and day of the week are selected using spinners. Step 2-4. Community members choose where they would be at the start of event, communication choices and their evacuation people.

4.2 Rounds of Play

Each round of play simulates roughly 15 minutes of actual time. The Fire always goes first, followed by the Emergency Personnel, and then the Community Members. The Fire uses a series of custom developed spinners to simulate the dynamic nature of wildfires. The Emergency Personnel always have two options. They can address the fire or issue warnings. During each round, the Community Members start by selecting a Chance Card. These cards may indicate a blocked route, flooding, lack of gas, or a favor from a neighbor. Community members may then choose to communicate with one of their selected methods or move.

Game play continues until the Community Members are have made it too safety or have been overtaken by the fire. The game typically lasts 45 minutes and is followed by a facilitated discussion.

4.3 Game Mechanics: Setting the Stage for Systems Learning

Although games are most associated with the general category of "fun", they are commonly used in service of more serious pursuits such as strategy, planning or education (Djaouti et al, 2011). For analog games, these various objectives are achieves through the design of physical components (game pieces) and the game mechanics, defined as "the various actions, behaviors and control mechanisms afforded to the player within a game context." (Hunicke et al, 2004).

For the purposes of our project, each of these elements had to be designed to help illuminate the ways community members approached transportation, communication and strategies during an evacuation. We needed both a concrete and an abstract understanding of how they might behave. The design of the game pieces supported our understanding of *what* they were doing while the game mechanics, or rules, helped tease out *how* they were likely to behave with all of the uncertainty and stress of an evacuation event.

The game board is as table-sized map which harkens back to the plotting tables used by WWII military strategists and illustrates the greater region with roads and a few geographical features (Figure 2). For the purposes of the game, additional elements were added to the map. A grid overlay is used to indicate fire locations and a series of “steps” correlate to road sizes and congestion. For example, each “step” on a curvy, single lane will be much smaller than a step on a 2 lane highway.



Figure 2. Game pieces on the map prompt the players to discuss the implications of the wildfire scenario during a round of play.

Each player gets their own set of custom-designed game pieces. The shapes were laser cut from mat board and finished with engraved icons or a customized set of stickers. Each player chooses from a set of tiles representing communication, transportation and “loved ones”. In addition, the players each received a small folding piece of paper with a communication icon. This is used to share messages (hand-written notes on a Post-it) without other players being able to benefit from the communication. The tactile feel of the game pieces were a critical part of making the game clear and fun, but the game pieces real function is to help bring the game mechanics to life.

Game mechanics bridge the gap between the simplicity of the game and the complexity of the system. These rules can be used to create a sense of anxiety, intrigue, delight, or any number of human emotions (Hunicke et al, 2004). For our project, each aspect of the game was designed with the specific purpose of foregrounding elements of the system that might not be visible with more traditional research methods.

We designed the game mechanics to concentrate the play around the issues that made wildfire evacuations so challenging. Specifically, we needed to make sure that the game

would put players in a situation that would force them to make quick decisions under stress with high degrees of uncertainty and potentially conflicting information (Table 1).

Table 1. Aspects of the evacuation experience were translated into game mechanics

Systemic element	Game Mechanics
Urgency	Limited Moves – Players can only communicate or move during each turn Players must make their move within 1 minute
Stress/Anxiety	Limits to the amount of steps a player can move per turn The rules insure the fire is ever present and moves quickly Chance Cards add difficulty to plans Traffic choke points are replicated through the "steps" overlay
Uncertainty/Changing Situations	Prior strategies may change due to the Chance Cards Chance Cards may introduce anything from new fires to power outages, road blockages or penalties based on vehicle choice The location of the Fire isn't always clear[6] Different players receive different communication based on prior choices

The set of Chance Cards were an essential piece of the game mechanics in that they created a way to introduce many possible variables without disrupting the rapid pace of the game. By forcing player to choose a Chance Card at the start of every turn, we were able to replicate the dramatic changes that can take place during a wildfire evacuation. Certain cards alter the dynamics of the fire, while others pose challenging decisions (such as whether to help a clueless tourist) which have impacts on the short term moves, but also act as provocations for the discussions after the game (Figure 3).



Figure 3. An example of the chance cards that are at the beginning of each turn. The chance cards introduce various forms of uncertainty that emerges in an evacuation scenario.

5. Going Beyond Learning

The game is a tool that enables rapid learning that would not be possible in the context of an actual evacuation. However, the game also plays an addition role in the community as an educational tool. Much the way one might learn from an experience of a real life evacuation, the game offers players a glimpse into a world without the associated risks.

We designed elements of the game to amplify this potential aspect of the prototype through our use of intrigue and unexpected elements. We leveraged the ways curiosity can support learning by prompting the players to choose not just between cars and SUV's, but also by presenting more unusual options like surfboards, bicycles or tractors (Gruber et al, 2014).

Some of the more quirky options generated interest, and often a few chuckles, but the wide range of possibilities also helped to create a sense of ownership from the players. After looking over the available transportation tiles, one player suggested we should include horses as well. This sort of idea generation demonstrates the benefits of collaborative design. Not only did it provide a useful suggestion for the next iteration, but it also prompted an additional conversation about the challenges of evacuating large animals. This type of impromptu discussion is exactly the type of unscripted behavior we hoped the prototype would spark. Occasionally this type of insight emerged during an informal discussion, in other instances we teased out these surprises during a more structured conversation.

The facilitated debrief creates a space where both the research team and the community members can develop a deeper understanding of the experience. Even the richest game will be a far cry from an actual evacuation so the debrief plays a critical role in helping the research team to inquire about interesting behavior that may have come up during the game. In doing so, the team can mitigate some of the risk that might come from trying to draw conclusions from a brief moment in a rapidly unfolding game. The post-game discussion also provides the players with a context that helps them reflect upon the experience and clarify what they took away from it (Dieleman and Huisingh, 2006).

Although this board game is a prototype with a serious purpose, that should not diminish the role that fun plays in the overall experience. By making the game something enjoyable, we increase the odds that people will want to play it again. Each experience of the game creates an opportunity for new insights to emerge and offers the players a way to develop more tools, strategies and approaches to wildfire scenarios. An additional benefit of repeated play is that it increases the likelihood that the players will develop relationships and ties that go beyond the game. Many cities are currently finding ways of bringing people together in order to nurture what is known as *bonding social capital* because it correlates with greater survival rates during disasters (Aldrich and Meyer, 2015; Hawkins and Mauer 2010). It is possible that by merely playing a game together, the community is developing a greater sense of resilience.

6. Conclusion

This paper highlights the ways that a new approach to prototyping can be used to explore complex systems with minimal risk and time. Due to the fact that this is an evolving research project, we have yet to produce concrete recommendations or potential policy interventions. Yet, even though we are still in the initial phases, our team and our community partners are confident enough in this approach to continue to expand the use of the game with a wider community. As of this writing, I am developing the third major iteration of the game which will be played with larger group in Bolinas during the winter of 2021. Our interdisciplinary research team is currently developing a version of this game for evacuation planning with one of the largest universities in California as well as several communities throughout the state. The initial findings suggest a rich potential for the ways board games can be used to quickly explore other complex systems in dramatically reduced timeframes.

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EndNote:

[1] See Intergovernmental Panel on Climate Change and https://www.economist.com/graphic-detail/2017/08/29/weather-related-disasters-are-increasing

[2] Site visits and personal correspondence.

[3] Conversations with emergency personnel in the community of Bolinas and Louis Comfort, University of Pittsburgh.

[4] The term solution is in quotes because a challenge can never be fully solved in a systems context. In this case a “solution” describes a design team’s best, current thinking about a systemic challenge.

[5] Most evacuation drills happen once a year. In contrast, a board game could easily be conducted on a weekly basis offering a dramatic increase in the feedback cycles.

[6] During early versions of the game the fire was on the map for all players to see. In a wildfire event, this is rarely the case so in subsequent iterations we “hid” the fire from the players and they could only know its location through communication channels.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Revised Function Analysis of Sustainability - understanding the complexity of sustainability.

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Abstract | This article presents and discusses the case study "Scraping the surface," a workshop about sustainable design held for master's students of different design majors at the FHNW Academy of Art and Design. Through marketing we, as consumers, are bombarded with products claiming to be sustainable. As a result, sustainability has become a buzz word. "Scraping the surface" highlighted the complex factors a designer needs to consider when designing sustainable products. During the workshop students discussed how a designer can have an impact on the lifecycle of a product or a system through material choice, production method, design for longevity, design for sustainable behaviour using the principles of behaviour change and design for the end of product use. Students were asked to bring a product that they found to be sustainable and to justify their reasoning using its characteristics. A list of criteria was compiled and converted into a function analysis. After the workshop a literature review was conducted to identify words and actions that could be added to make the list more holistic, focusing on ecology. To conclude, the proposed Revised Function Analysis of Sustainability can be used as a tool in the early design process to identify opportunities, specify deliverables and aid communication in development teams in terms of sustainability. The tool can also be used as a teaching and learning tool to provide a visual overview of possible traits that can be applied throughout the life cycle of an object. This can help to encourage upstream activities to prevent product renewal and avoid landing in the waste hierarchy. The template includes the potential benefits to the ecosystem and gives examples and further references. Consequently, the purpose of the tool is to be used as a creative tool rather than an assessment tool, specifying both desirable and undesirable outcomes.

KEYWORDS | DESIGN, SUSTAINABILITY, FUNCTION ANALYSIS, CREATIVE METHOD, SUSTAINABLE DEVELOPMENT GOALS

1. Introduction

Every year Institute FHNW Academy of Art and Design offers workshops for their Masterstudio design students. External partners are invited to host the workshops for students of all four specializations: integrative, fashion and industrial design as well as scenography and exhibition design. The Master workshops serve as the program's experimental production platform.

The workshop "Scraping the surface", that was given in the fall of 2019 included 35 students with 6 different nationalities with bachelor degrees from different institutes and subject specializations. The given theme of the workshop was sustainability. The goals of the workshop were for students to understand the complexity of ecological and social sustainability, learn about sustainable design methods and gain new insights that can be relevant to future projects. By building on students' prior knowledge and establishing a common vocabulary, students could discuss what can be done as a practicing designer to raise awareness of sustainability issues in the design industry and to avoid or minimize unintended impacts of one's work.

The approach of this workshop was not to give students instructions on what is or is not sustainable. Instead, discussions about complex issues served to point out how complex and interdependent matters of sustainability are. By encouraging critical conversations about the impacts of design decisions, students could realize that we are merely scraping the surface.

While this workshop was not centered around distinguishing what is or is not sustainability, some subsets, amongst many, have often been found as parts of the whole – Design for Ecology, Environment and Social. The plethora of opinions about this vocabulary have led to much confusion, debate and misinformation.

Aside from these discussions, the majority of the workshop time was spent on a project. The brief was to suggest a design aimed at changing a certain behavior. The focus of the workshop was primarily on the dilemmas associated with ecological and social sustainability and how (unconscious) behavior of users can be considered in the design process.

> "Within the field of sustainable product design the focus has been strongly on the supply side; how can impacts be lowered through design-for-disassembly, recyclability, use of environmentally conscious materials and dematerialisation. However, the way users interact with a product may strongly influence the environmental impact of a product. Designers can try to influence this behaviour through the products they design" (Wever, van Kuijk, Bok, 2008).

Nudge strategies (Rothman, 2013) were introduced in the beginning of the workshop to suggest ways to influence behavior and decision making of groups or individuals. Reinforcing an automatic and unconscious behavior through design could help consumers to operate in a more sustainable way. *Behavior change strategy cards* by Artefact group (Artefact) were also introduced and used as inspiration.

The most interesting result of the workshop was not the design proposals but rather the discussions around sustainability, inspiring the *Revised Function Analysis of Sustainability* presented in this paper.

2. Design and sustainability

2.1 A change in perspective

Over the past decades consumers have become increasingly critical towards corporations and the impact businesses have on the ecosystem and on society as a whole. In recent years the public has become better informed about pressing environmental matters. Most agree that we will face significant issues in the near future as the result of our current linear consumption-based economic system unless effective and radical changes are made. Scientists have long been aware of society's impact on the environment, but it took multiple years for a public debate on this matter to emerge.

In 1987 the World commission on Environment and Development issued a global manifesto commonly referred to as the Bruntland Report where the concept of sustainable development was introduced.

> "A sustainable development can be defined as a development that satisfies the needs of today without compromising the ability of future generations to meet their needs" (Bruntland, 1988).

Sustainability within design is not a new concept. In 1971 Victor Papanek released *Design for the Real World* (Papanek, 1971) and it has since become part of many design curriculums around the world. Yet in the 2000 edition of the *Getting an industrial design job* (Siegel, 2000) the word "sustainable*"* is not even mentioned. In the *Core Skills Assessment Worksheet* from 2000 we find "environ. impact" listed but not much more. In the 2008 version now called *Get a design job* (Siegel, 2008), you have only to read through the first pages to find the words "sustainability and green design." In the Core Skills Assessment Worksheet from 2008 you find "Uses empathy, informed judgment, reason", where as in the earlier edition the word "empathy" was not mentioned at all. This shows a change in attitude towards the designer's expected skillset. Design will inevitably have an impact on

the many challenges related to climate change, ecology, living patterns, transportation, digitalisation, urbanisation, alienation and an aging population.

2.2 Education on Design for Sustainability

In some design education curricula, it is obvious by course titles and literature lists how design for sustainability (DFS) is covered; in others, DFS is not universally standard in the design project process. Since the topics within the subject of design are increasing while the time for education remains the same, effectively covering all areas of sustainability within the curriculum is a challenge. Although design educations are already relatively successful at integrating aspects of sustainability into their curricula (Melles et al., 2010), significant improvements still need to be made to educate designers that are equipped to produce work suitable for a sustainable future during their careers. There is a need for DFS to become an integral part of all projects and not only the ones specifically dealing with sustainability as the main topic.

In *Preparing the way for mainstream sustainable product design- Methods and approaches to inspire change* Vicky Lofthouse discusses designer's capabilities in relation to Design for Ecology, a subset of DFS:

> "A survey by the Design Council in the UK identified that only 15% of design businesses feel they are very well-equipped to advise their clients on sustainable design issues (Design Council, 2010). This lack of confidence in their ability to address sustainable design issues has repercussions when it comes to developing appropriate briefs and challenging the client's constraints and assumptions. Having the confidence and ability to do this for a sustainability brief depends on the skills, abilities and knowledge of the designer and is formed by the designer's education, training and experience (Stevenson, 2013). If this knowledge has not been gained at university, there are few options available through ongoing professional development" (Lofthouse,2017).

It is unclear if students, teachers and design professionals are aware of the tools available to them. Much of the confusion results from Design for Environment, another subset of DFS, having many names - green design, eco-design, life-cycle design, clean design, etc. One major entity, the Ellen MacArthur Foundation, works with business, government and academia to build a framework for an economy that is restorative and regenerative through design. On their website there is a section called *Schools & colleges resources* with a generous offering of free workshop material as well as methods made by partners such as IDEO (Ellen MacArthur Foundation). Despite the convenience, a potential reasoning for relevant parties not being aware of these resources may be a result of the rapid expansion of the field of Design for Environment. Experts are producing valuable resources at a rate difficult to follow.

"There are many issues that determine the likelihood of designers to have the opportunity to engage in more responsible design (Stevenson et al., 2011) such as time challenges and a lack of demand from clients" (Lofthouse,2017). Lofthouse offers an opposing argument that a key barrier to engaging in responsible design is a lack of confidence because of a lack of education and practice amongst designers. This was supported by empirical evidence collected during a number of consultancy commissions. To lower the barrier, Lofthouse stresses the importance of introducing student designers to tools and methods while they are still in school.

> "The ability to confidently work with eco-design and sustainable design issues could be improved by using tools as part of brainstorm processes, where they can be a useful way of guiding the consideration of environmental and social issues across the product life cycle. By providing students with practical tools, they will be equipped with skills that are not widely held in current industrial design practice, increasing their value as graduates" (Lofthouse, 2017).

It is important that education addresses a range of approaches and alternative methods. Ideally students should be familiar with concepts addressing both life cycle thinking and systems thinking, being familiar with approaches such as: zero waste, design for circular economy and design for sustainable behavioural change.

2.3 Changing the system from within

The 2030 Agenda for Sustainable Development was adopted by all United Nations Member States in 2015. At the heart of this urgent call to action are 17 Sustainable Development Goals (SDGs). Both developing and developed member participation makes this a global partnership (United Nations). Working with visual communication, a mission to present the goals clearly and understandably makes a complex topic approachable. The SDGs are a helpful tool to give an overview of the complexity of sustainability by dividing it into individual, easier-to-digest topics. The goals can be helpful for designers in their practice, as well as for the public, creating a common framework to refer to.

SGDs Awards, launched by Kyushu University, challenge design students to develop concepts to transform society. In their competition statement we can read:

> "Society is increasingly raising its expectations for design. Problems targeted by the UN's Sustainable Development Goals, which include such concerns as hunger, poverty, and the issue of food, may seem irrelevant to design, but efforts to solve them through design are materializing all over the world. The role of design is moving beyond 'formative expression through color and shape' and is becoming a valid method to solve the issues faced by society" (Kyushu University).

This statement gives design students a more hopeful outlook on the role of the designer than the title of the book called *Design is the problem* (Shedroff, 2009). Shedroff recognises

that the role as a designer comes with a lot of responsibilities. He suggests, “Don’t do things today that make tomorrow worse” (Shedroff, 2009), which is a great suggestion, but in many ways stands in conflict with today’s businesses’ models and consumer behaviours. Many students struggle with the prospect of their future role as a professional designer and are disturbed by the fact that their future income likely will be dependent on making and selling more goods. History tells us that with the introduction of products made to solve problems, we also create, new unintended problems.

> “Despite how optimistic, idealistic, and future-oriented most designers are, design has sometimes created big problems in the world. Even where our best intentions have been engaged, our outcomes have often fallen short—sometimes making matters worse— because we didn’t see the whole picture when creating what we envisioned.” (Shedroff, 2009)

Entering the design industry at the time when great change is needed poses several challenges. Even though you possess both knowledge and ideas of what needs to be done, getting all stakeholders onboard will be difficult.

> “An observed side effect of this disconnect between theory and practice is that motivated students become disillusioned when they look for work in the area of sustainable design because they become aware of the limited options within the industry, where sustainable design practice is typically of minimal importance for most of the design industry” (Lofthouse, 2017).

Industry might be interested in sustainability but only when not competing with their bottom line. It is difficult to compete in price while producing locally in small batches compared to others who are producing in large batches overseas.

> “The measurements we must take to secure a just, equitable and inspiring transition away from fossil fuel, clash directly with the reigning economic orthodoxy at every level. Such a shift breaks all ideological rules, changing everything we think about economy” (Klein, 2014).

In his book *Design for the Real World: Human Ecology and Social Change*, Papanek (1971) suggests that as a designer you have the following options:

- Continue to design luxury items for a privileged few
- 10% of your time on solving problems of abject need, while continuing with their job
- Find new areas of opportunity solving social needs
- Teach or curate
- Drop out of design
- Change the system from within

If you are serious about working with SDG as a designer, you will soon realize that is currently not a very cushy field and sacrifices have to be made. Finding employment is challenging, work conditions might be difficult and salaries are low.

Changing the system is not an easy thing. Where should one start?

Johan Rockström, the founding director of the Stockholm Resilience Centre argues for the benefits with the SDGs as a common road map but reveals in his speech that scientists are concerned that the roadmap looks more like a "smorgasbord" from which you can pick a topic of interest. The integrated framework called "The Wedding Cake" focuses on the safe operating space, stating that there are some non-negotiable SDGs, namely nr. 6 on water, nr. 13 on climate, nr.14 on ocean and nr. 15 on biodiversity (Rockström, 2018).

While all the SDGs are of importance, goals 6, 13, 14 and 15 need to be considered in all design processes. In short, we need to priorities any damage to the biosphere. This includes a range of actions, sometimes in conflict with each other. How should we prioritize?

- Avoid global warming
- Avoid use of non-renewable resource
- Avoid pollution
- Avoid harm of diversity
- Avoid destruction of eco-services

It is important that designers both understand and have the capacity to communicate to others that design for sustainability is much more than considering recycling or using recycled materials. The SDGs can be used by designers to inspire socially and environmentally sustainable projects. This new hopeful perspective on the responsibilities of a designer is important to students and relevant to the challenges we face as a global society However, this outlook is not reflected in career opportunities nor entirely in students' education.

3. The Workshop

3.1 The initial assignment

Preparing a design workshop lasting 5 days that feels relevant to 35 students is a challenge. When the given topic is sustainability and the target group consist of people with very different backgrounds the tasks become even more complex. The risk is high that what is new to one individual is obvious to another.

To quickly get an overview of the students' knowledge a task was designed and communicated to the participants in advance of the workshop. Each person was asked to

identify an object that they thought was sustainable and bring it, or a picture of it, to the event. Sustainability was not defined and no one asked.

The students were divided into teams of 4-6, which were carefully considered in order to mix people's educational backgrounds and cultures. Once in their teams, students were asked to discuss their objects and explain how they related to sustainability. Subsequently students took the identified characteristics and turned them into single-word descriptors. They then created categories of their own choice and placed the words into these categories. Students were also asked to enter the words into "Answer garden", a digital tool which can show how often words are used. If a word appeared several times in the group discussions they were asked to put it in more than one time.



Figure 1. Answer garden word compilation

3.2 The assignment results

The result was interesting. Many of the students had German as their native language and struggled to get a correct translation of their characteristics. People constantly looked up definitions in their computers and discussed if the word suggested was accurate to what they actually meant.

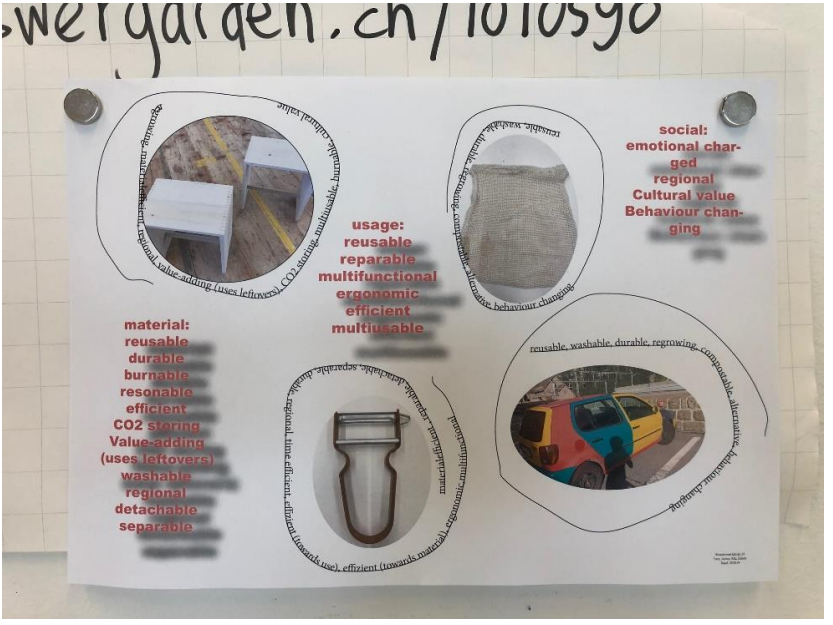


Figure 2a. Example of student work



Figure 2b. Example of student work

Some of the words, such as *wabi-sabi,* were not known to all of us. Many of the suggestions were easy to relate to, whilst for some suggestions the link to sustainability was not immediately obvious. Claims were often built on assumptions made on no or limited information about the origin of the product.

At the end of the session a list with a selection of words was compiled, showing the results of all groups.

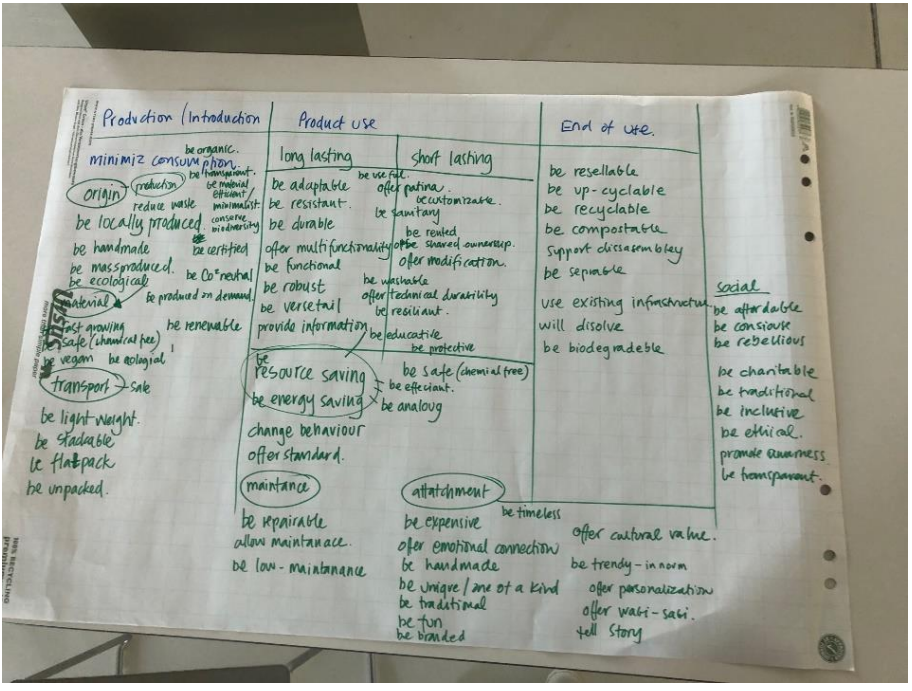


Figure 2c. Summary of words

The result showed similarities to a functional analysis, focusing on the expected performance of a product rather than on specific features of the product. The list was a reminder of the many ways in which a product could be considered sustainable, but it lacked an explanation and information to how the mentioned characteristic/function had an impact. Students were interested in the result and asked to receive a copy.

4. Methods for a more sustainable practice

There are many methods available to guide every step of the design process. Deriving from the field of engineering, Function Analysis is a rudimentary method often used by industrial and product designers, based on Function Structures as popularly described by Pahl et al. (2007) in their book *Engineering design, a systematic approach*. "There are many concepts and terms for describing what a device actually does. For example: function, behaviour, performance, property and purpose." (Lagerstedt, 2003).

In the classical functional analysis, the functions are described by a verb and a noun. This is a clever way to make the information short and quick to process.

Enable Writing
Discharge Ink
Refill Ink
Protect Nib

Figure 3. Function analysis example of a fountain pen

By analysing each function, the tool forces the creators to think through the aim of the product in an abstract way. Correctly performed, the functional analysis becomes the document that ensures, to both the creator and the client, that nothing has been forgotten and all relevant areas have been considered (Landqvist, 2001). The function analysis is a useful creative tool that can be used for development of new or existing products. It allows for a focus on function rather than focus on features of existing products, broadening our view in order to find more creative solutions. Each function can be classified in the categories: main function, necessary function, desired function and unnecessary function. Each category can then be given a descriptor such as basic functions, production, ergonomic, construction, marketing, etc.

The early phases of the design process are both exciting and challenging. In her thesis, *Functional and environmental factors in early stage of product development-Eco functional matrix*, Lagerstedt discusses the importance of this early stage.

> "When designing a completely new product, at the outset the knowledge of the new product is small but the freedom is almost total, as nothing is established. Information about the product increases as the product develops, but at the cost of design freedom. A basic dilemma is that sustainable design solutions often demand radical changes and 're-think' of product systems and therefore rely mainly on decisions early on in the product development process" (Lagerstedt 2003).

A risk with tools, methods, guidelines and checklists is that they can limit the creative process. Many of the current methods created to promote design for sustainability are

complex and do not correspond to the ways in which designers work in the early creative phase. For example, the Life Cycle Assessment (LCA) tool aims to give an accurate picture of the environmental impact of a product. This key instrument requires expertise and time-consuming, detailed calculations, which can make it cumbersome to creativity.

As product development teams are often made up of many individuals with different specialities there is a need for appropriate tools. These aids should be capable of being used cross-disciplinarily to help establish objectives and identify opportunities. To be useful, information must be kept simple and be limited. There is a need for tools that do not require advanced calculations, but rather can be used for brainstorming. The purpose of these needed tools is to identify potential areas of inquisition and gaps of fact-based knowledge to challenge preconceptions

Lofthouse explains in one of her papers (Lofthouse 2017):

> "Many of the tools that the students are introduced to provide a structure through which they can think about eco-design and sustainable design issues. By using them as a brainstorming tool, they can be a useful way of guiding the consideration of environmental and social issues across the product life cycle. Often they are also useful as a mechanism by which design teams can communicate proposed product improvements to a client or interested party. The ability to do this confidently is clearly missing in current design practice. "

Some sustainability tools include suggestions and information, but others aim to spark discussion. The Tarot Cards of Tech created by Artefact (Artefact) do not give any answers or solutions but merely encourage the user to think of the impact technology and products we design can have in the future, aiming to avoid unintended consequences.



Figure 4. The Tarot Cards of Tech created by Artefact (Artefact)

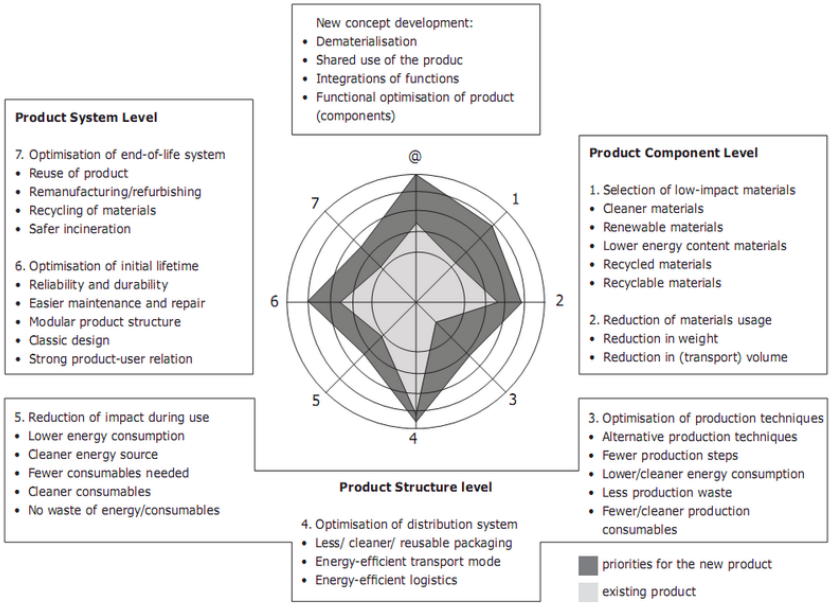


Figure 5. The EcoDesign Strategy Wheel (Brezet and van Hemel, 1997)

Other tools such as The EcoDesign Strategy Wheel (Brezet and van Hemel, 1997) look at impact in comparison to existing systems. The Eco Design checklist helps to ask relevant questions that can impact the different stages of the life cycle of a product.

Life cycle stage 5: Recovery and disposal
What problems arise in the recovery and disposal of the product?
How is the product currently disposed of?
Are components or materials being reused?
What components could be reused?
Can the components be reassembled without damage?
What materials are recyclable?
Are the materials identifiable?
Can they be detached quickly?

Are any incompatible inks, surface treatments or stickers used?
Are any hazardous components easily detachable?
Do problems occur while incinerating non-reusable product parts?

Table 1. Example of The Eco Design checklist (Brezet and van Hemel,1997)

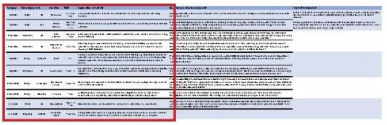
5. The Revised Function Analysis of Sustainability

After the workshop, the list of "sustainable" functions suggested by the students was put into a new format. Only the functions related to the SDGs 6, 13, 14, 15 (with focus on the environment) were added to the list. A verb was added to each function and they were sorted into the following categories: material, production, logistics and end of life. A column was added to better describe the environmental impact of each function. A literature study was done to identify more characteristics. One of the books used was *Products that Last-product design for circular business modells* (Bakker, den Hollander, van Hinte, Ziljstra, 2014).

The *Revised Function Analysis of Sustainability* presented below is inspired by the result of the exercise from the workshop and merges approaches used within existing methods. The list of functions is organised to reflect the product's life cycle. There is also a possibility to add questions and to fill in which SDG is being addressed.

Category	Subcategory/verb	Function	SDG	Explanation/What is it?	Question you should ask yourself	Why is this important
Material	Origin	Be	Renewable	6.4, 12.2, 15.2	How long does it take to renew the resources used? Are the resources received in healthy and resilient conditions? Are resources of the ecosystem taken?	Makes it necessary to renewable, using up the resources without leaving waste right to recycling plan. It might be hard to live with the potential of this to give rather to make use of bad resources.
Material	Origin	Use	Waste streams/ materials	6.3, 11.6, 12.5, 12.4, 14.1,	Is the material really coming from a waste stream, or taking the waste away from another country purpose? Is the use of a recycled or recycled waste stream really helpful, does it be important for product, or do the recycled energy and chemicals make it look costly to use (extraction) as a product?	Finding ways to add value to our waste streams as a circle edged product we does the amount of waste produced but the overproduction and of the waste streams can take a new / import look. If they were using a virgin material.
Production	Processes	Be	Water produced	7.3, 12.2, 12.5,	Does it take producing that then actually bring does the sustainable import product, or because it? How can it adapt the design to make it more sustainable waste produced during production? How can it adapt the design to make it more energy-saving production? How can it adapt the design to make it more toxic chemicals used during production?	
Production	Processes	Be	Production demand	12.2, 12.5	Producing only the products or parts that are needed, instead of filling warehouses with products and according to a prototype being shipped when demand drops, can lower a company's CO2 footprint.	Do I need to change the design to make it possible to produce on demand? Can producing on demand impact the product features in a negative way? Are the processes used for on-demand production in an even more energy saving way? How many inspired products are actually produced? Does producing on demand make the product unsustainable for users?
Logistics	Design	Integrate	Label	12.4	Making sure that the information on the label is not the last e.g. by integrating the label into the product mold, and/or making sure this information is easily perceivable for the consumer. Information about the product's size, weight, composition and durability should be possible to find in a few steps.	Who needs access to what information and how are they most beneficially going to find it? How can I ensure the information is available after the product's other material? What information is necessary to inform proper reuse and feasible repair and upcycling or recycling?
Logistics	Packaging	Be	Unpackaged	12.5, 14.1	Fit a product can be designed in a way it will travel and require packaging for travel or retailing, storage and before display, but with a low CO2 emissions. Added to the packaging, altogether.	How to we want and energy consumptive are involved in the packaging, relative to the product itself? Do the changes in the design to make waste or energy loss in the future making or packaging plans? Could the more beneficial to make the packaging sustainable, instead? Does the sustainable unpackaging increase the risk of the product being damaged or broken on?
Product Life	Design	Encourage	Evaluation/ change	12.6, 11.6	Depending on the product and context, different methods can be employed to nudge users to make sustainable choices.	What are potentially the most disruptive material changes? How big is the impact? Can be easier compared to the rest of the product's life cycle? Does the weighing the need for the consumers outside make people from using the product? How effective is the weighing during real usage? Does adding or weighing the item also energy usage or waste creation during production more than the benefits of the product's use?
Product Life	Design	Consider	The Whole	12.6	Anticipating future needs of the consumer that is technological advances and standards is important to make long-lasting products that sustainably be used for a long time.	What are the most material new or different or options the product can improve or do by this? Can it be more standard or technologies in the product should it? Can I design the product to adapt to the changes in the near future?
End of life	Waste	Be	Compostable	12.5, 14.1, 11.6	Biomaterials that can be composted can become the nutrients for new biomaterials.	How do I make sure the product is actually composted? Is the material compostable with existing infrastructure in all the places where the product/waste ends up? Can the material be non-compostable materials are added to the product owing to the? Is the use making and properties of the material sustainable?
End of life	Recycling	Indicate	Separation points	11.6, 12.5	Making it clear to a worker in a recycling plant how a product can be taken apart can increase the chance that the product's take apart and more of its materials can be recycled.	

Figure 6a. Examples from The *Revised Function Analysis of Sustainability*



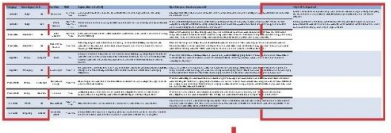
Category	Subcategory	Verb	Function	SDG	Explanation (What is it)	Que
Material	Origin	Be	Renewable	6.4, 12.2, 15.2	A renewable source can replenish the material at an equal or larger rate than it is being removed.	How the r
Material	Origin	Use	Waste streams	6.3, 11.6, 12.3, 12.4, 14.1,	Waste streams that are currently landfilled or incinerated can be useful sources for sustainable materials.	Is thi upcy mak
Production	Processes	Be	Mass produced	7.3, 12.2, 12.5,	Mass produced products can utilise optimised processes in which waste is reduced and energy is used efficiently	Does desi prod
Production	Processes	Be	Produced on demand	12.2, 12.5	Producing only the products that are required by users, instead of filling warehouses with products and counting on a percentage being scrapped when demand drops, can lower a company's CO2 footprint.	Do I featu prod
Logistics	Design	Integrate	Label	12.4	Making sure that the information on the label cannot be lost (e.g. by integrating the label in the product's mold, and/or making information accessible online) you can ensure that information about the product's use, repair, components and materials is accessible to future users or owners.	Who avail upcy
Logistics	Packaging	Be	Unpackaged	12.5, 14.1	If a product can be designed in such a way that it does not require packaging for transportation, storage and in-store display, this eliminates the CO2 emissions related to the packaging altogether.	How desi sust
Product Life	Design	Encourage	Behavioural change	12.5, 11.6	Depending on the product and context, different methods can be employed to nudge users to make sustainable choices.	Wha prod the r than
Product Life	Design	Consider	The future	12.5	Anticipating future needs of a user as well as technological advances and standards is important to make long-lasting products that will actually be used for a longer time.'	Wha tech
End of life	Waste	Be	Compostable	12.5, 14.1, 11.6	Biomaterials that can be composted can become the nutrients for new biomaterials.	How whe sour
End of life	Recycling	Indicate	Separation points	11.6, 12.5	Making it clear to a worker in a recycling plant how a product can be taken apart can increase the chance that the product is taken apart and more of its materials can be recycled.	

Figure 6b. Examples from The *Revised Function Analysis of Sustainability*



Category	Subcategory	Verb	Question you should ask yourself
Material	Origin	Be	How long does it take to renew the resources used? Are the resources renewed in reality and what impact does the renewal of the resources have?
Material	Origin	Use	Is this material really coming from a waste stream, or taking the source away from another useful purpose? Is the use of a upcycled or recycled wastestream really helping to lower the impact of my product, or do the required energy and chemicals make it more costly to use a wastestream as a source?
Production	Processes	Be	Does mass-producing this item actually bring down the sustainable impact per product, or increase it? How can I (adapt the design to) minimise or eliminate waste produced during production? How can I (adapt the design to) minimise energy used during production? How can I (adapt the design to) minimise or eliminate toxic chemicals used during production?
Production	Processes	Be	Do I need to change the design to make it possible to produce on demand? Can producing on demand impact the product features/functions? Are the processes used for on-demand production more wasteful or energy intensive? How many surpluss products are actually produced? Does producing on demand make the product unavailable for some?
Logistics	Design	Integrate	Who needs access to what information and how are they most realistically going to find it? How can I ensure the information is available after the product is off the market? What information is necessary to inform proper use and to enable repair and upcycling or recycling?
Logistics	Packaging	Be	How much waste and energy consumption are involved in the packaging, relative to the product itself? Do the changes in the design increase waste or energy use more than leaving out packaging saves? Could it be more beneficial to make the packaging sustainable instead? Does the elimination of packaging increase the risk of the product being damaged or thrown out?
Product Life	Design	Encourage	What are potentially the most impactful behavioral changes? How big is the impact of this behavior compared to the rest of the product's lifecycle? Does the nudging limit users too much or even exclude some people from using the product? How effective is the nudging during real usage? Does adding a nudging function increase energy usage or waste creation during production more than the reduction of impact it effects?
Product Life	Design	Consider	What are the main reasons users dispose or replace this product, can I prevent or delay this? Can future standards or technologies make this product obsolete? Can I design the product to adapt to future changes in the user's needs?
End of life	Waste	Be	How do I make sure the product is actually composted? Is the material compostable with existing infrastructure in all the places where the product will be used? Can I be sure that no non-compostable materials are added to the product during its life? Is the sourcing and production of the material sustainable?
End of life	Recycling	Indicate	

Figure 6c. Examples from The *Revised Function Analysis of Sustainability*



Category	Subcategory	Verb		Why is this important
Material	Origin	Be	nd what impact does the renewal of	Unless a resource is renewable, using up the resource without having a watertight recycling plan is wasteful and harmful to the potential of future generations to make use of that resource.
Material	Origin	Use	useful purpose? Is the use of a e required energy and chemicals	Finding ways to add value to our waste streams is a double edged sword: we lower the amount of waste produced and the new products made out of the waste streams can have a lower impact than if they were using a virgin material.

Figure 6d. Examples from The *Revised Function Analysis of Sustainability*

Some of functions presented in the *Revised Function Analysis of Sustainability* are in conflict with each other, hence the list cannot be used as a checklist. Each function must be evaluated and potentially weighted based on importance.

The benefit with the *Revised Function Analysis of Sustainability* is that it builds on the function analysis, an already familiar tool for designers in their practice. The *Revised Function Analysis of Sustainability* can be used as inspiration and relevant functions can be directly extracted to create a project specification or, simply, to inspire and formulate completely new suggestions. This way one can take an already existing function analysis and add to it or conduct a brainstorm session focused on sustainability, depending on what suits the project best.

6. Conclusion

The *Revised Function Analysis of Sustainability* offer many potential uses. The tool can be used similarly to how it was used in the workshop: to facilitate a discussion and to create a compilation of the knowledge within a group. Instead of viewing the list as a static instructional tool, the structure of the list itself can be used as a creative or pedagogical tool by either compiling one's own list from scratch or adding new functions relevant to one's own work.

The tool can be used by designers in the early design phase to:

- aid conversation with stakeholders by offering a vocabulary to talk about ecological sustainability
- raise aware of factors that could have impact on the ecosystem
- get ideas of possible approaches to be considered in order to minimize negative impact
- give tangible examples of how products/systems have been designed to address a certain function
- save time in generating a functional analysis by offering options
- get agreement on a design brief by identifying which functions that are necessary, desired, etc. (without having to evaluate a concept.)
- ensure that all relevant areas have been considered
- explore potential directions for a product and question if a decision that, at first glance might seem positive, could have a net-negative impact
- to explore other areas of sustainability (i.e. gender, labour rights…)

The Revised Function Analysis of Sustainability needs practical validation, but design students who have reviewed it have expressed interest. Hopefully the tools can be used to improve existing products as well as to help identify new businesses that can build on a green approach. The value provided by this tool is perhaps not only financial, but rather focused on the mitigation and prevention of negative ecological and social impacts. Value in this case surpasses only financial consideration and adds value to saving the environment. We already have evidence that consumers are willing to pay more for ecologically

sustainable products and businesses need to see the efforts made towards design for sustainability not as a treat but as an opportunity.

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Acknowledgements:

Thanks to Prof. Werner Baumhakl and Nicole Schneider at FHNW Academy of Art and Design for the invitation to host the workshop and to the students of the master class for their contribution.

We also thank Dylan Bertram for copy-editing of this paper.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Role of Social Ecologies within Social Design and Social Innovation

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Abstract | The paper examines how the understanding of social ecologies helps the design processes drive social innovation and systemic change, specifically in the area of social design. The paper defines the term social ecology as it relates to the design process and how it's understanding impacts problem framing. As with all systems (ecological, societal, or political) what surfaces to the top is not the problem but only an indication of the problem. Beneath this surface, there are several contributing factors that are referred to as "social ecology." For the designer, therefore, to be able to arrive at a solution that is sustainable, there needs to be the ability to recognize the factors that create the core socio-ecological environment. These societal contexts have made it imperative for designers to broaden their approach in gaining a deeper understanding of the social ecologies within which they operate in an effort to create sustainable impact. There exists a symbiotic convergence between the design process and social innovation, and it is within this convergence that this paper positions the crucial role that the understanding of social ecologies plays — one that is not only essential but critical.

KEYWORDS | SOCIAL DESIGN; SOCIAL ECOLOGY; SOCIAL INNOVATION; DESIGN PROCESS; PROBLEM FRAMING

1.Introduction

The paper examines how the understanding of social ecologies helps the design processes drive social innovation and systemic change, specifically within the area of social design. Social Design is an emerging area where design methodologies are used to address societal imbalances. Designers are increasingly transitioning from their traditional roles and expanding their footprint by addressing 'wicked problems' (Rittel & Webber, 1973) like poverty, urban renewal, digital divide, youth violence, and education through participatory and co-creative practices that instrument and render social innovation (Mulgan, et al., 2007). With the emergence of new areas of influence like complex systems, or environments for living, working, playing, and learning, (Buchanan, 1992) the role of the designer has expanded and evolved to embrace broader expectations. The emergence of the virtual realm in the 1990s created a paradigm shift and brought a sharp focus to the crucial role that users came to play in influencing design. In addition, designers increasingly started shifting their skills towards addressing systemic problems (wicked problems). The two factors together contributed heavily to this critical deflection. In a world that is rapidly becoming more global, economies are traversing several boundaries, cultures are converging and as a result, many socio-economic challenges are becoming a shared predicament that we as humans face today.

The challenges for the designer within this context become much steeper. This has made it imperative for designers to extend and broaden their approach in gaining a deeper understanding of the context within which they operate in an effort to create sustainable impact through design and social innovation. Within this new paradigm, in addition to serving as innovators, the role of designer transformed to incorporate additional roles: to that of being collaborators, facilitators, catalysts, and cocreators. Today, the designers, therefore, are not just designing products or communication vehicles for limited audiences but have broadened their realm of influence significantly to include the design for communities, societies, and cultures. This shift within design clearly illustrates a very intentioned move from addressing consumer-driven problems to more systemic ones. In this widening scope of influence, the singular role that designers have traditionally played has given way to more collaborative and participatory practices where instead of working *for* the designer works *with* and *within* a group of equally invested stakeholders. Given the extensive nature of problems being addressed, the aim is not only to share knowledge but also to share the decision-making power amongst all shareholders that have stakes in the defined issue (Del Gaudio, et al., 2016).

2.Defining Social Design

Social design, its definition, practice, and pedagogy still remain nascent. Due to a significantly increased preoccupation with social design within the design discipline more and more programs are offering it as an area of research and specialization. Given expanding

opportunities in practice, increasingly curricula are folding it within their design programs with much of the investment being dedicated to developing pedagogy to prepare future designers to help them confront the new challenges that wicked problems and systemic issues within a societal context pose. There are several descriptions used for this new emergent area. For the purposes of this paper, the term that will be used is Social Design. However, given the fact that it is still developing and there are various definitions that are being used contemporaneously to describe it, it might be important to review these interpretations to see not just how they work together to define an area as a whole but more importantly, help in understanding what might be a succinct definition that might emerge from this examination to create a clearer understanding of the area that we are using the term social design to mean.

In reviewing the literature, there are three approaches to defining the term that emerge, while some offer a direct definition, others imply social design by talking about its expanded need through the role of the design within societal contexts and lastly in the way it manifests itself through social innovation. The term design for social change has been used the longest (Koskinen & Hush, 2016). However, there are several other descriptions that the term social design concomitantly occurs with. Some of the early references begin with the questioning of the professional designer in how they have failed to look beyond their solutions and the need for a more expansive definition of design has been examined (Cross, 1972). Chick & Micklethwaite reference the major research project by Lauren Tan titled *Understanding the Different Roles of the Designer in Design for Social Good* (Tan, 2012) where she examines the design methodology of projects in the Design of the Times (Dott 07) Initiative. In her project, she describes the seven roles of the designer that helps create a better understanding of the paradigm shift in the definition of the designer's role. The roles described are designer as co-creator; designer as communicator; designer as strategist; designer as capacity builder; designer as entrepreneur; designer as a researcher; and designer as facilitator (Chick & Micklethwaite, 2011). Others have located social design with social entrepreneurship, social movement, social innovation, and design activism (Armstrong, et al., 2014). In regards to social design, the arguments and context set forth by both Victor Papanek (Papanek, 2000) and Victor Margolin arise out of similar arguments in defining the role of design and thereby the role of the designer in impacting change for the better. Papanek positions his argument for design as… the most powerful tool with which man shapes his tools and environments (and, by extension, society and himself). Rooted in the model followed within social work Victor Margolin and Sylvia Margolin (Margolin & Margolin, 2002), introduced the concept of "…design for populations in need rather than for the market alone…" and introduced the Agenda for Social Design. They question, "…what role can a designer play in a collaborative process of social intervention?"

However, increasingly now the term social design has largely been associated with social innovation. The European Commission defines social design as, "…used to describe particular approaches to social innovation. It is meant to empower people at local level to invent together solutions to economic and social problems. It contributes to offer new values to

guide public administrations' actions through collaborative working, experimentations, and prototyping." This definition combines several elements like "particular approaches" which may be read as methodologies; "invent together" which implies collaboration and therefore alludes to the idea of participatory practices and lastly "social problems" where it defines the new realm of problems that the designer today is confronted with. According to Andrew Shae, "Some call it design for the greater good. Others call it social design. Whatever you call it, it's clear that an altruistic impulse is on the rise in the design community" (Shea, 2012). In The Social Design Methods Menu, the definition offered is, "A practical learning journey taken by people including managers and entrepreneurs, to create useful, usable and meaningful ventures, services and products that combine resources efficiently and effectively, to work towards achieving desired outcomes and impacts on society in ways that are open to contestation and dialogue" (Kimbell & Julier, 2012).

Ezio Manzini repositions the role of design(er) within innovation, "… (social initiatives) emerge from the creative recombination of existing assets (from social capital to historical heritage, from traditional craftsmanship to accessible advanced technology), which aims to achieve socially recognized goals in a new way. This common trait also gives us a first definition of what social innovation is and why it appears" (Manzini, 2014). Another comprehensive definition of social innovation comes from the initiatives of the Young Foundation where Murry (Murry, et al., 2010) defines it as, "…new solutions (products, services, models, markets, processes, etc.) that simultaneously meet a social need (more effectively than existing solutions) and lead to new or improved capabilities and relationships and better use of assets and resources. In other words, social innovations are both good for society and enhance society's capacity to act." The interesting but critical difference that Manzini (Manzini, 2015) outlines are the differences between social design, social innovation, and design for social innovation.

All the attempts above demonstrate the need to redefine the role and impact of a designer and describe his/her contributions through social design or the resulting social innovation. Often the two terms are often used either in conjunction or as substitutes for one another, this paper argues that while social design is a methodology, social innovation is a goal for social design in that it instruments social innovation. Both social design and social innovation operate within very similar parameters of scope and influence, viz-à-viz design. However while social design addresses process of defining design interventions, social innovation shifts towards the impact that these interventions affect. The definition therefore that is proposed within this paper is that *social design is a design methodology used to facilitate and promote social innovation through collaborative and participatory practices to address societal imbalances*.

3.Understanding the term “social”

Within this paper, the use of the term *social* has significant import whether we use it as social design, social innovation, or social impact. The Oxford dictionary defines it as, “relating to society or its organization.” The key takeaway is that the use of the term ‘social’ is an acknowledgment that design in its considerations cannot address the individual alone but that it needs to do so within the context of the society and lies deeply embedded within inherent and interdependent social connections within a society. In looking at problems therefore while an individual can be at the center of design considerations, it can be argued that it the context within which the design considerations are being examined that are equally important because the problems exist within a larger complex ecology created by interrelationships between the stakeholders. It is this argument that leads to the importance of understanding the import of the concept of social ecologies within the area of design. As with all systems (ecological, societal, or political) what surfaces to the top is not the problem. These are mere symptoms and therefore serve only as an indication of the problem. Beneath this surface, there are several contributing factors that within this paper are referred to as *social ecology*. For the designer, therefore, to be able to arrive at a solution that is sustainable, there needs to be the ability to recognize the factors that create the core socio-ecological environment and the resulting interdependencies and interrelationships. Instrumenting social innovation, therefore, becomes dependent on the understanding of these social interdependencies and interrelationships.

4.Emergence of social ecology as a concept

Social ecology as a concept emerges from the discipline of ecology and while rooted within ecology social ecology as a term aspires to connect the concepts within biological systems and apply them to social systems.

The origins of the term ecology are attributed to Ernst Haeckel, a German biologist who in the mid-19th century defined ecology, as “the study of interactions among organisms and their environment.” What is focal here is the use of the word *interaction* because that, in turn, creates a system of interconnections that are being referred to here as ecology. The concept of ecology and the recognition of the interdependencies in the natural world was further elaborated by positioning it as “an entire science of the relations of the organism to the surrounding exterior world, to which relations we can count in the broader sense all the conditions of existence. These are partly of organic, partly of inorganic nature.” (Friederichs, 1958). Based on the seminal work of Haeckel, the idea of an interdependent system in how it defined the struggle for existence was further developed by Charles Darwin and Alfred Wallace whose theory expanded and introduced the concept of the struggle for existence and development of hierarchical systems and relationships defined by a need for survival that they defined as *natural selection*. This concept of natural selection was later reframed

by Herbert Spencer as *the survival of the fittest*. Its succinct and clear framing allowed it to be understood as a concept of progression within living beings.

This methodical and systematic research lay the clear groundwork for not only in the way we came to understand biological ecology but also in how that model came to be applied to be used in understanding the ecological systems within human communities. Originally coined by Ellen Swallow Richards in 1907, the idea of human ecology was further developed by Park and Burgess. (Park & Burgess, 1921) In a study located in Chicago, they demonstrated how the concept of biological ecological systems could be used and applied as a blueprint to explain the human struggle for survival (biological) in its fight for resources (economic). However, his approach was questioned by Milla Aïssa Alihan (Alihan, 1938) who argued that the work as being too narrowly tied to the biological model and that it ignored the cultural or social aspects of human ecologies and in her book she presented a broader framework of defining ecologies by introducing the term social ecologies.

It was Murray Bookchin, (Bookchin, 1996) who helped expand, define, and contextualize the term social ecology as distinct from the biological ecological models. An American social theorist and political philosopher, it was Bookchin who explained social ecology as, "The ecological principle of unity in diversity grades into a richly mediated social principle; hence my use of the term social ecology." As is evident, instead of just constraining himself to the relation of ecology to society he was looking at a more philosophical explanation for ecological balance in human societies. Stokols (Stokols, 2018) developed the idea to position it within the current context by defining it as a "transdisciplinary, overarching (or *metanalytic*) perspective for framing scientific and societal problems in relation to alternative spatial, temporal, sociocultural, and virtual *contexts*". He offered a framework within social ecology "as a dynamic analytical framework—a conceptual mapping system or problem framing device". With its roots in the work of Alihan and Bookchin, the term social ecology today is being expanded and is used concurrently by different disciplines as it pertains to defining interrelationships within their discipline. Hong, Crosby, and Lee (Hong, et al., 2017) use it in an attempt to understand criminal behaviors within the social-ecological framework. Here they are using the term social ecology to describe an "…overview of the factors associated with criminal behaviors within the social-ecological framework, which is conceptualized as an interaction between the behavior of an individual and his or her environments." Manzini positions it as favorable environments that serve as "enabling ecosystems" of cultural and social systems (Manzini, 2015).

It is clear that the hallmark of ecology is its encompassing and synthetic view of nature, as opposed to a fragmented view. It is the "relationships" and the "synthetic" aspects of that definition that the paper hopes to graft and transcribe to promote and position social ecology within the design discipline. What this paper hopes to extract from the ecological context is the interpretation of *the relationship between elements* (in this case all stakeholders) and how it can be used to instrument sustainable social innovation. Social

ecology within this context is being viewed in how social orders end up affecting the inter and intrarelationships within a societal context.

5.Role of social ecologies within design

Ideas of participatory design and co-creation are rooted in the recognition that increasingly designers are turning towards seeking effective, efficient and sustainable solutions to address major social problems and challenges. (Phills, et al., 2008) In this process oftentimes, given the complexities of the problems being addressed, it becomes necessary for designers to work in larger groups that involve multiple multi-disciplinary stakeholders. Stakeholders are defined as participants in a process where an issue being addressed affects each and every one of the participants. (Dille & Söderlund, 2011) This paper posits that social ecologies provide a framework for understanding the structure of relationships and the forces that help define and direct these relationships between these large groups of stakeholders. An understanding of the social ecology gives an understanding of the inherent relationships between stakeholders. This clarity in understanding therefore can lead to design interventions that are well rooted within the specific problem being addressed increasing the chance for sustainable solutions that can be defined as social innovation.

6.How social ecologies drive social innovation

If designers are to use social ecologies as a framework for engaging in participatory and co-creative practices it might be useful at this point to understand what distinguishes biological ecology from social ecology. Biological ecologies are by far uniform across the planet. The relationship between species remain consistent regardless of the geographical region we are examining. By that argument, biological ecologies are therefore also predictable. Social ecologies in contrast are deeply fragile and are often predicated and determined by deeply held cultural norms/beliefs, the precarious political temperament, and pre-existing social factors and mindsets. This inherent predisposition of complex relationships is something that the designer needs to carefully analyze in order to make sure that the process of participation and co-creation are informed by and framed within this understanding. Fundamentally rooted in the awareness of the complicated web of intersectionalities, the challenge for the designer is to understand and acknowledge the kind of relationships that pre-exist within stakeholders. The mapping of social ecology, therefore, helps mitigate some of the fragility that systemic issues pose for designers by giving them a tool to develop a deeper understanding and insights into the systemic issue being addressed. However, the biggest impact the understanding of the social ecology creates is that it gives designers/stakeholders a deep insight into the intricacies of the problem allowing them to recognize the deep-rooted details in the interrelationships by helping them identify the points of deepest impact.

Lidicker quotes from Edward Haskell's paper titled, *A Clarification of Social Science*, where Haskell states that "All theories of world importance, theories which affect world policies, are basically co-action theories." Lidicker (Lidicker, 1979) takes that social model and reframes it so that it applies both to the biomic and the social models by categorizing interactions into two groups, intra-action, and co-action. In borrowing that idea and bringing it into design, intra-actions can be seen as relationships between larger stakeholders and their sub-entities. and co-action on the other hand can be used to define the relationship between one stakeholder group and another.

The paper posits that for the designers to be able to navigate the complexities of the systemic problem they need to understand the nature of interactions that produce the resulting interrelationships. These interactions can be divided into four categories that characterize the following relationships — competitive (resulting interaction is a double negative), predatory (resulting interaction is a negative/zero), commensalistic (resulting interaction is a positive/zero), or mutual (resulting interaction is a positive/positive).

This gives us the ability to use these interactions as a tool in mapping any systemic problem. Given below are the five steps:

- examining the symptoms/causes:
  the first step is to gather what is surfacing to the top
- mapping the symptoms/causes and connecting them to stakeholders: every cause emerges from a stakeholder
- determining the stakeholders: the previous step then allows for the identification of the stakeholders that become major players/participants/co-creators
- identifying the nature of interactions between stakeholders to see if relationships are competitive, predatory, commensalistic, or mutual: this is by far the most crucial of all stages of design and this is where the understanding of social ecologies helps understand the interrelationships that exist. Because the understanding helps identify root causes for the designer
- defining the intervention: having a clear idea of what a problem looks like at its most basic and fundamental level allows the designer to clearly recognize the intersectionalities of the relationships among the stakeholders

Design interventions, therefore, could be constructed in several ways. Relationships that are the weakest (predatory) provide maximum opportunity for instrumenting design interventions that can be targeted to help mitigate, modify, or change the fundamental quality of interaction. From an unfavorable outcome, the aim of design would be to push that relationship towards a more favorable outcome for the interaction. However, from the standpoint of design, one can also look at strengthening some of the existing relationships. So commensalistic or mutualistic relationships could be reinforced but in uniquely re-positioned ways pushing them towards different outcomes. If social innovation is defined as the *creative recombination of existing assets* the hope is that this paper gives designers/stakeholders the ability to use the understanding of social ecologies as a tool to

frame their problems and approach it so that they are able to drive social innovation through their design interventions.

7.Discussion

For the designer, the more systemic the problem, the greater are the scales of complexities that determine its social ecology. If designers are going to expand their footprint by increasingly addressing more systemic problems, they will need to find the tools to cope with the complexities of scale that systemic problems have inbuilt within them. Although borrowed from the social sciences, the paper locates the concept of social ecologies within the design process and positions its understanding as a tool to demonstrate how it can help designers/stakeholders identify areas of strengths and weaknesses within the problem. Above all, it helps position design interventions to succeed in instrumenting social innovation that is both propitious and sustainable.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Slow Engagement & Widening the Frame – Emerging Models of Social Innovation and Design Culture

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Abstract | Design can be seen as a subtle process of creativity, but often it also requires different modes of leadership, and thought that are deployed to solve complex problems (Kolko, 2010). As such, the field of social interest design, and the related practice of socially responsive design, offer direct opportunities for outcomes that create change in people's lives, and generate tools and knowledge for other designers to guide their journey (Anderson, 2014). Within the emergent nature of working and co-designing with communities, socially responsive design allows designers to shift their roles, and accept the shared knowledge of the stakeholders, while social interest design has a much more fixed role for the designer (Anderson, 2014). The design research group, Integral Living Research has been working as both social interest and socially responsive designers, for the past eight years with a variety of community partners to create new solutions to ease the stress of underserved urban communities. This research group uses design research and "insightful deep design thinking" a term coined by the author to assist with housing stress through five lenses: access to green space, access to fresh food, expanding privacy, expanding security, and enhancing self-efficacy all through spatial interventions or tools in the urban environment. While these solutions are often met with enthusiasm; implementation is frequently trickier, riskier and takes a longer engagement. "Widening the frame" for designers involves an adaptive and complex process of examining sustainable solutions and capacity as a part of the design engagement process a new kind of problem definition phase. It also requires what the author calls "slow engagement" wherein the designer allows their role to respond to context over extended periods to construct successful collaboration. Within this emerging ontology of design praxis and research; the Integral Living Research Lab deploys a novel complex process to help relieve the housing crisis from the inside. This approach is, in part, drawn from current social science literature on complex adaptive leadership theory in which leaders work within such complex systems in an emergent manner to adapt to the needs of an organization or team (Uhl-Bien et al., 2007). Placing

Complexity Leadership Theory (Uhl-Bien et al., 2007) and Adaptive Leadership (Heifetz, Linsky, et al., 2009), as a way forward for design groups; this paper examines the Integral Living Research Lab approach as a process case study to position such leadership theory in analog to the generative and adaptive nature of socially responsive design and social interest design . In examining the attendant experience-based process of this group, a new culture of design leadership is emerging that is responsive to communities in need while giving them unique voice within the design process.

KEYWORDS | DESIGN RESEARCH, HOUSING, SOCIALLY RESPONSIVE DESIGN, SOCIAL INTEREST DESIGN, LEADERSHIP THEORY

1. Introduction

The Integral Living Research group has collaborated with those providing housing services, and related care, to co-develop human-centered designs for the shared spaces in emergency and transitional housing, and substandard rowhomes (Nicholas & Anandan, 2017, 2016; Nicholas et al., 2017, 2019, 2017, 2020; Nicholas, Stein, Nguyen, Krespan, et al., 2018; Nicholas, Stein, Thanh Nguyen, & Michael, 2018; Nicholas & Michael, 2017). Solutions developed by this group include examining the linkages in home repair data for clients to provide wrap around care; examining privacy and stress related solutions in shelters; introducing fresh food and green space into the urban home; helping families with creative co-housing; and convening community around co-design processes for their own spaces. Previously the group also produced design-build gardens for the active seniors aging in place; and a mobile autism assessment unit to help mitigate the stress and stigma associated with autism diagnosis. Through these projects, the group has determined the need for a widened frame in the problem definition phase, one in which designers and their community stakeholders allocate energy to understanding the capacity for true implemented change. Specific projects by this lab have been documented elsewhere, and the goal of this paper is to use the lab's community leadership as a case study to draw conclusions in light of leadership theory models that are emerging. As stated above, the work primarily engages with a variety of third sector organizations, and such organizations that often have a heavy compliance burden related to their funding. Thus, the problem at the root of this paper is the limited capacity for these social support organizations to engage in sustained implementation of new or novel ideas that might ultimately benefit their clients.

In design problem-solving the basic process of discovery, inspiration and implementation anchor the path to solutions (Cross, 1999; Design Council, 2020; Frayling, 1994; Hambeukers, 2019; IDEO, 2011). Problem definition is a distinct process that underpins the work at early stages (Design Council, 2020). Many of the urban problems that society currently faces are

entangled with larger societal issues, and common design modes have limited efficacy in the face of such intermingled issues. Data-driven disciplines such as epidemiology now have much knowledge and expertise that can also inform a necessary adjustment in the design process towards a more evidence-based approach. Complex teams, and thinking, must now also be deployed to accomplish long term outcomes and change. Designers are pragmatically oriented, and outcomes are an integral part of the conventional work and process of a designer. As such, the field of social interest design, and the related field of socially responsive design, offer direct opportunities for outcomes that create change in people's lives, and may create tools and knowledge for other designers to guide their journey over time (Anderson, 2014).

2. Developing Design Leadership Theory

Design leaders are often judged in terms of business success; however, one goal of this paper is to advocate for another type of design leader, one with civic change in mind and the processes to create such change. Currently our societies in America, and beyond, face a housing crisis that is based in issues of access. This crisis is both complex and evasive to typical single silver bullet solutions. Such problems require that those involved bring diverse points of view and professions to bear at many points in a complex system that includes public services and facilities at many points. Buchanan, and others, defined a wicked problem as one that needs intensive collaboration, and out of the ordinary thinking to create positive change (Buchanan, 1992, p. p.15; Crowley & Head, 2017; W. J. Rittel & M. Webber, 1973). The housing crisis is just such a problem. The Complexity Leadership Theory (CLT) literature repeatedly discusses the need for adaptive leadership and adaptive space to operate within these types of complex environments (Uhl-Bien et al., 2007). Uhl-bien in particular provides multiple descriptions of both complexity and the fear that leaders often experience in dealing with complexity and change (Uhl-Bien et al., 2007; Uhl-Bien & Marion, 2009). Both social interest design and socially responsive design demand that we come to the table without preconceived notions of the problems we will need to help solve.

The American social system does not serve these in-need populations in a comprehensive manner, especially at the metropolitan level. Thus, regional governments must look to "informal coalitions, alliances, and networks that weave together nongovernmental actors with existing units of government in metropolitan areas (Adams, 2014, p. 1)." Such networks are the developing third sector in America, between private and public (Adams, 2014). Many of the types and scope of challenges that a third sector organization deals with, are related to capacity, nonprofit capacity is defined by Christensen and Gazley as follows: "the processes, practices, and people that the organization has at its disposal that enable it to produce, perform, or deploy resources to achieve its mission (Christensen & Gazley, 2008, p. 266)." Capacity is directly linked to an organization's aptitude for reaching goals, satisfying a mission and satisfying mandates (Christensen & Gazley, 2008).

2.1 Social Interest Design:

In the Integral Living Research work with community and community care providers, the term that is most often used for the initial work with stakeholders is social interest design. Integral Living Research has worked with shelters, behavioral foundations, local developers, and urban residents. Here, social interest design is a type of design practice in which community engagement is central to leading designers through the process of solving a problem (Anderson, 2014). Social interest design has evolved from the developing connection between public service and design, and social interest design has also been defined as pragmatic design processes and projects that benefit those who might not normally get the services of a designer (Anderson, 2014). Integral Living Research approaches the social interest work of housing insecurity through working in shelters to improve the environment and working with communities to improve substandard housing conditions. Habitat for humanity has long been involved in social interest grassroots design through their shared housing production process in which families themselves contribute to the building process (Habitat for Humanity, 2020). Much of the Integral Living Research Lab work, to date, was undertaken with nonprofit partners to assess and help solve physical or service-oriented issues. The Integral Living Research Group seeks every opportunity to be more effective when partnering with those in the third sector. In this work, socially responsive design and social impact design are clearly limited by the capacity of third sector partners who bear heavy compliance burdens (Gargan, 1981).

2.2 Slow Engagement

The author has coined here the term “slow engagement” to refer to the long-term collaboration, shared goals, and processes that have emerged over time with partners. For the Integral Living Research group, “slow engagement” is deemed necessary for solutions to be implemented in space, place, and behavior. This type of engagement requires the design team to contribute to their partners’ processes in ways that might be helpful outside of the frame of the project area, and to create space in which the partners are leading the process. Examples might include leveraging team expertise to advise on seed grants, supplying additional expertise and materials for larger funding opportunities, serving as advisor to nonprofit partners on their forays into social design, running community workshops that contribute to the organizational culture within the partner organization, and looking for opportunities to cede control to community member and stakeholders. Central to slow engagement is the ability to recognize that stakeholders’ and community members’ lived experience within the issues we are trying to solve are a form of expertise (Nicholas et. al, , 2019). These activities over time, can build both capacity and trust between community members and the researchers, but more importantly they give the research group the ability to witness the full process they are trying to assist with.

Several of the community partnerships in this group have been in existence for the better part of a decade and require leadership skills that differ at many stages. Literature on third

sector capacity has also emerged as an important resource to understand the partner roadblocks in the socially responsive processes engaged in here. The need for adaptive practices, and a commitment to the uncomfortable uncertainty this brings, has echoes in a truly socially responsive practice. Next this paper will examine capacity, and how it limits innovation, as a bridge to understanding how capacity relates to the work of social interest designers, struggling to implement with their third sector partners.

3. Capacity, Design and Complexity

As stated earlier, design is often a process that leads to a tangible outcome. This need to create something in the world is the key frame of reference that many designers are trained to operate within. Often, designers come to the table when a perceived improvement is needed by a "client". Social impact design and socially responsive design both require that designers attempt to check their preconceptions at the door.

3.1 Organizational Capacity

In defining organizational capacity, there is a consensus that the ability of an organization to complete work or meet its mission is a part of the defining characteristic of this term (Yu-Lee, 2002). Yu-Lee also defines the most granular aspects of organizational capacity as: "Entities" that include "space, labour, equipment, technology and materials" (Yu-Lee, 2002, p. 28). Despite such a well-defined schema of what makes up capacity however, the level of investment in capacitive "entities" does not alone reflect the true operational capacity of an organization (Yu-Lee, 2002). It is due to this inability to directly measure capacity that it is often defined differently, and with some confusion, by various organizations and industries. Such confusion is especially true in terms of how it might drive the abilities of organizations to work effectively (Gargan, 1981). The Integral Living Research group has anecdotally observed that in the current American housing environment, many organizations that serve these at-risk populations must use considerable capacity to maintain their compliance and funding. Many of the collaborations with designers seeking to improve the situation for stakeholders, are limited by the allocation of staff, counselors, and resources to the vital compliance arena that these organizations operate within.

3.2 Socially Responsive Design – in response to complexity:

Uhl Bien wrote extensively on the current complexity driven era, and how that has changed the face of organizational management (Uhl-Bien & Arena, 2018; Uhl-Bien & Marion, 2009). Social interest design is similarly influenced in that groups are emerging who choose to focus on solving specific pieces of the challenges faced by urban or rural stakeholders. In addition, there is a movement to a design problem solving process in which designers are a constituent in the process and not only the facilitators (Thorpe & Gamman, 2011). Referred to as socially responsive design, this participatory-oriented work is the natural next

version of social interest design in which designers create team co-design processes that draw on the expertise of community, care providers, and all stakeholders to drive the process of innovation forward (Sanders & Stappers, 2013). There are many groups that are coming to prominence for their socially responsive topic-driven work. These include: Design Resources for Homelessness that has created a repository of empirical research and tools for designers to design for the homeless (Jill Pable, 2019); Creative Reaction Lab's equity centered co-design model (Creative Reaction Lab, 2020), and Design for Social Interest and Sustainability, a network of centers and groups that focus on equity and socially sustainable models (Young Foundation, 2020).

The Integral Living Group often leads groups both as facilitators and conveners; the group seeks to cede creative voice to community, whenever possible. Giving over control gives the work a shared authorship, and a responsive nature. The main components of the process that the Integral Living group has developed as a socially responsive design practice are centered on the core concepts of *learning, creative, positional, and contextual orientations* as follows:

- Learning: iterative data gathering, iterative question making, engaging with community leadership; here community lived experience is treated as a form of expertise
- Creative: iterative ideation and synthesis, conversation making, problem validation with community leaders
- Positional: frequently checking bias, frequently checking transaction, frequently checking approach; here community lived experience is treated as a form of expertise
- Contextual: Slow engagement, engaging over time, showing up in the community, expertise from all quarters, reflection and compartmentalizing, confidential approaches

In order to put this work into a leadership theory context it is necessary to next examine the concept of complexity leadership, and briefly discuss the concepts that are most relevant to the practice of Socially Responsive Design.

3.3 Complexity Leadership Theory

Complexity Leadership Theory (CLT) (Uhl-Bien et al., 2007, p. 299) is drawn from complexity science. It is, a model for leadership that enables a flexible, creative, and learning oriented approach to leading and is oriented to what are called Complex Adaptive Systems (CAS) (Uhl-Bien et al., 2007, p. 299). Complexity Leadership Theory (CLT) was developed in part, in response to the struggle of many organizations to understand the changes in workforce, production and management required by the knowledge driven 21st century (Uhl-Bien et al., 2007). Unlike other models of leadership theory, complexity leadership does not call on leaders to control specific situations; however the goal is to create the correct environments for innovation (Uhl-Bien & Marion, 2009). CLT is a way of describing, studying and

understanding how leaders can adaptively control and grow innovation, while still being efficient in their business practices (Uhl-Bien & Arena, 2017, p. 11).

The CLT system is composed of two "lobes" that have distinct tensions; the entrepreneurial and the administrative (Uhl-Bien & Arena, 2017, p. 11). The "Administrative Lobe" is all of the functions that run an organization efficiently, they include top down administrative and productive functions (Uhl-Bien & Arena, 2017, p. 12). The "Entrepreneurial Lobe" consists of the practices that are flexible, dynamic, top down and will encourage innovation (Uhl-Bien & Arena, 2017, p. 12). The tensions inherent in this framework are at the very root of what limits many organizations to establish a continued environment for innovation (Uhl-Bien & Arena, 2017). Figure 1 below is adapted from Uhl-Bien and Arena's diagram "Theoretical perspectives on organizational adaptability. Dynamic Capabilities Transformation Process" (Uhl-Bien & Arena, 2018). The diagram shows the tensions arising between the two lobes, as a way of creating an "Adaptive Space" between ordered administrative space and the less predictable entrepreneurial space.

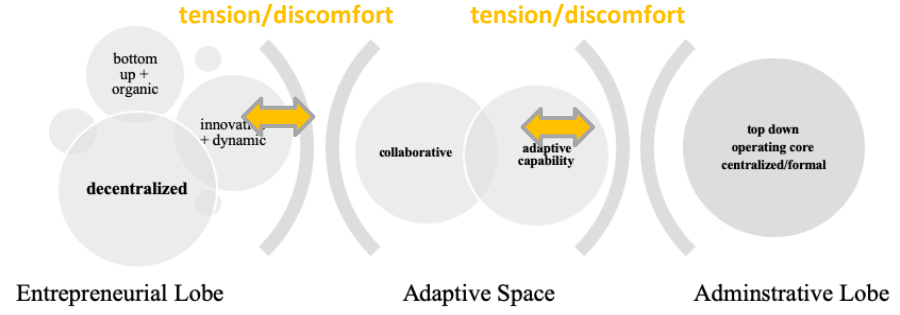

Figure 1: Adapted from Uhl-Bien and Arena's diagram "Theoretical perspectives on organizational adaptability. Dynamic Capabilities Transformation Process" (Uhl-Bien & Arena, 2018) Image Credit: Author

The Complex Adaptive System (CAS) emerges from the adaptive practices that work to connect these two lobes, and innovation arises from the tensions between them (Uhl-Bien & Arena, 2018). This model requires that leaders act to support and create spaces in which unexpected and uncontrolled aspects of their work can create novel situations and innovative moves (Uhl-Bien & Arena, 2017). "Emergence" as outlined by Uhl-Bien and her team, relates to the self-organizing nature of CAS and CLT and the creation of a space of discomfort for many leaders (Uhl-Bien & Arena, 2017). The true goal of a leader in this space is to enable the type of environment in which adaption leads to success, deploying the abilities and knowledge of every part of teams to solve complex problems (Uhl-Bien & Arena, 2017). In fact, in an interview with the Oxford review, from 2018, Uhl-Bien maintains, in support of the academic literature her team has produced, that many organizations unwittingly stamp out the very environments that are necessary for emergence, and

innovative practice. This is primarily due to their reliance on the administrative lobe, and their discomfort with and inability to recognize the value of, these tensions (David Wilkinson, 2018). In summary, CLT holds within it the concept of adaptive practice and spaces that are an important component of our process with community. These practices clearly require leaders to act creatively and with an open mindset (David Wilkinson, 2018). The similarities between the conceptual framework of CLT and Social Interest Design are striking and will be examined further below. Of particular interest is the tension between creative (or entrepreneurial) processes and administrative processes, as this tension has been found to limit the work of our group. Capacity in particular limits the social impact work done by our group and aligns with the administrative core functions of our partners.

4. Adaptive Leadership Design and Complexity Leadership

To better understand how leadership in design and this type of social interest work might build further capacity, here we examine how Adaptive Leadership (Heifetz, Linsky, et al., 2009) and Complexity Leadership (Uhl-Bien et al., 2007, p. 266) might be a more influential part of the design process to expand the frame within these engagements for both third sector partners and the designers who are trying to serve them. The ultimately, we hope to uncover the parts of these models that have the most in common with Socially Responsive Design.

4.1 Adaptive Leadership and Socially Responsive Design: a critical complexity lens

Adaptive leadership is an important component of a complexity driven approach (Uhl-Bien et al., 2007). Within the complexity driven approach, we have ambidexterity, activating triggers, and ideation, as core processes that push towards change for leaders (Uhl-Bien & Arena, 2018). In thinking critically about both CLT and AL, mapping these frameworks across the Integral Living Group's core processes began to take on a currency as a critical step to examine possibilities in these frameworks for design leadership with our group and other similarly oriented labs. The social design process consists of many rounds of iteration and ideation, driven by information, feedback and reflection to synthesize diverse inputs into the problem-solving process. As stated above, many designers come to a problem after it is already somewhat defined, however in socially responsive design it is important to maintain a "beginner's mindset" pre-supposing the nature of the problem limits our abilities to solve the problem (Cross, 2011). In addition, in the Integral Living Research group the process of engaging with constituencies in order to create a shared culture is part of the work vis a vis the original concept of slow engagement mentioned above and reviewed in Figure 2.

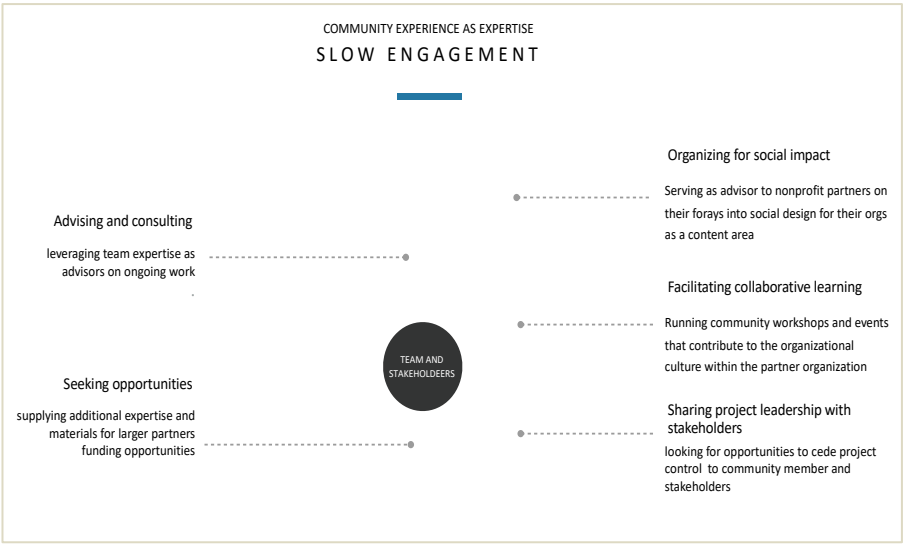

Figure 2: The core of the Integral Living Research group's process of Slow Engagement. Image Credit: Author

Undertaken in concert with stakeholders, the group is able to give input at many parts of the process, and at times will lead the process through community preceptors, and our processes of slow engagement. In past work, our group has uncovered a framework in which we examine how community lived experience is a form of expertise and should be treated as such (Nicholas, et. al., 2019).

The mapping of the socially responsive design process onto Uhl-bien's theoretical framework, gives us the opportunity to orient the process towards community more directly and ask the question, will CLT be a useful lens to the socially responsive design process? If we organize the socially responsive design process according to the lobes of CLT we learned about our ability to create adaptive space within our design processes. Through further examination of the slow engagement process we found that it aligns within the CLT concept of ambidexterity, defined above as the ability of leaders in this process to create and sustain a place in their process where ambiguity and a control create opportunities for unexpected success. Figures 3 reviews and maps our core processes according to the administrative, entrepreneurial, and adaptive lobes.

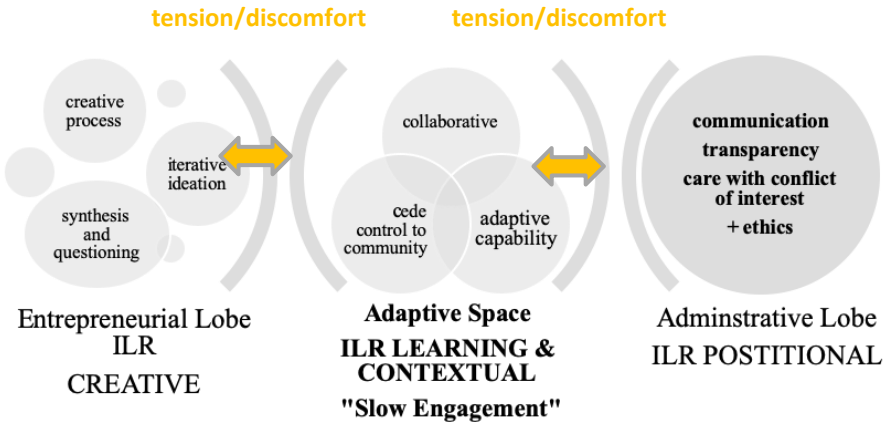

Figure 3: Adapted from Uhl-Bien and Arena's diagram "Theoretical perspectives on organizational adaptability. Dynamic Capabilities Transformation Process" (Uhl-Bien & Arena, 2018). Mapping the core process the Integral Living Research (ILR) Socially Responsive Practice within the CLT model. Our adaptive space is driven by community interaction. Image Credit: Author

Through aligning the Complexity model Uhl bien and Arena's "Lobes", it becomes apparent that the Integral Living Research work aligns with the adaptive space through the process of slow engagement. The following falls into the entrepreneurial "lobe": Ideations, iteration, learning, open mind-sets and creative thinking. The administrative "lobe" aligns with: engaging respectfully, managing conflicts of interest, transparency with clients, showing up, planning ahead, and communicating effectively. Most interestingly, the adaptive space of this model consists of our ability to cede control to the client and the community, often our goal is to reach a point where stakeholders are driving the control of the processes, and we are learning from them, as a way to help them create meaningful change. If the design team is able to be a participant and lead through creating an adaptive space for stakeholders, we will truly uncover the needs and functional limitations of those we work with including their functional capacity issues.

Adaptive leadership (AL) functions as a core orientation for many leaders, consciously and unconsciously, it can easily be mapped to the social interest problem solving method that was laid out it the earlier part of this paper. Using the underlying process employed by Heifetz to examine, diagnose and take action in relationship to a problem (Heifetz, Grashow, et al., 2009), the goals of the group were aligned in the quadrants below. In contrast to the CLT approach, Heifetz sees adaptive leadership as a process versus a set of capabilities; it is not a defined set of capabilities but rather an orientation towards problem solving (Heifetz, Grashow, et al., 2009). This orientation towards a process of problem solving in AL gives it a

natural affinity to design processes as varied as design thinking and design research, each of which are predicated on studying the problem to understand what the issues are before diving into solutions. Figure 4 below identifies the proper quadrant of the AL model in relationship to the socially responsive design process that we deploy.

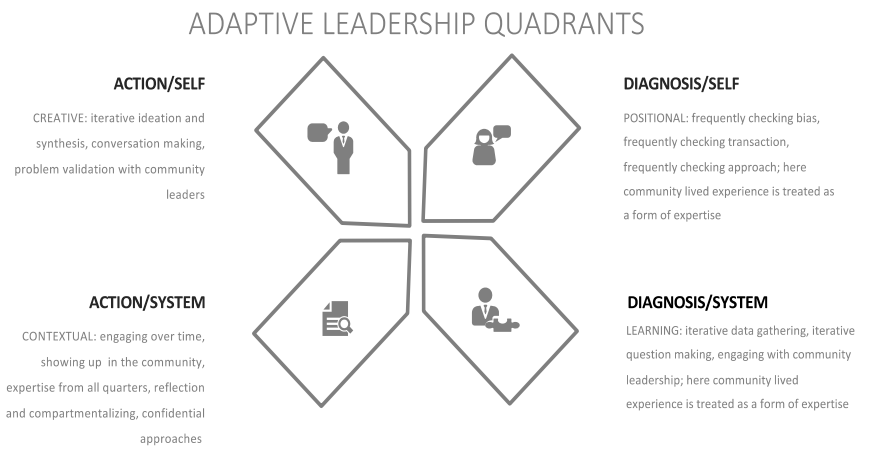

Figure 4. Diagram showing how the Integral Living Research Process maps onto the Adaptive Diagnosis and action quadrants—Adapted from Heifetz, R. A., Grashow, A., & Linsky, M. (2009). The practice of adaptive leadership: Tools and tactics for changing your organization and the world. Boston, Mass.: Harvard Business Press.

The contextual nature of AL specifically orients well with design processes which by their nature are inherently contextual. Figure 4, above, maps the core socially responsive design processes of *Learning, Contextual, Positional, and Creative* within the diagnosis and action quadrants in the AL model. Of particular interest here are the ways one might consider systemic diagnosis and context in the design process. The critical question here remains one of clarity and action, could approaching a socially responsive process with the adaptive and complexity-oriented lens give designers in complex socially responsible arenas a more successful approach? Will it help us focus further on the needs of those we work with? If we are able to deploy consciously as adaptive leaders, could we sit at the table with our constituents earlier before problems are defined? Opinions formed? Directions decided? These frameworks over time will re-organize the socially responsive design approach, through a novel re-orienting and reflecting on the process in relationship to context and community and affords an opportunity for further study.

In adapting the socially responsive design process in this way, the goal is to re-orient the work around our partners so that we become true allies in solution seeking with them as

stated in our definition of slow engagement. The critical point here is to slip into the idea that leadership is both a process and a capability that can be shared.

5. Conclusions

"Requisite complexity" refers to the nature of complex adaptive systems to evolve complexly in the face of new environmental conditions (Uhl-Bien et al., 2007), and this concept takes on special meaning when considering the complexity of the current, and future, housing crises. A cursory study of design leadership literature has revealed that the field is wide open in terms of formal theory. Many designers consider formal design leadership to be comprised of leading a design firm to be profitable or managing multinational teams. While this is definitely the leadership that drives the design industry, especially in America, the conception of design leadership as a type of stewardship to move our creative fields in a more ethically responsible and equitable direction, has not been examined at length in relationship to the formal leadership theories offered by social science-oriented leadership fields. These theories offer an opportunity for new ways to look at leadership in the field of design, beyond profit or business success. The goal of this paper has been to give voice to such formal leadership theories within the practice of socially responsive design, and at the same time examine those theories as possible vehicles for change in design process. This is a beneficial lens as socially responsive design is a truly complex process, and Complexity Leadership Theory holds much that can augment those that practice it. In return, Complexity Leadership Theory deploys some concepts that may draw on design processes – perhaps design can lend itself to leadership theorizing in the future.
The process space of the housing lab Integral Living Research has served as an ongoing test bed to examine leadership, design leadership and possible future directions of practice. The value of social equity leadership in the arena of housing inequities cannot be overlooked. Further study within the social impact and socially responsive practices that are emerging to solve our most complexes of problems is of course, necessary.

This paper has found that the subtle process of slow engagement, defined for the first time here, is aligned with the parts of complexity leadership and adaptive leadership that are most necessary for successful change, and the hope is that this work will strengthen such social equity leadership efforts in the future, and lead to further study on Design Leadership Theories.

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Acknowledgements: The author would like to thank Dr. Shivanthi Anandan, Dr. Yvonne Michael, Dr. Laurien Alexandre, and Dr. Lize A. E. Booysen, and The Scattergood Foundation

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Smart, Safe and Green System. A Resilient-Based Strategy for Sustainable Buildings and DIY Design

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Abstract | This paper - after an overview of the sector's issues - aims to present Smart Safe and Green System, a working prototype for small and medium-sized buildings and industrial warehouses. It is an integrated and scalable green technological system, aimed at the energy adaptation of pre-existing façades, at the improvement of ambient air quality, at the aesthetic redesign of urban spaces, at the structural and thermal monitoring of buildings. What we intend to propose in this paper is an economically accessible and easy to implement project, which represents the synergy between methods, processes and tools of Design discipline and the most advanced research in the field of Smart Products, IoT and plant-based technologies, for the promotion of a Do-It-Yourself approach as well as a Transition Design as a guide for a resilience-based social change aimed at a more sustainable future.

KEYWORDS | DO-IT-YOURSELF DESIGN, PLANT-BASED TECHNOLOGIES, INTEGRATED SYSTEM, ARTIFICIAL INTELLIGENCE, CLIMATE-CONSCIOUS CONSUMER

1. Introduction

As recalled by ISPRA (Istituto Superiore per la Ricerca e la Protezione Ambientale) and Rapporto del Sistema Nazionale per la Protezione dell'Ambiente (SNPA), for several decades our continent has been facing the unavoidable issue of sustainability, which any project proposal and resource management depends on necessarily (SNPA, 2019). In the building and energy field, the common goal is to reduce building organisms to "zero energy" - or even transform them into POA, "Positive Energy Architectures" (Tucci & Monticelli, 2018) - by 2020 and also to reduce to zero the consumption of new land by 2050. In practical terms, therefore, the feasible strategies will be directed towards a more responsible use of materials and sustainable building technologies, together with an adaptation of the existing buildings through a redevelopment and conversion of disused structures and unused land (Finocchiaro & Di Leginio, 2019). The theme of redevelopment of buildings is therefore the core of this project, in fact the research focuses on the recovery of the existing and energy improvement, through the study of hypotheses of application on various types of construction in order to cover a larger percentage of cases. There are two main areas of interest to which the project is addressed: on the one hand the housing area, and on the other disused industrial areas. In the case of housing, the main problems of adaptation are in the energy field, as most old buildings do not have (or are strongly lacking) any criteria in terms of sustainability and energy saving, as they are characterized by traditional technological systems, now obsolete, or because they are the result of design errors. In the case of industrial areas, these are abandoned buildings: according to the WWF's Report "Re-use Italy 2013", from a functional point of view, out of 575 reports no less than 131 relate to buildings that have had industrial use in the past (Ombuen, 2013), which could find new life through an adaptation of technological systems and a use reconversion. More in detail in this paper, an overview of the themes that frame the design proposal will be followed by a description of the prototype structured in three sections, one for each part of the project.

2. Plant-Based Technologies for energy adaptation

The preliminary analysis phase of the research was based on the investigation of construction techniques more widely used or experimental, effective for the buildings' adaptation, focusing interest on those "hybrid" systems consisting of the integration of the building with vegetation, or the so-called "green façades" - or VGS, Vertical Greenery Systems (Radić et al., 2019), winning in terms of effectiveness on both the building and urban scale. The design of the green façade is not only an excellent remedy to the problems of overheating of poorly insulated and energy-wasting buildings, but also a proposal for the aesthetic redevelopment of anonymous, poorly maintained and crumbling façades in urban or industrial areas where the presence of designed greenery is particularly scarce (Tatano, 2008). The presence of vegetation in urban areas is nowadays a fundamental reflection

theme regarding the adaptation of cities to the important climate changes in progress, which must be faced with effective and intelligent systems. The design of green surfaces (both horizontal and vertical) is in fact relevant in the abatement of the so-called "heat islands" inside urban centres, in the thermal absorption, in the production of oxygen and in the purification from pollutants, which plants are responsible for, through physiological mechanisms such as chlorophyll photosynthesis, phototropism, evapotranspiration (Bellomo, 2009).
The state of the art analysis has made it possible to identify, first of all, the distinction of two main categories of green façades, which are on the one hand green covering - or green façades - and on the other hand vegetated walls - or living walls (Bit, 2012). These two systems differ in their technological characteristics and used components: green covering is a relatively simple technological system, which provides for the application of vegetation on any envelope, as it is not integrated with the structure, but rather supported or detached; while the vegetated wall is a type of façade integrated with the envelope and equipped with an organization, and therefore a more complex realization with functions of support and nourishment for the vegetation (Patrick Blanc's patent of "mur vegetal", in Blanc, 2008).
As far as the realization of the supports is concerned, it varies according to the envelope on which they are assembled. They can be divided into rigid or stretched support structures: in the first case the elements are parts of the structure, or lattice panels, as well as elements modules-moulded and assembled in different configurations, while in the second case they are tensioned cables, meshes and nets, mostly made of steel or fibre-reinforced synthetic materials (Bellini & Daglio, 2009).
In parallel, the variety of plant species most commonly used was examined, each with its own characteristics of growth, appearance and exposure. The green cladding, compared to the vegetated façade, allows a greater versatility of configuration at a much lower cost and maintenance, while maintaining a very high level of energy efficiency, including a good result with respect to the solar radiation shielding, a good success in the control of heat and energy flows, in the management of noise pollution, as well as in the protection of the envelope from atmospheric agents, in some cases up to excellent results that see significant energy savings (Flores Larsen et al., 2014).

3. DIY approach and Transition Design for smart resilience

"The art of resilience" (Bohigas & Montlleó, 2018, p. 28) is a complex operation that requires interventions of radical change, of redesign not only on a large scale, but also of precise green oriented interventions, focused on the small scale. Since the objective of the research is the application of a sustainable system for the redevelopment of existing buildings, case studies and technological systems that respond to the category of green coatings have been analysed more specifically for their flexibility of use, adaptation to the pre-existing and

energy efficiency. As argued by Calzolari: "In recent decades the concept of resilience to be developed at different scales has emerged: from the product, to the building organism, to the city". (Calzolari et al., 2018, p.191) and consequently the need to act with modular and scalable systems, applicable according to different configurations, depending on the structure to be upgraded.
From an economic point of view, most of the green cladding systems currently on the market, despite being less expensive and easier to manage than vertical gardens, are still subject of specialized companies that offer different products at different price ranges. Smart Safe and Green project is based on the desire to fill the gap between the ordinary user and the highest forms of technological sophistication, particularly in the field of energy adaptation of building structures. It represents an intervention hypothesis designed ad hoc by a multidisciplinary team, characterized by a high degree of flexibility, adaptability and simplicity of implementation that directly involves the end user in the installation and operation of the technology.
The inclusive and participatory approach reflects emerging trends in the field of Transition Design, a "design-led approach for addressing complex, wicked problems and catalysing societal transitions toward more sustainable futures" (Irwin, 2018, p. 19). Transition Design argues that the unsuccessful problems solution results from a wrong involvement of stakeholders in the processes, because social and environmental problems that people face today are too complex. The Do-It-Yourself approach of this kind of design is core in the process of individual user empowerment and action, in the will to face very complex problems and systems such as climate change and energy adaptation of buildings. The involvement of users within the process is considered as a "more democratic design process" and "closer to the user" (Atkinson, 2006, p.1), not identifying it as the opposite of professional designers' activity (the most amateur form of bricolage), but as an opportunity to "express a greater aesthetic individuality not bound by the constraints of mass production" and to avoid "passive consumption" (Atkinson, 2006, p.1).
Professional-user interaction, in a process of Transition Design, is identified as a potential, not a deterrent, within the design process of renewal and transformation. As claimed by Sangiorgi, in fact, "the key ingredient for transformative practices is the understanding of citizens as agents and their active role in the creation of well-being" (Sangiorgi, 2010, p. 4). Objective of the transformative approach of these processes is the definition of the most effective tools and methods for the realization of what is called Lifestyle or Lebensstil, explained by Smith as a "kaleidoscope of transformations realized and imagined, a complex collage of activities, values, visions, roles and skills" (Smith, 2014, p. 5).

4. Smart, Safe and Green project

The proposed experimentation is a prototype of a technological system applicable in a rather wide range, in particular in the energy adaptation of pre-existing façades, in the

improvement of the air quality of indoor and outdoor environments and in the aesthetic redesign of urban spaces, as well as in the structural and thermal monitoring of buildings. First of all, the research has been carried out according to a desk mode, oriented to the collection and analysis of case studies, both from a technological and botanical point of view: some examples of realization (both green coverings and vegetated walls) have been examined and analysed according to different parameters to verify their effectiveness in terms of microclimatic control functions (both in summer and winter), depending on the used configurations, materials and species. Each case study was analysed in the form of a sheet, taking into consideration the geographical location and exposure, structure, construction details, used species, in order to identify compatible and efficient solutions. After the preliminary desk research phase in the field of green systems, we moved on to the development of the prototype project, analysing what emerged from the comparison between different technologies and the collection of case studies: Smart, Safe and Green consists of a light support system to be fixed dry on the skin of existing buildings, aimed both at housing purifying plants and at positioning a data collection system using sensors, with the aim of improving the energy performance of buildings, structural monitoring and air quality improvement. In order to fulfil these functions, the project involved the construction of a prototype set out in three parts: a façade system, a roof system and a series of specially developed markers accompanied by special monitoring software. The third function of the system differs from the first two because it is not part of the green theme of energy adaptation, to focus on the equally important one of the structural health of the buildings, thanks to a monitoring system (Fig.1).



Figure 1. Left: assembled prototype of the steel mesh screen, with Tillandsia plants leaning against it. On the right, detail of the position of the plant on the prototype.

In the project, both for the façade system and the structural one, the same screen/structure is used both to support the vegetation, to be affixed to façades to be redeveloped, and to monitor their stability and deformations related to external actions through intelligent technological systems. The creation of grid systems with a modular configuration would make it possible to adapt the cladding to the pre-existing envelope, also referring to the presence of openings for lighting and natural transpiration, using suitably designed uprights and knots.

4.1 Façade system: one green screen, many benefits

The green system for the façade consists of a kit of stainless-steel stretched cables - with cheap accessories and fastening elements - configured as a frame and put together at a distance from the wall to ensure adequate ventilation behind it, on which plant species are housed. For the greening of the support, the research experimentation proposal foresees the use of the Tillandsia Usneoides species also known as "Spanish moss" or "Moses' beard". Belonging to the Bromeliads species, it is native to Central America which prefers therefore very humid and warm climates. The main characteristic of Tillandsia is the absence of underground roots: in fact, it looks like a tangle of long leaves with aery roots, which feed on the air's humidity that they absorb through special structures placed on the epidermis (trichomes) that open when the plant needs to hydrate and close under a certain threshold of humidity to prevent the evaporation of what has accumulated (Kuaanan et al., 2014). Another very important peculiarity of this species is its function as a detector and purifier of pollutants and fine dust (polycyclic aromatic hydrocarbons). A team of researchers at the University of Hidalgo (Mexico) claims that Tillandsia Usneoides is "one of the most widely used organisms for the biomonitoring of atmospheric metals due to its ability to accumulate and retain pollutants" (Martínez-Reséndiz et al., 2015, p. 262). In addition to the phyto-purifying action, the advantages of Tillandsia are different: the skin's trichomes of this plant have the dual function of shielding the sun's rays and facilitating the water reception by ensuring a reduction of solar radiation on the façades; this species can live in direct sunlight, therefore preferring a south-east orientation and can withstand the winter cold up to several degrees below zero; it does not require maintenance because of its rather slow and regular growth.
Although from the technical point of view, therefore, the façade-prototype falls into the category of stretched systems, it lends itself to further customization: the steel rope mesh can also be combined with prototype segments made with the proprietary patent of the Med Marine s.r.l. company, made of composite fibres, which allow the insertion of plant pots (and therefore the possibility to choose crop species other than Tillandsia Usneoides), drip irrigation or hydroponic systems and humidity sensors.
It should be remembered that, for the prototype, it was decided to prefer an executive project that, not anchored directly to the building walls, but fastened to protruding elements

of the roof (in this specific case wooden beams) would allow a greater detachment of the frame from the external perimeter surface. In fact, being able to detach the frame 30-50 cm from the subfloor, allows to maximize the advantages of the shading effect of the frame itself, as it guarantees a back ventilation. In this way, the heat generated by any uncovered parts can be taken away, as well as the moisture generated by any irrigation, residual moisture from rainfall, condensation from low temperatures at night, or simply moisture and escape from the interior of the building through the perimeter wall. In the case of adherent plants, this humidity may not dry out, resulting in the formation of mould and biological patina.

In addition, in the components' executive design, an attempt was made to standardise the lengths of the eyelets in order to simplify assembly as much as possible: therefore, the presence of the difference in height was managed through the cable tension system itself, consisting of a lamellar wooden beam, anchored to the floor of the courtyard with threaded rods (Fig.2). The use of threaded rods drowned in the floor allows, in combination with anti-slip nuts, to adjust the height of the wooden beam from the ground and therefore the tension of the steel ropes. Being able to easily manage the length variations of several eyelets with a single adjustment (the beam system), is an important simplification of maintenance activities.



Figure 2. Left: detail of the anchoring system of stretched cables to the ground through a wooden beam; right, detail of the steel mesh knots.

4.2 Roof system: green indoor comfort

Referring to the roof, the project foresees a micro-ventilated horizontal greening system, consisting of a main element, a container tray in composite material (derived from fibres processing), also made with proprietary technology developed during the project, which through assembly and fixing components is easily anchored to the main types of roofing envisaged (tiles, corrugated sheets, shaped panels), together with accessories with windproof function to prevent it from tipping over. The production technology developed has made it possible to customize the tray's shape, making its use possible on any type of cover, without the need for adaptation. In order to meet the specific requirements of energy regulations and economic evaluations two issues have emerged: on the one hand, the need to switch from longitudinal profiles to a continuous coating package and, on the other, the replacement of the Tillandsia plant species (used in the façade system), which is excessively expensive for the entire roofing surface, with different species which, not being epiphytic, adapt perfectly to a pre-cultivated soil substrate (Fig.3).



Figure 3. Left: installation of the trays on the roof for the experimentation phase; right, detail of the installation of the cultivation layer

The crop selection aimed at the use of species capable of withstanding both summer heat, with periods of reduced water supply or drought, and resistance to winter temperatures. In particular, has been organized three zones, with three different species: a zoysia matrella

meadow (macroterma species), a zoysia tenuifolia meadow (macroterma species) and a sedum miscellany meadow (belonging to the crassulacee).
Using rockwool layers put between the trays and the meadow, and applying techniques typical hydroponics techniques, it is possible to obtain both the insulating effect and the substrate effect to house the plant component to be developed within the system. The wool mat, although flexible, maintains its shape and does not fill the central gutter: in this way the excess water flows and flows into the gutter (Fig. 4).

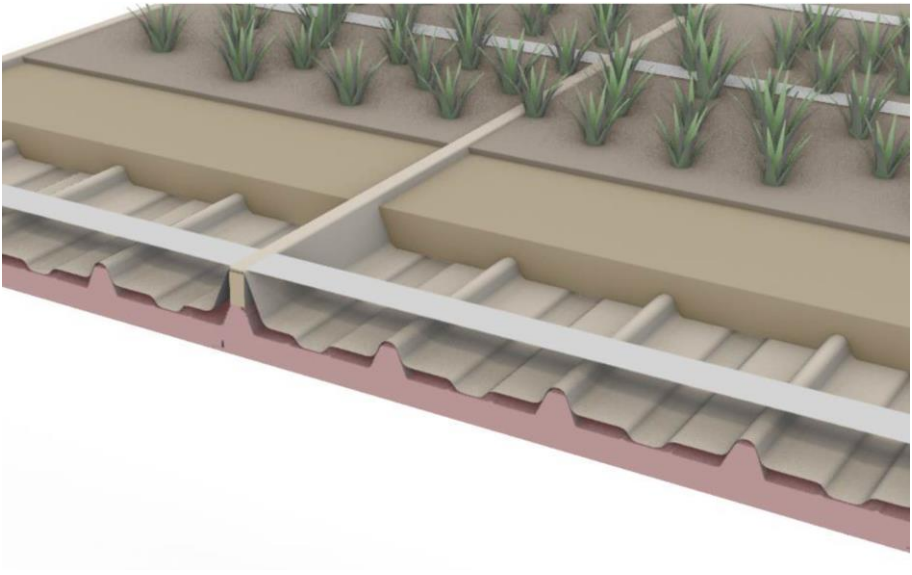

Figure 4. Three-dimensional representation of the roof system: detail of the stratification

The windproof function is achieved by fixing the rock wool under a fibreglass mesh. In a short time, the plants, rooting beyond the soil block and stretching inside the rock wool, will also anchor the crop finish to the whole system, which will remain firmly on the roof.
The strength point of the roofing project is the capacity of the fibreglass tray to maintain its shape, creating a ventilation cavity and, at the same time, a sufficiently flat surface to be trampled on. Compared to previous applications of the existing patent, in fact, the shape of the trays is particularly innovative due to the continuous ribs that increase the moment of inertia of the section and the resistance to vertical weights, allowing the trays to be walked on during assembly and in case of maintenance. It is important to note that the creation of the trays was based on a completely new application of the existing patent and therefore required a strong commitment to research, development and experimentation. In addition, together with the innovative shape, the dimensions of these elements are also particularly

important, as they are modular, with a width that can be raised as desired, limited in the prototype to one metre for ease of transport and assembly. The experimentation has also revealed a considerable reduction in temperature during the summer climate and good thermal insulation during the winter, making the energy-wasting environment of an industrial shed, as comfortable and habitable area.

4.3 DIY monitoring: Smart product for structural safety

As the third and last part of the Smart system, we describe the technological prototype of the software for structural monitoring of buildings. The objective of installing a structural monitoring system is to verify the availability of non-invasive diagnostic tools, able to provide detailed information on the state of conservation of the monitored structures and to detect risk factors at an early stage.
The prototype for the structural monitoring function of the test building uses various techniques and technologies: a minicomputer connected to a camera takes photographs at regular intervals at the structure to be monitored and then sends the captured images to a remote server, while expert software processes the images stored on the server. Using computer vision techniques, the points to be monitored are recognized, the data sets are produced and then analysed, using machine learning algorithms, for the actual detection of any anomalies (Fig. 5).



Figure 5. Monitoring system: detail of markers applied on the structure for the point detection

The identified system exploits the branch of technology linked to DIC (Digital Image Correlation), which is essentially a non-contact optical method to measure displacement, deformations and vibrations in objects or materials subject to applied forces. The method, in fact, compares two images, before and after the deformation and displacement, acquired in white light or IR with a camera.
In order to take into account irrelevant displacements (such as possible camera rotation due to wind or other small instabilities), a complex artificial intelligence system has been developed that compares the relative positions of the various monitoring points, making the system reliable even when unskilled labour is used during assembly. The entire complexity of the measurement has been moved to the server side, so that the user does not have to worry about anything. For this reason, systems for self-calibration and self-configuration of devices via Qr Code have also been developed so that the user only must position the devices to start the entire monitoring process (Fig. 6).

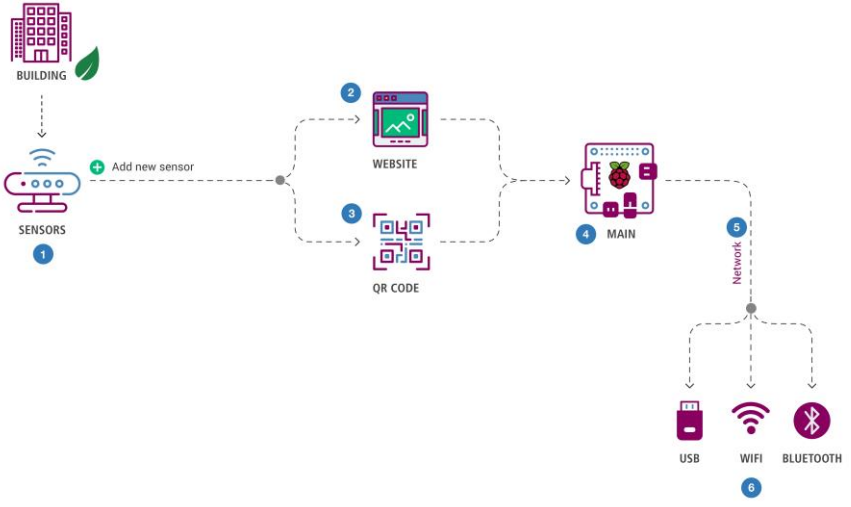

Figure 6. Representation of the installation and operation process of the monitoring system

Since the system stores and detects images and metadata in a database, it was decided to extend the database also to the data monitoring from third-party sources such as weather or environmental data on air quality, as well as data from other sensors, such as electricity, water consumption or other. Each of these parameters can generate specific alarms when pre-set thresholds are exceeded, warning of the need for specialist intervention. In order to simplify the specialist intervention, the database also contains the entire design history of the building, so that all relevant information is stored in a single repository: from

construction projects to consumption, from authorization documents to the various interventions to the description of maintenance operations carried out. With a view to simplifying the user side, a data access grid has been created so that the data can be seen or managed according to use: owners, tenants, administrators, professionals have all been profiled and each of them has a visibility of the data linked to the specific need for intervention or monitoring.
Therefore, we can say that the monitoring system's core is an expert system related to a series of sensors and an informatics network, an intelligent device in full IoT area, connected to network. Moreover, it falls within the well-established category of Smart Product-Service Systems (SPSS), which "integrate intelligent and e-service products in a single solution" (Lu et al., 2019, p.1). These systems, in fact, go beyond traditional services, as they are based on sharing and access, no longer based on ownership, and are "preferred (by consumers) because they provide more benefits at a lower cost" (Lu et al., 2019, p.4).

Conclusions

Referring to the issues raised upstream of this proposal, concerning possible building adaptation interventions, energy-wasting buildings and disused industrial sheds, an attempt was made to respond through the study of current proposals' panorama, overcoming it through an innovative project. Smart Safe and Green intends to propose itself as a modular, adaptable, scalable and customizable model for interventions on problematic building structures. It represents a possible answer, alternative to the commercial proposals, often too expensive and impossible to realize without a skilled workforce. Referring to the green façade and roof system, "the use of plants in the façades of buildings is a useful bioclimatic strategy that offers many advantages for the thermal, acoustic and psychological comfort of the inhabitants. There are also environmental benefits through the reduction of energy for heating/cooling indoor spaces and CO2 emissions" (Flores Larsen et al., 2014, p. 1772). Referring to the software, simulating the operation of this system in a wider range, we could think of using this detection technique for monitoring the structural integrity of even large buildings and large transport infrastructures, such as bridges, viaducts and dams, since monitoring has become a crucial aspect for the prevention of natural disasters, in order to ensure the safety of people and things. In design terms, the bottom-up approach is certainly representative of this proposal, as it would allow individual citizens (inhabitants and consumers) to provide for their own change, to be actors in an evolving change project over time. As argued by Burns (2006), it is no longer a question of "designing a response to a current problem, but [...] designing a means to continuously respond, adapt and innovate" (Sangiorgi, 2010, p.3). The Design objective, in this climate of enormous and immanent changes, is therefore denoting itself as a promoter of practices and projects as flexible, economic and efficient as possible, which review the role of the end user in a non-marginal position: not simply a "user" of a product-service, but a participant in the implementation process.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Strengthen Ties of Social Bonding Through Design from and Emotional Perspective.

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Abstract | Emotional perspective of design has pursued until now mainly economic, and commercial objectives, however has a great potential to benefit society, because human emotions, have a central role in the determination and construction of human social relationships, also are elements that shape certain human behaviors that can produce pro-social effects, much needed in the current context.
This paper presents the most relevant studies of the research project which aims benefit society from the emotional perspective of design, through them, the paper responds questions as, what role do emotions play at the social level? what are the emotions that could be useful to achieve ends in favour of society? what could be the paths that allow the development of a design from the emotional perspective and the benefit of society?. Finally, is presented design set up categories of application, to materialize design from the emotional perspective with a social accent.

KEYWORDS EMOTIONS, SOCIAL BENEFITS, SOCIAL DESIGN

1. Introduction

This paper presents the most relevant studies of the research project, which aims to take advantage of emotional design in favor to contributing solutions to some of the complex social problems of our time, as social fragmentation, as intercultural tensions, social discrimination, and civic burnout.

The potential role that design plays and could play in collective problems of our time, is an issue that is not new in the area, since it has been discussed in a variety of studies from different approaches; such as the social responsibility of designers from a historical and ethical point of view (Papanek, 1984; Madge, 1993; Margolin, 2007; Woodham, 1997); or the potential damage of the design in terms of the damage caused by leading users to constant consumption and by extension to a huge generation of waste (Whiteley 1993; McDonough 2002; Chapman, 2005), and how to change people's wasteful behaviours through design (Lockton, Harrisson, & Stanton, 2008; Bhamra, Lilley & Tang, 2008; Lilley, Lofthouse & Bhamra, 2005; Lilley, 2009)

Considering the studies mentioned, an aspect that needs to be discussed widelier and even to extend the study perspective, is by one hand the question of how far the use, of rather than the production and disposal of products design of all kinds (objects, services, spaces, etc.), has led to unwanted social implications. By the other hand and above all, it is necessary to reflect on the potentiality that is offered by the design to, through its use and interaction, guide people to have prosocial practices and behaviors lead in a relevant way to improve the current social context.

There are few studies with this perspective, this means, to encourage a change in behavior through design, we can mention by its relevance the Tromp (2013). It points out that the human perspective from which the industrial products have been developed by now, has led to the effective satisfaction of the individual user's needs, but has ignored or even been detrimental to the collective goods. The influence that undoubtedly the design has carries important social implications, this influence considers Tromp (2013), is often hidden and is involuntary by the designers, so that's why it becomes an important study object.

Design perspectives as emotional design, are still young, so they mainly respond to economic and productive considerations. These considerations are based on the power of emotions to seduce and change human behavior. In this way, the emotions induce to consume products.

Emotional design has a great potential to benefit society, from the basis of human emotions it has a central role in the determination and construction of human social relationships. In this way they are also raised as elements that guide, motivate, shape, certain human behaviours and interactions. In this manner emotions can lead pro-social implications, much needed in the current context.

There are important contemporary examples of collective human situations, that demonstrate the pro-social implications of emotions which are experienced collectively. The

potential of emotions to modify behaviours, seduce or motivate could be exploited from the design for other objectives such as human and social purposes.

In this manner, exploring the topic from other disciplines, allow to propose its theoretical bases, and at the same time conceiving specific guides to design´s developed with the purpose of increases the designer's understanding on how to actually materialize this positive influence of a design from the emotional prosocial perspective.

Based on these ideas, three relevant studies on the subject which are presented in this text:

- The study of the role that emotions play in determining the human social dimension
- The identification of specific emotions that can lead to behaviours with clear pro-social effects from examples of contemporary social situations
- An initial proposal of specific modalities to develop and materialize design from the emotional perspective with a social accent. The objective is to guide interactions and behaviours for the benefit of society.

2. The Emotional Design

The emotional perspective of design can be said that formally begin in 1999 with the foundation of the International Design and Emotion Society (1999) at the University of Delft based in the Netherlands. Later, in 2004, it becomes widelier known with the approach and conception of the term by cognitive psychologist Donald Norman through his book Emotional Design (Norman, 2004).

The emotional design in Latin America is also a subject of a great interest as it is that the academics who work on it have formed in 2014 a network dedicated especially to the study of the subject, called the Academic Network of Design and Emotions (RADE, 2014).

At being recognized that the success of an object in the market can be determined largely by its appearance, the pleasure and satisfaction it produces in the user, the emotional human field has become a relevant issue and of a great interest, in general, in design of mass-produced products (Helander, 2006). Donald Norman has underlined this fact by pointing out that emotions have the power to change our perception, as a result of the interaction and emotional relationship with the objects in which we coexist in our daily environment (Norman, 2004).

The identification and explanation of the process in which objects generate emotions, was explained by Desmet who, from the discipline of industrial design and based on the tradition of the three cognitive theories of emotion (Lazarus, 1991; Ortony, Clore & Collins, 1988; Roseman, 1996), conceives a basic model to explain the generation of emotions through products (Desmet, 2002).

So, from the great potential of emotional design to lead to the success of product in the market to now, it has mainly pursued economic, to mass production product objectives. Are many products and services which, have applied the principles of emotional design, so through the evocation of emotions by means of its design or advertising, associates the product with specific emotions and feelings and thus induces its consumption.

In order to maximize the view of the great potential of the emotional approach, we looked for projects with a social perspective in the design area. We searched for projects that in some way take advantage of the emotions. We explored different approaches of design like "design for social innovation" and could find examples of projects which involve in some way the emotional human dimension. An example of an academic project from this area consists of offering a sensible tourism services where the heritage, cultural and natural resources of a Brazilian lagoon were enhanced through the connection of fishermen´s memories, knowledge and traditions from the local community, particularly the fishing activity, and the fishermen themselves (Franqueira & Gomes, 2017).

From the industrial design approach there is a relevant study, it is that of Tromp & Hekkert (2010). Describes a project of graduation of the industrial design engineering of the Delft University of Technology in Netherlands, in which it was developed a product with the objective of contributing to a social change.

The project called "design for social cohesion", we can say that involves the approach of emotional design, because it evoked to lead the integration of immigrants into a certain social context, through promoting an identification between the involved human beings, those who migrate and those who welcome them.

It was a proposal based on knowledge and affective identification among these actors as people as they are, since as human beings we usually have aspirations, desires, emotions and feelings many of them similar among us, although our geographical and cultural origins are very different.

This project was developed based on the assumption that receiving a gift from someone in the neighbourhood, accompanied by a personal message, could stimulate, or induce people, to a reciprocity. So that increases the possibility of that individuals responds positively to the issue and be encouraged to send a gift to someone else in the neighbourhood. The gift was also intended to offer a specific starting point of a conversation.

Another example which take advantage of emotions, is in the design area called "games for change"; the project called "iBeg" is a game that simulates the life of a homeless person living on the streets of Vancouver. In this game players step into the shoes of that homeless avatar and have to beg for money in order to survive. This game will hope raise awareness of them and also provide a mean for players to support organizations that help homeless (Worboys, 2014).

By the other hand, in the field of advertising, a discipline that in some way can be considered related with design, there are countless social campaigns that could be taken emotions into consideration. We must say that the majority of advertising campaigns always have sought to move in some way, but recently emotional approach in that area has been highlighted and taken advantage of (Forrester, 2018). These are examples that have clearly taken advantage of the emotional approach with some social objective. Some of them will be mentioned below, since they allow us to point out the potential of emotions in a meaningful human sense through specific examples.

There were advertising campaigns planned and presented in order to lead people to have pro-social behaviours. One example is a campaign developed by the advertising agency Neozink from Asturias Spain, called “Unicef Xanadú Action” whose objective was to encourage people to be generous, charitable, and donate small amounts of money to mainly help poor and disease children (Unicef, 2018).

By the fact that almost 7 million children die each year from causes that can be avoided and through the questions, “would you help to save a child's life for what it costs you a potato chips? Would you help save a child’s life with a simple gesture?”, The Neozink agency designed, adapted and produced blue envelopes vending machine from Unicef, and placed it into a shopping center in Madrid.

3. The role that emotions play in determining the human social dimension

It has been widely noted in previous studies (Bedolla, 2018; 2014; 2013), the great importance of emotions, that through design, lead to the improvement of quality and promotion of learning, care and increase human wellbeing, as well as to contribute to sustainability by strengthening emotional ties with objects.

This paper will pointed out a different approach of emotions, its potential as human subjective reaction analyzed from a social perspective, unlike the individual as has been done so far.

Emotions have a central role in the determination and construction of human social relationships, thanks to their ability to guide, motivate, shape, certain human behaviours and interactions that provide the possibility of producing prosocial effects, so necessary in the current context.

Affectivity is inherent in human nature and being a term derived from psychology, refers to the set of feelings, and passions of a person, as well as their preferences or aversions. Emotions are a central part in the construction of affectivity and have been defined (Dictionary of Psychological Terms, 2016), as a temporary alteration of mood, pleasant or painful, which is accompanied by a certain somatic shock.

One of the most relevant studies that provided knowledge about the importance of human emotions, belongs to the area of neurology and neurosciences (Damasio, 1994). It presents and explains extensively the mechanism by which emotions guide behavior and decision making based on the idea that the dualism proposed by Descartes is a mistake because it has separated mind and body, rational and emotionally.

The traditional concept of emotion from psychology assumes that it is an essentially internal and personal reaction of every individual; as a consequence, it has been assumed that emotions can be better analyzed from an individual in a psychological or cognitive perspective (Parkinson, 1996).

However, Parkinson (1996) proposes another perspective that leads to consider emotions more than as individual constructs but as social phenomena. Social psychology provides important theoretical foundations to understand other very relevant aspects of emotion; in this way the author does not deny that cognitive and physiological processes also contribute to the emotional phenomenon; the issue implies, rather, he says, the conceptual priority given to each of the factors involved in the emotional human process. In this way, the organizational principles of emotion depend ultimately on social aspects.

Parkinson identifies three modalities of social interaction that according to him clearly originate emotions in individuals:

- Social relationships, that is, emotions that are the result of real, anticipated, imagined, and memorable social relationships.
- Interpersonal influence, that is to say reciprocity and emotional contagion often unconscious and nonverbal among individuals of a certain social group.
- Cultural values, refers to the social establishment of emotion, based on the implicit and explicit objectives in which the individual lives.

Le Breton (2013) on the other hand, from the field of Anthropology, points out that emotions are relationships, a social and cultural construction. The author explains that an emotion is at the same time interpretation, expression, significance, relationship, and regulation of an exchange. They are collective expressions of the individual and the group simultaneously, and represent signs of a collective language; an open system of meanings, values, rituals, and vocabulary.

From the field of Sociology, Hochschild (1975), one of the three pioneers of the so-called sociology of emotions, incorporates emotions as a key access path for the knowledge of any phenomenon or social situation.

4.Specific emotions that can lead to behaviors with clear pro-social effects

Once the social relevance of emotions was clear, from the question “What are the emotions that could be useful to achieve prosocial purposes?” the study of the classifications of social emotions was carried out.

Based on Shlomo et. al. (2008) there are various classifications made in this regard. One of them indicates that social emotions are not innate and that they are those caused by some kind of social event (Oatley, 1987). Another classification indicates that they are simply those most frequently communicated to other people (Fridlund, 1991). A third classification mentions that they are those that characterize social processes that are generally shaped by emotions (Frijda, 1986).

The previous classifications said that the specific emotions indicated as "social" are many. The most frequently mentioned are: guilt, envy, shame, gratitude, admiration, pride, jealousy, sympathy, obfuscation, and crush. And then they will be those that make sense in relation to others and that arise in a particular social context. Based on this, Shlomo, Anat and Parkinson (2008) broaden the characterization of social emotions; they propose as a basis for identifying them, the nature of the evaluation or assessment that gave rise to them; which can be a direct or indirect social situation and not necessarily involve or make direct reference to another person.

From this idea, there are significant emotions socially experienced, which regardless of the direct or indirect nature of the social situation that create them, it is clearly seen the benefit in the community. In this way an example is social anger which is a social emotion that led people to agree, to organize and integrating the social movement called “de los indignados” that emerged in Madrid Spain, in May 2011. One of the participants of this movement, said that it represented a time when people woke up and began to identify, to feel together, and to talk about certain issues that were socially implicit and that worried everyone (Grueso, 2012).

Another social situation which is socially experienced involve empathy and solidarity. Both are human capabilities that contain different emotions, mainly a certain degree of sadness and anger. An example of this case is a voluntary woman group self-designated “the Patrons” from the community of Amatlán de los Reyes, in Veracruz Mexico. They had a generous interest of helping immigrants in need, providing them food and assistance in their passage through Veracruz in the train called "the Beast” (Solis, 2016).

Another example of solidarity and empathy is undoubtedly the experience lived by a large part of Mexican society in Mexico City. During the earthquakes on September 19, 1985 and 2017, in the face of the human and material disaster that occurred, a large number of the

city's inhabitants took over the streets to offer selfless help to everyone who needed it (Campoy, 2017).

We also can mention collective sadness which is social emotion recently experienced in Venezuela, as a result of the social, economic and political situation by the population. Sadness was noted as the emotion that 95% of people lived. At the same time, the sadness of contemporary societies was described as a revolutionary power, as a direct consequence of the dynamics of the political and economic system of that country which it was also, it was identified as the germ that could overcome it (Impulso, 2014; Tristeza, 2017).

Collective joy is shared and guided by a group called "underground joy" which is a group of musicians and clowns. Originated with the objective of carrying out interventions in people´s world traveling by public transportation, mainly the subway in the city of Buenos Aires. They share music, dances, smiles and looks, with the aim of people disconnect from their internal dialogue (Alegria, 2012).

By analysed these examples and others, of them, in an initial way (since it's a subject that starting to be explored), it was possible pointed out some of the pro-social reactions or effects:

A reaction of cohesion, cooperation, participation, and meeting mainly related to positive emotions. A reaction of awareness, concern, and interest in others, related mainly to negative emotions.

From this, four groups of social emotions were identified based on their effect in favour of the social field:

1. Social adhesive effect: Empathy, Solidarity, Joy, Anger

2. Social adhesive effect based on its great cultural load: Patriotism, Religiosity

3. Concern and concern for others: Sadness, Compassion, Anger

4. Awareness effect: Shame, Guilt, Fear

The examples that have been presented were not intended to be exhaustive in any way, but simply to show the social effects of the experience on certain emotions at the collective level. Thus, based on these social reactions, initially and incipiently, we propose the identification of emotions that produce clear pro-social reactions or effects.
Effects that are independent of whether they are emotions that are qualified as positive (for the pleasure and satisfaction they generate) or negative for the type of experience the individual lives. Both emotional experiences, stimulate in people attitudes that benefit society.

In relation to the qualification of negative emotions (as sadness, anger and disgust), Fokkinga (2013) claims, these are also very useful since on one hand, they are also able to lead a rich experience, which generates great interest, and by the other hand, they are

especially able to emphasize the morality of our actions as they stimulate and focus people's attention.

5. Modalities to develop and materialize design from the emotional perspective with a social accent

Previous studies, were the basis to know the core of emotions and their social implications. Also point out that emotions could conduct people to pro-social behavior.

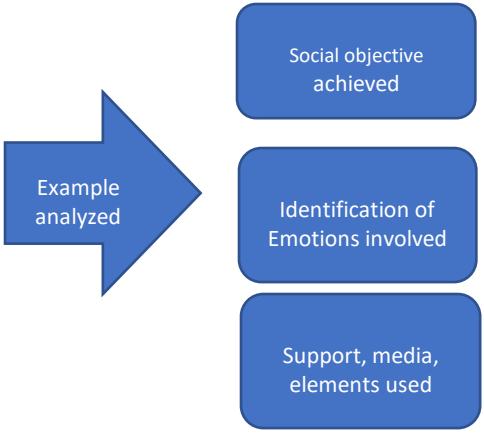
From that, the research project continuing into search a way to know how to materialize the positive social influence of design, from pro- social emotional approach. Which aims to increases the designer´s understanding of how to integrate this approach into design.

According to this, we carried out an initial proposal of specific modalities, which goal has been proposed a guide to engage pro-social emotions in design, and in this way, take advantage of the potential of social implication of it. Is an initial proposal, because it looked for taking advantage of social emotions to develop pro-social Design, is a topic that starting to be explored. For this reason, the needs to continue the research and widelier reflection ahead and mainly, develop projects with social objectives based on this group of modalities

Thus, based on the pro-social actions (like cooperate, share, and collaborate) that social emotions conduct, which were identified previously (empathy and solidarity, collective anger, sadness and joy), the way followed to conceive an initial proposal of the modalities, was based on searching some examples of ítems from Design, Advertising, Computer science or any discipline, which in some way, they accomplish lead to the prosocial actions mentioned.

The examples of items, were analysed to identified if they allow pro-social actions. The analysis was done independently if they were related with some emotion. In fact, this analysis of ítems done, was the initial approach in which we began to visualize and conceive, specific manners to conduct into pro social actions, that are related directly with social emotions that we identified.

The analyses of the mentioned examples were carried out through the identification of the following aspects in each of them:



Figure?

The goal of that, was to identify these pro-social actions through some examples of items, that is based on taking positive behaviour of social implications, in relation to coexistence and social integration, educational and communicative processes.

In this way, three modalities are initially proposed to conduct to pro-social actions: cognitive modality, interactive modality and sensory modality; which are described below:

5.1 Cognitive modality

It has been proposed cognitive modality base on the analysed and the reflection of some examples of ítems, services and design products, which function is based on explicit and textual ideas. These ideas make a clear reference to affective situations which could conduct to pro- social actions, making reference to emotions or else directly to pro-social actions. In this way would have a notorious influence in people's behavior.

Below are presented the analysed aspects of some design items in a brief way, for space reasons (Table 1):

Table 1. Analysis for the cognitive modality

Examples of items analysed	Social emotions involved identified	Modality identified
-Product whose function is to make an audio recording of personal experiences	Recording personal experiences could generate empathy in others.	Cognitive: Influence through explicit emotive ideas
-A table game based on textual ideas	Textual ideas could promote respect, diversity, and tolerance	
-Digital networks such as Twitter, Facebook and others.	These allow anybody to see at any time the problems and concerns of millions of people. Which can cause empathy by helping users see other people's perspectives and thinking processes	

Since disciplines like conductual economy and cognitive psychology (Smith 2016) we can raise the theoric basis which can explain the relevant influence in people of explicit emotive ideas communicated through different ways.

Between factors that allow this, Smith (2016) claimed that the person´s formation of moral judgments, is raised, within the framework of a "natural order" of social extension.

On that matter the concept of sympathy has particular importance to Smith (2016), because is the principle that explains the formation of moral judgments, and over all, is also a method through which the individual expresses a favourable judgment of the neighbour´s behavior and expect others to do the same.

In the field of teaching the design degree, it is possible to mention very briefly a class exercise in which a conceptual application of this cognitive modality was proposed. It was a concept for a project whose objective was to promote solidarity between people. It started from the idea of looking for the most appropriate means to send a message to adolescents and young people about the importance of solidarity and mutual help in order to achieve a common goal. For this, video games were identified as an element of great popularity among adolescents and young people to transmit an explicit message; An existing video game that has some popularity ("Battlefield V, Medic Edition") was chosen for this, set in a warlike context, which states that a group of doctors help a battle squad survive and triumph.

Given that the game somehow already involves team support, the project simply consisted of redesigning its packaging, seeking to emphasize the importance and emotion of teamwork, help, communication and mutual support. ; in this way, the game's packaging presents textual ideas that stand out: "teamwork will lead to victory, if you go on your own you will find defeat."

5.2 Interactive Modality

It has been proposed interactive modality base on the analysed and the reflection of some examples of ítems which modalities of interaction lead in some way, to cooperate, share, and collaborate; which can offer the opportunity of coexistence and social integration. These items allow through them, a behavior that presented some positive aspect of social or collective interaction for the benefit of the community.

Examples of some design elements analysed are presented below in a brief way, for space reasons (Table 2):

Table 2. Analysis for the interactive modality

Examples of items analysed	Social emotions involved identified	Modality identified
- A collaborative digital table which modality of use is collective	Induce to collaborate, share, and considering neighbour. In this way invariably organize and conduct a collective teamwork in an educative or laboral context.	**Interactive:** User behavior can be regulated externally This regulation is primarily a logical consequence of restricting the operation of an object or space to a specific mode of use. Secondly, it represents an external influence element motivated by the design element.
- Products that perform their function through ludic or playful interactions, derived from basic games and devices from social psychology. These devices are a kind of games which set targets and challenges. Set an operant conditioning by means of reinforcements and unpredictable rewards, which manage to invite people to use them and through this they generate a social or even environmental benefit.	Ludic is directly related with joy, which is an emotion that Ekman (1972), pioneer in psychology in the study of emotions, classified like a basic human emotion and in this common sense to every human being. The ludic leads people to be solidarity with others.	

In the field of teaching the design degree, it is possible to mention very briefly a class exercise in which a conceptual application of this interactive modality was proposed. This is the proposal to apply the ludic approach, in exchange for donating some kind of humanitarian aid. The project application consisted of the conceptualization of a machine that offers the user to play a game of bowling in exchange for donating money to provide some type of humanitarian aid that the same machine describes and offers to provide. In this case, the ludic approach is used as the initial attractive element to interest and bring people closer together and later a donation is requested from them in exchange for said ludic experience: a bowling game.

5.3 Sensorial Modality

The sensory modality was identified based on examples whose common element was to somehow take advantage of the emotional expressiveness of different elements that integrate the aesthetic language of the product. Aesthetic language composed of visual, tactile, auditory, and olfactory characteristics or attributes that can constitute the aesthetic language of some design ítem.

Examples of design elements analysed that led to the identification of this modality (Table 3):

Table 3. Analysis for the sensorial modality

Examples of items analysed	Social emotions involved	Modality identified
Multisensory language of the screens of different devices capable of causing sensations and emotions on a conscious and unconscious level. More than two senses favour on greater information retention. Use of color, images, shapes, sound, music, aromas or other sensory stimuli that manage to establish a particular emotional state for the interaction of a user with a system, space, or object.	May be made reference to color images, sound, music, that refer all together to social situations or collective events that generate positive emotions for example expressions of solidarity or empathy	**Sensorial:** The intervention of the senses in the human emotional dimension explains why sensation perception is the primary level of receiving information from the environment. There is a parallel level, which we find to the emotion, which will occur once the vision, hearing, touch, taste, smell have informed us of the colors, sounds, tactile sensations, perfumes, etc., for which both the sensation as perception have acted as a first filter in emotional unleashing.
System that based on hearing, reflects or mimics the mood of a user by voice, to increase the commitment that the user feels to an action or service (chatbots or computer programs with which it is possible to have a conversation, to request some type of information or to carry out an action).	Voice, sound, or music, that refer to social situations or collective events that leads to positive emotions, for example expressions of solidarity or empathy	
Characterized objects with a significant character to attract people's emotions, or make them emotionally connect with their behaviour	Emotions have the ability to guide, motivate, shape, certain human behaviors and interactions that provide the possibility of producing prosocial effects, so necessary in the current context.	

We can explain the emotional implications on the human being, of the expressiveness of the aesthetic language of the product, because human sensory systems, are integrated by processes that determine human emotions widely and deeply. This statement is based on previous work (Bedolla, 2002), which study was developed based on disciplines such as medicine, and mainly experimental aesthetics.

In this case, the proposed application in the context of teaching the design degree consisted of an object that has the objective of encouraging the adoption of pets (dogs) that are in foster homes. The Project consisted of a panel that presents emotional images of dogs that need a home and the affection of an owner. In this proposal, the objective was to soften and visually and audibly sensitize people to these needs of these animals through the aforementioned emotional images and sounds of solitary pets, as well as an explicit invitation to dog adoption.

6.Conclusions

The study presented here has been an initial exploration. The modalities to developed design, in order to modify behaviors, for the benefit of society from the emotional perspective of design, are not definitive or exhaustive. They represent different modalities, to begin the identification on how to materialize pro-social emotional approach in design is necessary to explore its application and usefulness.
The emotional approach is based on a relevant human dimension, which by now has been studied from a social perspective in a very limited way. It is necessary to keep continuing the studies of this topic in a widely manner. Design discipline has already taken advantage of emotional approach of design but in an implicit, limited way, with commercial goals and in an individual and non-collective human approach.

As a strategy to modify people´s behavior, the emotional perspective proposes motivate, lead, influence, and guide people to change their behavior based on emotions. This is a proposal which aims encourage people to improve their behavior in a more human and sensitive way.
These are the characteristics that define this human approach, which are very different from others strategies that change behaviours, cited by some authors like coercitives or persuasive. (Tromp 2013; Lockton 2009).

From the human's innate affective dimension, emotional prosocial design approach claims that, people are able to get sensitizing, worrying, caring, love, and even outrage. Design ítems are presents in many ways in people´s or their neighbor´s daily experiences that could promote people to reflecting, responsibility, and reaction directly and indirectly to have a positive social implication in society.

Emotions studies from social approach are such an important topic for the current society. In order to successfully resolve social problems of our time, we would have to consider that

people who conform our societies are the source and the strength to counteracting many of them. Global and local social problems are not only a governmental task, individuals play a crucial role on it. And everyday design ítems can represent the means for this.

On that matter, is necessary to study and reflect on the ways in which is possible through design change people´s behavior, mainly by emotional approach of design. We reiterate, emotions have a great potential, a great powerful to seduce, to move and touch people and in this way can encourage their decisions and behavior. Emotions can become a relevant tool to designing for social benefit.

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Deyanira Bedolla Pereda has a doctorate in technological innovation projects from the Polytechnic University of Catalonia (UPC) in Barcelona Spain, master in Design and Bionics from the European Institute of Design in Milan Italy. Currently a full-time research professor at the Autonomous Metropolitan University Cuajimalpa unit, department of design theory and processes of the Division of Communication and Design Sciences. Her main research area is the study of the relationship between design and people from the human affective dimension (emotions).

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Study on the Sustainable Design of the Young Elderly Oriented Smart Wearable Products

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Abstract | At present, the problem of aging has become a major strategic issue that has attracted the attention of the world. As the most active group in the elderly, the young elderly is closely related to the demand change of two span of middle age and old age, so its applicable products are transitional and easy to be abandoned. The young elderly-oriented design is helpful to grasp the sustainability of the products. The researcher grasps the core demand elements of smart wearable products for the young elderly through the sustainable design method and puts forward three principles which further put forward a set of sustainable design standard paradigm. Therefore, it can systematically solve the problem that the current smart wearable products cannot meet the demand of the young elderly and the problem of easy abandonment, as well as expand the extension direction of the concept of sustainable design.

KEYWORDS | SUSTAINABLE DESIGN, ELDERLY ORIENTED DESIGN, SMART WEARABLE, THE YOUNG ELDERLY, STANDARD DESIGN PARADIGM

1. Introduction

With the general improvement of people's living standards and medical technology, it has led to the changes in the age structure of the population. There are a large number of social and economic issues because of the increasingly severe problem of aging around the world. Compared with the elderly, the characteristics of the young elderly include better average physical health, higher social participation, more average education and learning ability, and higher use frequency of smart products, which determines its status as one of the important audiences of smart wearable products. How to make smart wearable products better meet the needs of the young elderly and improve the quality of their life is a valuable research topic.

The researcher establishes the core demand factor system of young elderly oriented smart wearable from four aspects of physiology, psychology, social participation and lifestyle through the sustainable design method guided by user needs. On the basis of it, the researcher puts forward three design principles, which are usability principle, experiential principle and low additional burden principle, and utility evaluation module to construct the standard paradigm. It is of great significance for improving the life quality and consuming structure for the elderly.

2. Aging problem and current status of elderly oriented smart wearable products

Since 2003, the world has entered an aging era as a whole. By 2015, 12.3% of the world's population is over the age of 60, which will rise to 16.5% by 2030. Most countries in the world have entered the age of aging. As the "silent revolution", aging has exerted extensive and profound influences on the development of various social structures and functions in the world. The large number and complex elderly people have various demands for the elderly oriented product, which is a double-edged sword. On the one hand, these demands bring tremendous pressure to the design optimization and update iteration of the elderly oriented products. On the other hand, these requirements also provide a lot of opportunities and development space for the industry of elderly oriented products, as well as designers.

With the rapid increase of aging, the market for elderly oriented products has expanded greatly. However, the elderly related industries, especially the smart wearable industry, are still relatively in their infancy. In the face of the complex needs of the elderly, there is still much room for progress in the design of elderly oriented smart wearable products. It is also far from the concept of sustainable design. One of the main reasons is that there is no further segmentation of the elderly. At present, young elderly oriented smart wearable products are in the state of relative lack and blank. The transition and discard ability of products suitable for this group of people are ignored, which not only causes unnecessary

waste of resources, but also fails to meet the multi-level needs of the elderly. Through investigation and research, it can be concluded that there are common design mistakes in the following aspects in the elderly oriented smart wearable products that have been developed and released.

2.1 Misunderstanding 1: Products for the elderly are the simplified versions of conventional products

Although there are many excellent elderly-oriented products, most products for the elderly in the large global elderly market are the simplified versions of conventional products. Many so-called elderly products in the market are actually formed by processing existing conventional products by simplifying, degrading, and enlarging their functions. These products do not consider from the user's perspective whether the design is really suitable for the elderly and whether it meets the real needs of the elderly. Without the standard design and development process, this type of product is generally based on the personal experience of designers or reference to existing similar products in the market for design transformation, which not only results in inaccurate design positioning, but also generates unnecessary waste of resources and environmental pollution, violating the concept of sustainable design.

2.2 Misunderstanding 2: The elderly is not differentiated by refinement

In the traditional sense, people over the age of 60 are collectively referred to as the elderly, and elderly oriented products are products targeted at this group of people. With the increasingly serious aging problem, as well as the gradual improvement of living requirements and consumption levels, the elderly group also presents complex and diverse demands for the related products. Therefore, the refined differentiation of the elderly plays a crucial role in the sustainability of the design of elderly oriented smart wearable products. Sufficient refinement of the elderly group is conducive to the design of applicable products, the improvement of product application period and the reduction of the wasteability, so as to make the products conform to the concept of sustainable design. There are many specific manifestations in the refined differentiation of elderly population, such as gender, income level, family member structure, and medical condition of the living place, among which the most basic is age differentiation.

However, most of the refined differentiation modules in the design process of currently elderly oriented products are missing. The public generally regards the elderly group as a terminal-level user group, which obviously does not meet the specific practical needs of the elderly nor conform to the concept of sustainable design.

2.3 Misunderstanding 3: The elderly is thought to have only physiological needs

Based on the gradual aging of physiological functions, the most obvious characteristics of the elderly, designers will more consider the material functions, and lack of the emotional experience, such as spiritual comfort and entertainment requirements. Due to the continuous improvement of living standards and the change in consumption concept, more and more elderly people pay more attention to the quality of life and spiritual enjoyment. In other words, purely physical functions can no longer satisfy their needs for emotional experience. Although the original creative motivation of human beings originates from the material needs of life, it should not be limited to the material level. In particular, in the face of special elderly groups with diversity and complexity, designers should focus on their inner world, re-examine the user needs, and find the appropriate design methods to carry out design practices. When it comes to the issue of aging, most people passively regard the elderly as the “weak” image of “being supported” and “taken care of”, so they only focus on helping them physically and materially, ignoring their needs to realize their self-value. It has to admit that this traditional concept is ambiguous and one-sided.

3. Young elderly and sustainable design

Sustainable design refers to the harmonious development of people and the environment, which requires that the design can not only meet the needs of the current generation, but also take into account the development needs of the future generations. The establishment of sustainable consumption mode, the extension of product’s life cycle, and the reduction of product’s discardability are all the concrete manifestations of sustainable design. Lisa Rogers proposed that sustainability has become one of the basic principles of design innovation, and the environmentally sustainable compatible methods of products are warmly pursued, especially when they are attractive designs. Manzini Ezio said that sustainable design focuses on planning the whole life cycle of products through systematic products and services, which has achieved the purpose of prolonging the service life of products, while reducing resource depletion and environmental pollution.

Based on the refined distinction of the elderly in the age dimension, the classification standard of the young elderly is usually defined by their physiological age. Peter Laslett, a British sociologist, divides human life into four stages. He defined the third age stage, that is, the stage of young elderly people, as the stage when they just retired but their physical functions did not show obvious decline. According to UNESCO, young elderly people are those between the ages of 60 and 69. Between the middle age and the old age, the young elderly is closely related to the changes in the needs of the two spans. Therefore, the applicable products for the younger elderly are transitional and easily discarded. The elderly oriented design for this age group is helpful to grasp the sustainability of the products.

Compared with the elderly, the characteristics of the young elderly include better average physical health, higher social participation, more average education and learning ability, and higher use frequency of smart products, which determines its status as one of the important audiences of smart wearable products. In addition, the cultivation of the habit of using smart products makes it easier for the young elderly to accept and use smart products, which is conducive to solving many social pension problems caused by the increasingly severe aging trend. To sum up, as a continuous design research, the research of smart wearable design models for the young elderly is not only consistent with the concept of sustainable design, but also has great social significance and economic value. It is worth noting that the main target population in this study is defined as the young elderly aged between 60 and 69.

4. Analysis of young elderly oriented smart wearable product demand factors

Facing the current and future trend of population aging, the researchers use the pre-test questionnaire, industry expert interviews and focus group research to mine the demand factors of intelligent wearable function of the young elderly.

The pre-test questionnaire included three groups of open-ended questions about the intelligent wearability of the young elderly, including instinct level demand, behaviour level demand and reflection level demand, with a total of 12 open-ended questions. We invited 4 intelligent wearable designers and 8 young elderly people to participate in the pre-test questionnaire survey. By collecting the pre-test questionnaire and collating the text data, we get 11 key requirements semantics of intelligent wearable for the young people in three groups, as shown in the Figure 1.

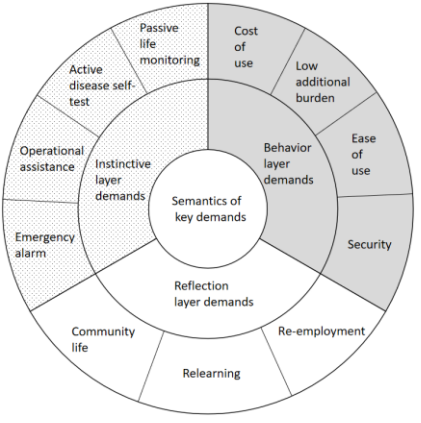

Figure 1. The key requirements semantics of intelligent wearable for the young people

Three associate professors of industrial design, one intelligent wearable product development manager and six design doctorates were invited to draw up the outline and content of the focus group survey through expert interviews based on the key semantic references obtained from the pre-test questionnaire. Focus group research adopts the method of group interview. In Jianggan District of Hangzhou City, China, we selected 20 target users of young elderly people. The inclusion criteria of the group were as follows: A. familiar with the basic concepts of intelligent wearable; B. using or understanding at least one intelligent wearable product and being able to objectively evaluate it; C. agreeing to this study and participating in the research voluntarily. The interview process was recorded and organized into text information with the consent of participants. We conduct in-depth coding analysis on the NVivo analysis tool through the grounded theory analysis method. Grounded theory analysis method is a qualitative research method. Its core idea is to summarize experience from the collected raw materials and upgrade it to theory. Finally, the code analysis results are shown in the table. Five spindle codes and 15 open codes will be used as two-level elements and three-level elements respectively to form a hierarchical demand element system.

Table 1. Young elderly oriented smart wearable demand factor system

Spindle coding (Secondary elements)		Open coding (Third level elements)	
Element name	Word frequency	Element name	Word frequency
B1 Physiological needs	60	C11 disease monitoring	21
		C12 action assistance	9
		C13 visual assistance	14
		C14 memory assistance	5
		C15 low burden	11
B2 Psychological needs	32	C21 interactive experience	12
		C22 loneliness relief	6
		C23 inferiority relief	7
		C24 anxiety relief	3
		C25 depression treatment	4
B3 Social participation	27	C31 re-employment	9
		C32 community connection	6
		C33 organization association	10
		C34 information sharing	11
B4 Life style	28	C41 scientific health	7
		C42 learning needs	13
		C43 interest cultivation	8

According to the factor system, Likert scale questionnaire is generated. The questionnaire involves 160 young elderly people randomly selected from the Hangzhou Civic Centre and the surrounding rural areas of Hangzhou city in China, of which 142 are successfully recovered, 11 are excluded and 131 are valid. Based on the hierarchical structure of the young elderly oriented smart wearable demand element system, the analytic hierarchy process is applied to determine the influence weight of each criterion layer element on the target layer. The final composite weights are shown in Table 2. It can be concluded that the core demands elements

are C11, C21, C15, C32, C42 and C13; the sub-core elements are C22, C41, C31, C12 and C43; the peripheral elements are C14, C23, C33, C34, C24 and C25. According to the results, it can be concluded that in the current development of aging issues and smart wearables, the core elements of young elderly smart wearable needs include disease monitoring, interactive experience, low burden, community association, learning needs, and visual assistance, while the sub-core elements include relief from loneliness, scientific health, reemployment, action assistance, and interest development.

Table 2. Weight analysis of young elderly oriented smart wearable demand factor

Index level	Criterion level				Weight to total objective	Index weight sorting
	B1	B2	B3	B4		
C11	4240				1818	1
C12	940				403	10
C13	1662				713	6
C14	723				310	12
C15	2436				1045	3
C21		5461			1322	2
C22		2565			621	7
C23		1020			274	13
C24		467			113	16
C25		376			91	17
C31			2497		410	9
C32			5329		873	4
C33			1297		213	14
C34			889		146	15
C41				3236	533	8
C42				4487	739	5
C43				2278	375	11
Impact on overall objectives	4289	2421	1642	1647		

5. Principles of young elderly oriented smart wearable sustainable design

There is a huge market for young elderly oriented smart wearables. Because of its popularity and interdisciplinary nature, it has also received extensive attention and research in this field from the academic community. However, there is no appropriate discussion on the principle of young elderly oriented smart wearables from the perspective of design. Based on the theoretical research foundations, design practices, and experimental data in the smart wearable direction in recent years, this paper combines first-hand data from interviews with groups of experts and scholars in related multi-disciplinary fields, summarizes the sustainable design principles of young elderly oriented smart wearable products, including usability principle, experiential principle and low additional burden principle.

5.1 Usability principles

Intelligent and digital products not only bring convenience to users, but also improve the technical barriers to their use, which have certain requirements on user's learning ability and may lead to the psychology of fear and avoidance of elderly users who are weak in learning new things. Therefore, designers should follow the usability principle when designing products for the elderly, reduce the difficulty and psychological pressure of the elderly on the use of the product as much as possible, and improve the operability of the products. As an important indicator for measuring design quality, usability is to judge whether the product system is attractive, easy to learn, efficient, controllable and error-proof from the perspective of users, which will be explained in detail below. Firstly, attractiveness means that users are interested in the product and are willing to use it. Secondly, efficiency refers to the rapidity with which users can complete tasks by using the product. Thirdly, learnability refers to how the product supports first-time use and in-depth learning. Fourthly, controllability refers to the user in the process of using the product as far as possible through control operations to achieve their own ideas. Fifthly, error-prevention refers to how the product helps guide users to avoid incorrect operation.

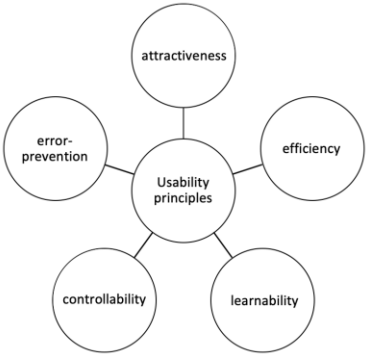

Figure 2. Usability principle of young elderly oriented smart wearable

5.2 Experiential principle

Experience can be divided into two parts, namely the technical system, and product design and service. The experience design of smart wearable products should incorporate the design semantics commonly associated with the elderly. For example, in terms of operational behaviour, the design can add elements familiar to the elderly, and mimic the interface, creating a feeling of familiarity, familiarity and nostalgia that the elderly is willing to communicate with. In addition, simple swipe gestures, voice and gesture recognition should be applied. In this way, a set of operation system that is easy to understand and consistent with the behaviour of the elderly can be formed, thereby better realizing the autonomous management and application of wearable products for the elderly.

5.3 Low additional burden principle

Despite having a higher average physical fitness and learning ability than older people, young elderly people are still below the average for all ages. Therefore, the design principle of low additional burden is particularly important in young elderly oriented smart wearable design. The low additional burden principle requires products to minimize the additional burden on the elderly during the use process, which mainly includes two aspects of physical burden and psychological burden. On the one hand, the principle of low physiological burden requires designers to fully understand the physiological characteristics of the target group, so as to avoid problems such as complicated operations, excessive product volume and self-weight. It is necessary to optimize the design by means of selective design in combination with the physiological decline that may occur commonly in the elderly. On the other hand, the principle of low psychological burden refers to the maximum embodiment of the design equality, that is, the care for the elderly. People's cognition of the information begins with the intuitive feeling of objects. Therefore, smart wearable products for the elderly group can mitigate the additional psychological burden brought by the use of traditional products by imitating them in the appearance design and control interface, thus effectively reducing the cognitive costs.

6. Young elderly oriented smart wearable sustainable design paradigm

The young elderly oriented smart wearable sustainable design paradigm is the most important part of this paper. Through preliminary theoretical research and a large number of design practices, this design paradigm can be divided into four modules, which are demand determination module, design principle module, multidisciplinary design module and utility evaluation module.

6.1 Demand determination module

According to the results of the investigation and analysis of the demand factors of the young elderly, the demand determination module is summarized. Through the questionnaire survey, this module uses the analytic hierarchy process to rank the weight of 15 level-3 demand factors under the 4 level-2 demand factors, and finally obtains 6 core demand factors.

As shown in Figure 3, the demand determination module is composed of 4 level-2 demand elements, including physical needs, psychological needs, lifestyle and social participation, as well as 6 level-3 core demand elements, including disease monitoring, interactive experience, low burden, community connection, learning needs, and visual assistance.

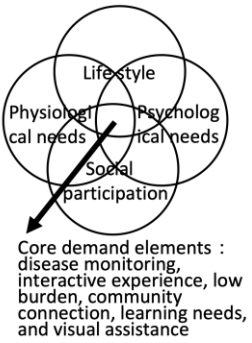

Figure 3. Demand determination module

6.2 Design principle module

Based on the concept of sustainable design, this module is composed of the 3 design principles of young elderly oriented smart wearable products mentioned above, namely the usability principle, the experiential principle, and the low additional burden principle. These three design principles constrain and guide the thinking and direction of young elderly oriented smart wearable design and put forward various design requirements for designers.

6.3 Multidisciplinary design module

Due to the convergence and intersection of the research directions of multiple disciplines, there must be a multidisciplinary design module in the design paradigm. Smart wearable design can be divided into three parts, which are monitoring and acquisition part, analysis part and sharing part. Among them, the monitoring and acquisition part consists of electronic information technology, composite functional materials and structural modelling design. Through near-field communication technology, the monitoring and acquisition part is associated with the intelligent mobile terminal of the analysis part, which is linked to the remote cloud service of the sharing part through the network.

6.4 Utility evaluation module

In this study, young elderly oriented smart wearable products are comprehensively evaluated in a hierarchical way from the aspects of biophysical performance test of materials, electronic unit performance test, controlled simulation test of environmental chamber, information data operation test and user experience. Designers can test and evaluate smart wearable products through the level-5 utility evaluation module and adjust the design according to the comprehensive evaluation results at all levels, so as to obtain rigorous design products that can truly meet the demands of users.

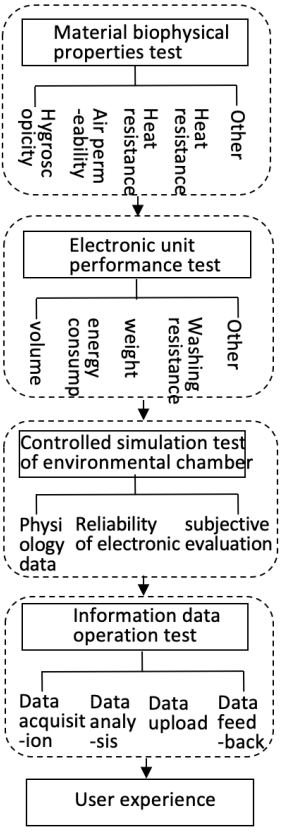

Figure 4. Young elderly oriented smart wearable utility evaluation module

Based on the concept of sustainable design, the design integrates four modules in order, so as to achieve a reflective closed-loop system with perfect or redesigned standards, and continuously promote the development of young elderly oriented smart wearable design. Throughout the process, paradigm is the basis of design. At the same time, through continuous improvement and optimization of the research and development model, the design standard has a higher universality, aiming at providing theoretical basis and research and development reference for the product design in this direction.

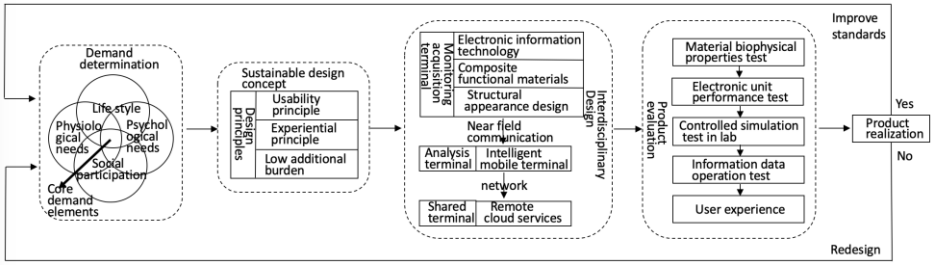

Figure 5. Young elderly oriented smart wearable sustainable design standard paradigm

7. Conclusion

With the increasingly severe problem of aging, there are a large number of social and economic issues around the world. With the development of artificial intelligence, big data, Internet of things, 5G and other technologies, it is inevitable that a new wave of smart wearable products will explode. The smart wearable industry with increasingly mature technology is undoubtedly one of the best ways to solve the problem of aging. How to make smart wearable products better meet the needs of the large and complex elderly and improve the quality of life of the elderly is a valuable research topic, among which the research on the applicable product design paradigm for young elderly is more critical. On the one hand, these products are transitional and easy to discard. On the other hand, the understanding of the needs and habit development of the young elderly to use smart products will have an important impact on the same group of elderly people ten years later. Therefore, there is an urgent need for in-depth sustainable design research in this field.

Based on the investigation and analysis of the multi-dimensional demand elements of the young elderly, the core demand factor system of young elderly oriented smart wearable is established. In accordance with the previous research practices, this paper creatively innovatively proposes four design principles of young elderly oriented smart wearable and combines the multidisciplinary design module and utility evaluation module to construct the standard paradigm of young elderly oriented smart wearable sustainable design. The whole research and development program process is a sustainable ecological closed loop. This research fills the relative gap in the field of academic design in this direction and has a high level of cognitive leadership. However, there are deficiencies in this research, which hopes to be further improved in subsequent theoretical and practical research. This study provides theoretical basis and research and development reference for the relevant design practitioners, promotes the smart wearable industry for the elderly, and proposes valuable solutions to many problems caused by aging.

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Acknowledgements: This work was supported by the Key Special Projects of 2019 National Key R & D Plan (2019YFB1405704), 2020 Humanities and Social Sciences Planning Fund Project of the Ministry of Education (20YJAZH087) Postgraduate Research & Practice Innovation Program of Jiangsu Province (KYCX20_1891). The authors acknowledge the above financial support.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Surviving in the wild: Sustaining design and social innovation initiatives in Asia-Pacific

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Abstract | In recent years, the importance of sustaining social innovation initiatives, once initiated, has gained increasing attention and, in particular, the role that design(ers) can play in this process. However, both the academic study and the practice of design and social innovation are currently lacking sufficient insight into how initiatives are sustained outside of experimental or academic settings and rarely move beyond the involvement of designers and/or researchers. The paper shares experiences from practitioners from Asia-Pacific that are operating in the real world, highlighting their precarious working conditions. The significance of building and maintaining healthy social relations in essential in this context, as these enable the weaving of a strong social fabric around the initiatives that will provide necessarily shelter and to endure long after the practitioners' involvement. Therefore, facilitating the creation of meaningful social relations should be the key objective for design, instead of designing artefacts.

KEYWORDS | DESIGN AND SOCIAL INNOVATION, SOCIAL RELATIONS, HONG KONG, THAILAND, MALAYSIA

1. Introduction

Design practitioners, together with other professionals who are operating in the social innovation space, often find themselves in an inherent paradox; their aim is to create long-term social change, whereas their involvement is often short-term, project-based and/or contingent on available funding. The notion that designers can (and should) contribute to the survival of initiatives that they are involved in, has been acknowledged relatively early in academic discourse (Burns et al., 2006; Brown & Wyatt, 2010; Iversen & Dindler, 2014). Ideally, however, it should be the community who ultimately bears the responsibility for sustaining design and social initiatives (Janzer & Weinstein, 2014; Wang et al., 2016; Cairns, 2017). Several promising directions, described further on in this paper, have been suggested to achieve this desired end-state. However, most studies on sustaining design and social innovation describe initiatives which trace their origins to institutional frameworks, often academia or government, and are situated in relatively stable environments. Furthermore, accounts that proceed beyond the involvement of researchers are rare; a notable exception is a study by Hillgren et al. (2016), which follows the Malmö Living Lab over a seven-year time period. Little is known about initiatives that originate and operate 'in the wild', often with limited or no resources at all, as accounts from practitioners are mostly descriptive in nature and do not shed light on how they manage to sustain themselves. In a way, this is not surprising, as design and social innovation is a relatively young discipline, which is still developing (Irwin, 2015).

2. Background of the study

Academic discourse is currently dominated by studies that examine design and social innovation in a European or North American context (Meroni, 2007; Morelli, 2007; Jégou & Manzini, 2008; Murray et al., 2010; DiSalvo et al., 2011; Ilstedt Hjelm & Mårtens, 2011; Westley et al., 2012; Meroni et al., 2013; Di Prete & Mazzarello, 2017; Olivastri, 2017), with the rest of the world considerably less represented. Although a western orientation in design and social innovation research does not necessarily have to be an issue, the assumption that concepts originating from the west can be simply modified and implemented in other, non-western contexts, is problematic (Bala-Miller et al., 2008; Manzini, 2015), as transferring successful ideas and methods from the west into an entirely different context might not be appropriate nor desirable (Brown & Wyatt, 2010). There is a danger of imported solutions and paradigms replacing local knowledge and practices, which might be better suited to tackle issues in their original context and, in addition, can also be used as examples that the west could learn from (Bala-Miller et al., 2008; Akama et al., 2019).

The dominance of the western perspective in academic discourse on design and social innovation can be regarded as part of the broader discussion concerning the decolonisation of knowledge (Mignolo & Tlostanova, 2006; Mignolo, 2007). In particular, the *decolonising design* approach, which respects the relation of ideas, projects and ideas to their particular

contexts and prefers to design relations that recognise differences instead of singular perspectives and "common denominators" (Schultz et al., 2018). Moreover, the centre of design culture, traditionally perceived to be based in the west, should be disconnected from the colonial narrative of modernity and reconnected to *pluriversal* narratives, which assume that multiple centres of design can exist simultaneously (Onafuwa, 2018).

This paper therefore aims to contribute to a more pluriversal body of knowledge on design and social innovation by sharing insights from Hong Kong, Bangkok and Kuala Lumpur. The study is part of a larger PhD research project which aims to determine what constitutes design and social innovation initiatives in the Asia-Pacific region, investigating why projects are initiated, for whom value is created and what role design plays in the process.

3. Perspectives on sustaining design and social innovation

Academic discourse suggests a variety of approaches on how to sustain design and social innovation initiatives. Three major streams, that at times overlap, can be distinguished herein: the first aims to create favourable environments and/or (social) infrastructures to support both current and future initiatives, the second focuses on upscaling and replicating the initiatives themselves and the third aims to preserve the initiatives' underlying ideas and concepts.

Sustaining through creating favourable environments

Enabling (eco)systems, consisting of cultural and social structures, are described by Manzini (2013, 2015) as a requirement for design and social innovation initiatives to be able to flourish and spread. Within these ecosystems, designers can contribute through their skills of visualisation, storytelling and scenario building, and build capacity within the community by for example, making use of toolkits.

Infrastructuring, suggested by Björgvinsson et al. (2012), is another approach aimed at reinforcing long-term commitment. It entails a process of continuously building and expanding a network of stakeholders, while being flexible regarding the allocation of time and resources. Rooted in Scandinavian participatory design, projects in this approach are perceived as *Things*, socio-material assemblies in which both designers and other actors participate. Designers therefore need to consider that after their initial involvement, design Things might continue with other actors and stakeholders. In this context, the term 'infrastructuring' refers to the act of creating an infrastructure that consists of relations that are connected through different times and places.

The enabling systems and infrastructuring approaches have in recent times grown closer, as studies have been examining how design Things can shape the building of future social relations (Light & Akama, 2014) and strengthen social resilience by facilitating collaborative encounters between community members (Cipolla, 2018; Manzini & Thorpe, 2018)

Sustaining through upscaling and replicating initiatives

The advantage of scaling-up initiatives, according to Jégou and Manzini (2008), is that it enables a large of number of people to live sustainably. The scaling-up of design and social innovation initiatives does not entail an increase in size, but utilises creativity, design, entrepreneurship and technological knowledge to enhance the accessibility and effectiveness of initiatives, which in turn facilitates implementation on a larger scale. Similarly, when replicating initiatives, it is not the creative communities themselves, which are highly localised, that are to be replicated. The emphasis should instead be on replicating the service ideas that are deemed suitable for adaptation to new contexts. Furthermore, initiatives should be scaled up and replicated by increasing their numbers (not their size) by connecting them to a larger network. The importance of scale is also underlined by Mulgan (2017), who asserts that it plays a role in linking initiatives to broader programmes. Smart adaption should be given priority over innovation when upscaling, without neglecting the skills needed to adapt social innovations to new contexts.

Sustaining through preservation of concepts, ideas and examples

Upscaling and replicating of initiatives, as described in the previous section, are one way to preserve the concepts and ideas that underpin design and social innovation initiatives. In addition, (design and) social innovation networks, such as DESIS, DESIAP, SIX, Impact Hub and Ashoka can safeguard the knowledge and contacts of the field itself. An accessible and convenient way to both retain and replicate design and social innovation ideas, particularly its methods, are the toolkits, guides and courses offered by various organisations and academics. Examples are IDEO's *Field Guide to Human-Centered Design* (IDEO.org, 2015), frogdesign's *Collective Action Toolkit* (2012) and the *Social Design Methods Menu* by Kimbell and Julier (2012).

The building of strong social relations requires considerable effort, but yields many benefits for the design and social innovation process. As suggested by, for example, (Light & Akama, 2014) in this study, too, social relations were found to strengthen initiatives by providing a foundation from which new ideas can emerge, even when the design component fails or ceases to exist. They can also help create a sense of ownership among the community.

The three main categories of approaches are, however, currently still too theoretical and speculative in nature. A large majority of the cases discussed are limited in scope and/or consist of pilot projects, that tentatively project future scenarios. Toolkits and courses spread knowledge through their dissemination tools and methods, but often do not provide enough insight into contextual factors, which are also not immediately apparent to prospective users. Moreover, examples of real-life initiatives continuing for a long period of time using any of the suggested methods are virtually non-existent.

4. Methodology

The PhD research study, from which this study derives its results, comprised seven months during which Hong Kong, Bangkok and Kuala Lumpur were visited. The researcher spent roughly two months in each city, contacting initiatives, building relationships with those involved and conducting interviews. Case studies, defined by Yin (2018) as an in-depth empirical investigation of a phenomenon within its real world context, were considered as a suitable method to examine how the initiatives operate in their own respective environments. A multiple-case study design was used for this purpose, which entailed the selection of multiple cases in multiple countries, each of which was studied in their own context. Eventually, sixteen initiatives were selected as case studies, five in Hong Kong, six in Thailand and five in Malaysia (see figure 1 for an overview).

HONG KONG		
Initiative	**Initiated by**	**Usage of design**
Goodseed	Government	Capacity building, design thinking, co-creation
DOMAT	Architectural agency, social enterprise	Architecture, product design
Fine Dying (SI.DLab)	Non-profit social design agency	Design thinking, co-creation, empathy, immersion, prototyping, capacity building
Form Society	Independent	Event organising
Play Depot	Independent	Design activities are organised by stakeholders
BANGKOK		
Initiative	**Initiated by**	**Usage of design**
Co-create haroenkrung (TCDC)	Government	Urban renewal, prototyping, visualisation, event organising
Deschooling Games	Independent	Game design, event organising, co-creation
Pom Mahakan	Independent	Design thinking, prototyping, co-creation, community architecture, participatory mapping
Bangkok Chinatown	Architectural agency	Design thinking, prototyping, co-creation

CROSSs	Architectural agency	Participatory design, architecture, prototyping, designing relations
The Rambutan	Independent	Graphic design, activism
KUALA LUMPUR		
Initiative	**Initiated by**	**Usage of design**
Earth Heir	Social enterprise	Product design
3nity Design	Design & branding agency	Branding, graphic design, product design
Green Pocket Park (POW Ideas)	Architectural agency	Architecture, art
Lorong Bandar 13 (Think City)	Government	Urbal renewal, architecture, co-creation, visioning
Water Warriors & Mukim Pasangan (University of Malaya)	Academia	Designing relations

Figure 1. *Overview of the sixteen initiatives that participated in the study.*[1]

The data was collected through semi-structured interviews with stakeholders, which were recorded using an audio recording device. The questions asked during the interview were structured around the *Activity Theory* framework[2], which studies both individuals and their contexts simultaneously by studying the activity that is generated in the process (Engeström, 1999). In addition, other relevant topics or themes identified during the conversation were highlighted in handwritten notes.

Thematic analysis was used to analyse the collected data. A method that is widely used in qualitative research, it can identify, analyse, and report patterns (themes) within data (Braun & Clarke, 2006). The data in this study was approached in an inductive manner, which entails the presumption that the findings are the result of the analyst's interaction with the data, leading to the identification and construction of patterns, themes and categories (Patton, 2015). Reoccurring topics in the interviews were grouped into broader themes and further grouped into three key themes (see figure 2). The findings discussed in this paper focus on the third key theme: sustaining design and social innovation.

[1] A detailed description of the case studies can be found in Tjahja (2019)

[2] For a more in-depth discussion of how Activity Theory was used in the larger PhD research study, please see Tjahja, Yee & Aftab (2017) and Tjahja (2019)

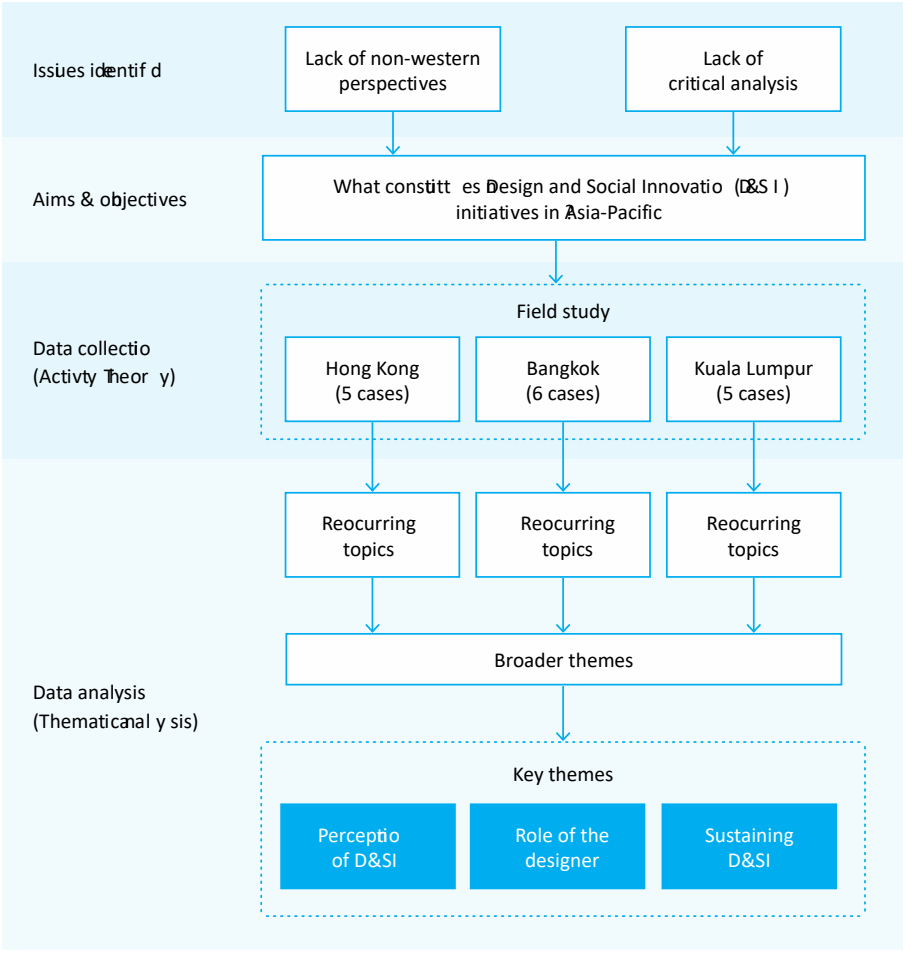

Figure 2. A methodological map of the PhD research study.

5. Findings

The insights gained from the practitioners who participated in the study regarding the continuation of their initiatives can be categorised in four themes: the importance of building and maintaining social relations, issues surrounding the upscaling and replicating of their initiatives, difficulties finding a suitable business model and the lack of public space.

The importance of building and maintaining social relations

Social relations can influence the design and social innovation process in various ways and can have dimensions and modalities that are not always immediately apparent. Practitioners in all three cities reported that the building of (new) social relations was beneficial for their initiatives both during and after the process. Maintaining good social relations with community members and other stakeholders was essential for building both trust and capacity within the community as well as creating a sense of ownership of the initiative, with some respondents noting that the social aspect of their work ultimately was more important than the design aspect. Furthermore, several initiatives managed to create new social ties among the local community, which stakeholders perceived to be a valuable outcome.

In Bangkok and Kuala Lumpur, social relationships are often characterised by a high degree of informality, which helps to expand networks and create new opportunities in the process. Particularly in Bangkok, both the positive and negative effects of social hierarchy were significant, interacting with practitioner's work on multiple levels and in different scenarios (Author et al., 2017). For example, having access to key figures that are situated high in the hierarchical ladder can be of significant benefit in terms of an initiative's progression or provide opportunities, which would have not materialised otherwise.

Issues with upscaling and replicating

Academic discourse perceives the scaling-up and replication of initiatives as an effective way to spread either the initiatives themselves or the ideas that underpin them. None of the bottom-up initiatives in this study, however, have managed to do this successfully. Several of the respondents reported the lack of manpower as a major issue, either within their own initiative or the stakeholders involved. Furthermore, most of the initiatives are just one of many projects that the practitioners work on. Combined with the insecurity of not knowing to what extent they can secure funding for their social activities, making strategic decisions whether to prioritise social or commercial projects or whether to expand their team can be challenging. These precarious conditions in which initiatives oftentimes are forced to operate, make upscaling and replicating a goal that is difficult to attain for most. Even if initiatives do manage to upscale and replicate, the eventual outcome might not be desirable. An example is the case of the Water Warriors initiative, which was scaled-up by its host university. However, the process of institutionalisation introduced concepts such as accountability and bureaucracy, while not sufficiently taking into the social network that the initiative created between the various stakeholders involved. This threatened the initiative's original bottom-up character, leading to a loss of motivation for the practitioners working on the project.

Difficulties finding a suitable business model

Arguably, the most important question that could be asked in the context of sustaining design and social innovation is "who is going to pay for it?". It is therefore striking that this question often remains unanswered. In Hong Kong, for example, both housing and living costs are among the highest in the world. Practitioners therefore often do not have the luxury to carefully plan out their activities, but need to hit the ground running, particularly when it comes to financing their initiatives. Most of the non-government initiatives studied are not subsidised and have to find other ways to support themselves. In the best-case scenario, income from commercial activities is transferred to fund social activities. In some cases, however, such as Form Society and The Rambutan, the practitioners fund their initiatives using their own private savings. Ultimately, none of these scenarios are sustainable in the long run. Moreover, even when an initiative is fortunate enough to receive funding, it cannot be relied on as a stable source of income.

A related issue is the lack of a suitable legal entity for the initiative. In Thailand, for example, it is currently not possible to mix business and social activities within one organisation, which leaves practitioners unable to make use of tax exemptions and provides no ground for the initiative to exist at all. Academics and practitioners therefore have to take into account that legal frameworks can vastly differ per country or territory, potentially limiting an initiative's present and/or future opportunities. For example, the general environment in Hong Kong and Malaysia appears to be more favourable towards social innovation compared to Thailand, making the threshold to engage in design and social innovation significantly lower in the first two countries. This does, however, not necessarily mean that it is practiced less in Thailand.

The lack of public space

In several of the initiatives, such as Co-create Charoenkrung (Bangkok), Play Depot (Hong Kong) and Lorong Bandar 13 (Kuala Lumpur), design interventions were performed that had an impact on public areas. However, in all three cities the availability of public space was an issue. Public space, particularly in Europe, is often assumed to be owned by the (local) government. However, in Bangkok and Kuala Lumpur, most of the spaces that appear to be public, such as parks and riverfronts, are owned by private parties who have no particular interest in participating in social innovation. Since government influence over these companies is limited, their lack of cooperation can disrupt any kind or intervention that affects public areas. In Hong Kong, physical space itself is extremely scarce and one of the city's most urgent issues. The availability of public space is generally not considered to be as a condition for social innovation from the dominant western perspective. This is exemplified by a study conducted by Thammasat University for the Co-create Charoenkrung project, which found that public space as an indicator was, in fact, missing from western models and therefore had to be added to their own co-creation model for creative districts.

6. Discussion

For many initiatives, particularly those stemming from an academic or institutional context, upscaling and /or replicating are often considered the ultimate indicators of success. However, this might not be necessarily be true for initiatives that originate from outside of these frameworks, whose growth is inhibited by the harsh and unforgiven conditions in which they need to operate; they are simply surviving. Even for initiatives which do have a background in academia, such as Water Warriors, the clash between its grassroots philosophy and the university's institutional framework proved to be a serious challenge to its existence, as scaling up the initiative failed to include the social network which was present in its original incarnation. Therefore, it should be reconsidered whether upscaling and replication should be a default progression path for an initiative to take. In some cases, it might be preferable for initiatives to remain small, local, but true to its original intentions and principles.

Private organisations currently have little incentive to engage in social innovation, which can be problematic for initiatives that propose any kind of spatial transformation. More effort needs to be undertaken to better understand how to motivate these organisations to participate in, or at least facilitate, social innovation efforts. However, practitioners also need to accept that some organisations will never be persuaded to participate, which can have significant implications for the scope and scale of proposed interventions. For initiatives it is therefore essential to communicate appropriately with their stakeholders, managing their perceptions and expectations, and setting goals that are realistic in order to avoid disappointment or even disengagement.

A common factor which binds most of the bottom-up initiatives in this study is the precarious state in which they find themselves. In addition to helping local communities, they also need to sustain themselves, which is a constant struggle. Embracing this notion of precariousness by incorporating it in their practice might be one way for practitioners to deal with this. Designers would have to accept the fact that they themselves will most likely not be making a change nor bear witness to it. Their main task then would be to build capacity and transfer ownership to the community within a limited timeframe, which would not be far from the project-based way of working that designers already practice. However, whether such short-term interactions with the community would have sufficient meaning or value is debatable.

If designers should indeed shift their focus to the creation of favourable environments for communities to co-design with one another, a more effective solution might therefore be to create enabling ecosystems for the initiatives themselves as well. By aligning their own goals with those of other stakeholders or actors, practitioners might be able construct an environment where they are supported by those who have an interest in the success of the initiative.

Social relations are forces that can be considered as fundamental to design and social innovation and whose significance we have only recently begun to understand. Their influence can be felt in a variety of ways, particularly when trying to sustain initiatives. For example, upscaling and replicating can fail if the social components are not taken into account. Maintaining healthy social relations with the community, governments and private organisations can help initiatives survive in inhospitable environments. But perhaps most importantly, the social fabric that has been carefully built up for the community by the practitioners has the potential to outlast the initiative itself. The creation of the social relations that constitute it should therefore take priority over any design activity as any designed product, service or intervention would have no meaning or value if the social dimension is absent.

7. Conclusion

The experiences shared by practitioners from Hong Kong, Bangkok and Kuala Lumpur contribute to a more thorough understanding of how design and social innovation initiatives that grow up 'in the wild' manage to sustain themselves. The constant precariousness state of the initiatives, and in some cases the practitioners themselves, is perhaps is what stands out most. Initiatives that are rooted in academia or government could be perceived as ships who have a home port, a safe harbour where they are based and from which they can sail into the open sea. In contrast, initiatives that are 'out there', are ships constantly battling a rough sea, which might not necessarily be hostile, but merely indifferent to their existence.

For design to make a truly meaningful contribution to social innovation, its primary objective should be to enable initiatives to move beyond their exploration and experimental stages towards long-term independent survival. The construction and maintenance of social relations, awareness on the many complex ways how they exert influence the design process and how they can be grown and managed in a more effective way is crucial for the well-being and survival of the initiative in the long run.

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Acknowledgements: Part of the PhD research field study was supported by the Design Research Society.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Sustainable Deliberation; an Empathetic 'Mantra'

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Abstract | In the current scenario, sustainability, as a way of life is being touted as the new 'mantra'! The design thinker is seen to perceive it as a Social Innovation. Identifying the specific issue of Plastic Pollution, 'Refuse and Reduce' are ideals of a bygone era! The volume of plastic waste needs serious deliberation; but, with 'solution-led' plans using design thinking. reCharkha – The EcoSocial Tribe, is the story of looking at this social issue of plastic waste in the face and, identifying realistic solutions. Adopting the ideals of a circular economy, through a policy of 'RE-USE BY UPCYCLING', seems to have worked as a smart solution!
reCharkha's uniquely sensitive approach uses traditional technology, which is sensitive to the environment and also brings about economic well-being and women empowerment. reCharkha's way to revitalize a craft, which focuses on 'Handmade in India' as the current cultural trend, infusing cultural abundance within contemporaneity; that every sensitive millennial wants to be a part of.

KEYWORDS | DESIGN THINKING, UPCYCLE, PROVIDING LIVELIHOODS, WOMEN EMPOWERMENT, REVIVING CULTURAL CRAFT

1. India; A fertile ground for sustainable change

The Indian diaspora lives within unique and varied lifescapes. While some live in villages or rural settings, others live in industrial towns or uptown cities, also known as urban settings; besides 'villagers and urbanites', they could also be categorized as local, global and 'glocal' Indians. Their social and cultural realities are varied, the urban college-educated professionals being more world-wise from their rural counterparts who have little exposure. There is great diversity in lifestyle and language across India and many folks have minimal literacy. They are inherently steeped in tradition; there seems to be a revival of a newfound 'Indianness'* in their perceptions despite of globalization. They are respectful of belonging to a rich heritage of glorious traditions and values inspired by naturopathy and *ayurved* and a fascination and pride for the treasures inherited in the form of Indian crafts. Indian culture, being resilient in nature, is seen to be robust in its value - based social fabric; India is a fertile ground for adaptivity to sustainable development aimed at betterment of society.

As utilized in due context by various designers, 'GLOCAL'15, the term first appeared in 1980s in a publication of the Harvard Business Review, at a 1997 conference on "Globalization and Indigenous Culture"; sociologist Roland Robertson stated that 'glocalization' meant the simultaneity or the co-presence – of both universalizing and particularizing tendencies.

2. Empathy; The core of social change

Design for Social Development* or Service Design* are popular terms used within the field of Social Development; it identifies a cohesive integration of design thinking within a focus on strategic thinking. Being a powerful tool, an 'empathetic design strategy, is seen to improve the chances of success of development projects. It strives for behavioral change through information dissemination, education, or generating awareness. Further, it provides relevance through tangible products or system solutions that engage people to change long-established practices or rigid mindsets.

Proposing suitable solutions for the upliftment of any scenario means revisiting some of the basic premises that we normally take for granted. It requires understanding of a 'world view' that is aligned to a global sensibility, as also, respecting cultural sensitivities of communities that deeply value their roots. Design for Social Change* demands that characteristics of empathy, engagement, responsibility and an overall 'Sustainable Deliberation' become the significant drivers in the professional practice of social development. The role of ethical considerations at national, international and global level, as also interdisciplinary design practice norms need to be taken into consideration. Research of professional models and performance assessment methods need to be applied. Regular participation in ethical debates and analysis of processes prevailing within current environments, are seen to be useful in achieving collective or personal goals.

Any type of development requires some kind of behavior change on the part of all involved stakeholders. In order to effect behavioral change, it is necessary to understand why people do what they do and understand the barriers that may stop positive change in adopting newer relevant practices. An empathetic attitude would be critical to understand peoples' barriers that any change would entail, as perceived by them. A study of ethnography and cultural contexts has proven to be an effective way to understand target audiences. Meaningful and wholesome research is about feeling the 'pulse of a particular audience', listening to their feedback, and responding appropriately. Whether discussing a development project or broader economic reforms — from health, environmental issues, education or grassroot development to private sector development, financial support or judicial reform, the idea is to build consensus by generating a well-informed dialogue among stakeholders. The success or failure of a project can often be affected by the relevance of Design Innovation and how well it engages essential aspects of local, political, social and cultural realities. Reform efforts or development projects have often been successful, when built on a substantial foundation of an 'immersive approach' to Design Thinking.

3. India: a land of varied perceptions

India is called a Developing Nation; indeed there have been some clear indicatives of a focused change in terms of industrial, political, economic and social change. The fairly focused pace of 'development' is rampantly affecting the entire landscape of India in a drastic manner, both Ecologically and Socially. Many of India's cluttered, overpopulated and unkempt cities and towns clearly indicate an insensitive disregard for an eco-system that defines a progressive society. Many heart-rending questions arise regarding the environmental degradation as also the degeneration of the social fabric as is being witnessed in India, especially more so in urban India. These need to be urgently addressed. Are littered roads a part of the smart-city landscape? Does pollution get substantially addressed within the framework of the regulatory civic systems? Are the present conditions and possibility of a chaotic and hazardous future not disturbing the mindsets of the educated and cultured urbanite? The empathetic steps taken to improve this scenario, need to be addressed urgently, as also, the rate of change needs to hasten as a priority.

However, as one goes away from the urban areas to remote areas or then to the newly rediscovered farmhouse living concepts, one can experience a contrasting situation! Here, the relationship between people and their EcoSocial surrounding is still somewhat intact and humane. They seem to respect and worship nature, not necessarily extending a ritualistic tradition, but with keener sensibilities of a mind not invaded by the gory impacts of industrialization gone wayward! A strong social bond within the community, inherently much more at peace with what is around them and within themselves too! These are the real 'Grassroots' of India. That's when one realizes that the inherent culture of India is essentially substantial and resilient in nature!

However, as one goes away from the urban areas to remote rural and tribal areas, one can experience a contrasting situation! Here, the relationship between people and their EcoSocial surrounding is still somewhat intact and humane. They seem to respect and worship nature, not necessarily extending a ritualistic tradition, but with keener sensibilities of a mind not invaded by the gory impacts of industrialization gone wayward! A strong social bond within the community, inherently much more at peace with what is around them and within themselves too! These are the real 'Grassroots' of India. That's when one realizes that the inherent culture of India is essentially substantial and resilient in nature!

Our interdependence on this inherent EcoSocial fabric amplifies India's traditional wisdom, which is being practiced even today; be it Ayurveda and Naturopathy, which uses soil and plants to cure many chronic diseases; be it organic and traditional farming, which optimizes use of water, soil, microbes and other living organisms to produce healthier food; be it conventional housing, which uses local stone, soil and other natural resources to make climate resilient houses well-suited for the diverse geographic and climatic conditions of our country; be it our beautiful and extraordinary handicraft which has always provided a source pride and livelihood to a large population of our country. Precisely, 4.3 million people directly and indirectly are still involved in the craft production; the handloom industry is the second-largest employment provider for the rural population in India, after agriculture.

A drastic degradation of the environment has prompted a realization in today's generation; environmental issues that are causing societal upheaval will not cease or reverse, until social beings change their ways. Practices of the yesteryears could well be an inspiration for a sustainable lifestyle! A deliberate 'move' towards sustainable living, a revival of simple living; possibly prompted by drastic environmental issues that have definitely caused huge concerns, can be observed. Sustainability, as a way of life is being touted as the new 'mantra'…..a lifestyle!!!





Figure 1: Ancient system of medicine 'Ayurveda'; Figure 2: Nature, Climate resilient houses

4. Design: a professional problem solver

Design is seen to have transformational power. Design methods, design attitudes and approaches are being looked upon as tools to create and deliver sustained value. Businesses and brands that are substantial in terms of their commercial footing, are seeing design as the source to build the competitive advantage in terms of innovation, differentiation and sustainability. Socially motivated organisations, in their CSR programs, are increasingly using design thinking as holistic problem solving tool, in terms of exploring how design could make their systems and processes effective.

Design has always been respected to be a problem solving activity; design innovation offers scope to change the world. The design thinker is seen to perceive social innovation with a rare depth when proposing a substantial solution. Design innovation is seen as that which possibly brings relevance, energy and strength and prompts a holistic and realistic solution. The generation of creative concepts provides functional relevance to validate the strength of a purposeful idea.

However, the challenges and opportunities of developing nation like India are different from those of a developed economy. Therefore, even though design is already making inroads into the developing economies, the role of design needs to be contextually envisioned.

From the typical rhetoric, like "Good Design is Good Business" (Watson, 1950) to the more recent one like "Design as a Source of Competitive Advantage" (Martin, 2009), the role of design is no doubt significant globally. Even in India, designers have done a lot of study on this front such as, in their book, Design and Environment: An Introductory manual, Kumar and Vyas, elaborate the concepts of and significance of Design Thinking. Organizations like KPMG are India's design thinking practitioner's workshops. When the Design domain interfaces with Business it generates 'structure and process orientedness'. Whether it is Research, Production or CSR, all could become "templatised" with clear set of objectives generating characteristics of reliability, predictability and scalability.

> "Design has emerged as a high-profile activity, indispensable to quality in sophisticated sectors of manufacture and communication. Yet the original inspiration for bringing design to this land—to lift the quality of life for millions living at the margins of existence in villages and urban slums—remains virtually untouched" (H. Alpay Er, 1997)

Design process contributes to providing a systematic approach to social design and in turn, contributes to improving human well-being and livelihood. The agenda of Social Design is inspired by, among many others' Victor Papanek's * idea that designers and creative professionals have an inherent capability as also the responsibility to cause real change in the world through substantial design. Papanek expands the term of 'Responsible Design' as contributions made through more ecological products made of eco-friendly materials or developing living environment and habitat that is conspired with natural elements. He also remarks on designing for people 'needs' rather than their 'wants'.

Social design thinking also indicates the integration of products and processes as creative capital. Another author that contributes to the development of this definition of social design is Victor Margolin*. He writes in "The Politics of the Artificial" about the "designer's ability to envision and give form on material and immaterial products that can address human problems on broad scale and contribute to social well-being." The restrictive view of social design as charity is insensitive to economic development of a section of society. It needs to be respected as professional contribution to the development of the larger well-being in terms of the potential of the patenting of products and processes that have substantial value. Also, companies like IDEO* have established the significance of human-centeredness approach to generate innovative solutions.

5. Social Design with a realistic vision: the designer, “an Agent of Change”

The growing menace of plastic has been a nightmare within the lifestyle of a so-called modern society. It’s an oft used material which has engulfed the environment amplifying, ‘unashamed utilization of the ugly against adaptation of the wholesome’. When addressing the issue of Plastic Pollution in India, ‘Refuse and Reduce’ are ideals of a bygone era! Plastic came into existence only about 6 decades ago, and its mass production has already generated 8.3 billion metric tonnes of it, mostly as disposable products, thus, 6.3 billion metric tonnes is now plastic waste. Out of this, barely 9% has been recycled. The remaining 91% which has not been recycled is either dumped into layers of landfill or finds its way into water ways and finally into the huge gyres of plastic waste created in our oceans. More than 8 million tonnes of plastic enter the oceans each year, equal to dumping a garbage truck of plastic every minute*. As much as 80 per cent of all litter in our oceans is made of plastic. Thus harming the entire ecosystem, be it marine or terrestrial! Marine debris is harming more than 800 species. 40 per cent of marine mammals and 44 per cent of seabird species are affected by marine debris ingestion. According to some estimates, at the rate we are dumping items such as plastic bottles, bags and cups after a single use, by 2050 oceans will carry more plastic mass than fish, and an estimated 99 per cent of seabirds will have ingested plastic. Plastic waste kills up to 1 million sea birds, 100,000 sea mammals, marine turtles and countless fish each year.





Figures 3 and 4: Typical sites of street dumps and landfills harming stray animals and causing air pollution





Figures 5 and 6: Plastic waste being thrown into rivers and the state of rivers dumped with waste



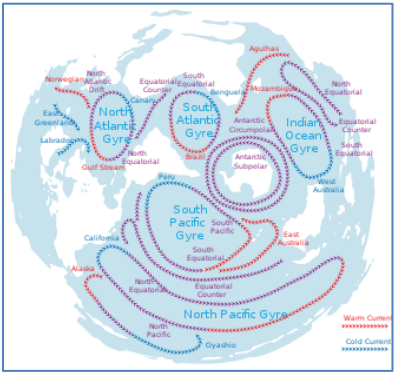

Figure 7 and 8: Plastic impacting marine life and extent of Garbage patches created all over the planet

The volume of plastic pollution and the harm from such waste, needs serious deliberation; with 'solution-led' and workable plans. reCharkha, an Eco-Social Initiative, is the story, among many others, of looking at the social issue of plastic waste in the face, and, identifying realistic solutions driven by sound process of design thinking derived through extensive research.

At reCharkha, a chronic global issue, caused due to the modern, wasteful and unsustainable lifestyle, the need to find inspiration at the grassroots of a substantial traditional systems proved to be a seamless and most natural eco-social solution!

REfuse and Reduce, though definitely the ideal solutions, are impractical and extremely difficult to implement, given that plastic has become such an essential part of the lives in any Indian urban setting! REcycle is another known solution. The currently used techniques of recycling or reprocessing plastic waste, range from incineration, pyrolysis and chemical recycling, are however methods also causing pollution!

reCharkha's first foundation pillar being "EcoSocial Conservation", REuse by UPCYCLING was adopted as the ideal solution. Based on the theory of 'REUSE', reviewed with practical ideals and infused with innovative ideas; it proposes social innovation to uphold the ideals of sustainability for the current scenario in India, delving deep to align with the mindsets and perceptions of the contemporary Indian target audiences. Adopting the ideals of a circular economy through a policy of 'RE-USE BY UPCYCLING', to address the problem statement of 'Stalling the rate of the ever-growing plastic dump', seems to have worked as a smart solution!

Another relevant aspect which reCharkha identified was that of addressing livelihoods in the rural settings which suffered due to severe deficit of livelihood opportunities. Before launching the program, a core team of reCharkha, toured various rural and tribal areas of India extensively, to gauge the situation from closer up. Realization dawned in form of apathetic facts. A majority of these rural dwellers were dependent only on rain-fed agriculture, which typically takes place for 4-6 months every year. For the rest of the year, many had to migrate to towns and cities in search of odd jobs. Because of this, majority of the working men had to live away from their families, as bringing up families in the cities is even more expensive. The younger generation is being driven by circumstance to move away from an agricultural economy, leading to large scale migration of rural youth to urban areas. This is draining away village youth to overpopulated towns and cities, further burdening the urban infrastructure. Most modern skill development and livelihood development programs are seen channelized specifically at rural youth. Their movement towards urban centers saw a waste of this facilitation since it could not be reutilized by the younger or older generations!! Thus, presenting how mis-focussed strides in economic development are shamefully disregarding the issues of livelihood and tearing apart the delicate social fabric. This called for specific addresal of the issues of a typical community.

6. Community development with a holistic, yet individual focus

Community development is subjective, since focused people in consideration; their socio-economical background, their ingrained culture and traditions, their lifestyles as also their typical habits and intricate perceptions are community specific.

Development and culture, as being closely interdependent on each other, are dynamic concepts. A historical survey of its relevance is seen in many a case studies that claim Social Change for typical communities that demand individualistic solutions. Here, the three conventional 'dichotomies' call for discussion in terms of factors that influence a design proposal for change: (a) tradition and modernity, (b) universalism and relativism, and (c) individualism and collectivism. This generates questions like, the right of an individual and also as active agents, participating in generating a holistic solution with an institutional approach; the feasibility of a broader system in terms of both its crafting and delivering a substantial output. The illustration below gives a framework for Design for Social Impact:

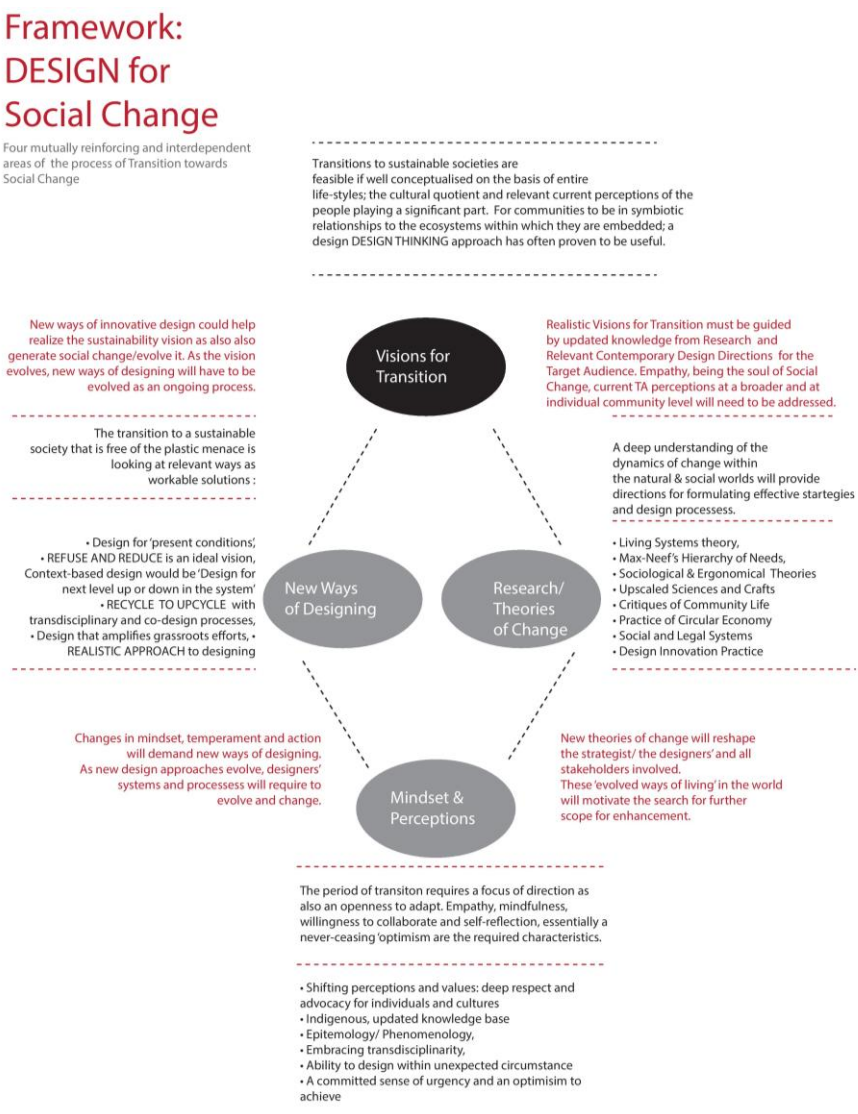

Figure 9: Framework – Design for Social Impact

In 2015, reCharkha launched the first project through the implementation of its second foundation pillar, 'EcoSocial Change', where they focused on a community with potential to be ideal stakeholders, a bunch of quick and eager learners, to contribute to the solving of a huge social issue. A remote village in the western hills of the Union Territory of Dadra Nagar

Haveli was chosen and nurtured to become Agents of Change!! This 100% tribal village, consisting of the Warli tribals, traditionally known for their artistic inclinations of crafting wall paintings, excitedly joined the revolution. They extended their inherent artistic abilities to learn a new craft, Handloom Weaving. Today, 14 young women and men of the village, have mastered the art, and work fulltime towards a huge common goal. Essentially many more local women are hired for many of the activities of this project, which has overall impacted about 20 families of a tribal village. This has generated an unheard phenomenon of 'Women Empowerment' through generating of livelihood for a nascent female section of society. The project promises definite scope for engaging large volume of helping hands, when scaled to benefit a larger target of society.

The UPCYCLING process is very engaging; waste plastic bags and wrappers are collected from waste pickers and enthusiastic hubs of society, from grocery and shopping bags of all microns, wrappers of household items such as detergent packets, diaper packets, food packets (wafers, cookies, biscuits) and many other items that are 'wrapped' to interesting waste such as old VHS and audio cassette tapes are utilized (as depicted in the image below)



Figure 10: Raw material used for Upcycling by reCharkha – The EcoSocial Tribe

These are sanitized and sorted into different colors. The original colors are retained and deliberated upon to generate interesting designs and patterns; (they are not dyed as the colorfulness provides scope for furthering the saleability). The cleaned waste plastic is cut into strips using just a pair of scissors to form plarn, and bundled to be used to weave a beautiful fabric using a traditional spindle (charkha) and handloom. The entire process of weaving fabric is manual and a labor of love as its outcome is a magical expression of unique compositions crafted by deft interactions of the warp and weft system of the weaving process. Here, the third pillar of "EcoSocial Sustainability" comes to light with the revival of a sustainable and culturally rich hand weaving system as the choice to generate plastic fabric from the handloom.

The fabric is tailored into designed products by a team of 18 men and women in Pune; functional yet trendy handbags, totes, purses, laptop/electronic accessories, home décor products and other utility items are manufactured for a conscious buyer. Our Pune workshop consists of 18 women and men. A conscientious team of 32 fulltime employees, and indirectly impacted 20 plus families form the invaluable team which is growing with the scope of this EcoSocial Initiative.

The in the link below, shows the "Why" and "How" of what we do:
https://www.youtube.com/watch?v=g7xkPF2fa18

The fourth and vital foundation pillar of reCharkha, namely "EcoSocial Participation" smartly engages the customers as supporters of the cause by involving them in the collection of plastic waste (from societies, schools and families) volunteering to design market trending products and marketing and selling the products by spreading the message of EcoSocial Development to a larger population! The production and generation of sales for the range of daily-use products has become an EcoSocial Movement; aiming to create a new generation of Conscious Consumers!

Though consumerism is the culprit of the growing problem of plastic waste, to prompt the buying of products made from reused/upcycled/recycled material, seems to be a realistic solution benefitting the environment; thus, reducing those many resources from being freshly extracted from the environment. A typical UPCYCLED-HANDWOVEN BEACH BAG from reCharkha, has upcycled about 45-50 waste plastic bags and wrappers, thus removing them from the waste stream! Simultaneously, resources required to create a new beach bag from virgin polyester (a petroleum product) or even a plant-based resource are avoided! Each Upcycled Handwoven Beach bag from reCharkha, creates 1 to 1.5 man-days of work for the underprivileged in our society as a strategically designed effort of EcoSocial relevance, a proof of resilience in Design thinking and doing!



Figure 11: EcoSocial Conservation



Figure 12: EcoSocial Change



Figure 13: EcoSocial Sustainability



Figure 14: EcoSocial Participation

reCharkha, an EcoSocial Initiative, is the story, among many others, where practical ideals are infused with innovative ideas. Design thinking proposes social innovation to uphold the ideals of sustainability for the current scenario in India. 'Handmade in India', as a much-favoured trend, infuses cultural abundance and contemporaneity. This design solution amply validates the resilient character of a well-designed project and its products.

Its narrative has a uniquely sensitive approach that extends a dynamic concept. It is seen, reviving traditional values and the nuances of an eco-friendly craft; as also lending a personalized involvement by the craftswomen and the prospective consumer. The unique upcycled products make an emphatic statement that abhors undue industrial encroachments on the environment. A major issue was addressed through the initiative to balance the 'migration imbalance' between rural and urban areas. Furthering the concept of women empowerment, it has provided livelihoods to many and emancipation to rural women who are proud members of this Movement for Social Change.





Figure 15 and Figure 16: Our Tribal women manually sorting and shredding plastic waste







Figure 17 and 18: reCharkha's UPCYCLED-HANDWOVEN Bags and Pouches





Figure 19 and 20: reCharkha's UPCYCLED-HANDWOVEN Home Décor collection

7. Observations: Good Design is about Resilient Systems

At the broader level, it is amply relevant that Innovative Design Strategy, that empathetically involves people and culturally relevant tools, could well be an effective formula to generate social development. At an individual level, the testimony of an involved user who believes in the benefits is proof of the fervour generated by the cause. Design for Social Change validates it resilience in the fulfilling of, the holistic ideals of "Conserving the Environment" and "Enabling EcoSocial Empowerment".

Design Thinking and its optimistic process is seen to push designers ever onward in pursuit of workable solutions through empathetic response to stories of real troubles. Intractable issues may need a more intricate level of immersion at certain levels of the design process. An empathetic strategic designer is capable of attending to the nuances of the social spaces they work in and address 'what' they are driving themselves towards, 'who' and 'what' is shaping a relevant change and 'why'. The sensitively innovative designer is able to interpret the world around them and visualize innovative ideas of 'how' to change society for the better.

Wicked social problems demand a critical and analytical approach to important resources that drive substantial change in providing resilient solutions. The interdisciplinary approach of design prompts deeper immersion into the research activity rather than just borrowing from social sciences and ethnography; specially where ethnic contexts are essentially significant as is in the Indian socioscape. Here concepts such as reflexivity can generate deeper awareness through participation of communities that would best understand how and what they can change! With blurred interdisciplinary boundaries, it becomes important to respect the contributions of each specialist as also develop credible tools to reflect on the nature of the individual's contribution and its possible and actual impacts.

8. Philosophy of Change

In relevance to ambitious development, **"**There is no passion to be found playing small – in settling for a life that is less than the one you are capable of living." – Nelson Mandela

With respect to the empathetic approach to sensitive development "User centricity is the key to Good design solutions" Kumar Vyas

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Teaching and Practicing Service Design and Social Innovation: Experiences with Communities at the Margins in São Paulo, Brazil

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Abstract | Wicked problems are present in societies from the Global North to the Global South such as displacement, dispossession and homelessness. These are indubitably key dimension of present time. The COVID-19 has deepened these problems. Such crisis requires us to consider challenges to scholars and professionals, regardless of knowledge area. Service design and design for social innovation are rooted in social issues and could be tools to address and mitigate these problems. Nonetheless, marginalised communities and dispossession remain at the margins in the service design and design for social innovation literature. From the analysis of two students' projects, we critically examine the significant contributions of service design and social innovation methods and tools in such contexts. The concept of alterity and arts-based methods emerged as a pathway for building a humble perspective for service designers working with wicked problems in the context of marginalisation. The SEEYouth research project will allow us to conduct an in-depth exploration of this perspective and its potential for addressing these problems.

KEYWORDS | SERVICE DESIGN, SOCIAL INNOVATION, COMMUNITIES AT THE MARGINS

1. Introduction

From the Global North to the Global South, countries have been facing perverse social problems, also called wicked problems. Living in precarious conditions of urban poverty and without fundamental human rights, such as access to health services, food, education and employment, marginalised people often face a lack of dignity in their everyday lives. Service design and design for social innovation are rooted in social issues (Miettinen & Valtonen, 2012; Manzini, 2008; Meroni & Sangiorgi, 2011). According to Buchanan (2001, p. 36), 'design is fundamentally grounded in human dignity and human rights'.

Nonetheless, marginalised communities remain at the periphery in both service design and design for social innovation research and literature. A simple search[1] using the Web of Science search engine and the keywords, "marginali*ed" (using asterisk to get both British and American English) and "service design", resulted in only 12 articles. Seven articles were found when the search was performed by replacing "service design" with "social innovation" and "design" + "marginali*ed". Another search using the keywords "margins" and "social innovation", resulted in nine articles; and "margins" and "service design". Replacing marginalised with "poverty" resulted in 16 and 21 articles, respectively, when added to the strings "service design" and "social innovation" and "design".

Some of these papers were written by authors from the DESIS Network research group, which has been working with social issues in the context of social innovation. Authors, such as Carla Cipolla (Brazil) and Satu Miettinen (Finland) and their collaborators have published many articles, mostly presented at conferences, that encompass communities at the margins in Brazil and Africa.

However, recent service design and design literature has highlighted how future professionals in the field should be better trained to tackle social issues that are considered to be wicked problems (e.g. Augsten & Gekeler, 2017; Sepers, 2017). Souleles (2017) has written about the need for empathy, ethnographic and action research to address social problems. That approach is based on collaborative and participatory methods in which the researcher and the participant are viewed as equals (Souleles, 2017).

Thus, this article describes two projects developed by undergraduate students from the University of São Paulo, School of Architecture and Urbanism, to improve the life of a group of *catadores* (recycling material collectors) in the city of São Paulo, Brazil. This article also introduces the "Social Innovation through Participatory Art and Design with Youth at the Margins: Solutions for Engaging and Empowering Youth with Trans-Atlantic Mirroring" (SEEYouth) project where lessons and methods learned from previous experiences of teaching and conducting research with communities at the social margins will continue to be developed.

[1] The search was first performed on 15 January 2020 and then again on 10 December 2020. Data were updated to reflect the results obtained from the second search.

The analysis of these projects will critically examine the significant contributions of service design and social innovation methods and tools in such contexts; it will also discuss the possibility of scaling up local experiences to the context of being at the margins. Furthermore, if that is possible, what structures could support its scalability? (Morelli, 2015). The projects and their potential impact shed light on how to enhance students' awareness of local and global social issues by designing from a humble perspective.

2. Visibility and Dignity to Cope Marginalisation

In this paper, we describe two projects developed by undergraduate students in two courses, Design for Sustainability and Introduction to Service Design, both offered by the Department of Project at University of São Paulo, School of Architecture and Urbanism (Brazil).

The Design for Sustainability course was created and taught by Professor Maria Cecilia Loschiavo dos Santos since 2003; it discusses environmental, economic and social issues related to design in terms of production and consumption. It encompasses site visits to COOPAMARE and design with/for this group (Santos, 2004; Santos et al., 2016). COOPAMARE was formed by a group of homeless people that created a cooperative to collect recycling materials almost 30 years ago. Nowadays, most of the people are no longer living on the streets, and a group of youth refugees from Haiti is also working with them. Some challenges, such as prejudice and poverty, still persist while additional ones have emerged, such as gender discrimination and language issues.

Immersed in the urban context, the culture of the catadores is built from the disposal of items accumulated from industrialised society (Santos, 2014). Students are introduced to the context of the catadores' every day journey, by visiting the cooperative and observing their work in the field (inside the cooperative and on the streets), and engaging in dialogue with the group's members. Based on a collaborative and participatory process, students, professors and catadores widely discussed the existing problems and opportunities to address and resolve them. By knowing the catadores' everyday life and struggles, and their survival strategies, the students have been developing several projects that aim to promote the visibility and dignity of the catadores so they can better cope with their marginalisation.

The Introduction to Service Design course was offered for the first time at the same school in 2019. Feeding was chosen as the main topic. Services related to food are a global issue and several service design strategies can be applied, including providing opportunities to mitigate poverty and alleviate hunger. In this first experience, some of the students deliberately chose to develop feeding services for people at the societal margins as a way to enhance their dignity.



Figure 1. Catadores and their "carroça" cart (right side). Image: Amanda Kubo e Caroline Speridião.

2.1 Improving the Lives of Catadores' through Food Services

Most of what the catadores' experience takes place on the streets, where they collect the material. Problems, such as the lack of both financial and situational conditions (as well as hygiene and cleanliness guidelines for proper food) emerged as one of the problems that the students observed in the catadores' routine. As noted by Santos et al. (2016), many citizens consider catadores to be dirty people, even delinquents. It is common to see restaurant managers prohibiting catadores from entering their establishments and justifying their attitude as a way of not disturbing their clients. Catadores are only allowed to receive surplus food from the restaurant after the lunch period, and to eat outside the establishments, deepening their vulnerability.

To address and resolve the situation of being at the margins in financial and social interactions related to the essential right of eating in the catadores' daily journey, the students proposed a service that involves a wide range of stakeholders (actors) using the Stakeholder Map tool.

Developed by two students, Amanda Kubo and Caroline Speridião, Sustenta! is a system that encompasses service and product design; it is intended to offer opportunities to eat with dignity while promoting socialisation. The system will provide eating spaces and workshops, together with the delivery of a kit, that is aimed to transport food in a cart during the catadores' working hours. According to Kubo and Speridião:

> "The proposal is to carry out the revitalisation of spaces for coexistence within warehouses, points for recycling materials and cooperatives, in addition to organising small workshops aimed at handling food within these spaces. To pursue this solution, we count on donations and much collaboration from volunteers and partners, such as local restaurants, associations, neighbourhoods and NGOs."

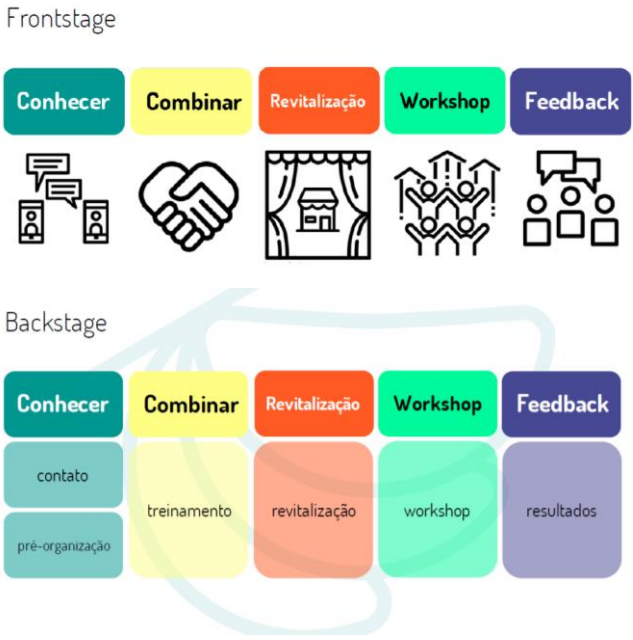

Figure 2. Frontstage and backstage of the Sustenta! service. Image: Amanda Kubo and Caroline Speridião.

2.2 Increasing Knowledge about the Relevance of the Catadores' Work

In the city of São Paulo, every inhabitant produces 352 kg of garbage a year. Only a bit more than 1% of that is recycled, and the problem would be worse without the work of the catadores: they are responsible for gathering more than 90% of the material that is to be recycled. There are more than 30 cooperatives and 15 thousand catadores in the city. Together, they collect around 30 tons of recycling materials per day, thus playing a crucial role in society and in protecting the environment. Nonetheless, their work is still invisible and undervalued, which keeps them at the margins of society. Thus, the students decided to develop an app to increase knowledge about the relevance of the catadores' work, mitigating their invisibility. As one student, Juliana Eiko Hiroki, noted:

> "Coopera, SP! consists of a free educational game for mobile phones (IOS and Android), developed to make the population aware of the importance of the issue of solid waste in cities, of recycling collectors in society and their cooperatives, in addition to the processes involved since collection, separation and reuse of this waste. Taking advantage of the current situation, in which cell phones and their countless applications and games occupy a large part of people's time, the objective of this work is to disseminate on a large scale the importance of recycling collectors, besides to make the population aware of the steps involved in the recycling process."



Figure 3. Coopera, SP! app: through a game, the population of the city could become aware of the recycling process and the relevance of the catadores' work. Image from Juliana Eiko Hiroki.

3. Youth at the Margins

As researchers, we have a shared aim to continue the use and development of the humble inquiry and participatory development in the SEEYouth project. This project will investigate the youth marginalisation that occurs inside groups of homeless people and refugees in São Paulo, Brazil and in Helsinki and Kemi, Finland. Five universities (University of Lapland, University of São Paulo, University of the State of São Paulo, University of Leeds and University of Montreal) received funding from several funding instruments (Academy of Finland (A/Finland), United Kingdom Research and Innovation (UKRI/United Kingdom), Fonds de Recherche du Québec—Société et Culture (FRQSC/Canadá) and Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP/Brazil).

The researchers from the four countries have worked on similar projects and have an interest in increasing scientific knowledge about the tools and methods from service design and arts-based-methods applied to tackle poverty and marginalisation.

From the previous Participatory Development with the Youth (PARTY) and Margin to Margin projects, tools, such as The Hero's Journey (Sarantou et al., 2017) and storytelling methods (Miettinen et al., 2016), were designed to increase youths' self-esteem, motivation and awareness. Often self-esteem and motivation are crucial for youth to have the courage to live their life and the desire change, searching for something new. Toward that end, it is important for an individual to see himself/herself not as someone on the margins, but as a powerful person who can find his/her own path.

4. Alterity and Humble Dialogues as Possibilities for Service Design and Social Innovation Teaching and Practice

Collaborative approaches are often used to tackle wicked problems (Roberts, 2000; Suoheimo, 2016, 2019). In wicked problem projects, designers often serve as facilitators of a co-design, participatory process (Prendiville, 2018; Sepers, 2017; White & van Koten, 2016; Suoheimo et al., 2020). As White and Koten (2016, p. 41) noted:

> "In catalyzing social innovation for sustainability, designers need to take a role that is more facilitator than leader; in which they design conditions and processes to stimulate the 'wide reaching social learning' (Vezzoli, 2006) that is required for the radical transition in society."

Participatory approaches are essential in service design projects (Stickdorn et al., 2011). Thus, service design can be a holistic approach of co-designing. As Tsekleves & Cooper (2017, p. 2264) stated:

> "Service design has an essential role to play here by placing the person at the epicentre of the design and development process, leading to a service responsive to the needs of the individual."

This perspective and these methods and tools can also contribute to the idea of how service design works in the background with so many professionals and their fields by facilitating their process of addressing wicked problems. The service designer does not necessarily have the most in-depth knowledge of the field, but his/her knowledge is sufficient to facilitate the experts' processes as they work with other relevant stakeholders. This requires that the service designer immerses himself/herself in the topic by studying it. Indeed, the first phase of Double Diamond (Design Council, 2019) or the Design Thinking process also demands that the service designer obtain knowledge about the problem at hand. However, how can this be achieved in the context of marginalisation?

When dealing with wicked problems and situations related to social and economic marginalisation, service design and social innovation methods and techniques are very useful for observing the context and mapping the stakeholders that could be involved in the solution, as proposed by the students in the Sustenta! project. Nonetheless, we felt that a humbler perspective is mandatory in order to better understand the social vulnerability in contexts of marginalisation. Only empathy, or "putting oneself in someone else shoes" or, in our case, "pulling or pushing a cart of recycling material for one day", is not enough since it is challenging to understand the life of a person who experiences prejudice and invisibility every day. As the Coopera, SP! project critically proposes, the solution could be that we, not the catadores, should change.

Recognising that we do not know how the catadores feel and think, and starting with being open to listening to and getting to know them, seems to be the very first step in the

immersion process. Alterity and the concept of otherness can be more useful than empathy as a preparation.

The second question that emerges is: how can a humble dialogue with the community be initiated and sustained?

Artistic participatory design and participatory service design share many common characteristics in terms of democratising power (Mohan & Stokke, 2000; Baum et al., 2006). Souleles (2017, p. 929) has stated this well:

> "Characteristic of participatory design is that it questions the notion that only experts can become co-designers. It stands in opposition to practices built on hierarchy and control. In fact, participatory design requires that top-down control be relinquished, and end-users become active and equal partners. In this respect, it adopts an egalitarian idea of sharing in the decision-making process."

Participatory methods are used in service design and art-based research to empower people. According to Baum et al. (2006), empowerment **aims to reduce inequalities and power differences between the people involved.** Participatory art and design are methods used to decentralise power in a way that enables local people to determine developments by themselves (Mohan & Stokke, 2000). Thus, local partners and NGOs play an essential role (Mohan & Stokke, 2000). Before this approach, it was assumed that the locals would play a passive role (Mohan & Stokke, 2000). Hickey and Mohan (2004) also wrote about the importance of involving power and politics in order to have efficient outcomes. However, this approach can be challenging because not everyone wants change.

According to Baden and Wimpenny (2014), in the broadest meaning of art-related research, art is used to 'sense, to explore, understand and represent human action and experience' (p. 1). Thus, in a way, art-based research is similar to service design because it is about the experience that emerges. The service designer aims to create an improved experience of a service (Stickdorn et al., 2011). Service designers should present the voice of the customers (which, in the context of this paper, could be understood as a community) in a development process (Stickdorn et al., 2011). According to Baden and Wimpenny (2014), it is difficult to define art-based methods because they can take various forms and contexts. Baden and Wimpenny (2014) also noted that art-related research is practised or has a connection with the social sciences and arts, as well as service design (Suoheimo, 2020; Sarantou et al., 2017).

Thus, the SEEYouth project explores alterity and art-based methods with youth at the margins of society in order to deeply understand both as tools for service designers. Service design and art-based methods go hand-in-hand when dealing with contexts of marginalisation, since the choice for these methods share the same aim which is to use participatory approaches to empower marginalised groups. A more systematic review on both service design methods and art-based methods could be useful for future research as it is not yet a widely researched topic. Now, they seem to be methods that are used in the

SEEYouth project or in other socially-oriented projects. Mirroring the results from the SEEYouth project between Brazil to Finland, and vice-versa, will enhance our comprehension of the possibility of scaling up local experiences.

5. Conclusions

The tools designed solely for wicked problems use collaborative strategies (Suoheimo, 2016, 2019) as well as service design (Suoheimo, 2020). Nonetheless, there is still a lack of research on service design in contexts of marginalisation.

Ultimately, service designers aim to create transformation; social innovation can be described as a process of social change to respond to wicked problems (The Young Foundation, 2012). Wicked problems require an interdisciplinary and holistic view in order to make real change. By working within marginalised communities, students could enhance their awareness of social and global issues.

Nonetheless, students are motivated with a shift in educational practice, which is plural and fraternalistic. They are keen to understand the "spontaneous design" as pointed out by Santos (2000) and Escobar (2018) who argues in his book Designs for the Pluriverse, "Every community practices the design of itself: its organisations, its social relations, its practices, its relation to the environment". (p. 184)

They acknowledge social movements and communities' role in managing their own situations and producing knowledge about their routines. This uncodified knowledge is increasingly demanded by students who recognise and are inspired by the fraternity among these communities' members at the societal margins.

During the COVID-19 pandemic, this feeling of fraternity proved even more vital in large urban centres like São Paulo and Rio de Janeiro, where there are several positive responses to social innovation coming from favelas like Paraisópolis (in São Paulo) and Complexo da Maré (in Rio de Janeiro).

In this scenario, it is essential to recognise the severity and the dimension of global problems, especially those characterised as wicked problems. This perspective requires a humbleness position and recognition of the design(er) restricted contribution, given the magnitude of the problem.

Thus, we call for attention to the need to teach design as a re-directive practice as proposed by Fry (2001), encouraging future designers' agency on imperative societal changes and challenges to build a "sustain-able" world, from a humble perspective, listening and learning to and empowering people at the margins of society. Alterity and arts-based methods seem to be a starting point to promote a humble perspective for service designers working with wicked problems in the context of marginalisation.

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Acknowledgements: Authors are thankful for the support from FAPESP (Proc. nº 2019/02481-2) and Academy of Finland (Decision no: 334786), as well as to all SEEYouth project members, especially to Prof Satu Miettinen.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The cot, the pot and other stories

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Abstract | This study is an extension of the author's investigation into alternative, organic and contextual meanings of iconic design in India for her presentation at an international Winter School Program in Europe (2018-19). It argues for a need to expand the scope of current design pedagogies, by celebrating and incorporating indigenous wisdom, through understandings of visual/ spatial strategies of ubiquitous objects along with Euro-centric Modernist ideals which largely form its basis. As chief mentor for courses on 'correlations' for Under Graduate and Post Graduate programs in design at a private university, the author is deeply interested in connecting seemingly unrelated domains, establishing patterns and deriving analogies of semiotics and semantics, to build new directives in design education/practice. The paper is largely intuitive, based on an analytical interpretation of a regional context and strives to seek common ground with Western premises and universal paradigms. It deliberately uses images taken by unknown people.

KEYWORDS | INDIGENOUS, UBIQUITOUS, VALUES, MULTIPLICITY, ADAPTABILITY

1. The context

> "As we live and as we are, simplicity with a capital 'S' is difficult to comprehend now a days. We are no longer truly simple. We no longer live in simple terms or places. Life is a more complex struggle now. It is now valiant to be simple; a courageous thing to even want to be simple. It is a spiritual thing to comprehend what simplicity means." (Wright, 1954)

In these unpredictable times, resources are at a premium- a consequence of the excesses committed in the past half century. More importantly, tolerance is at a premium; geopolitical hegemony, economic polarity and an increasing tendency of allegiance to singular (therefore myopic) ethnic, cultural identities have cumulatively resulted in widespread armed conflict. Every existence is perhaps endangered, in its own way. Survival instinct is on red alert.

2. From habit to ritual to culture

A habit when no longer questioned or contested and instead, treated as inviolate, becomes a ritual and this ritual when practised by an entire population gets termed as a 'culture'. So also, with the culture of resilience.

2.1 Resilience

However, 'resilience'- the ability to spring back from situations that leave adverse impacts and move on, is an innate attribute of every living species, a universal one for human species. Circumstances create change; change (external and oft reversible manifestation) brings transformation (internal and irreversible) which in turn is a function of resilience or the resistance to change. If transformations are expressed as equations of permutations and combinations between 'loss' and 'traction', varied formulae emerge due to the impacts of cultural, political and systemic phenomena acting as catalysts. Thus, resilience and culture are associates in the schema of transformation.

2.2 Culture and resilience-The Indian way

It is impossible to imagine the world's largest democracy without visualising the needs and aspirations of its alarmingly enormous and vastly heterogenous population; without understanding the immense geographical diversity and the consequential social, cultural and religious melange produced; without absorbing the multiplicity of meanings, the spectrum of paradoxes and complexity of challenges that inherently define its demographics. World-wide concerns of energy, depletion of resources, increasing conflicts and the eminent prospect of unsustainable futures, also plague India. Additionally, nearly 70% (*India at a glance*, n.d.) of Indian society, agrarian by nature, is driven by vernacular design which in turn is driven by sustainable, frugal means and is usually expected to fulfil multifarious purposes. The Indian

designer operates in this complex context. India had been a thriving civilization for over 5000 years before being reduced to a nation-state. In the second millennium A.D., it was subject to prolonged plundering under despotism and colonisation. It also has a tendency of being struck by every kind of natural calamity simply because its geography is inclusive of almost every kind of landform on earth. These persistently challenging, natural and man-made circumstances have ensured that resilience started as a 'habit' and eventually metabolised into a 'culture'; the culture of resilience has become second nature to its people.

2.3 Objectification of resilience

"India has always moved ahead with the awareness that the seeds of a solution lie within the problem itself." (Nath, 2015)

As Indians became resilient, they objectified it. By tracing the narratives of an object of daily-use in the heartland of India-the *Charpai* (day-bed/cot) and the *Lota* (pot), the study attempts to demonstrate how ubiquitous objects despite their commonness, have stood their ground on what they mean to people and thus established their own notion of design and resilience. Neither changing contexts, nor the passage of time has been able to alter radically, their functions, aesthetics, semantics and semiotics. It intends to demonstrate how, for the *Charpai,* the *genuis loci* (the spirit of place) and *genius saeculi* (the spirit of time) have practically stood still. Also, the study contends that conversely, the resilience of these objects somehow represents the design culture of resilience of the people of this civilization.



Figure 1. A typical Charpai placed in upright position

2.4 A notion of design in India

As rightly pointed out by Romesh Thapar in 1979, the biggest challenge for India then (and even today)- "To raise so many (people) to recognised levels of healthy and creative living poses problems which have no parallels in lands which have already developed and advanced." (Balaram, 2011). After over half a century of independence, the responsible and responsive Indian designer is still grappling with mediating between the design needs of 'development' and 'affluence'. She also feels the need to contemplate how the influences of a 5000-year-old history can produce narratives through design.
The way of life in the ancient Indian civilisation urged constant oscillation between awareness and introspection; it advocated continuous questioning of personal and social conduct or of modes of social organisation and seeking of provisional answers appropriate to varying contexts. The disruption during the epoch of foreign invasions and colonisation has produced a *Tabula Rasa* for contemporary, educated Indians; for these ways began to be seen as mere stories of the past with little relevance in present times. They also have largely been moulded by modern consciousness. Yet at another level these ways of life are not obsolete but very much in vogue and therefore must be brought to the level of Indian consciousness and could inform contemporary Indian design.

3. Framework of the narrative

3.1 The big picture

The pandemic forced us to insert abrupt, radical and heterodox ways of thinking and living into our already pluralistic society. The 'New Normal' is somewhat an oxymoron; for 'Normal' is about stability, familiarity and predictability (which the times were far from) while 'New' is about change. The study attempts to show how the *Charpai* was 'Normal' yet 'New'. More importantly, it also seeks to question the basic premise of the definition of design; the proposition being: what if the very understanding of 'what design is', emerges from 'what design can do'? In particular as a response to vulnerabilities to disruption of life as embodied by the pandemic. Infact, it would be pertinent to propose that this ubiquitous object actually embodies the attributes of an anti-fragility system.
Additionally, it seeks to position the aesthetics of the *Charpai* through Dr Paul Hekkert's (TU Delft) postulate that the aesthetics of a product emerge from how effectively and meaningfully it performs its intended functions.
Similar to the approach in Andrew Atwood's "Not Interesting: On the Limits of Criticism in Architecture', the study seeks to not focus on the 'interesting' (something that is attention seeking) but rather look at the uninteresting, the banal and the ubiquitous and be more critical and open to new ways of reading built-environment.

3.2 The cultural subset

If we say we must live our brand, our designs must reflect the values we bring to bear.
'Guna' is a Sanskrit word with many contextual meanings. Its most generic and correlative meaning is 'strand'. In another context, it means 'virtue', 'attribute, or 'tendency'. *Guna* also

refers to 'personality' or the 'innate nature' of an individual. Within its broad meaning, it incorporates three sub- components namely *Sattva* (aspect that spells harmony and positivity/goodness), *Rajas* (aspect of confusion/spontaneous passion) and *Tamas* (aspect of negativity/state of inertia and chaos). Present in varied proportions, together they determine an entity's character.

The study will attempt to show how the *Charpai* speaks about the *Guna* of adaptability- the attribute of merging with its context while keeping its identity intact, the *Guna* of its optimistic endurance or sheer persistence, the *Guna* of readily facilitating congeniality and multiple identities (that merge), the *Guna* of being adept at multitasking, the *Guna* of having the courage to initiate new meanings. It will then explain how these eventually add up to a notion of its culture of resilience.

The narrative has been conceptualised to accommodate several positions that lie on a wide spectrum defined by two extreme ends of an attribute; from the 'ephemeral to eternal', from the 'frictional to configural', from the 'primordial to ethereal'.

4. About the *Charpai*

4.1 A brief description

The *Charpai* is a traditional, hand-woven, day-bed, most commonly found in many parts of the Indian subcontinent, Pakistan and Bangladesh; particularly in the alluvial plains and the arid parts of north India. (Punjab, Haryana, Uttar Pradesh, Rajasthan and Gujarat). Also known as '*Khaat', 'Khatiya'* and *'Manji',* in Hindi it is a compound word of *'Char'* meaning 'four' and *'Paya'* meaning 'footed'. A frame of four posts (usually wooden in nature), connected by four horizontal members sports a woven surface; a thick net of fibres made from jute, coir, cotton, leaves of the date palm, strips of cloth and (unfortunately) in contemporary times- plastic ropes. This weave allows for voids in-between the fibres and is climatically suited to aerate in the hot, dry climate. Traditionally, one does not need a mattress to lie on it.

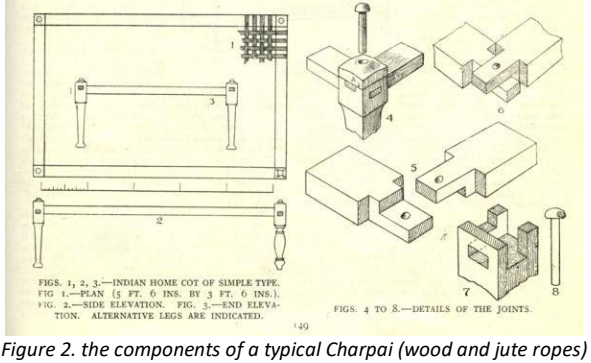

Figure 2. the components of a typical Charpai (wood and jute ropes)

In this seemingly simple 'DIY' design lies a measure of craftsmanship, of dexterity of warps and wefts, of innovation in the vivid patterns, textures and colours. Its making begins with the tying of a '*Jee'* (life knot) at one vertex of the bed. The diagonally-set weave has one end left free for weight adjustments; the linear members are positioned such that they control the sagging of the bed as it ages. Once the life of the surface is over, it can be easily strung at home.



Figure 3. A Charpai being strung or restrung, from c.1900



Figure 4. The diagonal weave gives it the required tautness and flexibility; the voids between weaves provides aeration needed in hot and dry climate



Figure 5A Varied sizes, colours, textures and materials of a contemporary Charpai



Figure 5 B Varied sizes, colours, textures and materials of a contemporary Charpai

4.2 A historical reference

The *Charpai* seems to have been in existence since antiquity; there is no convincing and absolute proof of its origin. It might have been an indigenous object or come in from Greece in the times of Alexander in the 4th. century BC. It finds mention in the chronicles of prolific medieval traveller Ibn Battuta who had this to say, "The beds in India are very light. A single man can carry one and every traveller should have his own bed. When you lie on it you need nothing else to render the bed sufficiently elastic." (Kumar, 2016)
Another important historical mention is the use in Malaysia, by British-recruited Punjabi Sikhs of the police force and night-watchmen of banks and big shops, when both countries were British colonies. A typically nostalgic and vivid memory of Malaysian witnesses of those times has been of burly Sikh guards bringing the light and airy bedsteads, propping it up near their posts, taking short naps while maintaining vigilance through the night and simply carrying it back home on their heads once the shift was over.

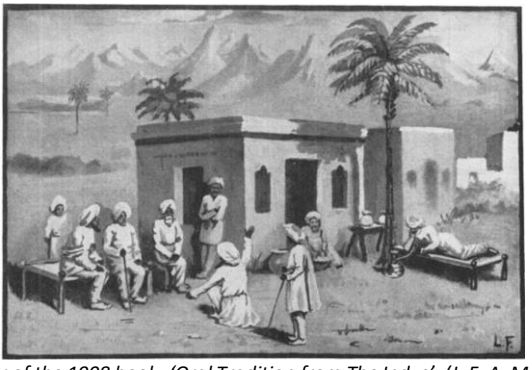

Figure 6. The cover of the 1908 book- 'Oral Tradition from The Indus', (J. F. A. McNair and Thomas Lambert Barlo) features prominently the Charpai



Figure 7. The Serendipity Arts Festival 2018 celebrated the Charpai as being 'Truly Indian'; showing the different weaves and their connotations

5. The analysis

5.1 From ephemeral to eternal

Ephemerality is a function of 'limited' time; a measure of temporality, fleetingness or cursoriness. The *Guna* of being ephemeral lies in the *Charpai's* kaleidoscopic adaptability; in its numerous and varied temporary but specific uses; in its ability to generate transient territoriality and to facilitate 'pop-up' architecture in a diverse set of circumstances.

For the homeless, the first claim towards making any 'space' their 'place' is communicated by fixing the *Charpai* somewhere in the middle-of-anywhere and this resolutely remains so, until eviction happens anytime. Thus, the time and space with the *Charpai* becomes ephemeral.





Figure 8, 9. The Charpai establishing territoriality of a quasi-shelter

Its daily-use pattern seems to follow the sun-path. In the mornings, elders use it to imbibe the 'good solar radiation' over the customary cups of tea. During late mornings, when they are through with a round of household chores, women of neighbourhoods create 'a place' on and around the *Charpai* for intimate conversations and indulgence in communal embroidery or knitting. One cannot underestimate the importance of this much-needed respite for this extremely hard-working section of the society.



Figure 10. Women of neighbourhood communities meet up and use the Charpai to converse; a welcome respite from a hard day's work

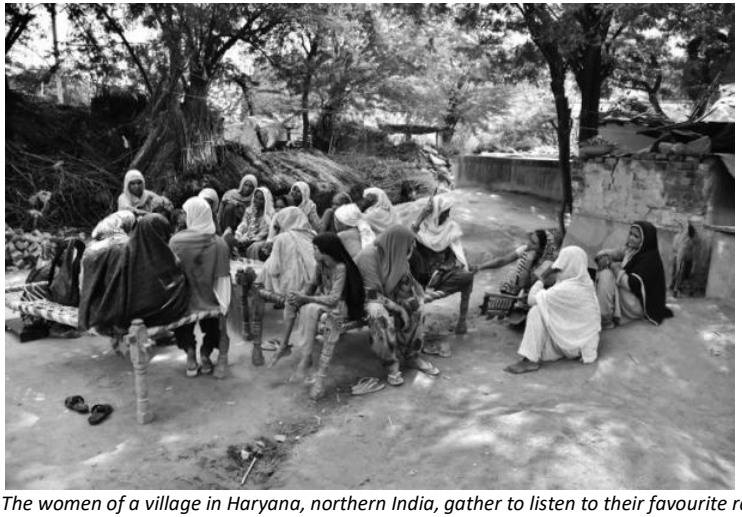

Figure 11. The women of a village in Haryana, northern India, gather to listen to their favourite radio program concerning health, education and empowerment.

By noon, it becomes a vertical or angular screen for elders and children to nap behind or as a 'double-decker-berth' for two generations. Children convert it into a trampoline; women, into a screen for privacy while bathing in not-so-closed spaces. Make-shift cradles with infants are hung on it; Pulses, condiments, wet clothes are sundried on it.



Figure 12.



Figure 13.



Figure 14.



Figure 15.



Figure 16.



Figure 17 a

Figures 10-17a. The multiple uses of the stationary Charpai as a day in the daily life of a villager unfolds



Figure 17 b. 'Khaat' embroidery; the fabric is stretched by tying to two sides of a wooden frame (Khaat or Charpai) using thick cords and embroidered from all sides simultaneously and easily because the fabric is taut. This mechanism is used by all top fashion designers in India.

The portability- the 'CIY-Carry it Yourself' factor, taken for granted in agrarian India, extends its adaptibility. Light enough to be balanced on the head by men and women, it can be transported on foot. Bicycle and motorcycle riders carry it effortlessly, by perching it between the driver and the pillion.



Figure 18.



Figure 19



Figure 20.



Figure 21.

Figures 18-21. Men and women carrying the Charpai easily by balancing it on the head; portability on bicycles and motorcycles which are the modes of transport in Indian villages

Once mobile, it transforms into a palanquin or a stretcher, to ferry the sick to the nearest hospices or people and their meagre belongings to safety, during floods. Probably because it is one object that is available in the vicinity of wells, it is a contraption to rescue children and animals who accidentally fall into them by tethering posts to ropes, turning it upside down and lowering into deep wells. This phenomenon is more commonplace in villages than urban denizens possibly imagine.



Figure 22. A sick person being transported in the most 'efficient' manner to the nearest ambulance; it is typical of remote villages of India



Figure 23. People and belongings moved to safety on a Charpai turned raft, during a flood



Figure 24. A leopard being rescued from a well

Wood and rope; hardy and indigenous materials ensure its longevity. People retain it for periods long enough to strike an emotional bond with it; discarding it does not feature in the scheme of things. This then spells a simple practice of sustainability- relevant in times when a 'throw-away', 'one-time-use' trend-a culture of disposability seems to be in vogue.

For urban denizens, physically disconnected from their roots in the village, the imprints of childhood experiences evoke nostalgia. As a mnemonic device, the *Charpai* becomes eternal-fostering memories that linger much after their yearly visit to their village is over. The realisation of its existence in village-households before the birth of a new generation or the death of a previous generation, is sufficient to nurture a notion of its immortality. Childbirth and the last rites of a deceased take place on it. The phrase '*Khaat Khadi Karna'* translated to literally mean 'placing the day-bed in an upright position' refers to the death of a person.



Figure 25. Often the dead are carried on the Charpai itself for their final journey

Us designers have a dichotomous interpretation of time as an insert in design; we design to express 'Zeitgeist"- the spirit of a time or, strive for it to be timeless. The *Charpai* indeed does both.

5.2 From configural to frictional

The *Guna* of being configural is about building relationships between parts, between parts and the whole, between the whole and the big picture.
The *Charpai* generates space that can be imagined by a set of prepositions- on it/above it/below it/behind it/by the side of it. Because it is ubiquitous, it can be installed in any space or can create it. Either way, it is never separatist but inclusive. Propped up conveniently and innocuously against a wall when not in use, it virtually infuses life into a courtyard by its sheer presence, once put down.



Figure 26. Basking in anonymity, propped up against a wall

During the rituals of the great Indian wedding in north-Indian villages, the bride's trousseau and items of dowry are prominently displayed on it, in the centre of the courtyard, for all villagers to view and bless. Importantly, it is a part of not just the pageantry of this great Indian wedding but of the institution of marriage itself. In a pre-wedding ritual in Haryana, the bride's maternal uncle brings the four posts of a miniaturised version of the *Charpai* and the father-of-the-bride fixes the horizontal members and the woven surface. Alongside, the real-sized one waits with her belongings for the '*Vidai*' (the send-off). She takes both versions to her in-law's place; they serve as a reminder of the values with which she has been brought up and the dignity with which she is expected to conduct herself. Also, the groom probably does not have a room of his own in the house occupied by three generations of a typical extended family. The newly acquired *Charpai* simply gives the couple 'place within space'.



Figure 27. The miniature Charpai symbolically carried by the young bride as part of her dowry



Figure 28



Figure 29



Figure 30



Figure 31



Figure 32



Figure 33



Figure 34



Figure 35

Figure 28. Women in the family collectively embroider the traditional Phulkari garment to be worn by the bride.

Figure 29. This is how a collection of loaned Charpais would look when a wedding is taking place in a village

Figure 30. The Charpai in democracy; A typical Gram Panchayat / village council in discussion; however, in recent times the authority of a male dominated and oft orthodox group called the Khap Panchayat in certain parts of north India as Haryana is being debated

Figure 31. The Charpai in democracy; A political party asks people to bring their Khaat (Charpai) to a political gathering and terms it 'Khaat Panchayat' as a pun on 'Khap Panchayat'-a traditional village council in these parts of India

Figure 32. A set of Charpais creating a temporarily safe sense of belonging for the homeless and displaced

Figures 33-34. The Charpai perched comfortably in road side eateries and highway joints called 'Dhabas' catering to urban and rural populations

Figure 35. The Charpai at ease in high-end resorts

"Whatever space and time mean; place and occasion mean more. For space in the image of man is place and time in the image of man is occasion." Aldo van Eyck (1960)

It is a common tradition in villages to lend their day-beds to a bride's family hosting a wedding and often reeling under the pressure to match up to expectations of a large visiting population. The hospitality it offers to the groom's side, becomes one of the critical building blocks on which the relationship between the bride and groom, between the families united in marriage and between entire communities and villages gets built. A lot of prestige is at stake here. The loaned *Charpais* become the wedding gift and blessing from the entire village; for she is their daughter and not just the daughter of one particular family. It would be fair to say that communities that celebrate together are likely to resolve conflict better. The literal and allegoric value of the day-bed in this domain cannot be underestimated. It reiterates the exemplification of rites and routines being larger than life itself. (Zumthor, 1998).

At the communal level, the powerful village elders (called the *Panchayat*) traditionally dispense wisdom and justice and upholds its social structure. The spatiality of this collective sitting on a *Charpai* under the shade of a massive Banyan tree, surrounded by villagers, squatting on the floor, all around them, is indelibly impressed in the Indian cognition.

Until a few years ago, people in India-particularly in rural/semi-rural areas, did not have defined rooms; there was no concept of 'my private space'! Spaces and furniture were intrinsically flexible. Today spaces are divided and private; furniture static. The *Charpai* positioned in multiple ways in multiple locations thus has the potential to resurrect the flexibility that is much needed in premium spaces which continue to be India's reality.

A *Charpai* goes where its maker might not still be able to- this paradox is a commentary on the harsh truth that even after three and a half millennia, this is the only extent to which social boundaries of a divisive social structure (the caste system) have managed to get blurred in this civilization. However, in the context of some 30 million crafts-persons in India (*Craft Traditions of India Past, Present and Future; Textbook in Heritage Crafts for Class XII*, 2011) who craft their livelihoods with their hands, the perspective changes. One can imagine the kind of 'big impact' such 'small gestures' can create. These numbers spell good for India- a nation where numbers can be a malaise.

It is completely 'at home' in the imaginary domain of the homeless, in roadside eateries in villages/towns/cities or in the 'middle-of-nowhere' highway stoppages called 'Dhabas', or in luxury homes and high-end resorts. It can physically accommodate an entire quintessentially Indian, extended-family. When a lone person sitting on a personal *Charpai* invites another to sit beside him or her, the gesture makes explicit the position and dignity accorded; it defines a friend or an acquaintance of equal status. Such is the connotation of the simple act of sharing sitting-space on a day-bed. The '*Guna*' of creating harmony and cohesiveness by manoeuvring opposing ideas, lifestyles, constraints and challenges to create integrative solutions is most relevant to contemporary Indian designers, for this is the context in which they are operating. The *Charpai* is a resilient system that provides for basic needs equitably distributed. Social equity builds communities in which people know, respect and care for others and therefore perform better in adversities.

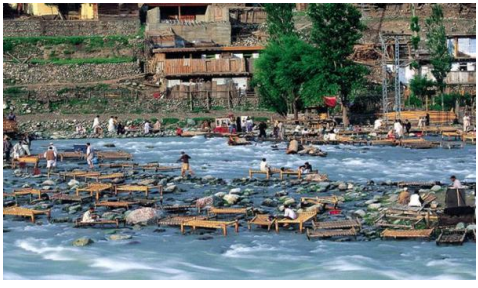

Figure 36



Figure 37

Figure 37. It is literally a legitimate election symbol in both India and Pakistan, speaking of its cognitive value in the minds of a large section of illiterates which is very much a part of the democratic process.

Figure 36. a common sight-scores of Charpai set on waters of the Indus river in Pakistan with people lounging on it throughout the day

It carries a very strong message of being of/for/by the people- the core sentiment of democracy. Its aesthetic value and historical relevance might be mediocre at best; however, by lending itself to social and cultural experiences, by allowing people to curate their own uses and build their own sets of relationships around it, the *Charpai* defines a different 'iconic'.

In times when social and religious conflict are commonplace, this quotidian object is helping blur 'mind-barriers'. It demonstrates how multiple identities need not be antagonistic; they can coexist and make their individual presence felt, appropriate to the context of a collective.

A lightness in friction is manifested physically, in the simultaneous looseness and tautness of the woven surface and its ability to tolerate extra stress. It cannot get more rudimentary, more child-like, than to say that villagers actually peel potatoes using its abrasive fibres.

In a very pertinent 99u talk on 'Design for Friction' Steve Selzer (*Steve Selzer: Designing for Friction—Adobe 99U*, n.d.) rightly comments that if we so completely do away with friction in our lives, eliminate meaningful collisions and confrontations, we are in effect promoting a culture of lethargy, complacency, intolerance and an inability to navigate change.

5.3 From primordial to ethereal

'Primordial' for the *Charpai* would emerge from being non-pedigreed design. Created by ordinary people, used simply as a piece of furniture to sit or sleep, it spells abundance, accessibility in stark contrast with Western museal objects-exclusive and inaccessible, to be viewed in awe, consecrated and therefore dehumanised. The *Charpai* sits in its original, ethnographic field-replete with people and contexts and narratives.



Figure 38. The poorest subsistence farmer uses the posts to plough his field; this is the real ethnographic 'field' of a Charpai

There can be no rationale for something to be termed ethereal. A thing is ethereal because it just is- called *'Tattva'*-the truth, the essence, the 'thatness' of something. Ironically, a recurring and timeless theme in India's metaphysical and visual culture says, 'it is in what is not, is what is. It is called '*Shoonyataa*' - void or empty space, evocative of nothingness. And then there is *'Sunnata'*- silence in a meditative state or as a phenomenological experience.

Together, they create opportunities to introspect individually and collectively. The *Charpai*- wherever, whenever and however facilitates just that.



Figure 39. The ethereal aspect of the Charpai

6. Relevance of this narrative

People-centricity has been the core idea of Martin Heidegger's theory of existentialism or Christian Norberg Schulz's theory of phenomenology (Norberg-Schulz, 1980) or a Dickensian novel. Yet for most Indian designers, a preoccupation with Western models of design pedagogies and practices under influence of Western theories of modernity has meant ignoring the wisdom of indigenous design in design thinking-particularly of its semiotics, of its ideologies of time and space; perhaps for the reason that design became a defined discipline in colonised nations only after they gained independence.

7. The interesting case of the *Lota*

Interestingly however, in India that was not the case. Just after a decade of independence, upon invitation from the Government of India, the American designer couple-Charles and Ray Eames took on the gargantuan responsibility of documenting the problems of design, mapping the impact of Western technology/design and recommending upgradations to the deteriorating quality of consumer goods- a legacy left behind by the British. Their unconventional and visionary perception of design was as a value system, as "an attitude that could discern the strengths and limitations of both tradition and modernity." They argued for an assessment of "the evolving symbols of India" and the need to connect these values and symbols to the problems of environment and shelter.
The *Lota*-a round water pot, typically of clay, polished brass, copper, silver, bronze, stainless steel and even plastic became the fixed symbol of utilitarianism in an evolving pattern of design. They called it "the greatest, most beautiful" object they had seen and admired

during their visit to India. A multipurpose metal vessel whose versions include '*Kalash*' and a wider '*Matka*' is a participant in all walks of Indian life. It is used for collecting/storing/ retrieving/pouring water and keeping it cool, for performing religious rituals- from celebratory to death, practising yoga and primarily to bathe and clean oneself after defaecating. It is used to carry many other liquids, semi-solids and grain. In Gujarat and Rajasthan, called a dowry pot also used for carrying small objects as clothes or jewellery. It provides efficient service with poise and dignity and this is the purpose of all design. Its sculptural form allows it to fit into the palm of the hand and be lifted, the curve of the hip is aligned to the rhythm of walking. The centre of gravity when empty or full is such that several of them can be carried on the head; women even dance gracefully with a series of them. This semiotic role is perceived pan-India. For Muslims, the '*Wudu*' and '*Ghusl*' ritual purification require water, for which a *Lota* is commonly used.

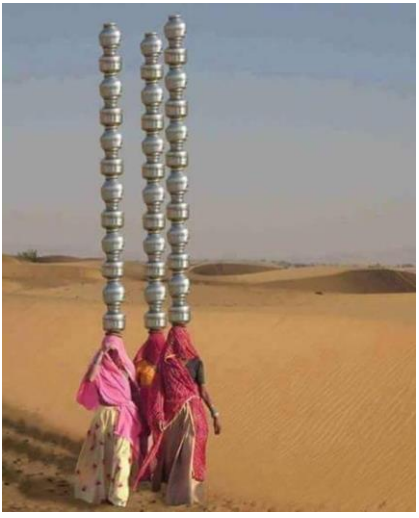

Figure 40. Women balancing several Lotas and walking to and fro, from the distant well on a daily basis



Figure 41. The centre of gravity of a version of the Lota, called the Matka is such that one can perform a rhythmic folk dance complete with face and hand gestures, swirls and continuous feet movement.



Figure 42. Women performing the 'Kuan Poojan'- worshipping the well, on the occasion of the birth of a child



Figure 43



Figure 44



Figure 45



Figure 46



Figure 47

Figure 43. 'Griha Pravesh'- a post wedding ritual in which the new bride enters her husband's home by topping a Lota (also known as a 'Kalash)' full of rice; a symbol of bringing with her Goddess Laksmi- the Goddess of wealth and prosperity
Figure 44. A typical housewarming invite would contain the 'Kalash' as a symbol marking the auspicious event.
Figure 45. A wedding ritual of giving away of the bride by her parents, to the trustworthy groom is called 'Kanyadaan' and is marked by pouring holy water from the 'Kalash'
Figure 46. Celebrations of 'Pongal' a harvesting festival in South India marked by allowing milk and rice to boil over the pot.
Figure 47. A Hindu cremation ritual includes circumambulation with a pot of holy water, which is broken before the pyre is lit

The India Report (Eames & Eames, 1958) was based on the concept of 'Reinventing the *Lota*'; such had been the impact of this object of resilience. The mapping organised into components of aesthetics, anthropometrics and ergonomics, physics, logistics and materiality not only became the basis of design directives and education for the nascent nation, but recognised a new definition of design of the *Lota*.

8.Conclusion

Somewhere along the line, in the past six decades thence, these directives seem to have got lost in translation. Today, if the world has largely acknowledged that design is about "devising courses of actions aimed at changing existing situations into preferred ones" (Simon, 1969) and if wisdom is knowledge accumulated over time, the wisdom of traditional, indigenous design of sub-cultures must be incorporated while addressing the challenges that design intends to make. Conversations revolving around these need to be conducted in India, the global forum needs to be engaged with so it can regain its place in our lives.

Design has always been about being different. What if its value lies in not being different? Rather than what stands out in the crowd, what if the crowd itself is that which stands out? Is it time to challenge the conventional criteria of declaring something as being 'designed' through the nomenclatural lens of formalism-composition, structure and representation? Because *"As we live and as we are, simplicity with a capital 'S' is difficult to comprehend now a days."* (Wright, 1954)

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Acknowledgements: I would like to thank:My esteemed colleagues Shemal Pandya and Mudita Pasari for their critical appraisal, meaningful insights and for always being there on hand, to assist whenever needed.My professional partner and husband Manoj Gupta for invaluable support in every possible way.The Design Village and Cumulus for the opportunity to apply and present my paper.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Materiality of Resilience

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Abstract |Following a long series of transfers from material behaviour and ecology, the notion of resilience is today a general concept in systems thinking for ecology, cybernetics and information theory. Recent debates around the ubiquitous use of the term necessitate a renewed enquiry into its implications. This article proposes a case-specific, interdisciplinary approach to resilience by reconstructing its initial links to materiality. Through the lens of biological material sciences, architecture and design, our three studies will investigate the materiality of resilience as opposed to isotropy, inertness and durability, revealing how it is embedded in the context. Building up from the material base of resilience, we argue for the agency of resilient materials and technologies in the development and organization of projects and propose connections between the resilience of materials and that of social, political and ecological systems.

KEYWORDS | MATERIALITY, INTERDISCIPLINARY STUDY, BIO MATERIALS, THERMAL ADAPTIVITY, WASTE RECYCLING.

1. Introduction

1.1 The evolution of resilience: the path to dematerialization

The notion of resilience has followed a long trajectory of transfers between various societal and disciplinary contexts. Although already present in writings from Bacon in the 17th century (Hellige, 2018), the notion initially spread during the course of the 18th century in material sciences and applied mechanics. The physicist T. Young, and later the material scientist W. J. M. Rankine, exerted a considerable influence on the physical and mathematical use of the term. Rankine (1858) defined "Resilience or Spring as the quantity of mechanical work required to produce the proof strain," and mathematically linked this notion to the moduli of strength, stiffness, elasticity, and pliability of a material. In the beginning of the 20th century, the term gradually escaped the sole field of materials science and was applied to mechanical components to qualify their capacity to withstand shock.

These approaches to resilience imply a material or system that can absorb a shock load and return to initial state. A major shift in the understanding of resilience came later from psychology and medicine. The decisive impulse to expand this understanding was given by the physiologist W. B. Cannon, who studied self-regulating and protectively stabilizing organisms. Unlike the concept of resilience in materials science, homeostatic systems do not return to their original state, but, through adjustments, produce similar conditions after each loading event (Hellige, 2018). Close to that of resilience, this concept was subsequently adopted by early cybernetics theory.

The further metaphorical shift of resilience and homeostasis came from the field of early animal ecology in the 1930s and 1940s to describe the way populations could adapt to shock, invasion or climatic variation. It was observed that some ecosystems were more adaptive to change than others and that this capability depends strongly on the variability of animal populations and food sources, thereby introducing the key factor of diversity to resilience.

A breakthrough in the concept of resilience came with the work of C. S. Holling, who developed an analytical theory of resilience for systems and economics. His understanding of resilience implied a logic of small scales, of versatile and heterogeneous units that withstand disturbance, based on the assumption that "ecosystems are not modular systems; they owe their resilience above all to their inhomogeneous structures, interdependencies and their network character" (Holling & Goldberg, 1971). But very soon, a major debate broke out between him and his colleague W. Häfele, who used this systemic thinking of resilience as a template for organizing energy production. Holling and his research group generally rejected nuclear energy, large-scale technical monocultures and centralistic system architectures as incompatible with the goal of resilience. Häfele, on the contrary, used the "notion of resilience to describe large energy systems rather than single, weakly interacting small entities" (Sassin and al., 1977). By doing so, he severed the link between resilience and

materiality, turning it into system thinking on a large scale, which might be applied independently to nuclear energy, finances, supply chains or urban planning, as is the case today. It was this decoupling process of resilience from actual materials and units on which it is based that made such appropriation possible. And in many ways, this controversy still prevails today.

1.2 The ubiquitous use of resilience

Since then, resilience, as an operational strategy of risk management, has flourished, progressively asserting itself as "a dominant discourse in discussions of international finance and economic policy, corporate risk analysis, the psychology of trauma, development policy, urban planning, public health and national security" (Walker & Cooper, 2011). Recent studies show how resilience has been deployed in varied ways with "different geographies and temporalities, diverse effects and different kinds of political implications" (Simon & Randalls, 2016). For some, this expansion derives from its inherent "tendency to metabolize all countervailing forces and inoculate itself against critique" (Walker & Cooper, 2011).

Nevertheless, recently critiques have arisen in several fields. A seminal article by Walker and Cooper (2011) has showed that the success of this ecological concept in colonizing multiple arenas of governance is due to its intuitive ideological fit with a neoliberal philosophy of complex adaptive systems: "Abstract and malleable enough to encompass the worlds of high finance, defense and urban infrastructure within a single analytic, the concept of resilience is becoming a pervasive idiom of global governance." Other voices, like that of the historian and media theorist O. Halpern (2017), argue that "combined together, resilience and technology create a form of preemptive infrastructural governance that naturalizes precarity, sacrifice, and violence as a necessary economic value, rather than as a politically derived option." The work of Wakefield and Braun (2014), analyzing resilience as a "*dispositif*" ["construct"] in the sense of Agamben and Foucault, contend that resilience generates governing strategies in which "crisis is no longer that which is to be warded off, eliminated or overcome, but that which must be absorbed, attenuated and survived." In a way, resilience has become a way to "depoliticize" risk and crisis, as well as a powerful tool in maintaining social vulnerability, as the anthropologist Roberto Barrios has successfully shown (2016) by raising the relevant question: "Given this substantial list of critiques, should we abandon the concept of resilience in disaster research and risk reduction?"

The ubiquitous use and contradictory appropriations of the notion of resilience demands a renewed enquiry that would link back to its early materiality. As with all bio-inspired concepts that gradually move away from the sole realm of biology, the risk of simplification and application to any situation is evident, as Holling already warned in the 1970s (Holling & Goldberg, 1971). In this article, we will use our expertise in material case-studies to highlight some essential aspects of the notion. Our aim is to show that resilience can still be a relevant concept for renewed design strategies and socio-economic organizations, if it remains grounded in bottom-up strategies and retains a deep understanding of its materials´ logic.

We reiterate here the need for a case-specific, interdisciplinary approach and for the reconstruction of the early definition of resilience with its implicit links to materiality.

2. Three perspectives on material resilience

Three different disciplinary approaches will help us shed light on the materiality of resilience. The first approach will allow us to deepen understanding of resilience in bio-materials. The second example will show the use of resilient materials in the architectural space, thus redefining its relationship to the environment. Finally, the third study will demonstrate how materials generate specific socio-economical agencies.

2.1 Resilience in bio-materials

In engineering disciplines, the concept of resilience is fairly straightforward: resilience is the ability to store mechanical energy upon loading and returning to its original state afterwards, without energy loss. In the stress-strain plot, which typically describes a material's mechanical behavior, resilience is measured as the area below the linear part of the loading curve. The larger this area, the more resilient the material. Mechanical resilience ought not to be confused with the concept of toughness, which describes the ability to absorb shocks and dissipate the mechanical energy at the cost of damaging the material itself, defined by the area below the stress-strain curve up until failure.

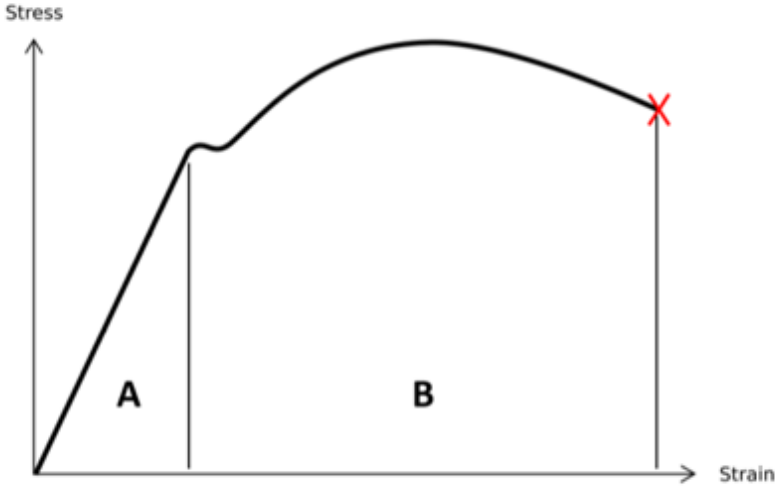

Figure 1. Loading curve of a ductile material: resilience (area A) and toughness (area A+B).

This definition of resilience sketches the main aspects of how resilient materials behave: they respond to external perturbations not simply by resisting them and eventually failing, but rather by accommodating them and "continue performing." Escaping the narrow boundaries of this definition rooted in mechanics jargon, biological materials provide a large repository of examples that can be used to highlight the link between resilience, in a broader sense, and its materiality: in this section, by analyzing some exemplary systems from biological materials, we will introduce some important aspects that clarify this link and serve as abstract principles for the applied test cases presented in the next sections.

Seed dispersal units (such as pine cones) are plant structures that store seeds and spontaneously deform to release them into the environment. Detached from the parent living plant, these structures comprise non-living tissues: therefore, both the sensing and mechanical actuation required for seed dispersal must occur autonomously. In the pine cone, the scales open or close in response to changes in humidity over the day-night cycle. Ice plant seed capsules instead need liquid water to expose the seeds. This is possible thanks to specialized tissues (keels) attached to the inner face of the capsule valves composed of a lignified, diamond-shaped cellular structure filled with highly hygroscopic and cellulose-rich internal layer (CIL).

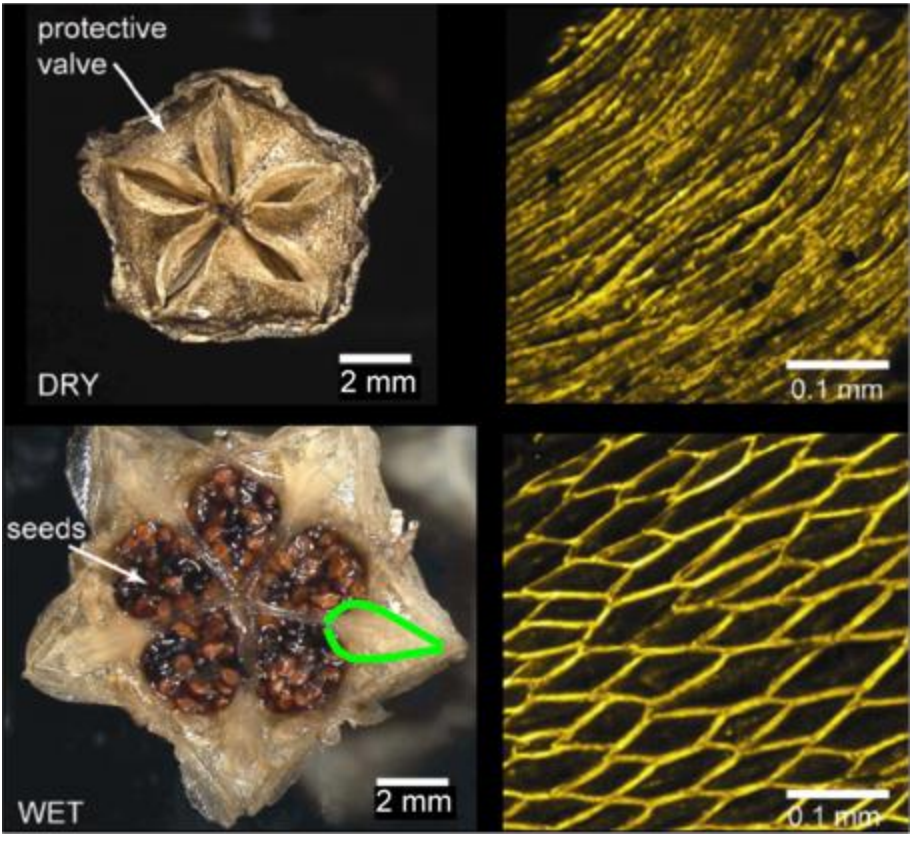

Figure 2. The ice plant seed capsule (left) in the closed dry state (top) and open wet state (bottom), with the keel tissue highlighted in green. A close-up view of the keel tissue (right), in the dry, collapsed state (top) and wet, expanded state (bottom). Adapted from Harrington, 2011.

Upon wetting the CIL swells and increases in volume, whereas the diamond-shaped keel cells convert it into a 400% extension, thus unfolding the capsule valves and exposing the seeds, which can be washed out of their housing in the case of rainfall. One could describe the ice plant seed capsules as resilient, since, as in the engineering definition, they react to an environmental stimulus by temporarily changing state and then reverting to the reference state once the stimulus is removed. Inspired by keel tissue the authors have explored cell shape as a means of controlling mechanical actuation and have formulated design-rules for actuating cellular structures with tailored behavior (Guiducci et al., 2014, 2015, 2016).

Another example closer to the present use of resilience is the plants of the genus *Banksia*. Widespread in Australia, where spontaneous combustion and bushfires occur routinely,

these plants have developed a seed capsule that stores the seeds in special follicles for many years. The long-term integrity of the follicles is provided by a mechanically stable pericarp and waxes with a melting temperature of ~ 50 °C, which are assumed to self-seal cracks, (Huss et. al., 2017). In case of a bushfire the innermost pericarp layer softens and internal stresses can be released, leading to a small opening of the follicle. The embedding of the follicle in the cone, the thickness of the pericarp and a porous separator between the seeds protects the seeds from burning and extensive heat (Huss, 2019). Such bushfires alone are not enough to expose the seeds though: only after repeated episodes of rainfall the follicle opens further and the seeds can be dispersed (Cowling & Lamont, 1985) (thanks to hygroscopic movements not dissimilar from those of the pine cones).



Figure 3. Cones of Banksia attenuata *in their closed (left) and open (right) states, respectively before and after the burning of a bushfire. Image credits: Michaela Eder.*

Only if this specific sequence of events occurs (a long enough bushfire followed by repeated rainfall cycles) can the seeds be dispersed and germination take place. This strategy allows seeds to disperse under improved conditions for germination: abundance of water (due to rainfall) and sunlight (fewer taller plants providing shade), richer soil (due to nutrients set free by fire (Sollins et al., 2007). The example of *Banksia* plants presents strategies that turn catastrophic events and extreme perturbations into an advantage for the organism, which has adapted over the course of evolution to the harsh conditions of its native environment.

The last example presented here is bone. Bone is at the same time a load-bearing material, a living tissue and calcium reservoir. It can heal and remodel. Such diverse functions are obtained through a specific hierarchical material architecture with different structural motifs at different length scales (Reznikov et al., 2014, Winer et al., 1999). Hard mineral particles

integrated within a triple collagen helix form the fibrous ultrastructural level, up until mm-scaled motifs such as osteons or trabeculae that make bone at the same time stiff and tough, two properties that usually conflict. One could think that such bone architecture is the result of a selection for the best possible material distribution; instead the latter derives from evolutionary selected processes (bone healing and remodeling) that make bone a resilient material system.

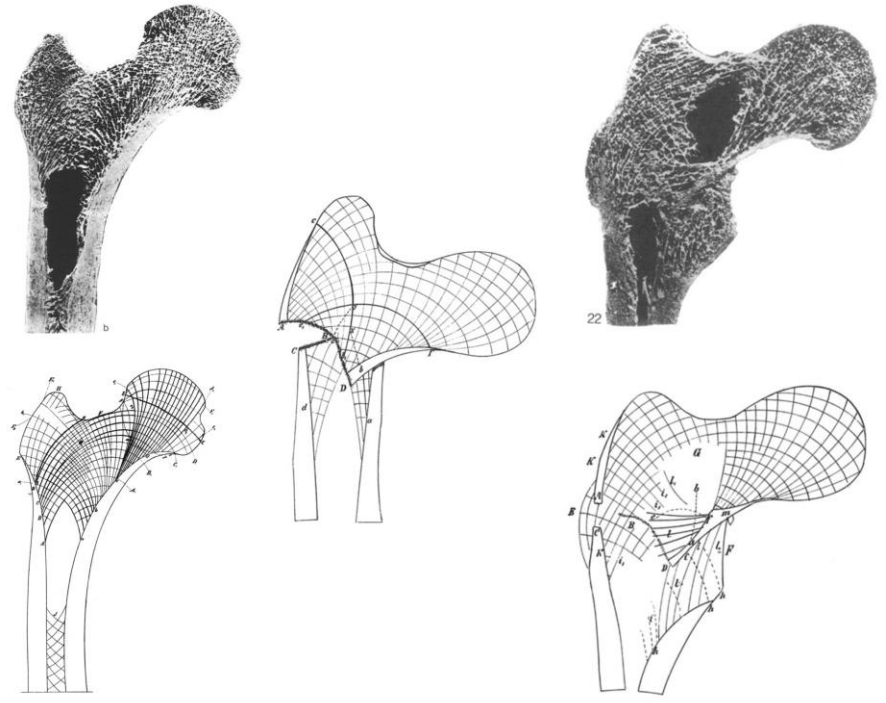

Figure 4. The architecture of trabecular bone in the femur head is aligned to trajectories of maximum axial load (left). Immediately after a displaced fracture, bone's architecture is unchanged (center). After healing bone morphology is partially restored and tissue distribution is adapted to new loading conditions (right). Adapted from Wolf, 1986.

This can be proved by looking at the architecture of a healed fracture with mismatching bone stumps. In this case the resulting bone architecture doesn't simply map the healthy one onto the external boundary of the new bone; instead it changes, adapting to the different loading condition. Since these conditions (the accidental morphology of the wrongly healed bone and the consequent unforeseeable loading) could not be pre-programmed in the genetic code, a different strategy must be operating here.

Mechanobiology shows that such bone remodeling derives from the ability of bone cells to sense the mechanical load in their local environment and resorb or deposit new bone "packets" depending on the actual load level (Fratzl & Weinkamer, 2007). These cells populate an intricate network of canaliculi only a few micrometers in diameter but extending throughout the bone.

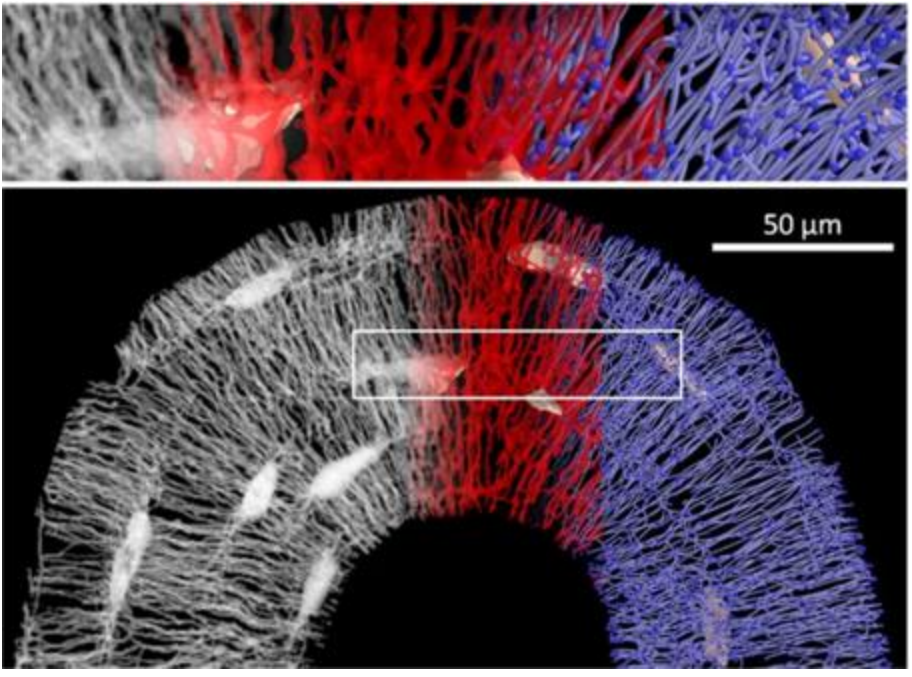

Figure 5. An osteocyte network of an osteon. The osteocytes sit in lacunae and are connected through canaliculi. Composite image from confocal laser scanning microscopy data (gray, left), binarized image (red, middle) and its edge-node mathematical representation (blue, right).

Moreover, by dissolving little amounts of bone minerals at such a large, distributed, cell-mineral interface, these cells are responsible for the homeostasis of calcium levels in blood. Thus, these cells can continuously adapt the bone architecture and mineral content to multiple loading and physiological conditions. Instead of following a fixed "masterplan" in a top-down manner, simple local rules allow for a living material that is structurally stable, constantly rebuilt from the bottom up, adapted to multiple requirements, and, in brief, truly resilient.

2.2 Resilience in architecture: designing material-based temperature modulation

The second case study from architecture examines how growing concerns about climate change and the effects of anthropogenic heat on the built environment have placed the concept of resilience at the heart of discussions about climate control in buildings.

Our dependence on air conditioning — a centralized, energy-intensive technology — is prompting us to rethink not only our normative, technological and energy practices, but also the closely related, underlying material and design concepts. A large part of the success of air conditioning lies in its ability to create a stable, controlled thermal environment. Originally introduced to heat, cool and dehumidify the air in various industries handling sensitive materials such as paper or cellulose-based textiles (Elliott, 1994), air-conditioning systems soon expanded into living and working spaces to ensure hygiene and perceived positive effects on well-being and productivity — as well as new, quantitatively adjustable levels of comfort.

Such interventions in the indoor climate have not only “standardized” the air as a medium but have also had a profound influence on architectural materiality. Ultimately, insulating and sealing the building from the outside to create a controllable and thermally neutral space has become a predominant material strategy for dealing with climatic fluctuations (Addington, 2009). Although recent regulatory efforts have been made to establish stronger links between indoor and outdoor climates in architecture, insulating practices have produced closed systems, which, paradoxically, respond more to the operation of mechanical devices and the general idea of thermal comfort than to the actual climatic context (Moe, 2014).

Following Holling's understanding of the differences between resilience and stability (Holling, 1973), this case study aims to shift attention from the concepts of climate control and quantitative thermal optimum to material-based and climate-dependent temperature modulation. Although Holling's writings moved away from the strictly material view of resilience to formulate a larger theoretical framework for systems behavior, his focus on decentralization and small, local interventions resonates well with design strategies that put climatic environments into a direct correlation rather than prescribing a specific performance. In addition, Holling notes that, should the material system be profoundly affected by external changes, such, as in our case, heat, the constancy and quantitative accuracy of the system becomes less important than the persistence of relationships.

The experimental investigation outlined here positioned between practice-based design and engineering explores the resilience on the basic level of the material through the design example with novel, bio-based phase-change materials (PCMs). By using materials that dynamically exchange energy with the environment; we are able to reinstate architectural materiality in the active shaping of thermal environments. The case study shows how such material entities, although acting locally, require a closer relationship between buildings and

the larger thermodynamic environment to respond to locally available thermal energy and accommodate seasonal and daily climate fluctuations.



Figure 6. Melting process of PCMs leading to heat absorption and temperature drop in the room.

Architectural elements for local cooling based on PCMs have inherently resilient behavior (Fig. 6). Unlike conventional building materials that are designed to withstand environmental forces, PCMs respond to surrounding temperature fluctuations by changing phase and storing thermal energy. The phase transition is triggered at ambient temperature (in this case at 24°C), which enables performance in the human comfort zone. When the surrounding temperature rises, the materials melt and absorb the excess heat; when the temperature drops, the materials solidify again and release the heat stored. In this way, PCMs undergo day-night cycles without degrading (Mehling & Cabeza, 2008) or requiring an additional energy source.

The decisive factor in the design of PCM-based elements is not only to ensure that the melting range of the PCMs corresponds to the daily temperature difference, but also to define the shape and arrangement of their encapsulations, which promotes heat transfer and improves their cooling capacity (Fig. 7). The study shows how the dendritic glass encapsulations, digitally designed and crafted by a lamp-working technique, can serve as a suitable geometrical concept to increase the contact area and contribute to the heat exchange between PCMs and the surroundings. In the experimental testing, this cooling

ceiling prototype facilitated temperature decrease and dampened the thermal loads during the periods of excessive heat.



Figure 7. Experimental prototype of the cooling ceiling based on PCMs.

The capacity of described material systems to absorb heat shock and adapt to changing climatic conditions resembles the resilience of biological materials which themselves are in constant energy exchange with their environment. Design interventions suggest a shift from practices of climate control towards designing open systems that enable collaboration and co-evolution of matter with the wider thermodynamic environment.

2.3 Resilience in design: local production strategies for social reintegration

Within the framework of design, we will explore not only the intrinsic properties of matter, but the interrelationships and co-evolutions of matter with socio-technical networks, in particular waste. What we generally categorize as “waste” does not constitute a uniform class of material. Waste is considered as such because, in its context, it does not conform to financial, technical, social and symbolic modalities that allow it to be considered as a resource (Berque, 2014). In this regard, plastic probably constitutes a major waste issue. Produced in larger quantities each year (Garside, 2019), often in single-use or short-lived objects, oil-based polymer waste degrades very slowly and endangers fauna and flora in many parts of the world. Yet, from a purely technical point of view, thermoplastics should not constitute such a disaster. Indeed, they are relatively easy to sort with simple methods (flotation, folding, flame), the temperatures for melting them are low (between 120 and

250°C), and they allow many useful forms to be obtained (rigid, flexible, films, foams, nonwovens, woven fabrics, etc). So why are plastics such a big ecological problem?



Figure 8. Thermoplastic Injection Molding mass-manufacturing production line.

The reason we examine here concerns the resilience of the technical networks this material relies on. Unlike metals, ceramics, textiles and wood, plastics were born and developed during the 20th century, driven by the chemical industry and large multinational oil companies. All the technical improvements, knowhow, machines and processes for the formation and synthesis of plastics evolved on the industrial scale, with high-precision machinery and process control down to the molecular level. There is almost no plastic craftsmanship, no local scrap specialist, and no knowledge of plastics classes outside industry, universities and research labs. Conversely, wood, metal, textiles and ceramics have existed for millennia, and the tools and knowledge associated with these materials are widely distributed. The large-scale technological system linked to polymers production and recycling lies at the heart of the waste issue of plastic, because it inhibits local sorting and reuse strategies. How can this status quo be reversed? Rather than proposing a technology involving the learning of new skills or a high degree of material stability (like 3D printing), a simpler and adaptable solution must be looked for, one that links up with diffused tactics, in the sense of Michel De Certeau (1984), already established in various territories and traditions.



Figure 9. Waste plastic recycling machine by centrifugal extrusion, 2013.

This was the initial motive behind our project in 2011. A Gaulard, N. Paget, C. Machet and E. De Visscher imagined a machine for transforming thermoplastics by hot centrifugation, using the principle of the cotton candy machine. This process can transform shredded plastic waste into fibers of various sizes and thicknesses, defined by the machine properties and the qualities of the plastic. This minor transformation, a simple elongation of the plastic, drastically alters its bonding possibilities with other techniques. Indeed, the textile arts such as spinning, weaving, felting, sewing, braiding and knitting, are widely distributed techniques, carried out by professionals and amateurs alike, in many artisanal and semi-industrial configurations all over the world. This minor transformation would be able to put plastics in the reach of local actors capable of transforming it into useful everyday objects and small economic gains. Suddenly, waste can become a lever for new distributed economic and socio-technical networks, based on an omnipresent and almost free resource.

To test this hypothesis, we had the chance to set up a workshop based on this technology in the suburbs of Antananarivo, Madagascar. From June 2018 to December 2019, we successively surveyed the context, built a machine locally, established a network of recyclers, selected young Malagasy people in professional reintegration, trained them on the machine and also in entrepreneurship and design, so that in the end they were able to set up a company and operate the machine by themselves. To understand the impact of the project, it should be recalled that Madagascar is the fifth poorest country in the world. The island, very rich in natural resources and renowned for its textile crafts and unique fauna and flora, is nevertheless plundered by endemic corruption, exploitation by large foreign

companies and drastic ecological degradation. This dramatic situation, although generated by several factors, worsened considerably during a major political crisis in 2009. With respect to plastics, though none are produced on the island, massive importation generates huge landfills, clogs roads, rivers and sewers, and poisons animals. On the other hand, the natural resources used by local craftsmen, such as raffia, sisal and natural silk, are of good quality and therefore increasingly sold abroad, depriving the craftsmen of their raw material and thus of their livelihood. It is within this framework that we established our new local recycling workshop. With the help of a local NGO and a Cultural Fund, we have selected ten young Malagasy people coming from precarious conditions to be trained in machinery, design and business management. The project is now active and they are using the waste to create a new fiber for local crafts.



Figure 10. Team of young Malagasy learning to use the machine, 2018.

This project was conceived and designed to be decentralized. The machine is small, transportable, and easy to use, needs very little maintenance, and can be produced locally in a simple mechanical workshop and with a few standard parts. The machine processes significant quantities of diverse plastic waste, which does not even need to be homogenized or filtered. At most, the head requires cleaning, a quick and easy operation. All these properties are exactly the opposite of the usual manufacturing processes for plastic fibers, in particular industrial micro-extrusion, which operates on a very large scale, requires a high degree of precision, does not tolerate plastic variations or impurities, and is therefore only

suitable if associated with constraining and precise sorting and the cleaning and homogenization of waste.

The technologies and materials, their form, properties and functioning generate certain socio-technical arrangements and networks. These are political, in the sense that they reorganize the networks of actors and the ways in which opportunities and problems are perceived collectively. Providing a machine to link and activate local, traditional and distributed technical networks furthers new socially resilient ecologies.



Figure 11. Textile products made from fiberized waste and weaving techniques, 2019.

3. Conclusion

What lessons can be drawn from these three different material perspectives on resilience? And most importantly, how can they improve understanding of the process by which the term has gained general acceptance? The biological material systems provide interesting aspects which can be linked to the two other case studies First of all, the resilient strategies described do not require separation between hardware and software, but are instead integrated systems of material and information pathways. Compared with state-of-the-art manmade devices, such as, for example, a robotic arm, such systems do not rely on predefined scenarios and an extensive energy supply. A further feature concerns the contextual adaptation of these solutions. None of the case studies are applicable to global

systems or to every context; they work within a range of stimuli generated within a specific set of parameters, distributed and redundant. And, most importantly, these material strategies are not dependent on precision and control; instead, they respond to a wide range of changes and accept impurities, variations and peaks.

One surprising common element in all these examples is the fact that none attempt to restore some predefined original state. In many different ways, the systems react to fluctuations and shock but use them to benefit from these situations to ensure a more efficient, long-lasting and small-scale adaptation. Comparing this feature with socio-economical resilience, we could support Barrios's question that probes the idea of stability itself and the inherent problem of resilience in humanitarian sectors: "restoring back to what?" (Barrios, 2017)

The Anthropocene we now live in and the many risks it entails is a call to relink our design strategies to materiality. As the virtual world of the Internet is unthinkable without all the cables and infrastructures it requires to function, resilience cannot be thought without the materials and technologies its logic is based upon. Creating a new large-scale urban planning with concrete, steel and glass will never end up fully resilient, as these inert materials are made to withstand, rather than to work with, change. We argue for the agency of resilient materials and technologies in the development and organization of projects and for connecting the resilience of materials with that of social, political and ecological orders.

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Acknowledgements: We would like to thank members of the Cluster of Excellence “Matters of Activity. Image Space Material” – Prof. Dr. Claudia Mareis (Humboldt-Universität zu Berlin), Prof. Dr. Dr. h.c. Peter Fratzl, Dr. Michaela Eder, Dr. Richard Weinkamer and Dr. Mason Dean (Max Planck Institute for Colloids and Interfaces) for their support. The case study from architecture has received funding from the European Union´s Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement No. 642328. The research at the Cluster of Excellence “Matters of Activity. Image Space Material” at the Humboldt-Universität zu Berlin has been funded by the German Research Foundation (DFG - Deutsche Forschungsgemeinschaft) under Germany's Excellence Strategy – EXC 2025 – 390648296.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The poetics of waste in contexts of satisfactory use and social action

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Abstract | The issue of sustainability is linked to lasting processes. However form a fashion standpoint the impulse for change affects the life expectancy of products, both from material durability linked to programmed obsolescence and from psychological obsolescence. This research explored how material objects could become a desire for new uses by satisfying new needs while retaining their original meanings and further enhancing their value. The purpose was to connect the world of material relationships with emotions, analyzing sustainability as a broad process of social relationships that generate knowledge and awareness in the consumption and use of garments. The methodology was developed from three contexts that used participatory observation as well as interviews and questionnaires for data collection and analysis. The results provided evidence of greater awareness and reflection on the subject by the participants.

KEYWORDS | FASHION DESIGN, SUSTAINABILITY, EMOTIONAL DURABILITY, SOCIAL PRACTICE, CO-DESIGN

1. Introduction

The concept of durability that is part of product design, development and manufacturing processes and their life cycle becomes especially relevant in the definition of specific design strategies for sustainability (DfX) which are relevant from the area of eco design. In this way, well-designed products and materials have the potential to extend their duration; However, despite the fact that this phenomenon has been accepted and recommended in the last twenty years as an aid to the objectives of sustainability and a brake on planned obsolescence, triggering durability as a design strategy through the longevity of the physically useful product is a reductionist solution that it does not consider. The impulse for change as a constant in fashion directly affects the life expectancy of products through what is known as psychological obsolescence, which underlines the psychosocial nature of fashion. The concept of emotional durability linked to the field of social and sustainable fashion design is not an objective to be achieved but rather a result derived from the use of the product. From this perspective, durability can become a desire for a new type of use to continue satisfying "changing" needs while retaining its exceptional meaning and further enhancing its emotional value. (Fletcher, 2008; Fletcher, 2010; Fletcher and Gross, 2012; Nakano, 2009; Chapman, 2009).

Although there are several research and fashion trials that deal with the concept of emotional durability as part of one of the future paradigms to be taken into account in the field of current sustainable fashion, most studies do not provide real practices on how to problematize these aspects from work and reflection with people (Lee, 2008) in search of a real social commitment, but rather reflect on these aspects and their implications from a theoretical approach. Although some studies are closer to the action of this concept, as is the case of Fletcher, in his Local Wisdom project, he does not examine the field of study with sufficient academic rigor. Its purpose is presented as a social practice (performative) and not of rigorous research where there seems to be no clear structure or use of specific data collection and analysis tools.

In this sense, despite the importance of aspects of emotional durability as a challenger of obsolescence in the field of fashion and given that there is hardly any design research that deals with this area rigorously, our research aims to study the relevance of these aspects through an empirical study of a sample collected over time to expose the results of this study in an open event where the results of several years were shown, new data was collected and a new reflection was reinforced in the relation of pledge-human commitment.

Our goal was to increase the resilience of consumer-product relationships by reflecting on the empathy and attachment of objects by providing a more expansive and holistic scenario of the emotional longevity of garments. Our hypothesis was to demonstrate that from social practices it is possible to re-educate consumers by exploring through the reflection and dialogue with the product the long-term possibilities of this.

2. Theoretical framework

2.1 Sustainability and slow fashion

Fast fashion dominated by just-in-time production and rapid distribution and marketing times have accelerated the growth of consumption driven by programmed obsolescence and changing fashion trends. This fashionable system of using and throwing has caused a destructive need in the consumer where he often buys more than he needs. Consequently, this has led to the accumulation of waste, which in recent years has significantly increased solid waste of textiles and clothing in landfills, from 7% to 30% in five years (Pookulangara and Shephard, 2013) .

More specifically, recent reports by Asirtex inform us that in Spain, the world leader in fast fahion fashion companies, the average consumption during the period (2017_2018) per person was 34 items per year, which is an average of between 10 and 14 kilos of discarded clothes per year, of which only between 1.5 and 2.5 kilos are recovered in recycling containers, leaving a good part of this consumption without recycling and therefore in solid waste condition.

To counteract these effects, the slow fashion movement has emerged strongly opposing, on the one hand, the devastating effects caused by the insatiable demand for fast fashion and, on the other, challenging the current mass production system. Slow fashion seeks to improve the quality and transparency of production and consumption processes by addressing issues related to cultural diversity, identity, symbolic expression and the design of durable products (Nakano, 2009; Fletcher, 2008; Fletcher, 2010; Fletcher and Gross, 2012; Howard, 2004).

Slow fashion can put a brake on the fast fashion industry by rethinking its design, production, distribution and marketing model, impacting the entire product life cycle in a circular, responsible and conscientious way.

Empathy, attachment and narrative generated from human behaviors and relationships with the product are essential to build a sustainable long-term commitment to the product. Such aspects are unfortunately not priority elements in the general study of sustainable design for durability, since they are difficult to work and their conception is neither easy nor effective in the short term. It is more attractive to work the durability of a product in a sustainable key from the technical and functional approaches, which are of greater productive and commercial interest due to the reduction of costs, convenience and attractiveness that they produce quickly and directly. However, these environmental solutions do not provide real long-term solutions, since as Chapman says “the machine of inefficient consumption continues to emerge in a wasteful way, but now it does so with recycled materials instead of virgin materials”(Chapman, 2009, p.29). That is why "The commercial and ecological unrealities of this model must be questioned." Following Chapman's speech "The sustainability crisis is a problem of behavior, and not simply of technology, production and volume." (Chapman, 2009, p. 33)

Sustainable design methodologies should deal more with fundamental issues, such as the meaning and place of products in our lives. New and sustainable products must seek to instill a new meaning and value in a critical area of human effort that, in many ways, has become directionless and superficial. Consequently, the design for sustainability should emerge within a cultural framework rich in criticism, positioning it as a central pioneer of a committed social, economic and environmental change, rather than dealing with providing answers to only technical solutions (Chapman, 2009; Fletcher, 2010)

2.2 Emotional durability vs material durability

According Payne “Once fashion trends advance, the aesthetic value of a garment decreases. It becomes wasteful.” (Payne, 2012, p.205). Clothes are not disposed of because they are worn, but because they are outdated.

According to Binotto and Payne “Fashion in the modern era is based on the logic of perpetual stylistic change and operates within what Entwistle (2009) calls an aesthetic market that fetishes the new” (Binotto and Payne, 2016, p. 8) and consequently condemns the “old” or old-fashioned in the interior of a waste consumption framework.

To alleviate its effects, the concept of emotional durability is opposed to the culture of use and throwing and the psychological obsolescence caused by consumer trends in the fast fashion industry. Material durability challenges the limits of the material culture of waste, achieving results that go beyond the rational considerations of whether or not an object is in good condition. The concept of emotional durability has emotional and empathic implications with the product from the relationship and emotional connection with it, extending the desire for its use from its original meanings, which enhances its value and causes a new need for use and consumption through time.

Norman (2004) argues that a "favorite object" can become a symbol installed from a positive frame of reference consisting of pleasant memories and experiences extensible to one's identity.

In the same perspective, Fletcher (2012) warns us that in order to challenge obsolescence and promote the emotional durability and longevity of products, it is essential to focus our attention on the competences of clothing and on the “art of use” and not so much on the Product as matter. In his Local Wisdom project, he analyzes the care, repair and satisfactory use of clothing from the perspective of the “art of use”.

Other researchers, more recently, focus their attention on the poetic competences of waste by enhancing their plastic beauty to strengthen their social bonds and emotion attachments from the notion of charm as a driver of new relationships and experiences susceptible to affectivity that promote reflections and ethical responses and social commitment (Benett, 2001; Binotto and Payne, 2017; Žižek, 2009)

On the other hand, based on Chapman's considerations (2009) that “possessions are symbols of who we are, what we have been and what we are trying to convert ” (Chapman, 2009, p. 34) and since these allow the incorporation of new meanings to the original meanings, it is

easy to understand that the products that have the most functionality provide important signs and indicators in human relationships.

Thus the design paradigm for durability must be understood and interpreted beyond the longevity of a useful product, technically speaking.

"One of the new and more difficult paradigms of sustainability is precisely to increase the resilience of consumer-product relations, which proposes a more expansive and holistic approach to the design of durability and the experience lived through it" (Chapman 2009, p. 35)

3. Methodology

The research methodology has been mainly qualitative. The techniques used have been based on data collection through participatory action techniques, observations and thoughts aloud. For its development semi-structured interviews, questionnaires and audiovisual records have been used.

The methodological processes of observation, action and interaction in praxis have been carried out by creating scenarios and social practices that have involved different users (e.g., researchers, designers, street people, educators, etc.).

The general line of work has continued the practical procedure developed in our previous investigations. These processes have been worked on in different scenarios: practical/ observational, artistic or communicative /reflexive.

The research has been implemented in a phase called Connections that has been structured in three stages or degrees of involvement an Exhibition, Meeting and Barter of clothing. Each stage had a relevant development and impact for the scope of this research.

From a broader approach, Connections 4 had the main objective of connecting the world of material relationships (clothing) with social relationships and emotions derived from past experiences. The objective was to enhance the competences of clothing, focusing attention on the art of their satisfactory use, either through the accumulation of memories and experiences, or from the capacity of reuse. Specifically, the concept of sustainability in fashion was analyzed as a broad process to generate knowledge and awareness in the consumption and use of garments. The intention was to challenge the system of fast fashion and industrial interests, to curb the psychological obsolescence of the mass consumer, driving through the different stages (exposure, encounter and barter) the emotional durability and longevity of the products.

The work approach was structured in 3 stages of development:

1. Stage Connections 4: Exhibition

This first stage shows; the results of the project materialized and visualized through the exhibition.



Figure 1: Poster designed by the group of research for dissemination and invitation to exhibition/encounter and barter.

Objectives of the exhibition

The main objective of the exhibition was to show the results of the 10 best testimonials (clothing stories) from a sample of more than 50 videos and photographs collected during the three previous editions. The images, texts and videos exposed tell real fashion stories based on their own experiences, based on the art of the satisfactory use of the garments, and /or the feelings and emotions linked to them.

A second objective addressed the issue of creating a history of fashion itself that extends beyond historiographic practices, dating and classification, to narrate fashion through real experiences and anecdotal stories.

General Panorama

In the study on the design of the exhibition, the materialization of the concept and the social impact and potential awareness that the present exhibition may have had in the art space "La Colectiva" in the local society of Xàtiva and its surroundings, has been kept in mind; on the one hand, the strong communicative impact of the selected proposals (photographs and history of clothing, with a strong emotional charge); and on the other, the design of the exhibition space: the organization of the exhibited pieces (size, number, type, impact etc.) the impact of the intangible elements (music etc.), the impact of the tangible elements of accompaniment and ambience scenographic, the design of the infrastructure useful for the proper functioning of electronic and / or visual devices, the place and location of artistic pieces and other useful objects arranged within the communicative and narrative space, and the visitor's journey through the exhibition space and for the rest of the event.



Figure 2:The exposition's inauguration

Procedure

The exhibition that was being prepared during the month of July and September of the year 2018 was inaugurated on October 5 of the 2018/2019 course in the artistic space of the "Colectiva" located in Xàtiva. The exhibition kept its doors open to the public until November 5.



Figure 4: Pictures from the exposition



Figure 3: Pictures from the exposition

Instrumentalization, materials and infrastructure used

The exhibition shows a selection of the best photographs taken during the meeting of connections 2 and 3 of the previous years and a selection of the best narratives both in audio and video format with audiovisual support (Ipad and television).

Each one of the exposed images was linked to a significant phrase that identified and represented it, in addition to a QR code where the visitor could access with his mobile phone to visualize the history of the garment told by the person represented in the photograph.



Figure 5: The exposition's inauguration

The total number of images and stories told were 10 of which 7 were presented in color and in A2 size on a 1 cm thick cardboard holder and 3 were presented in black and white in 100x70 size on a 1 cm cardboard support . The phrases linked to the images were made on

vinyl and were attached to the wall next to the photograph and to a QR code also printed on A5 size vinyl on a 1 cm thick cardboard holder.



Figure 6: Exposition room



Figure 7: Picture's details with their artefacts (Ipads) that tell their emotional stories.

As for the audiovisual stories due to budget limitations and exhibition space, it was decided to exhibit only 3. They were mounted on a loopy audiovisual support on digital tablets that were inside a wooden box hanging on the wall next to each image.

In addition, at the entrance of the exhibition space a television was installed with a video that introduced the exhibition with a brief explanation and showed all the testimonies (fashion stories) collected in the exhibition.



Figure 8: Pictures of all participants

The exhibition space was divided into three: on the one hand there was the exhibition with everything explained, on the other there was the space where the bartering of clothes was carried out, which will be explained in the following section, a third space was destined to the recordings of the stories of the garments and the photographs of the users with them, finally, a third space was enabled where an audiovisual of last year's parade was projected and whose concept was related to the base concept of the event and the present investigation. In this same projection space a snack and information about the project were placed (See the image 9).



Figure 9: The exposition's meeting point

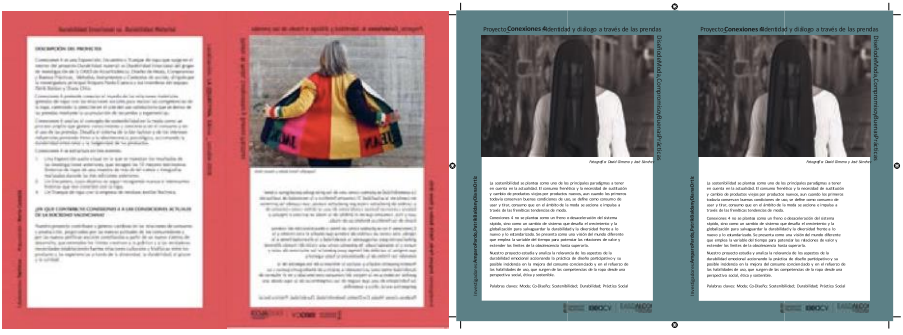

Figure 10: Exposition flyers

2. Stage Connections 4: Encounters

Objectives of the encounter

The main objective of the meeting was to continue collecting stories of clothing or accessories that maintained an emotional bond with its users.

A second objective was to make the task of using and throwing away difficult by activating the self-reflection and self-awareness of the users participating in the meeting through the dialogue with the garments.

General Panorama

In the general study of the concept of emotional durability, compared to the material durability of the garments that is derived from different theories and studies, this meeting aimed to generate the self-awareness that the objects we buy (clothes) can transcend their aspects or material characteristics to the immateriality and intangibility, which makes them unique garments of difficult detachment and makes their removal impossible ennobling them and keeping them as unique and special. Consequently, reflection and awareness about the fact that a poetic look at everyday objects (clothes) can lead us to keep them

paying attention to care, pampering, patchwork, etc., would facilitate the brake on the mass consumption of using and throwing away and challenge the rules of programmed and psychological obsolescence produced by consumer trends. In short, to raise awareness that the simple objects that we buy can become, through dialogue with them, special objects, worthy of keeping and repairing, avoid compulsive consumption and enhance reflective and responsible buying.

Procedure

The meeting was held on October 5, 2018 and its duration was only a few hours.

For the planning of the meeting there was a team of audiovisual and photography professionals, in addition to the support and collaboration of students of the EASD Alcoi school, of the sustainable fashion subject, who were instructed and prepared for the process.

The complete team of professionals and participating students were coordinated by the researchers / professors of this paper, who were in charge; on the one hand, to choose the place, prepare and design the stage of the staging and design the questionnaire / interview directed; on the other, they prepared all the necessary material, made the appropriate HR contacts and organized and coordinated the meeting during its duration.

Instrumentalization, materials and infrastructure used

The instrument designed to gather information at the meeting was a semi-structured interview combined with an ad hoc questionnaire.

The questionnaire only collected demographic and anagraphic data such as age, name, place of residence, profession and marital status, while the semi-structured interview served to explore the subject under study by raising open-ended questions that allowed the participant to reflect on the topic and express himself freely.

The interview was designed based on a focus group of students and fashion teachers.

A pilot questionnaire was previously conducted and tested with a small sample of participants in the EASD of Alcoi. After the various tests and subsequent corrections, not only the interview items were adjusted but also the technical aspects of how to approach and raise this.

The materials used during the recording of the interviews were some purchased by the team of researchers, others borrowed and most of them from the team of researchers and the team of professionals hired to carry out the recordings.



Figure 11: Data recollection from the interviews to participants

Table 1. Main questions

Table Rows [STYLE: _DCs Table]
¿What is you name, age, place of birth?
¿What is your profession?
¿What garment have you brought and what do you want tell us about it ?
¿What emotional bond ties you to it?
¿Where do you store this garment?
¿Do you use it often?
¿What do you think will happen to it ?
¿What would you change this garment for?

The resource inventory was as follows:

Two cameras, two video cards, a laptop, several spotlights and flashes, paper material for the backgrounds and two microphones.

Data Analysis

The qualitative analysis of the data was carried out by means of audio-video transcription and photographs of the subjects endorsing the garment.



Figure 12: Photographies of the participants

3. Stage Connections 4: Exchange

The barter was held on the same day October 5 and its duration lasted for the entire duration of the exhibition. Objectives

The main objective was to make participants aware of the possibilities offered by the exchange of clothes as a brake on programmed obsolescence, which leads us to the practice of continuous wear and tear.

The second objective of the barter was to serve as a claim for the citizens of Xàtiva to approach the event, since given the complexity of the project and the general ignorance of the topic addressed, in the Xativa social group, we needed an element that was attractive. In this case, the possibility of offering an exchange of clothes at zero cost might seem an interesting practice that additionally attracts people to the meeting and the exhibition to involve them in the whole process.

General Panorama

On the basis of an increasing number of studies on sustainable fashion management, textile waste management and fashion activism, this barter was designed which was attended by the Texlimca waste company and the ASIRTEX association, who provided us with all the clothes displayed in the pop up store, previously selected by the barter.



Figure 13: A participant tells the story of his garment



Figure 14: The participant choose the garments for the exchange

Procedure

The barter took place on the same day October 5 and its duration lasted the duration of the exhibition.

Instrumentalization, materials and infrastructure used

The barter was located at the back of the room, in a space designed to keep in tune with the concept of reuse and exchange. One of the walls of the room was organized with boxes of old pallets hung as shelves. In them all the cataloged clothes were placed according to the value previously granted by the researchers.



Figure 15: Photographies of the organization of the garments during the exchange. Table 2. Table of catalogation of the garment

Scale of evaluation from 1 to 5		1	2	3	4	5
1	Current fashion esthetic					
2	Good conservation and cleaning of the fabric					
3	Sofisticated garment					
4	Outer wear in good conservation					
5	Good overall state of the garment					
6	Vintage esthetic					
1€	3€	6€	8€	10€	15€	20€

The organizers of the barter were the same researchers, both were responsible first of all to design the space, organize it, make an inventory of all the garments lent by the company, assess each of the garments based on criteria (See table 2), receive the people / costumers, meet their needs and place the exchanged garments in containers that were specifically designed to insert the exchanged garments.

On the other hand, the principal investigator was the one who took care of selecting the material, before the barter celebration, at the Texlimca company premises. The criteria followed for the selection were described in table 2.



Figure 16: participants during the exchange

4. Results

Although the selected sample was random and could not be controlled with great rigor from the generality of the stages performed, it could be controlled more comprehensively through encounter and barter. As for the Meeting, the number of participants was 15 subjects, and although more participation was expected, the sample was good and showed qualitative data of great validity and reliability for our study; however, Barter participation was much higher reaching the figure of 50 participants.

The first stage of the project, the exhibition of connections, produced results that were shown in an exhibition aimed at the society of Xàtiva, which took place in the art space of the Xàtiva Collective. Although the results in this case are not palpable the repercussions that the visual and narrative impact of the exhibition were fundamental elements to give clarity and knowledge on the subject to the potential visitors participating in the other stages of the project (encounter and barter).

The second stages of the project the connection meeting, In the light of the analysis of the analyzed audio video recordings, three large blocks of qualitative data of validity and reliability were thrown in our exploration.

> The strong empathy of the participants towards the chosen garments, in a very personal dialogue relationship, since they all gave effective and clear answers to the questions posed. All the participants had a relevant story to tell about their garment, they maintained an emotional bond with it, they kept it in a special place or with special attention, they used it on special occasions because they considered it special, and they would not change it for anything, leaving it mostly as an inheritance to someone special.
>
> The narrative, powerful and discursive capacity, thrown from the interviews analyzed, it was possible to create a fashion story from testimonies about stories of experiences and emotions lived with the clothes, since all the participants had something important to tell about their favorite or special clothes.

> The strong attachment relationship that the users maintained with their garments evidenced the importance of the longevity (emotional durability) of the garment since the assumption of a new use and a new meaning.

In the third and last stage of the research, from the analysis of data made from the inventory made before and after bartering on a bank of 60 garments supplied by the company Texlimca, it was estimated that 80% of the garments were exchanged for others supplied by the participants who attended the event.

5. Discussion and Conclusions

This research has had special relevance in the strong involvement that the participating society has had in the exhibition, in the barter and in the meeting, a fact that has had a positive impact on the achievement of the objectives set and the consequent ad hoc validation of the hypothesis raised in this studio. From the extension of the theoretical notion of the concept of emotional longevity of garments, theorized by different scholars of the field (e.g., Fletcher, 2012; Chapman, 2009; Norman, 2004; etc.) to the scope of participatory social reality, explored by other relevant researchers, (e.g., Lee, 2008; etc.)very satisfactory and relevant knowledge has been generated about the theoretical-practical field on which to continue advancing and improving towards a idea of a more responsible, committed and participatory fashion consumption. The different scenarios worked on in this research have served as the basis for exploring the field of emotional durability of fashion products, their longevity, their skills, their poetics, their strengths and how to extrapolate all these concepts to commercial realities that challenge massive consumption in favor of a more holistic and committed consumption based on the shame of buying. In the first part of this research, the concept of emotional durability was explored from the emotional connection that a product (article of clothing) can have in our lives from the relationships we maintain with them, their meanings and the place they occupy in our lives. This exploration was carried out through an exhibition where a selection of photographs of people wearing a symbol garment was shown, accompanied by an audio video testimony and QR code, which narrated the affective richness of the garment-user relationship, demonstrating its powerful emotional longevity and their inability to get rid of it. An overview of the results achieved in this exhibition made visitors aware of the strengthening of relationships with the objects that we acquire and the creation of their own unique fashion stories. These results allowed not only to strengthen the vision of a more committed consumption but also to contribute to the literature proposed in the investigation of the emotional durability of objects (e.g., Chapman, 2009; Fletcher, 2012; Binotto and Payne, 2017; Benett, 2011; Žižek, 2009). In the second part of this research, perhaps one of the most relevant to the fulfillment of the hypothesis of our study demonstrated, once again and through the compilation of new ad hoc testimonies, the existence and potential of the emotional components that can emerge of the garment-user relationship. This confirmed that the affective bond and falling in love with the object, beyond its material skills and/or use, is possible, which turns the garment into almost a relic, and builds with it its own and unique history of the fashion that transcends the historiographic boundaries of clinical and impersonal dating and classification traditionally used to tell the story of fashion.

In general, these findings contribute, on the one hand and directly to Norman's (2004) theories about how a “favorite object” can become a symbol installed in a positive frame of reference made up of memories and pleasant experiences that can be extended to one's own identity; and on the other, to the more specific arguments of Chapman (2009) on how a possession can become a symbol of ourselves, being able to incorporate new meanings added to the already original ones that exceed its material usage skills. In the third part of this research, which was carried out through a clothing exchange, we were able to confirm how the material and usability competencies of a product also take on special relevance when they are exposed in an attractive way and within a culturally rich frame, as was the case in this research. In this sense, although the initial approach to barter was to serve as a

claim for the rest of the activities, we were able to demonstrate by the interest and the amount of garments exchanged that the waste loses its condition of waste when it is exposed in an attractive way, emphasizing, if possible , its flaws (i.e., stains, worn, broken etc.) in order to enhance the plastic beauty of these. This enhances its capacity for transformation even more: from waste to “bargain” garment, unique or vintage fashion. In addition, these results reinforce the considerations of (Benett, 2011; Binotto and Payne,; Žižek, 2009) offering a real and commercial vision of their theoretical arguments by reaffirming that the poetic competences of the residue from the notion of charm that can be derived from the The same, they can strengthen the relationship with the user by promoting new relationships and experiences with him, promoting reflections and ethical responses of social commitment and responsible consumption.

In general terms, the theoretical and practical implications of this research have led to joint reflection by researchers and participants, raising new questions of scope on how to strengthen future relationships with the products we buy, sell and / or design, promoting and valuing skills more affective and poetic competences of garments turned into residue from their methodological implications of design and development to the commercial realities of pre and post sale. If we can establish empathic relationships with the objects (garments) we buy, before even acquiring them, we can build a commitment to emotional durability with them. Inviting users to participate in the design processes (pre-design) or perhaps in the (post-design) to mend, custumize and/or remanufacture the garments already acquired or in use, will not only increase their skills but also all the emotional relationships that are built through those active experiences with the garments.

Our challenge for the future is to promote the shame of buying to buy by strengthening and extending the material, poetic and emotional longevity of the products we buy or those that we no longer want by committing ourselves to waste. Our challenge is to enhance relationships of empathy with products and make our own fashion history based on the experiences lived with the garments we acquire, this form of consumption being the key to building a sustainable commitment with the planet with future generations.

This research has allowed us, through a random sample, to get a good reading of the field of work at a general level. Therefore, it is expected that the reiteration of this study from the increase in the size of the sample and its extension to other populations will allow us to collect more data and thereby expand our expectations.

In conclusion, with all that has been discussed and starting from the main objective, it was shown that from social practices it is possible to re-educate consumers by exploring through reflection and dialogue with the product its long-lasting possibilities in favor of greater consideration and extension of the potentially durable aspects that can influence the design for the sustainability of the products.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The potential of Theory of Change to visually model the underlying logic behind service design projects

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Abstract | Theory of Change emerged in the past decades as an approach to better plan, drive and evaluate community initiatives and philanthropic projects, and has since been used more widely to support a variety of innovation processes. Within design practice and design research, however, Theory of Change remains underused and underexplored. This paper intends to focus on two applications of Theory of Change, mostly in light of its potential to visually model and communicate the underlying logic in service design projects. Particularly, the paper will examine how these two different visual representations of Theory of Change had contrasting purposes and, therefore, experimented with varied ways of displaying the key assumptions, activities, outputs and outcomes of the two projects by, for example, operating on visual elements such as scale, texture, colour, transparency, layers, patterns, grids and modularity.

KEYWORDS | VISUAL MODELING, SOCIAL INNOVATION, THEORY OF CHANGE, VISUAL ANALYSIS

1. Introduction

Especially when dealing with social innovation processes, service design requires a strong degree of collective sense-making and strategizing for the vision of the designers to be realised (Simeone, 2019; Simeone, 2020; Morelli et al., 2020). Theory of Change emerged in the 1990s as an approach to better plan, drive and evaluate community initiatives and philanthropic projects (Stein & Valters, 2012) and has since been used more widely to support a variety of social innovation processes (Brest, 2010). Theory of Change is a holistic tool to understand processes, where one identifies the current situation (in terms of needs and opportunities), the intended future result (expected or hoped for outcomes), and what needs to happen to move from one situation to the other to reach one's goals (Rogers, 2014). In other words, a Theory of Change is concerned with how and why an initiative works (Weiss, 1995).

What distinguishes Theory of Change from other tools is (a) its joint focus on collaborative design and on the surfacing underlying organisational assumptions and (b) its use of figures (often labelled 'Theory of Change maps') as a means of socialising the vision behind the intervention. Given these attributes, design research has shown some interest for Theory of Change, mostly in relation to how it can support design projects in complex contexts of intervention (Alter, Whitham, Dawes, & Cooper, 2019), including social innovation (Tonkinwise, 2015). However, to date, the construct of the Theory of Change remains understudied in design research and under-applied in design practice (Jones, 2015). This paper intends to offer a contribution in this direction by examining two applications of Theory of Change: (1) a UK Government funded project to scope the possibility for the nationwide roll-out of smart meters and (2) a European Commission funded project oriented toward offering a supporting service for all those city actors interested in using design to develop urban and social innovation projects. These two projects produced very different maps – i.e. visual representations - of Theory of Change. The specific focus of the paper will be to study how these two representations helped articulate the underlying logic of the two projects. These visual representations had contrasting purposes and, therefore, experimented with varied ways of displaying the key assumptions, activities, outputs and outcomes of the two projects by, for example, operating on visual elements such as scale, texture, colour, transparency, layers, patterns, grids and modularity. As suggested by some experts in the use of Theory of Change (Davies, 2018), there is a great need to more closely examine how a deliberate use of varied visual elements can improve the expressive capacities of the tool.

The contribution offered by the paper is, therefore, twofold. First, the paper intends to study how Theory of Change can help identify the underlying logic behind service design projects. Second, the paper aims at more closely exploring how different visual representations of Theory of Change can provide a greater level of granularity in modelling and communicating such logic. In a broader perspective and in relation to theoretical and practical implications,

the paper will also examine how Theory of Change can support the work of design researchers, educators and practitioners.

2. Theoretical and methodological framework

2.1 Theory of Change in design research

In the past decades, design has greatly expanded its scope (Manzini, 2015). Its potential to address, frame and reframe complex and wicked problems has been widely recognized across fields as varied as design research (Buchanan, 1992), business studies (Martin, 2009) and innovation management (Dorst, 2015). Theory of Change can support design projects that deal with contexts of interventions that are more and more volatile, uncertain, complex and ambiguous (Jones, 2015; Bennet and Lemoine, 2014). Particularly, researchers have noted how the granular representations provided by Theory of Change can help understand the functioning of sociotechnical systems (Norman and Stappers, 2015; Jones, 2015). Indeed, Theory of Change can work especially well when design is considered as an activity that is not limited to the manipulation of materials but is extended to a conversation with a social context (Simeone et al., 2019). This implies a critical evaluation of the state of things and a creative process to imagine how to change them through an activity of problem-solving and (collaborative) sense-making (Manzini, 2019).

Within design research, Theory of Change has been used to look into various aspects, from user engagement processes (Alter et al., 2019), all the way up to theory of agency (Mom, 2007) and design practice (Wahlin and Kahn, 2015). However, some design scholars noted that Theory of Change remains underused in design (Tonkinwise, 2015). One particular area in which design scholarship could usefully contribute to the wider development of Theory of Change is the design of the products of the process: Theory of Change maps. Whilst scholars such as Davies (2018) have explored drawbacks in how Theory of Change maps represent programmes visually, an alternative visual vocabulary using design principles remains lacking in literature on Theory of Change.

2.2 Theory of Change as a way to map and communicate in service design projects

Theory of Change mapping involves identifying anticipated causal pathways through which an intervention leads to a set of outcomes, and the articulation of the assumptions (or underlying theories) of how the hoped-for change will come about (Darby, Liddel, Hills and Drabble, 2015). In other words, a Theory of Change explains how an intervention (a project, a programme, a policy, a strategy) is understood to contribute to a chain of results that produce the intended or actual impacts (Ling, 2012). Theory of Change ensures that co-production is central by bringing together key stakeholders and lets them collaborate through continuous conversations, eventually facilitated within workshops (Alter et al.,

2019). Theory of Change, therefore, allows who is managing, designing or facilitating the intervention to capture a wide range of voices, to observe dynamics and, in general, to operate successfully in those situations in which there is a degree of uncertainty and confusion on how to proceed and over the final outcome to be reached (Jackson, 2013). As such, the fine-grained mapping of all the key components of a project provided by the Theory of Change can be a powerful tool to identify the underlying logic and assumptions in complex interventions (Davies, 2018). Service design - with its focus on the functioning of complex ecosystems and on journeys dynamically co-created by various stakeholders (Meroni & Sangiorgi, 2011; Stickdorn et al., 2018) - provides an ideal ground for Theory of Change to be applied.

Theory of Change is not a purely intellectual exercise: Theories of Change maps "can only be useful if they are designed to serve a clear purpose, and once designed, the organization adheres to that purpose" (Hunter, 2006, p. 194). The main purpose of a Theory of Change is to make sense of the initiative that is being designed within a specific organisational setting and in contexts in which multiple stakeholders interact (Anderson, 2004; Weiss, 1995). In these situations, the underlying logic of an intervention is not always clearly articulated but at times, it emerges from the interaction of diverse stakeholders and their dynamics of sense-making, which might be pulling the project toward different directions (Mirabeau & Maguire, 2014). When applied to these contexts, Theory of Change can also be helpful to share and clearly communicate the underlying logic of an intervention to these varied stakeholders; Theory of Change can act as a form of storytelling, as "an art of weaving, of constructing, the product of intimate knowledge" (Gabriel, 2000, p. 1). Making sense of an initiative is a social phenomenon, so that much of the work to build a Theory of Change is crafting together a narrative from disparate perspectives. In order for this sense-making to achieve its purpose, the main result (the 'Theory of Change map') needs to be effective in communicating a coherent narrative (Davies, 2018).

Much of the success in the application of the Theory of Change depends on the very design of the Theory of Change map. To date, little has been written academically or otherwise on the design features of Theory of Change maps and the lexicon is largely underdeveloped. Boxes are filled with text descriptions of 'events', and arrows connect them, representing expected causal connections between these events (Davies, 2018). Maps are most often arranged from left to right under the categories 'context', 'activities', 'outputs', 'outcomes' and 'impacts'. The use of design elements is minimal. This leads to maps that are unable to effectively display the underlying logic in a clear narrative, even when these are understood by the consultant drawing the maps.

This paper intends to address this gap by examining how the visual dimension of Theory of Change can offer a particularly fruitful avenue to identify and communicate the underlying logic of complex interventions, including those large-scale service design projects that see interplay of varied stakeholders.

2.3 A case study approach

This study adopts a case study approach (Eisenhardt, 1989; Eisenhardt & Graebner, 2007), which has proven to be particularly fruitful while analysing a variety of phenomena within real-life contexts (Berg, 1968; Breslin & Buchanan, 2008), and scholars examined the relevance and the limitations of this approach (Dasgupta, 2015). Particularly, this paper follows a research approach that selects two cases - Smart Metering Early Learning Project and Designscapes - since they offered contrasting situations and approaches (Yin, 2009).

The authors of the paper directly participated in the design and implementation of these two projects, quite significantly relying upon the application of Theory of Change. This internal positioning gave the authors the opportunity to collect data and insights, mostly through direct and participant observation based on ethnographically-inspired methods (Czarniawska, 2012) but also carrying out surveys and interviews (about 250 participants, including other team members and representatives of partnering organizations). Within the context of this paper, this material has been selectively examined to distil insights on how Theory of Change was visualized and used to identify key logic pathways behind the two projects. The visual analysis of the two different applications of Theory of Change has been conducted using dimensions (e.g., scale, texture, colour, hierarchy, layers, patterns, spatial distribution) highlighted in visual design literature (Lupton and Cole Philips, 2008).

3. Representing Theory of Change

3.1 Case 1: Smart Metering Early Learning Project

The context

The roll-out of smart electricity and gas meters to households and small businesses in Great Britain by the Department for Energy and Climate Change (DECC) began in 2011 with the Foundation Stage. During the Foundation Stage, the Government and delivery partners aimed to learn from early activity about how consumer engagement can best be achieved, and feed lessons into planning for the next stage. This project summarised and analysed evidence from a range of sources, including three new DECC research projects, into how GB householders engage with smart metering, carried out with cooperation from energy suppliers; GB and international evidence on smart metering and energy feedback; and some evidence from non-energy domains such as public health, where applicable to understanding behaviour change processes (Darby et al., 2015). This project used Theory of Change as a way of structuring and undertaking the analysis. Theory-based evaluation systematically develops and tests theories related to links between policy delivery and outcomes, and is particularly useful for evaluating complex interventions involving many actors.

The visuals

The Theory of Change maps were created following analysis into evaluations of similar services, theories of behaviour change, interviews with key stakeholders and two Theory of Change workshops. Figure 1 below is an example of horizontal layout for a future service design related to smart meters. In this project, as a prospective programme, the most important aspect for the stakeholders to understand was the causal logic and the connections between different activities. In addition, the planned roll-out of the programme was highly complex, with many interdependencies between partner organisations, some of whom appeared unlikely to be fully motivated to join the programme. Given this, the map focused on the implementation and planning by exploring different scenarios and assumptions relating to varying engagement from the key stakeholders. The map below is a scenario requested by the client where smart meters would be rolled out alongside household level electricity micro-generation.

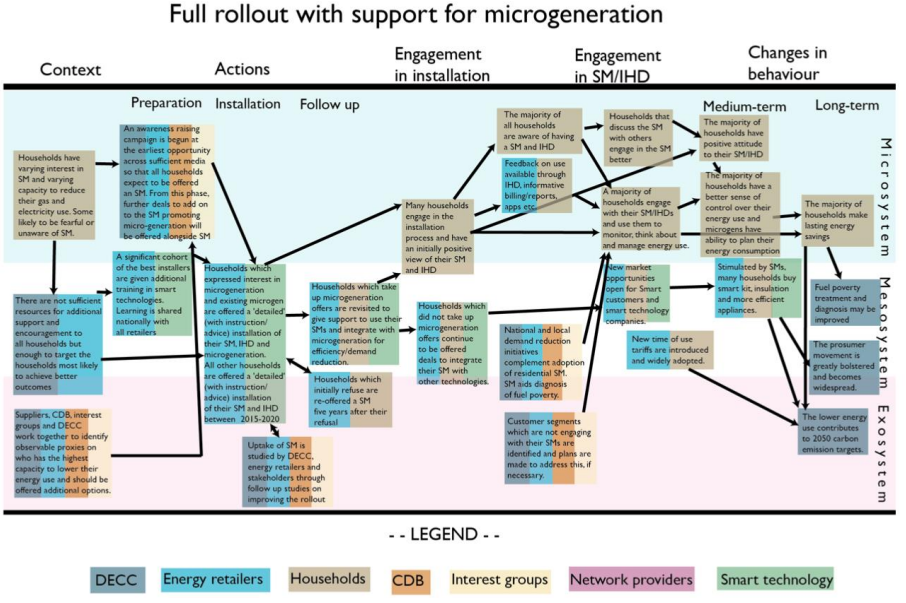

Fig. 1 Theory of Change map from the Smart Metering Early Learning Project

In this map, issues and context for the programme were arrayed to the left and connected to the actions. Actions are broken into preparation, initial action and follow-up action as suited to the programme. The colour-coded boxes help to show which part of the system needs to be engaged at each stage and where benefits would accrue. As a complex national-level programme, the rows are layered from micro to macro as a way of making sense of the programme activities and the interactions between the strategic level and household implementation.

3.2 Case 2: Designscapes

The context

Designscapes is an EU-funded project oriented toward fostering design-driven innovation in European cities and beyond. The project intends to leverage the capacity of cities to harbour ecosystems (Peltoniemi & Vuori, 2004), in which private companies, NGOs, city administrations and citizens can work together on innovation projects and processes. Designscapes intends to build on the generative potential of these environments by implementing a service that (1) selects a number of promising ideas and projects from various European cities, (2) provides them with some direct funding and (3) supports them with mentoring and coaching activities on how to use design approaches and methods. The idea is that Designscapes could accompany local stakeholders through a 'change journey', in which they fully realize the potential of design to support their innovation projects and processes. Service design was, therefore, a key approach used to model and implement this change journey and to understand how the service provided by Designscapes could support it.

The visuals

The figure below was the second Theory of Change map, the first being highly technical and not clearly distinguishing the key stages of the programme. Because the previous Theory of Change map did not present an easily understandable picture of its critical features, it remained unclear how the stages of the programme would work in practice and the critical points along the pathway. Figure 2 shows an alternative, streamlined way of constructing Theory of Change maps, with less detail whilst retaining the overall meaning. Mayne and Johnson suggest that in some cases simplification of a Theory of Change may be needed because "for many interventions, displaying all of the elements of their [Theory of Change] in a single diagram can be cumbersome, resulting in a too complex diagram of arrows and boxes" (Mayne and Johnson, 2015, p. 415).

Figure 2 focuses on the assumptions and risks between each causal link. The greatest amount of text concerns assumptions, which highlight the intrinsic frailty of a programme and the number of internal/external conditions that need to be attended to in order to achieve outcomes. The lack of detail in the 10 central boxes means the map has limited utility as a signpost for implementing the strategy. Instead, the sparse writing emphasises the intended pathways the project may progress along and the critical dependencies between each step.

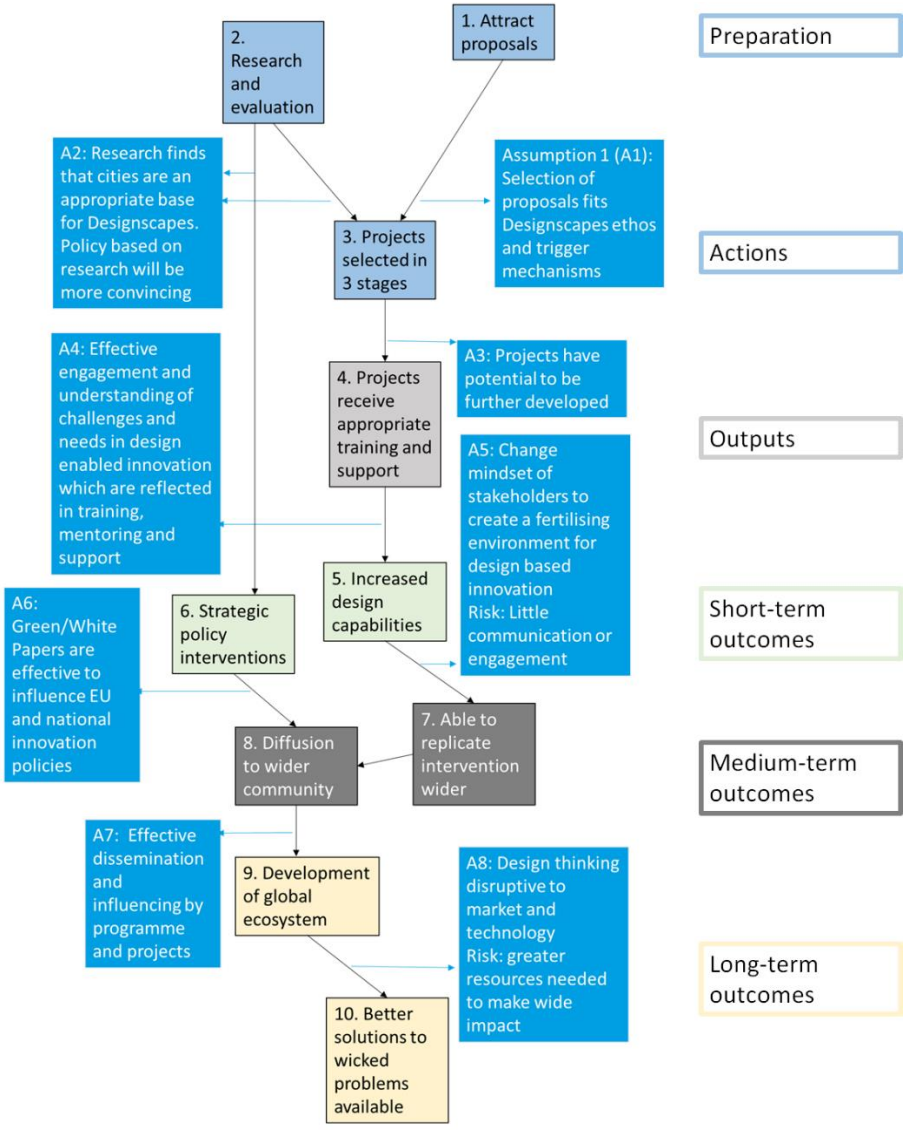

Fig. 2 Theory of Change map from Designscapes

4. Discussion

The two cases examined in this paper show that visual mapping may have substantially different instantiations and this in turn, can have different implications on how Theory of Change can be used to address action and generate meaningful change. Rather than being designed by a single person, these maps can also emerge from negotiation and collective sense-making processes that might involve different project stakeholders. Indeed, the tool can be used as a way to engage stakeholders in granular conversations about key aspects of a project: its broad vision, its goals and its strategy to meet these goals. The use of this tool does not require professional visualisation capabilities from those in charge of producing or contributing to a Theory of Change map; however, the following considerations could clarify the characteristics of different visual choices and highlight their potentials and shortcomings.

4.1 Visual analysis

Figure 1 was intended to (a) display the responsibilities of different partners, (b) emphasise the complexity of the system design and (c) raise awareness of the difficulties and considerations that would be involved. Conversely, Figure 2 was designed as a way of making the Designscapes programme more understandable to project insiders and highlight the key risks and links in the service design. Given this, table 1 examines some key visual aspects of the two different representations of the Theory of Change.

Table 1. Key visual aspects of the two different representations of the Theory of Change

Visual aspect	How it is implemented in the Smart Metering Early Learning Project (Fig. 1)	How it is implemented in Designscapes (Fig. 2)
Directionality	Theory of Change is here represented as ramified and multidirectional. Rather than proposing a single linear pathway, this Theory of Change - with its spatially distributed connections - proposes a sort of map that can be navigated in different ways	The Theory of Change is here implemented as a vertical and somewhat linear progression
Temporal dimension	Multiple concurrent causal links, with elements connected by multidirectional arrows, which also trace loops. Steps are not only progressive but they can also be simultaneous	Predefined sequence of steps, few of them in parallel
Spatial distribution	Theory of Change is plotted against a grid composed of three rows (levels) and five columns. However, the visual elements of the Theory of Change are also positioned in between rows and columns and categories. The grid is quite permeable. The high density of connections and	Even though, at times, concurrent steps are horizontally displayed (e.g. step 7 and step 8), a vertical linearity still remains the key

	ramifications among the elements of this Theory of Change is another striking aspect	aspect in terms of spatial distribution
Use of colour	A kaleidoscope of colours is used to signal different levels (microsytem, mesosystem and exosystem) and the interaction of various stakeholders for each activity	Colours are used to distinguish the assumptions from the steps and the steps among each other, roughly in line with the usual steps in a Theory of Change

4.2 Potential and shortcomings of these visual representations to identify and represent underlying logics of service design interventions

Table 2 summarizes the underlying logic behind the two projects.

Table 2. Underlying logic of both projects

Underlying logic of the Smart Metering Early Learning Project (Fig. 1)	Underlying logic of Designscapes (Fig. 2)
Key change mechanisms are pinpointed as a series of key actions, which are strictly connected to a multistakeholder engagement process and which lead to some hoped-for changes in behaviour. The whole underlying logic behind this intervention is articulated across three levels (microsystem, mesosystem, exosystem)	A stripped-to-the-core sequence of steps is envisioned to reach the goal of Designscapes. The logic of this sequence rests on some key assumptions, also visualized in the Theory of Change. The sequence is the final representation of the key change mechanisms behind the project

Figure 2 proposes a streamlined version of the Theory of Change. In this visual representation, Theory of Change is stripped to its very core. On the one hand, this representation illustrates the key mechanisms that can ignite and support change in the Designscapes project and in its attempt to support city innovation across Europe. On the other, this representation strongly simplifies the logic behind the Designscapes design intervention and, in its attempt to reduce complexity and aid communication, takes out detail that might have a significant impact.

The ramified and multidirectional quality of Figure 1 seems to capture better the complexity of a social intervention like the one behind the Smart Metering Early Learning Project. Rather than reducing complexity, this figure fully elaborates it. The downside, as directly experienced by some of the authors of this paper, is that this type of visual representations can be difficult to interpret and understand if one is not used to working with Theory of Change. The richer use of design elements is likely to be beneficial to those who are

motivated to understand the map yet the complexity may deter less engaged stakeholders from interpreting the details.

It is interesting to connect these two representations to some wider reflections on how to plan and implement broad social changes like the ones tackled by Designscapes and Smart Metering Early Learning. From a viewpoint crossing various design disciplines, Friend and Hickling argued that key mechanisms behind large and complex urban and social interventions cannot be simply defined at the beginning of a project and through a top-down process, but rather they should emerge from "a continuous process: a process of choosing strategically through time" (Friend and Hickling 2012, p. 1). Their point is that long-term plans are actualized by day-to-day decisions and both plans and decisions are affected by pressure of urgency, competition for resources, turbulence and complexity in the world, cognitive and emotional overload, uncertainty and confusion, interorganizational and organizational conflict and all this can lead to "vacillation and inconsistency in the making of day-to-day decisions" (Friend and Hickling 2012, p. 4). To navigate this complexity, progress can take the form of choosing strategically over time: "intervening, or negotiating with others, […] taking decisions, […] investigations but also clarification of values and cultivation of working relationships with other decision-makers" (Friend and Hickling 2012, p. 4). Against these theoretical reflections, the two visual representations of Theory of Change are positioned quite differently. Figure 2 (Designscapes) aims at reducing uncertainty and simplifying complexity. It targets a more focused scope and adopts a more decisive approach in identifying clear key change mechanisms. As such, it can also be better understood by the various stakeholders who take part in the project and that are rarely all well versed in the theoretical and practical aspects of Theory of Change. Conversely, Figure 1 aims at accommodating uncertainty, elaborating complexity. It aims at a broader and synoptic scope and adopts a more exploratory approach, in which key change mechanisms are not so immediately highlighted and potentially also depend on the different pathways that such ramified visual representation of Theory of Change allows for. As such, Figure 1 remains more difficult to understand and interpret and is not immediately actionable as Figure 2.

5. Representing Theory of Change

The paper highlighted how the way in which the Theory of Change is visually represented can help render differently the underlying logic of service design projects. Within the broad community of theorists and practitioners working with Theory of Change, there is a great need to better understand how the deliberate use of varied visual elements while representing Theory of Change can improve the potential of this approach to pinpoint, represent and communicate key change mechanisms (Davies, 2018). As such, this paper shows how various visual aspects in two different representations of Theory of Change can help not only to identify key change mechanisms but also to position the whole underlying logic of the intervention in relation to two polarities: (1) choosing linearity, certainty and comprehensiveness or (2) embracing multidirectionality and complexity. Being aware that

Theory of Change allows for such a level of granularity can, hopefully, also encourage design researchers and practitioners to more closely look into the potential of Theory of Change as a method to identify and communicate the underlying logic of their service designs.

We acknowledge that the use of a limited number of cases can constrain the generalizability of the research implications. In addition, we are aware that we need to dig deeper into existing theoretical frameworks and constructs elaborated in visual studies and semiotics to provide a more solid grounding to our research. In its current, early stage, this paper also does not properly analyse how Theory of Change can be integrated with some specific methods, tools or processes of service design or how the two maps we examined emerged from the interactions and the negotiations among different stakeholders. We see this study as our first attempt to explore visual representations at the intersection of service design and Theory of Change. This is an area that could potentially be of great interest within design research and beyond.

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Acknowledgements: The research leading to this contribution has received funding from the European Union's H2020 Programme under Grant Agreement No. 763784. This article reflects the authors' views. The European Commission is not liable for its content and the use that may be made of the information contained herein.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The SDGs framework as strategic lever for design education.

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Abstract | Design and the creative economy have a responsibility in the realization of the UN Sustainable Development Goals, they are a powerful engine for the engagement of the general public, a vehicle for progressive values and a lever for the acknowledgement of the importance of culture and diversity. Culture is not a Goal within the framework of the SDGs, but has been embedded within the 2030 Agenda as a contributor to all of the goals. Design education needs an inner reflection on how it can translate the values of the SDGs into practical and ordinary actions, going beyond the curricula to embrace whole-institution and holistic life-cycle approaches whereby learning transcends the boundaries of formal training to extend to flexible community-based settings and informal everyday environments. The research sets the scenario of design education in connection to the SDGs, exploring the interdependent and interconnected system of relations of the creative economy.

KEYWORDS | SDGS, CREATIVE ECONOMY, DESIGN EDUCATION, SUSTAINABLE DEVELOPMENT

1. Introduction

Following a decision taken in 2012 at Rio+20 Conference on Sustainable Development, the Heads of State and Government participating in the UN Sustainable Development Summit in September 2015 unanimously adopted the document Transforming Our World: 2030 Agenda for Sustainable Development and 17 associated Sustainable Development Goals (SDGs). The decision has set the framework for "a supremely ambitious and transformational vision [...] of unprecedented scope and significance" (U.N. Desa, 2016).

The SDGs have raised the ambition, compared to the Millennium Development Goals (MDGs), and unveiled critical factors in the pursuit of sustainable development:

> "The SDGs need the identification of new critical pathways to sustainability. [...] The task is phenomenally complex [it] will; therefore, need the unprecedented mobilization of global knowledge operating across many sectors and regions. [...] Global problem-solving networks for sustainable development will; therefore become crucial new institutions in the years ahead. [...] The pathways to sustainable development will not be identified through a top-down approach, but through a highly energized era of networked problem solving that engages the world's universities, businesses, non-governmental organisations, governments, and especially young people, who should become the experts and leaders of a new and profoundly challenging era." (Sachs, 2012)

Sachs does not directly mention design; nonetheless, some of the arguments recall designers' domains, such as the identification of new critical pathways, the mobilisation of global knowledge sectors and disciplines, and highly energised problem-solving. No reference to the word design can be found in the 2030 Agenda either. Creative innovation, especially in the private business, is however, considered a crucial driver: "We call upon all businesses to apply their creativity and innovation to solving sustainable development challenges." (U.N. Desa, 2016)

Finally, Sachs' appeal to universities and to "young people, who should become the experts and leaders of a new and profoundly challenging era" position Design Education (DE), at the forefront of SDGs implementation.

The paper explores how DE disciplines and methods can be reconciled with the SDGs addressing four main issues:

1. How interconnected the SDGs framework is with design, culture, and the creative economy?
2. How are the SDGs entering design culture and creative economy practices?
3. How can the SDGs be reconciled with current thinking and actions of Higher Education (HE) and Design Education (DE) Institutions?
4. How is DE evolving to engage actively with the SDGs framework?

2. The overlooked connection of SDGs to design, culture, and creative economy. A review

2.1 The SDGs as a "Design Brief"

The design community reacted quickly to the publication of the SDGs. In November 2015, the Forward Thinking conference in Oslo focused on how to translate the SDGs into a useful framework for design and the Oslo Manifesto, "which asks designers to consider these honourable goals whenever they initiate a project, design a product, or accept a commission." (DMI Review staff, 2018), was published. The Manifesto defines the SDGs as "a Design Brief for the 21st Century" and states that "designers, architects, and creative professionals of the world have been handed a special and enormous responsibility, given to them by the 193 Heads of State. They must imagine and bring to life the design elements of a new, sustainable world — quickly." (The Oslo Manifesto, 2015)

A further challenge emerges in the Manifesto. Besides committing to responsibility, designers must go through "a process of life-long learning about what designs do, or do not, contribute to [...] the 2030 Agenda" (The Oslo Manifesto, 2015). A doubt is raised about the capacity of the design profession to understand what design can contribute to the SDGs. It recalls the idea that "Good design in itself does not necessarily produce sustainability outcomes" (Young, 2010). Designing for the SDGs implies addressing two entangled domains: the adoption of sustainable values and ethics in design practice, and the development of new design methods.

2.2 Culture, the creative economy, and the SDGs

The discussion about the connection between culture and sustainable development dates back to the early '70s (UNESCO, 1972) and the acknowledgment of its role in the promotion of sustainable development to the early '80s (UNESCO, 1982). The debate revamped with the 2030 Agenda when UNESCO urged that "a specific Goal focused on culture be included as part of the post-2015 UN development agenda, to be based on heritage, diversity, creativity and the transmission of knowledge." (UNESCO, 2013)

The 2030 Agenda document did not include the UNESCO suggestion. Culture was not listed within the 17 Goals. It is instead mentioned in one Target (11.4) dedicated to heritage under the Urban Goal (SDG11), and cultural issues are cited in other Goals: Quality Education (SDG4); Sustainable Economic Growth (SDG8); Sustainable Consumption and Production (SDG12); and Peaceful and Inclusive Societies (SDG16). The Future We Want Includes Culture campaign[1] criticized the exclusion, maintaining that the UN document "falls short of a full

[1] www.culture2015goal.net

understanding and affirmation of the importance of culture to sustainable development." (The Future We Want Includes Culture, 2015)

Indeed, the impact of culture and creative economy in the pursuit of the SDGs remains mostly implicit. In the Agenda, the word culture is only used with reference to the protection of "cultural difference," and no mention of creativity and creative economy is made. The exclusion of culture from the 17 SDGs has generated vagueness of operational references to culture in the SDGs, and the need for more systematic and operationalized understanding of the precise role and impact of culture and cultural industries on sustainable development (Hosagrahar, 2017).

The consideration of the monetary value of the cultural sectors by the UK Government policies in 1998 and 2000 (DCMS, 1998, 2000) led to a shift in terminology from cultural to creative industries and made the need for a better understanding urgent. Indeed, the reference to culture in SDGs 4, 8, 11, 12 and 16 paves the way to an extensive range of policies and programs encompassing both the culture's "significant non-monetary value that contributes to inclusive social development, to dialogue and understanding between peoples and generates merit to people-centred value." (SDG Fund, 2017) and its role as "one of the most rapidly growing sectors of the world economy, [...] a profoundly transformative one in terms of income generation, job creation, and export earnings." (SDG Fund, 2017)

Finally, further to the non-monetary and monetary value, a third impact of culture and creativity to sustainable development comes from the advertising, marketing, and innovative communications professionals "tremendous power to shape opinions" as UN Secretary-General Ban Ki-moon said when he called on advertising and creative communication professionals to create the "biggest-ever campaign for humanity" and to transform a complex and abstract agenda into "a personal and emotional story about how we can build a better world" (SDG Knowledge Hub, 2016). Despite this call to action, there are no specific guidelines or a blueprint yet about criteria for effective communication of the 2030 Agenda and the SDGs to all stakeholders (Mulholland, 2019).

3. SDGs and design education

> "The renewed attention to the purpose and relevance of education for human development and economic, social, and environmental sustainability is a defining feature of the SDG4 - Education 2030 Agenda. This is embedded in its holistic and humanistic vision, which contributes to a new model of development." (Education 2030: Incheon Declaration and Framework for Action, 2016)

Two years into the adoption of the 2030 Agenda, the Brussels Declaration (Global Education Meeting 2018) further acknowledged the centrality of education, training, life-long learning, higher education (HE) and research as key driving forces for sustainable development. Notably, in addition to being a specific goal and having direct implications on interlinked

SDGs, education is weaved through all of the goals and plays a structuring role in the "promotion of values of respect of life, dignity and cultural diversity" (Global Education Meeting 2018).

Within this context, HE has a privileged role in the process of building a culture for and of sustainable development and, in turn, a strong responsibility in the achievement of the 2030 Agenda. "Universities, with their broad remit around the creation and dissemination of knowledge and their unique position within society, have a critical role to play in the achievement of the SDGs. Arguably none of the SDGs will be achieved without this sector" (SDSN Australia/Pacific, 2017).

To reinforce the role of HE and consolidate the implementation of practices that collaboratively, rather than compartmentally, address the SDGs framework, a whole-institution approach will ensure cohesion and determine an appropriate basis for prioritising actions. In doing so, the SDGs targets can be addressing within and beyond the scope of the curricula - comprising research, leadership, governance and operations - engaging and activating the broader ecosystems of which academia is a part of. A transformational mind-shift in the acquisition, enhancement and application of interconnected knowledge, skills, values and attitudes, for an evolving world with ever-changing challenges. In other words, new models are for "learning throughout life to support the achievement of the SDGs" (Osman et al., 2017). Supplementing formal learning with community-based non-formal settings and informal daily life activities.

Governments, Ministries of Education and other bodies involved in education, training, and lifelong learning have developed umbrella initiatives or strategic action plans from the get-go of the adoption of the 2030 Agenda. Pending the assessment of results to date of such initiatives, the rising popularity of sustainable development is unquestionable.

The significance of the 2030 Agenda reinforced the discussion on sustainable development in terms of HE and DE, evidence to this should be given to the Kyoto Design Declaration of 2008. The Kyoto Declaration committed all members of the International Association of Universities and Colleges of Art, Design, and Media (Cumulus) "to share the global responsibility for building sustainable, human-centred, creative societies." The SDG Accord launched in 2017 by the Environmental Association for Universities and Colleges, and the growing number of dedicated national and international academic conferences, events, awards and networks have built upon the Kyoto declaration base.

In addition, the interest of the international ranking systems should also be noted - starting from the example of Times Higher Education (THE) University Impact Rankings that has introduced global performance tables assessing universities against the UN's Sustainable Development Goals on four main areas: teaching, research, outreach and stewardship (Ross,

2019) and that of UI Green-Metric World University Rankings that focuses on the condition and policies of universities in relation to Green Campus and Sustainability[2].

According to Irina Bokova (2012), former Director-General of UNESCO, "Education is the most powerful path to sustainability. Economic and technological solutions, political regulations, or financial incentives are not enough. We need a fundamental shift in the way we think and act."

Interdependence, growing of access and exposure to information, progress in globalization, and technology, to name but a few, "require creative and self-organized action because the complexity of the situation surpasses basic problem-solving processes" (UNESCO, 2017).

The concept is reinforced by the World Bank (2019) that identifies three types of primary skills for the evolving world: "advanced cognitive skills such as complex problem-solving, socio-behavioural skills such as teamwork, and skill combinations that are predictive of adaptability such as reasoning and self-efficacy." The World Bank report adds that the "combination of specific cognitive skills (critical thinking and problem-solving) and socio-behavioural skills (creativity and curiosity) is transferable across jobs" (World Bank, 2019). The relevance and cross-cutting nature of system thinking, critical thinking, collaboration, strategic innovation and anticipatory competencies are essential to deal with the increasing complexity and uncertainty and advance towards the implementation of sustainable development. (UNESCO, 2017)

The processes to achieve the interconnected and interdependent goals SDGs is linked to creativity and so much that

> "Creative intelligence has become a new form of cultural literacy which harnesses the power to create, connect, and inspire. Creativity and artistic expressions provide energy and inspiration as well as empowerment. Design is a key dimension of creativity and a major component of culture. Increasingly, design has become a channel to achieve transformation and integration of scientific and technological achievements, including infrastructure development and digitised manufacturing and production." (d'Orville, 2019)

A striking example of the use of design for innovation across sectors is the rise in the popularity of design thinking. An approach that could be said has now become "customary," fostering the appropriation of its methods and tools by other sectors and practitioners [3]. Jon Kolko (2015) states that:

> "Design thinking, first used to make physical objects, is increasingly being applied to complex, intangible issues, such as how a customer experiences a service. Regardless of the context, design thinkers tend to use physical models, also known as design

[2] Without entering into the merits or mechanisms of such systems.

[3] E.g. design today is taught in business schools, including London School of Economics, Harvard, Bocconi and INSEAD.

> artefacts, to explore, define, and communicate. Those models [...] add a fluid dimension to the exploration of complexity, allowing for nonlinear thought when tackling nonlinear problems."

Addressing the more recent development of design in response to the critical issues of sustainability Ceschin & Gaziulusoy evidence particularly design for social innovation, systemic design and design for system innovations and transitions approach. Notwithstanding the problems that still need to be resolved in terms of broad-scale implementation and effectiveness, it can be said that Design for Sustainability (DfS) has:

> "Progressively expanded from single products to complex systems. [...] the first approaches have been focusing predominantly on the technical aspects of sustainability, the following ones have recognised the crucial importance of the role of users, resilience of communities, and more in general of the various actors and dynamics in socio-technical systems. Similarly, the sustainability focus of the various approaches has gradually expanded. The earlier approaches [...] deal with the environmental aspects of sustainability. Moving on, aspects such as labour conditions, poverty alleviation, integration of weak and marginalised people, social cohesion, democratic empowerment of citizens and in the general quality of life, have been increasingly integrated [...]" (Ceschin & Gaziulusoy, 2016).

Skene & Malcolm (2019) put forward the concept that design has the power to sustain and to destroy. Schmidt and Donnert (as cited in Spangenberg et al., 2010) warn that: "Everything was fine in the ancient past. Nature produced no embarrassing shapes and colours; humans were busy struggling for survival and had no time to decorate their first wedges with scrolls. Everything was fine because in the ancient past there were no designers."

This warning reminds us that there can be good and bad design in terms of sustainability and that design in a vacuum is more likely to work against a sustainable planet. Setting design within an ecological context has the potential to provide transformative outcomes for society and the environment (Spirm, 2014). The authors go on to say:

> "Nurturing a systemic lens that is not simply human-centric can influence the direction of a project, resulting in a solution based on mutualism. The SDGs should matter to designers on many levels. [...], for the design student, it surely must be a priority to be familiar with the SDGs and be comfortable integrating them within the design process at both perceptual (Lakoff & Johnson,1999) and conceptual (Bernstein et al., 2010) levels."

4. SDGS framework adoption in practices, cases and examples

4.1 SDGs framework adoption in the creative economy

The SDGs framework has gained a primary role in non-financial business reporting. An influential initiative is the incorporation of SDGs in the last release of the GRI (Global

Reporting Initiative) standard, the most widespread in industry and service sectors. The majority (72%) of the companies surveyed by PWC (2018) mention the SDGs in their non-financial reporting. The share is even higher in the Technology, Telecom and Media group of industries (78%), in Energy and Utilities (78%) and Retail and consumer goods (74%). The research analysed the case of three sectors: Fashion, Food and Telecom that are a significant "landing place" for design students.

Fashion. Two large companies were analysed: Hugo Boss and Luxottica. Both have firmly integrated the SDGs as part of sustainability reporting, identifying SDGs as the "inspiration" of the company' sustainability strategy. Priority SDGs are selected in both cases. Further to product&processes related SDGs, the priority list also includes SDG 3 (Health), 4 (Quality Education), 5 (Gender Equality, Innovation & Infrastructure), 10 (Reduced Inequalities), 16 (Peace), 17 (Partnership), with specific targets. The connections with design range from product, to packaging, to R&S and consumer experience and satisfaction.

Food. One large and one medium-sized company were analysed: Ferrero and Illy Caffé that show a divergent approach to the SDGs as part of sustainability reporting. On the one hand, Ferrero, following a tight GRI standard scheme, sees the SDGs as a classification framework for the company's sustainability actions; on the other hand, for Illy Caffé, the SDGs are a source of inspiration to design company strategy. The different attitude is reflected in the SDGs prioritization model, with Ferrero considering all the SDGs and Illy Caffé making a tighter selection (9 goals) and, based on the CSR report analysis only, gives a different perspective on relationships between design and SDGs, more related to Corporate Identity and problem-solving with Illy Caffé; more traditional with Ferrero.

Telecom. Two leaders in the industry have been analysed: TIM the largest telecom provider in Italy and WIND-3, the third provider of mobile services in Italy. The two companies show a divergent approach to SDGs as part of sustainability reporting, TIM follows a GRI standard scheme, SDGs are a framework for the company' sustainability actions. WIND takes a different route, providing a report dedicated to SDGs that details the SDGs challenges for the sector with an emphasis on the new competencies for a SDGs-oriented scenario that ranks at the first place Complex Problem Solving, at the second Critical Thinking and the third Creativity, all tightly interwoven with design. On the one hand, TIM's approach is focused and accountable; on the other WIND's witnesses the need for a rethinking of companies' targets and competences.

4.2 SDGs framework adoption in HE

Sustainability has found its way into HE and DE; in some disciplines, sustainability was even perceived as a critique to the foundation of the education framework. Nonetheless, while the adoption of the globally recognized SDGs framework can facilitate HE to fulfil its social missions and core functions (Hsieh, 2020) in the advancement of sustainability and sustainable development, the actual and practical adoption of the SDGs framework in HE

and DE remains scattered and has yet to receive an encompassing review. A few examples of the directions put forward above in section 3 can be picked and highlighted.

An example of whole institution approach that uses the SDGs framework as driver for HE activities comes from the **University of Bologna (UNIBO)**. The UNIBO has integrated the SDGs into its mission and strategy since 2016, and adopted a set of metrics to monitor, evaluate, and document progress and impact cross-referencing each SDG against the teaching, research, third mission and institution sphere of the university. A dedicated UNIBO website collects and makes available information and reports on the results of activities with specific reference to the SDGs framework. The website interfaces with two more focused sites, one of the sustainable multi-campus project and one on the virtual coordination structure for cooperation development and engagement initiatives.

The role of DE in transformational mind-shift towards sustainable development that leverages on design culture as initiator and facilitator of awareness building and active engagement finds expression in the **Global Goals Jam (GGJ)** launched by the Digital Society School of the Amsterdam University of Applied Science and the UNDP. The GGJ is a two-day event during which diverse teams of people from all walks-of-life engage with the SDGs through design methods and tools. Key elements of the initiative are interdisciplinarity led by design, grounding the SDGs through a tangible local perspective, sharing of knowledge and experience between GGJ stakeholders, broadening awareness on sustainable development and the value of individual and collective action.

The University of Bergen (UiB) shows how the SDGs can provide a guidance to review and favour the evolution of sustainability culture and sustainable techniques in the study programs. The SDGs Bergen Initiative is built on four primary activities, amongst which the working group Utdanning (Education) 2030. The objective is to integrate within university education SDG-oriented tasks. An internal report has set recommendations on sustainable development and sustainability integration in research, education, and training across the institution, considering multi-disciplinarity and sustainability-focused study programs. Moreover, UiB offers SDG-specific courses within its undergraduate and research school programming. The direct engagement of students in SDG-related activities is highlighted as a critical component of the initiative.

The Impact Through Design. Sustainable Development Goals and Societal Challenges project addresses the issue of applied research in DE, with the objective of defining a systemic proposal for social impact through design, with a focus on the achievement of the SDGs. The project, co-produced by SocialFare and Elisava, gave way to an international Open Talk Series, events, working tables and discussion forums, providing multi-layered and transnational perspectives on the impact design can have on society and the 2030 Agenda.

5. Conclusions

The 2030 Agenda fosters the recognition of design, culture, and the creative economy's direct impact on the SDGs and their role as drivers for sustainable development, engines for the engagement of the general public, and vehicles for progressive values. Contextually, a self-reflection has begun about the changes that the 2030 Agenda vision is triggering in design disciplines. Nevertheless, the relationship between design, culture and creative economy and the SDGs is still far from being fully understood.

The industry examples show how the linkages between SDGs, design, and creative competencies, while on the rise of sector agendas, are still in a rethinking stage, with varying implementation models. The coexistence in the industry case studies of the SDGs as inspiration for problem-solving, complexity management and technical implementation of sustainable solutions solicits the reflection about the necessary coexistence of advanced cognitive skills and technical skills in design education.

Also, the SDGs emphasis on the need to protect "cultural difference" reminds us that design has always been linked to and enriched by local cultural heritage including the arts, the industrial and the crafts territorial fabric, and questions the appropriateness of a single "world design approach" to sustainable development.

DE needs to reason simultaneously in terms of whole-institution (the "design school"), holistic life-cycle approaches, and on the disciplinary boundaries (or non-boundaries) of academia and practice even beyond formal training.

The relationship between design education and the SDGs must be consolidated, yet no systemic analysis at local or global level has been found to validate their interconnection, neither in design curricula nor in a holistic whole-institution approach. Over time the meaning of design - the significance and relevance of the word itself - has expanded, and so have the disciplines it embodies; just consider the expansion beyond product, fashion, and graphic design and the developments that have not yet been foreseen. To this effect, when referring to DE in HE and its interpretations as "design school," a broad concept comprehensive of diverse disciplines, such as fashion, visual and digital arts, diverse applied models must be acknowledged.

The 2030 Agenda vision reinforces the shift toward a holistic approach, questioning the self-preferentiality that design schools and the design community have been found, at times, to indulge in. DE reflections on the SDGs are principally connected to methodologies for innovation, and thus curricula, with limited whole-institution processes observed instead in virtuous multi-disciplinary HE institutions.

6. Future research directions

To broaden and deepen understanding of how the SDGs can be reconciled with thinking and actions in design education, a multi-stakeholder approach should be pursued. The active involvement of companies, universities, design schools, creative professionals, and young people in a co-creating effort to identify tools capable of enhancing knowledge and synergies being an essential element of action.

Starting from the belief that sustainability is a transdisciplinary dimension, future research should:

1. focus on the evolution of design curricula, taking into consideration the dichotomy between sustainability-specific programs and cross-cutting content;
2. explore how transdisciplinarity reflects on traditional disciplines that are still linked to the industrial system;
3. develop life-cycle approaches to learning and innovation;
4. analyse how to improve the integration of the SDGs in the strategy of DE and the development strategy of the creative economy.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Tree and The Room: Co-Designing DIY WiFi Networks with Emergent Local Metaphors

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Abstract | The use of metaphor for communicating conceptual models of interactive systems has a well-documented history in Interaction Design. Although metaphors can primarily be understood as linguistic devices, designers incorporate them into the design process in order to make abstract ideas more concrete and tractable. In this paper we present two case studies where resident researchers worked with Greek village communities to explore potential uses of a "do-it-yourself" WiFi networking technology platform. Built using simple, low-cost Raspberry Pi computer hardware and specially developed, open-source software, this toolkit has the potential to enable hyper-local applications and services to be developed and maintained within a host community. During the co-design process, locally specific, spatial metaphors emerged - the tree and the room - that proved useful for collective sense-making. In this paper, we argue for the importance of foregrounding and supporting emergent design metaphors that are contextually meaningful within the local situation.

KEYWORDS | PARTICIPATORY DESIGN, CO-DESIGN, METAPHOR, WIFI NETWORKING

1. Introduction

This paper describes a pair of related design case studies that were undertaken during residential Test Labs situated in two villages in different areas of northern Greece; Kokkinopilos on Mount Olympus to the east, and Tsepelovo in the Zagori national park region, further to the west. These case studies are presented as examples where emergent, contextually specific and spatially oriented metaphors were influential in the progress and development of the installations. The paper begins with a description of the broader research programme and the motivations behind the case studies, and then presents a review of the literature addressing the use of metaphor in design. The two case studies are described, and the paper concludes with reflection and discussion of the ways that metaphors were influential in each case study process. This discussion then concludes with a summary of "implications for design", specifically some recommendations for approaching "in-the-wild", co-design projects with an awareness of the potential of metaphor as a design resource.

2. DIY WiFi networks "in the wild"

The two case studies presented in this paper were carried out as part of a larger research project called MAZI that was investigating the creation of grassroots WiFi communication networks, including the software applications and local services that can be built around them. Central to the aims of the project is the dissemination of low-cost, easily accessible "Do-It-Yourself" (DIY) networking technologies that enable participatory experimentation and co-design within local communities. The vision is that these technologies could support collective action and creativity, enhancing the possibilities for social life.

This approach to Do-It-Yourself community networking technology combines low-cost hardware with open source software applications. Within the research project, wireless networks were built using Raspberry Pi computers incorporating suites of specially adapted applications available to the user via a browser on their own laptop, mobile device or smartphone (figure 1).



Figure 1: an early version of the WiFi network zone in an outdoor location, including the Raspberry Pi computer and battery.

The toolkit itself is designed to be expandable in the future in order to incorporate a range of open source applications to meet demand, and there are online collaborative resources, including a presence on the GitHub software development platform, to support this ongoing development. At the time of writing, the toolkit includes applications for collaborative note taking and editing, photo and file sharing, website building, and creating polls and surveys.

This approach is not intended as a way to replace the more conventional and widespread Internet infrastructure, rather it is intended to be complementary. An appropriate analogy here might compare industrial scale agriculture to organic urban gardens. They each have different purposes and operate at different scales, but both can have a place within the wider ecosystem of food production. There is growing evidence of interest in developing local community networks, both in response to the perception of possible downsides of global scale networks, and also due to their potential as tools for community engagement, hyper-local knowledge sharing and supporting social cohesion (Davies & Gaved, 2017). The research undertaken within this project is exploring how DIY WiFi network technologies can be adopted by citizens as part of a move towards the "right to the hybrid city" (Antoniadis & Apostol, 2014). This idea that '"doing things locally" is an element of the Internet's future, not its past' (Antoniadis, 2018) is central to this approach. The overall aims of the research project are to make this technology better understood and more easily deployed, and to design and develop a freely available software and hardware toolkit. In this way, the toolkit can enable citizens and communities to build their own local WiFi networks for facilitating hybrid virtual and physical social interactions.

The case studies presented in this paper used early versions of the toolkit "in the wild", exposing the working prototypes and collections of applications to people in real-world situations within communities that represent the intended end users. This approach to design research draws from the anthropologically informed methods popularized by Suchman (1987) and others, and it places importance on understanding new technology interventions within everyday life, rather than working away from the setting, within the

researchers' own usability and user experience (UX) design labs. The term "in-the-wild" here refers to "carrying out *in-situ* development and engagement, sampling experiences, and probing people in their homes and on the streets." (Rogers & Marshall, 2017)

The insights and knowledge gained during this process were fed back to the technical developers of the toolkit, located in a research institution.

3. Metaphors in Design

In everyday language practice metaphors are widely used and their function is well understood. On the surface, the metaphor is a seemingly simple concept, although a comprehensive definition can be rather difficult to pin down. According to Lakoff and Johnson (2003), a metaphor is more than a linguistic or literary device used to express "one kind of thing in terms of another". Linguistic metaphors work, they claim, because the way that humans actually think about abstract concepts - the cognitive process - is largely metaphorical. As Underhill (2018) claims; "metaphor is fundamental to conceptual thought".

Metaphors are useful, possibly even essential, in order to communicate ideas between people, and this process is helpful precisely because people tend to think in a metaphorical way often without even being fully aware of this process. As stated by Lakoff and Johnson (2003), "metaphor is pervasive in everyday life, not just in language but in thought and action".

The metaphors we use to describe the world form and shape our understanding of it. As physical beings, our primary experience of the world is phenomenological, that is to say it relates to how we experience - first hand and in a sensory way - the physical things that surround us (Merleau-Ponty, 1962). Although phenomenology as an academic discipline is concerned with the study of subjective conscious experience it is clear that, from a practical perspective as humans, how we each experience the world is sufficiently similar that metaphors are useful and natural tactics to structure and communicate ideas and concepts. Lakoff and Johnson (2003) consider that the primary function of metaphor is understanding, building on the work of Richards (1936) who characterised metaphors as comprising of a tenor and a vehicle, where tenor is the underlying idea of principal subject and vehicle is the secondary subject which provides a figurative description of the tenor. For example, the ship (tenor) parted the waves like a plough (vehicle). The work reported in this paper has a particular focus on conversations that take place early in the design process. Typically, "design dialogues" at this stage are ill formed and fragmented as participants seek clarity both as individuals and as a group. The use of metaphor is an important conceptual tool where the tenor is intended to provide a domain specific anchor for participants, while vehicle definitions should come from sources that are commonly shared and accessible.

Bridging concepts can be useful for supporting shared understandings during the design process. They are similar to Schön's idea of generative metaphors which he characterises as

the carrying over of frames or perspectives from one domain to another (Schön, 1979). In design situations, Cross (1996) considers the role of language in forming bridges between problems and solutions, rather than leaping straight to a creative solution. To illustrate this point, during a study of a group trying to design a device for carrying a hiker's backpack on a mountain bike, Cross (1996) reported the impact of a single phrase, in this case "tray", and how it influenced the remainder of the design process. The concept of a tray acted as a bridge that lead to the revealing of novel solutions. This example resonates with the ideas around the role of language and its influence on the design process during the case studies that will be discussed in this paper.

The work of Frank and von Sommaruga Howard (2010) further explores the role of dialogue in design and they emphasise the importance of creating a conversation between designer and client that is both open-ended but that critically also allows for the possibility of new knowledge to be generated. While the focus of their research is primarily designer to client or designer to designer conversations, the aspirations are just as relevant to co-design practice where these roles could be represented by different stakeholders and actors, for example end-users, design researchers and organisational representatives. The dialogue that emerges from such interactions takes the form of a shared enquiry, where language and artefacts promote a way of thinking and reflection by a group, and the individuals that comprise the group. When discussing the importance of language during design meetings, Frank and von Sommaruga Howard argue that "language does not just accompany design, it is a constituent of design." Language is a part of the "doing" (designing) and the thing "done" (the designed work) (Dong, 2007).

4 . The Test Labs and the case studies

The lead partners in the two case studies were part of a non-profit organization, unMonastery described as "a social clinic for the future". The organization carries out place-based social innovations, aimed at addressing the interlinked needs of empty space, unemployment and depleting social services by embedding committed, skilled individuals within communities that could benefit from their presence.

In the paper we use the term "Test Labs" to refer to the residencies within each village. This is the term used by the resident researchers themselves to refer to their projects. The term "case studies" has a narrower scope and refers specifically to the design instances or examples discussed in more detail in this paper.

4.1 Interdisciplinarity "insider" researchers

For clarity, in this paper, we use the term "researchers" as an inclusive term to refer to the people who were resident in the case study Test Labs, and we also use the term to refer to members of the other organisations who were part of the wider collaborative project, some

of whom visited the Test Labs and were involved in the work in a more indirect way. The resident researchers sometimes described themselves as “insider researchers”, immersing themselves into the life of the village during their residencies. This approach resonates strongly with the research “in-the-wild” approach mentioned in Section 2 earlier in this paper.

4.2 The case studies

The two related case studies presented here were carried out in villages in northern Greece, each in a distinct area of the country, Kokkinopilos and Tsepelovo in the Zagori national park region. The Kokkinopilos case study took place over three visits of around two to four weeks each, while the Tsepelovo case study, the last in the timeline, comprised of one longer residential visit of nearly three months. In addition, researchers carried out various scoping and preparatory visits before the Test Labs were established and the design case studies took place.

4.3 Background and preparatory work

The Test Lab in Kokkinopilos was the first to be established and was selected after initial scoping visits revealed particular issues regarding the lack of internet access. Later visits identified a suitable vacant building in the village to house the Test Lab. This location became the primary focus for the lab in these early stages. However, a secondary location was also considered in the west side of the Greek mainland, centring around the town of Ioannina.

5. Case study 1: Kokkinopilos village

Kokkinopilos is a small mountain village, part of the Elassona municipality in the mainland of Greece, sited high on the slopes of the Olympus mountain range (figure 2a). Although this mountain region is popular with summer tourists, particularly the coastal side, Kokkinopilos is situated on the inland slopes of the mountain range, is less well known and can be difficult to access. The population is in the low hundreds, but the numbers fluctuate widely according to the seasons, with a very reduced population of mainly older people in residence during the winter months.



Figures 2 (a) Kokkinopilos village and (b) disused school building

In the early months of the Test Lab in 2016, a small, but constantly changing team made several visits to the village of Kokkinopilos engaging in relationship building and collaborative planning activities, often taking place in the social environment of one of the local tavernas. The primary aim at this stage was to build a trusting relationship which could become the ground for mutually beneficial collaboration. The unMonastery researchers expressed a wish to use the disused village school building (figure 2b) as an experimental co-living, co-working Test Lab. In exchange for the use of the building, an offer was made to do something for the village. This way of presenting the group not as *problem-solvers*, but as *a group with a need* was important to set the tone of the negotiations.

These taverna conversations revealed some desires among the villagers around the development of tourism within the area, without losing the particular atmosphere and serenity of the place. Specifically, mapping of the cultural sites was discussed, including the archaeology, the churches and water springs, and also to collect stories. These requirements came from expressions of the need to; increase the economic sustainability of the area, to enable the village to evolve for the future, and to capture existing knowledge. These perceived needs were a response to the concerns about the impact of the younger generations moving away to urban areas and the seasonal variations in agricultural life. Very specifically and concretely, the villagers asked for a website for the village, both in Greek and English.

5.1 The emergence of the Room metaphor: from digital to analogue

One of the concepts that was chosen to be developed was an archive of local knowledge to be kept in the village and accessed by visitors via the local WiFi network. This would be hosted on a MAZI zone built on Raspberry Pi computers supplied by the researchers.

Some of the resident researchers were particularly inspired by the approach of pretotyping; the stage that sits between abstract ideas and "proper prototypes" (Savoia, 2011). The pretotyping approach has the aim of informing *what* to build rather than focusing on *how* to build it. It focuses on testing ideas by building simple versions or mockups to test their acceptance by the intended user group. Pretotypes are intended to be even simpler, and used earlier in the design process, than the more familiar low-fidelity prototypes, and rather than being used to explore functionality or features, they have the single aim of investigating whether the concept should be built at all. The pretotyping approach was appealing in the highly exploratory context of the village Test Lab, and it informed the discussion between researchers.

This enabled the researchers and villagers to continue to collect material and have conversations about what to make available on the internet and what to keep on the local network. One of the classrooms in the schoolhouse was transformed into a walk-in analogue "network zone". This became a place for people to contribute and to collate thoughts and knowledge; a physical archive in the form of a room.

The creation of a physical, tangible space helped the team to see their progress, and also helped the villagers to grasp what exactly they were working on. The whole collection of collated content was easily visible when entering and walking through the room, and items could be touched and handled, added to and annotated.

Each aspect of the content categories intended to be incorporated into the networked WiFi zone hosted on the Raspberry Pis was translated into an analogue version – a hand-made map (figures 3 a & b) was made to mark points of interest that were shared with the researchers. Notes and lists were made and filed under the appropriate heading on the wall. Recipes, water sources, stories, history – everything had its place. A printer was bought (which was donated to the village at the end of the residency) and photos were printed in order to start planning the website for the village. An analogue Guestbook (figure 4) was set up – a green board with chalk and a small book with pen, for messages. Scrapbooks were made and passed around so that villagers could easily contribute.



Figures 3 a & b: The map of the village

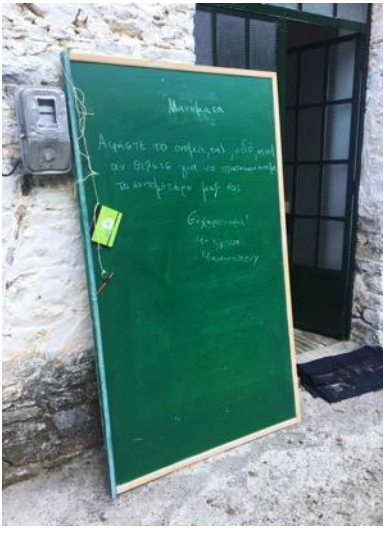
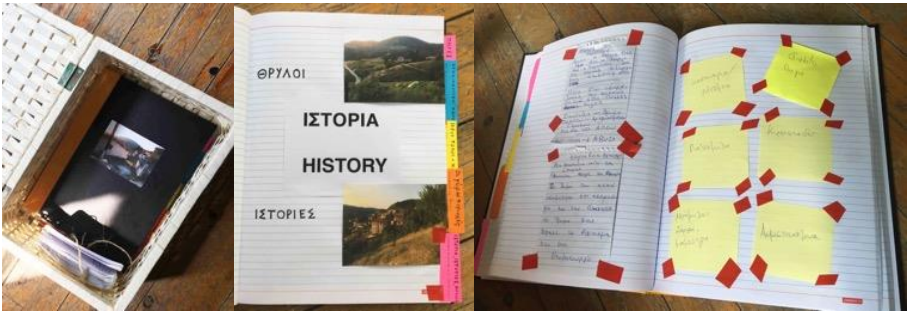


Figure 4: The analogue Guestbook

This analogue way of working continued for a couple of weeks, and it seemed to be positively received. The collections included; stories, history, water sources, recipes, artefacts (photos of), sacred locations, local idioms, Mount Olympus information, and local, medicinal plants. A local WiFi zone was created as a demonstrator through which the villagers could view the material that was proposed to include on the online website to be uploaded to the Internet.

At the end of the project, notes and photos were collated into a scrapbook and left for the village, along with files and photos on memory sticks (figures 5 a, b & c).



Figures 5 a, b & c: The scrapbooks

6. Case Study 2: Zagori Region and Tsepelovo village

The second Test Lab took place in Tsepelovo village, one of the Zagori region villages in the Pindus mountains of northwestern Greece. The nearest large town is Ioannina where people from the surrounding villages often migrate to, and even further to the capital, Athens. The surrounding mountainous villages are mostly populated by an older generation but in recent years there has been a noticeable desire for younger people to move to the villages mostly due to the beautiful natural surroundings they offer.

A building (figure 6a), in Tsepelovo village (figure 6b), owned by the Athens School of Fine Arts, was chosen as the residential hub of the Zagori region Test Lab. The building is mostly used in the summer months, and the Test Lab took place over a period of around two months duration late in the year (October to December) in 2017.



Figures 6: (a) The Zagori Test Lab building and (b) Tsepelovo village

6.1 Identifying needs

During the early scoping visits to the Zagori region, researchers identified a number of areas of action specifically in the mountainous regions. They discovered a desire to: build a community network; develop alternative tourism; archive local traditions and stories; create alternative forms of education; raise awareness of environmental concerns; and search for local resource sharing tools, including agricultural resources.

6.2 The Tree metaphor: the Platanos Provocation

Similar to the Kokkinopilos case study, one of the aims of the Test Lab was to develop a technological instance, installation or provocation in the village that would demonstrate the capabilities and possibilities of the DIY WiFi networking toolkit. Rather than bringing individual project examples to the village situation from outside, it was deemed important that the concept would be arrived at collaboratively with people living locally. From discussions during workshops, the idea of the "Platanos" emerged as an idea to raise awareness in the village of what was happening in the Test Lab building, and to try out the technology in-situ.

The plane tree, or platanos (figure 7a) in Greek is a permanent feature of many village squares, called the "plateia", in mainland Greece. The squares often include the village church and a water spring, and so the shade of the platanos provides a focal point for gatherings. People say that if the platanos could speak it could tell you everything about the village. It was decided to build a network zone around this concept in the main square of Tsepelovo, based around one of the applications of the toolkit, the Guestbook application.



Figures 7 (a) The Platanos in Tsepelovo village square and (b) the gathering in the village square

Early in the Test Lab residency a major village weekend event presented a good opportunity to interact with the extended community within the platanos square. This was the

commemoration of the Greek entry into the second world war and was acknowledged with a large gathering in the village square of residents and those who live elsewhere but who still consider the village to be their home (figure 7b).

The Platanos installation presented a Guestbook so that visitors could leave the Platanos tree a message during the gathering so that others could log in and see it. The installation was programmed and uploaded to the Raspberry Pi computing kit by the researchers during a process of collaborative learning about the technical aspects of the toolkit itself. Although the Guestbook was chosen to be fairly simple to understand and interact with, there were some deeper ideas influencing the overall concept, including ideas around collective decision making and decentralised democracy. Villagers could upload an image and type a short text message using their own mobile devices (figure 8). The presence of the installation network zone was promoted with posters around the village, and during the event itself the researchers were present, talking to the villagers, explaining the installation and encouraging the posting of messages to the Platanos tree. Some of the researchers were logged in as the Platanos tree's own profile, answering messages in the voice of the tree. The impression gained during the event was that people did enjoy the experience and the provocative nature of the concept opened up opportunities for discussions between the villagers and the researchers.



Figure 8: connecting to the Platanos Tree Guestbook

7. Discussion

The two case studies described in the paper illustrate the importance for the design process of identifying emergent, spatial, contextually relevant metaphors in the framing and communication of an early design concept. This was particularly important in this co-design project because of the situated, “in-the-wild” nature of the work. During a combination of collaboration, collective discourse and practical workshops in each of the Test Labs, the tangible metaphors emerged, and were further developed. These metaphors supported the identification of understandings and insights around the possibilities of the DIY WiFi networking technology. This shifted the emphasis somewhat away from early identification of concrete technological solutions, opening up wider discussions.

The visual, physical and spatial language of the two ideas, the room from Kokkinopilos and the tree from Tsepelovo, were demonstrated to be effective at communicating the affordances and conceptual models of the technology. Using the terminology of Richards (1936) as discussed in section 3, a metaphor is comprised of a tenor and vehicle pairing. In these studies, in each case the DIY WiFi network was the tenor, and the room and tree were the vehicles that described the purposes of the networks in terms that were meaningful in each local situation. Critically, these vehicles emerged from the co-design process and were grounded in the spatial context of each setting.

The room metaphor was developed as a creative response to a multi-layered situation and it provided a physical representation of the virtual DIY Network that was being developed – a hybrid network. The school room was a space that was familiar to the villagers, many of whom had been pupils there in previous years, and this encouraged a richer discussion about the nature and format of the village resources. The tree metaphor was more explicitly related to the everyday life of the village. The Platanos provides a canopy that enables the villagers to congregate and socialise. By creating a network that let villagers leave messages for the tree, and that gave a voice to the tree itself, the prototype built on the local myth that the Platanos knows all the secrets of the village.

To conclude, we propose two key lessons learnt from these case studies:

- Useful metaphors can emerge from the specific context: they should be grounded in the language of the local situation in order to enable shared meaning to occur. Designers and researchers should be alert to possibilities residing within the situation and must be sensitive about observing and listening to what the wider context could be communicating.

- The use of metaphors can support shared meaning through the framing of a need or problem, but they do not necessarily lead directly to solutions, their strength can lie in their power to provoke and to support discussion.

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Acknowledgements: The MAZI project (2016-2018) received funding from the European Union's Horizon 2020 ICT CAPS initiative under grant agreement no 687983

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Towards 'regenerative interior design': exploring a student project

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Abstract | Interior designers should design for regenerative systems in order to achieve advanced sustainability, beyond the current 'neutral' sustainable design approach. A broader and more positive regenerative design and development approach supports building social and natural capital within the new ecological paradigm. The interior design discipline has made little contribution to this agenda. This paper thus explores interior design strategies, which relate to regenerative design strategies, through a student project proactively implemented within the Interior Design department at the University of Derby, in an existing 3rd year module. A qualitative research design is used to analyse and code students' proposals, using a constructivist, grounded theory approach. The results present 'regenerative interior design strategies'. These varying strategies are used throughout the project, of which the most *grounded* tap into various social and environmental sustainability benefits. This can inform teaching about sustainability in interior design for a new ecological paradigm.

KEYWORDS | REGENERATIVE INTERIOR DESIGN, SUSTAINABLE INTERIOR DESIGN, INTERIOR DESIGN

1. Introduction

Interior design, as a built environment profession partly responsible for depleting the earth's resources, has the potential to also improve the environment. Within a new emerging ecological paradigm, an overarching concept of 'sustainability' includes using regenerative approaches, and an advanced hierarchical structure of benefits. While 'sustainable interior design' is well documented and researched, contributions to the regenerative design agenda are thin in both education and industry. This research aims to uncover some potential applications of regenerative strategies in an interior design project. The paper explains a proactive teaching strategy wherein the topic of regenerative design was introduced within a student interior design project called *VISION/MAQUETTE* (V/M) at the University of Derby, in an existing 3rd year module, in the 2019/2020 academic year. The objective of this paper is to explore interior design student strategies that link to regenerative strategies. This can provide insight into the ways in which the discipline can improve education about sustainability, and to improve its environmental efforts beyond the current neutral, tool-focused efforts.

After the introduction in the first section, the second section discusses sustainability, interior design strategies, the pro-active teaching strategy and student project. The third section presents the research design and method, followed by a fourth section that presents results and a discussion.

2. Background and review of literature

2.1 Sustainability in the new ecological paradigm

The new emerging ecological worldview is evolutionary, and comprised of living systems (Hes & Du Plessis, 2015). However, sustainability, as an overarching aspiration (Cole, 2012), is not being achieved with the current state of sustainable design, given its skewed sense of measurability and management. Non-integrative and flawed in its focus on the awarding of points, a new paradigm is needed that supports the advancement of the concept of sustainability.

Firstly, sustainability (see Figure 1) has a hierarchical structure that requires three, nested key ingredients (Fischer, et al, 2007), in place of the triple bottom line. As Fischer et al state:

> "Societies cannot exist without a functioning life-support system, and economies can only flourish within a functioning social system with effective institutions and governance structures." (2007, p.622)

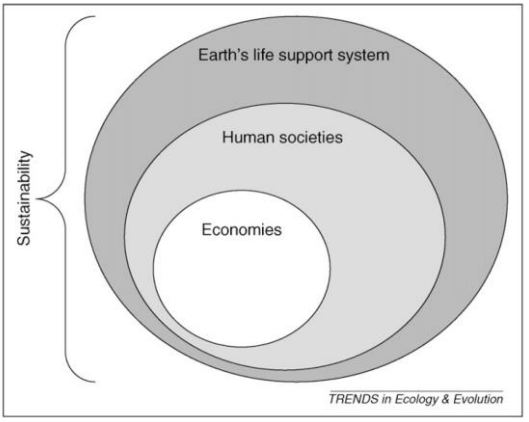

Figure 1. Three nested key ingredients to achieve sustainability (Fischer, et al, 2007, p.622).

Secondly, sustainability that acknowledges the importance of the environment necessitates a regenerating system. In such a system, positive development and regenerative design are key.

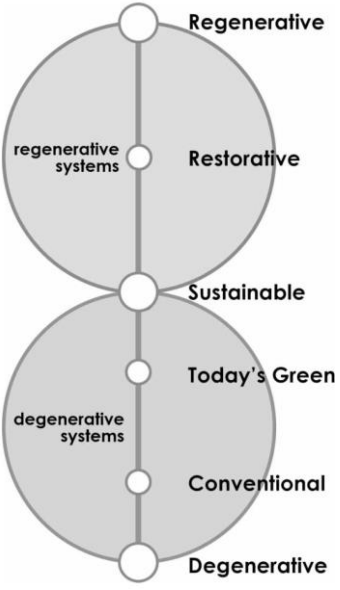

Figure 2. Degenerative and regenerative systems (Plaut, et al, 2012, p.114).

Positive development involves designing "…not just with, or like, nature, but for nature" (Hes & Du Plessis, 2015, p.93) and to "…leave nature better than it was before human settlement" (ibid, p.107). The "…caveat that the outcome should be net positive: more nature, more opportunity and more options" (Hes & Du Plessis, 2015, p.107).

Regenerative design, originally coined as designing regenerating landscapes, refers to a regenerative design and development methodology created by Regenesis (a professional interdisciplinary design team). Like positive development, regenerative design requires positive contributions that increase what existed before human development (Hes & Du Plessis, 2015). It is, however, broader than positive development, surpassing it in its aims for a "reconnection of human aspirations and activities with the evolution of natural systems – essentially co-evolution" (Mang & Reed, 2012, p.26). The concept of sustainability is impossible without regeneration: Figure 2 presents all these design approaches and the need for a regenerating system (Plaut, et al, 2012).

Interior design has long supported the need for energy conservation (Wahl and Baxter, 2008; Theodorson, 2014, p.37). However, links to positive development and regenerative design are less evident in this discipline, yet are clearly necessary, as it is an established profession that contributes greatly to the built environment, as well as to the degradation thereof.

2.2 Typical interior designer strategies

Interior designers have a specific role: to protect public "health, safety, and welfare" (Martin and Guerin, 2005, p.1; IFI, 2011). They make use of various tools and modes of production (Königk, 2010). Interior designers also design with and for human environmental needs, interior construction, codes and regulations, design, products and materials, professional practice, and communication (Martin and Guerin, 2005, p.52). Drawing from my own experience as an interior designer in industry, and from various sources (Kang 2007; Ballast 2010), interior designers in practice are expected to carry out a variety of tasks for a variety of projects. Some of these everyday interior designer practices (in the design stage alone) include: observing, interviewing, briefing, conceptualising, analysing, measuring, documenting, budgeting, using elements and principles of design, communicating, specifying materials, finishes and furnishings, evaluating products and details, drafting technical drawings, constructing models (digital or physical), understanding and applying building regulations, understanding building systems and services.

As the interior designers role continues to grow more complex (Guerin and Martin, 2004; Guerin and Martin, 2010), and require collaboration (Van Marrewijk, 2014; Theodorson, 2014), the discipline should look toward expanding its expertise, especially in the realm of protecting and benefiting the environment.

2.3 A pro-active teaching strategy and student project

An existing, 3rd year interior design module (6ID501 – Design: investigation and identity) supports a year-long major project which requires students to transform an existing space within a building of significance. The module had no explicit outcomes related to sustainability. This offered an opportunity to encourage students to design with more relevant social and environmental concerns, and less 'superficial' typologies for their major project. Therefore, an introductory project, called *VISION/MAQUETTE* (V/M), was inserted into the curriculum. The V/M project is influenced by my previous holistic teaching strategy (Di Monte-Milner, 2017) used at a previous institution.

This V/M project began with a questionnaire, issued to students in pre-project stage, to gauge their knowledge of the ecological paradigm, sustainability, and regenerative design. Thereafter, students were briefed, as part of a pre-design stage, to design a regenerative, spatial intervention (scaled model), as a bite-sized 'taster' of their upcoming, year-long major project. The intervention needed to: address a social and/or environmental issue; be placed within an inactive/underutilised space within their chosen site; be creative, and engaging; and use a regenerative design approach. It also needed to make use of multimodal forms of communication, to help present a popular and universally-accessible message or slogan. Students were then informed by myself and a supporting associate lecturer (whom I prepared), about the new, holistic ecological paradigm, and regenerative systems. Information was delivered via lectures, discussions, videos, and student-led group presentations. The design stage followed with one-on-one discussions in studio between student and facilitator, and a model-building, laser-cutting session in a workshop. Students submitted a digital presentation. In the final critique, each student presented a final scaled-model of their regenerative intervention.

3. Research design and methods

Situated in the constructivist paradigm, the study uses a qualitative research design, and is ontologically interpretive and epistemologically subjective. I present my own and the associate lecturer's research bias and self-reflection as facilitator. I have also had interest in the topic since embarking on a PhD in 2013. The aim is not to provide absolute truth, but valid truth. A constructivist, grounded theory (CGT) approach was used for content analysis, and coding was done inductively using NVivo™ software (computer-assisted qualitative data analysis software – CAQDAS). A non-linear approach was taken throughout coding so as to avoid forcing data into preconceived codes or categories (Charmaz, 2016).

3.1 The Data

The contextual data is comprised of documents related to the work of 12 students. Some students who took part are from one of the University's international partnering institutions

(HTBLVA Spengergasse). In order to comply, an ethical clearance procedure was followed, to adhere to the EU General Data Protection Regulation (GDPR). The data was gathered throughout the timeline of the V/M project, and is available upon request. Some of the data was prepared by myself, which is thus not raw data. The document types (termed by Charmaz, 2016) include:

- Elicited documents (8):
    - Questionnaires,
    - Questionnaire results (A) (only question 10 and 18 were coded).
- Diverse documents (12):
    - Studio discussions (B) recorded and scanned by author,
    - Final digital presentations (C) submitted online by students,
    - Photographs of the final submitted models (D), taken by the author,
    - Lecturers feedback (E) recorded and scanned,
    - Peer feedback (F) recorded and scanned.

Adding data that has multiple viewpoints is important in CGT to avoid forcing the data. Therefore, peer feedback (F) was also included as data to be coded.



Figure 3. Photographs of a selection of students' final models that were coded (Data D). Photos by author.

3.2 The research time line

The research process did not follow a pre-determined timeline or structure; instead, it inductively evolved as may happen in CGT (Charmaz, 2016).

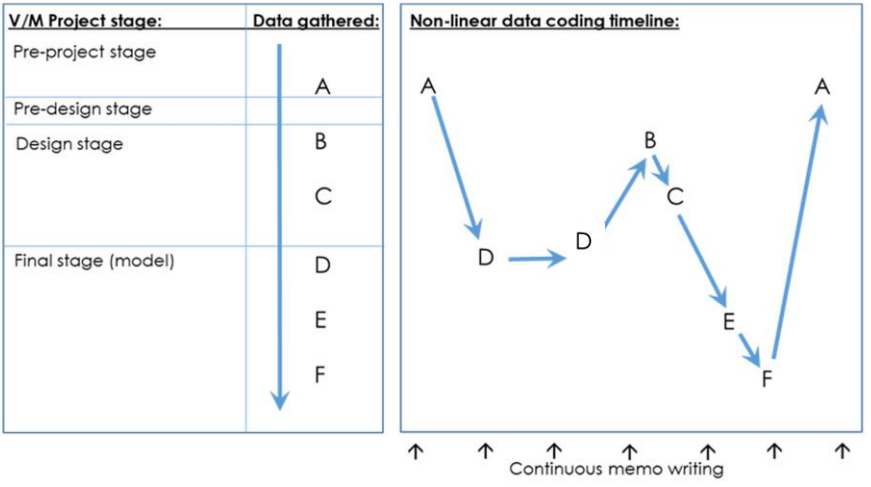

Figure 4. A timeline presenting both the events within the V/M project as well as the research programme (by author).

Although I acknowledge that my coding began with guiding interests (the lens of regenerative approaches based on previous literature I have read), these offered only some ideas for coding. Figure 4 illustrates that the process of coding was non-linear, and data was not coded in the order that it was gathered. Coding was instead iterative and cyclical (some data being coded twice at different stages of the timeline), ensuring that the data was not forced into pre-existing ideas from the literature.

A research journal (available upon request) includes a series of informal memos written throughout the project, which served as a method to clarify and generate codes and categories. These memos include eleven coding memos, three operational memos, and five analytical memos (which were also created in a non-linear order).

The coding method emerged as 'eclectic first-cycle coding' later on in the coding process, even though it never began as such. It initiated with coding of data A as a reflective exercise (to avoid coding into pre-existing categories). Initial coding of data D followed whereby I coded 'everything for everything' to avoid pre-existing ideas. Next, upon reflection, 'process coding' became more suitable for then coding data D, B, C, E, F, and A again. Process coding is coding using gerunds or action words (Saldana, 2016). The research objective was to determine design strategies/actions, so coding with gerunds seemed more appropriate.

Charmaz (2016) supports coding for actions using gerunds in CGT. Parent and child codes were used to make it easier to sort codes as they grew in number. Next, main categories emerged (e.g. wellbeing, senses and community were merged into one) and were raised to the level of focussed codes. Here, the main concerns became apparent. Finally, categories were discussed in terms of existing literature.

3.3 Delimitations

It is important to recognise that the students had already chosen their site and 'new use' for their major project before the academic year began. Introducing V/M in the beginning of the module was important, because, and as Bogenstätter states, decisions in "early design phases determine up to 80% of the environmental pollution" (2000, p.376).

The information about regenerative design that was delivered to students was based on a selected number of sources I had previously researched that were relevant to the topic. Students also co-creatively presented information to each other that they themselves found.

Some boundaries for the coding process were created. The quantities of the NVivo™ region percentages were not taken into account in this qualitative study when coding the photographs/images. No text was coded, and instead coding of regions was done due to the various types of sources that needed to be coded. Repeated references to the codes revealed 'groundedness', not frequency. It was also important to ignore repeated codes for field notes I had taken myself. Only repeats in the data compiled and presented by students were coded.

4. Results and discussion

In this section, the codes and categories are explained, and are followed by the resulting 'regenerative interior design strategies' used by the students (at different stages of the V/M project).

4.2 The codes

At first, I attempted to code any interior design strategy that I could see in the data (not just what I thought could be a 'regenerative interior design strategy'). For example, I coded what I saw in the data: *waste management*, or a *drawn gathering space*, or an *energy-generating element*. The amount of codes (representing strategies) grew considerably. It therefore became essential to group these codes (as child codes) within higher-order parent codes to make sense of the data. It then became appropriate that these parent codes reflect the stages of the V/M project:

- *Assuming* (a parent code in the pre-project phase);
    - Example of a child code: *waste management*.

- *Intending* (a parent code in the design stage)
    - Example of a child code: *gathering space*.
- *Designing* (a parent code in the final stage i.e. model).
    - Example of a child code: *energy-generating element.*

It is important to note that *intending* was further separated into *intending: initial* (data B) and *intending: final* (data C). This is because some codes represent students' design intentions, and not what they actually implemented in their final models.

It became obvious that child codes needed to reflect actions and so codes were renamed to gerunds, for e.g. *designing for waste management; designing a gathering space; designing with energy-generating elements*. The action/gerund *designing* used for all the child codes are a culmination of typical designers' tasks like specifying, drawing, analysing, technically resolving etc. These were presented earlier in the paper and emerged from my own industry experience and literature presented by Kang (2007) and Ballast (2010).

4.3 Emergent main categories

The action-type child-codes then totalled 178, and are available upon request. Those that were similar or significant were then raised (merged and renamed where necessary) into a total of 7 main categories (i.e. main strategies). Five of the seven main strategies fell in the parent *Assuming*; six in the parent *Intending*; and six in the parent *Designing*. Other unrelated strategies that were insignificant fell off.

The table below presents the five most significant of the main strategies, which I term 'regenerative interior design strategies'. They appear in bold, and in order of groundedness, in the table below. It is clear that different design strategies appear more grounded in some stages of the project than in others.

Table 1. Resulting main 'regenerative interior design strategies' in order of groundedness, with those most significant in bold.

V/M Project stage:	Data / Diverse documents:	Parent codes:	Main categories/strategies (out of many merged child-codes):
Pre-project stage	Data A	*Assuming*	***Designing for nett positive flora and nature***
			Designing to add value to existing
			NA unsure or not answered
			Designing to recycle reuse reduce
			Designing for and with communities
Pre-design stage	*N/A*	*N/A*	*N/A*
Design stage	Data B&C	*Intending: initial*	***Designing for and with communities***
		intending: final	***Designing to add value to existing***

			Designing for nett positive flora and nature
			Designing typologies
			Designing to recycle reuse reduce
			Designing with a regenerative design tool
Final stage	Data D, E, F	*Designing*	***Designing for and with communities***
			Designing to add value to existing
			Designing for nett positive flora and nature
			Designing to recycle reuse reduce
			Designing typologies
			Designing with a regenerative design tool

4.4 Discussion

This research uncovers a possibility of seven 'regenerative interior design strategies'. The five most significantly grounded of these are explained in order of significance below. It is important to note that the term '*designing'* is repeatedly used in the category and child code names. I use the term in this study to represent only some of Kang (2007) and Ballast's (2010) designer tasks, because it was a student project, and not an industry-related project. *Designing*, therefore, includes the act of researching, drawing, documenting, specifying, communicating etc.

Regenerative interior design strategy 1: Designing for and with communities

This main strategy is a consolidation of two strategies: *designing for wellbeing*, and *designing for and with communities*. Examples include designing for: the senses, spirituality, education, healing, mental health, physical wellbeing, a human-nature-connection, health and safety, comfort, interconnections, equity, accessibility, own voice, tolerance, respect, social activities, multi-cultures, future generations, local skills and art, and giving back to the community.

This category thus, in sum, is about designing for social benefits (see Figure 5), and is the most grounded of all five strategies. This supports the notion that interior designers "…shape spaces that shape the human experience" (IFI 2011). These strategies not only support design that is *for* society, but design *with* society. We know from research that for interior design to become regenerative, designers should focus on human issues (Sorrento quotes Ellison in her article, 2012, p.41; Pliess, 2011; Theodorson, 2014, p.37), because the occupants are emerging as key players responsible for the performance of buildings (Theodorson, 2014, p.42). Regenerative design also values the 'who' of a place through

design that can "continue to engage with the stakeholders long after the designers and builders have left" (Hes & Du Plessis, 2015, p.119). Because this main strategy further aims for designing to revive and re-value the community's skills and stories, it also promotes the regenerative ideal of designing for 'story of place'. The strategy of interconnecting people to a natural setting or 'place' also promotes co-evolutionary ideas. After all:

> "[h]umans are part of nature and as such have a contributive role to play in the health and evolution of the living systems of which they are part, continually participating as nature and developing the potential of both the system and its inhabitants." (Hes & Du Plessis, 2015, p.112)

Regenerative interior design strategy 2: Designing to add value to existing

This second most significant strategy represents: restoring, repurposing, improving the existing, adding uniqueness, or celebrating an existing building's uniqueness and character. Even though the major project already required students to reuse an existing building prior to this project, these strategies appeared to offer more than simply designing to reuse the existing.

In reviewing theory of regenerative design, this category can also link to 'story of place'. Revaluing existing stories about the place, and valuing uniqueness by improving a space, can help shape "relationships between people, the place in which they reside, [and] past and future generations" (Hes & Du Plessis, 2015, p.119). Understanding the existing site, evoking ownership of the site and ongoing learning and co-evolution of people and their place are important concepts in regenerative design. Although this category seems to respond mostly to the economic sphere of advanced sustainability modelling (see Figure 5), the added focus on stories means that the category straddles social and economic benefit.

Regenerative interior design strategy 3: Designing for nett positive, flora and nature

This strategy, initially called *designing for and with flora*, later merged with *designing inspired by nature,* as students referenced biomimicry and biophilic design. The strategy then also seemed to represent the use of energy-generating design, which reflects the nett positive contribution to natural resources synonymous with regenerative design.

A current trend in interior design is to add restorative natural settings in interiors to benefit occupants psychologically (Bringslimark, 2011, p.484. Interiors that use natural elements as positive distractions promote wellness (Ulrich, 1991, p.107), since "people particularly like to see natural contents" (Ulrich, 1993 in Bringslimark, 2011, p.470). This category can be positioned in the environmental sphere of improved sustainability (see Figure 5), while also benefitting society. This is most interesting, as it suggests the potential for interior design to not be solely for economic and social benefit, but for the environment that both of these exist within as well.

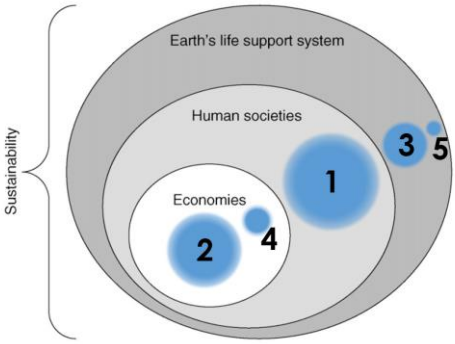

Figure 5. The proposed 'regenerative interior design strategies' (1-5) within an advanced model of sustainability (Fischer, et al, 2007, p.622, adapted by author).

Regenerative interior design strategy 4: Designing mixed typologies

This strategy – of designing for mixed typologies and spaces (like consumer, creation, consultation, educational, and commercial spaces) – did not seem to fit with any other aforementioned strategy. At first, it did not appear to be a regenerative design strategy, however, a design may have economic benefits if it includes a rich variety of spaces for an array of functions that benefit multiple users' needs. It adds on-going viability, which is an important element of designing for 'place as core' in regenerative design (Hes & Du Plessis, 2015, p.117). In contrast, design of unsuccessful or one-dimensional typologies will lead to more unused space and a wasted chance to generate any nett positive social or natural resources.

Regenerative interior design strategy 5: Designing to recycle, reuse, and reduce

This strategy includes using upcycled furniture, reusing waste, charity bins, recycled materials, waste and water management, and designing for multi-functional use. This mode of design aims to efficiently use and manage available materials and resources and benefits the environment in a similar way to the third strategy. If these two are then linked, this joined strategy would become the third most important category. This means interior designers can contribute to the environment even more than initially envisioned. Figure 5 presents this concept.

It is important to conclude that interior design students design with different strategies and at different stages of the project. They showed a better inclination to design for the environment at the beginning of the project, while designing for social benefit was most significant in the middle and end of the project.

4.5 Future recommendations

While the results obtained are useful, the number of participants was small, so the project can be repeated for further insight (a repeated project is already underway). These few student projects nonetheless offer some potential for developing 'regenerative interior design strategies' that can enable regenerative systems. This set of examples can be used to inform interior design students in future, and to promote the idea of designing for and with the environment throughout a project. It could further be beneficial to code these students' final projects at the end of the academic year, in order to see the extent to which they continued to use regenerative approaches. This could reveal further strategies, or uncover those that were never implemented in the end at all.
The project, however small, did include a mix of local and international partnering students. It could be interesting to study the differences in strategies used among these different cultures. A more collaborative student project could also have revealed even richer regenerative design strategies, and would have further supported Williams's (2012) idea that transdisciplinary approaches are key to designing regenerative places. As Williams notes, regenerative design has education and training challenges (2012), so this project can inform the way in which educators package whole/living systems thinking into existing curricula.

4.6 Limitations

This class was made up of a small number of students and participants, however the project was repeated in 2020 and is already being researched to offer further insight, because with this small data set, design strategies and responses cannot be generalised. These students have also not yet been fully employed as practising interior designers, so their design strategies are limited at this stage.
Students were also only shown specific information, which I am familiar with (having read about the topic since 2013), and the only nett positive regenerative design examples I was able to present to them were urban, landscape, architecture and product design examples. This could have influenced their own design strategies.
Furthermore, many students in the class are German-speaking, so although complicated jargon used in questionnaires and presentations was explained, at times concepts could have been misinterpreted. Regenerative design also presents some confusion in that it is a complex issue with no fixed steps to follow (Tainter, 2012).

5. Conclusions

Interior design needs to respond to the ecological paradigm of an advanced notion of sustainability by adopting regenerative approaches. Sustainable design is facing criticism. There is also little literature suggesting potentials for 'regenerative interior design'. A proactive, introductory V/M student project, inserted into an existing curriculum, uncovers some interior design strategies that can be used to design for regenerative systems (which is

finally proposed in this research as 'regenerative interior design strategies'). It also shows that students' strategies changed at different stages throughout the project. It also showed that there were five most grounded strategies, the most significant having social benefit. Some strategies did offer environmental benefit, suggesting that interior design can in fact also benefit the environment. These environment-focussed strategies were more significant at the beginning of the project however, and can offer insight into how the discipline can better teach and design for and with the environment, within the ecological paradigm. After the introduction in the first section, the second section presented sustainability in the ecological paradigm, followed by typical interior designer strategies, and the pro-active teaching strategy (where the student project was then described). The third section explained the research design and method, followed by a fourth section that presented results and a concluding discussion.

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Acknowledgements: Zachary Simpson (lecturer and researcher at the University of Johannesburg); Karen Winfield (associate lecturer in the studio); and all the University of Derby 3rd year interior design students who took part in this project between 2019 and 2020.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Trace: design and responsibility in the Prato textile distict

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Abstract | Nowadays customers expectations has changed and consumers have become much more conscious, demanding and always looking for transparent and traceable services and products. World fashion market is changing too, thanks to younger customers who share their experiences and needs through social networks and digital platforms: this developed a new critical approach to companies behavior, who are now asked to respond of their social and environmental responsibility. Unfortunately, despite their distribution, many of these platforms are not easily accessible. In this context, textile industry is one of the most articulated ones, appearing mixed and heterogeneous especially because of the presence of many companies and actors working in one of the longest supply chain of the manufacturing industry. Those reflections conducted to the design of a platform: Trace, that will provide clarity and guarantee the quality of Italian products throughout the supply chain.

KEYWORDS | ETHICAL FASHION, TEXTILE SUSTAINABILITY, TRACEABILITY, SUPPLY CHAIN, DESIGN MANAGEMENT

1. Introduction: the Prato textile district

Companies agglomeration in districts represents the primary vehicle of Italian manufacture international opening (Becattini 1998; Brusco, Paba 1997; Fortis 1998) also in the fashion sector. The Italian Fashion System is composed indeed of an archipelago of specialized territorial areas; this represents a unique wealth for industrial development opportunities.
It is possible to identify the textile-clothing sector in Italy in a strong fragmentation: there are local systems specialized in textile manufacturing activities, others in clothing, others in both. Companies operating in these local systems work together with mechanisms of exchange, generation, and reproduction of intangible resources such as knowledge or trust. (Becattini,2003; Becattini, 2015; Dei Ottati, 2005).
This research is rooted in the Prato textile district, which is composed of several companies dedicated to the processing and production of textile fibers. The Prato textile district has been assumed as an archetypal exemplification of Marshallian Industrial Districts' processes (Becattini, 2004). This is a particularly articulated reality in which different sectors coexist, including actors supporting the whole supply chain. All the peculiarities that qualify leading companies in the district seem to be as crucial as diversified in operating methods, technologies used, reference markets, and above all, the organization of the supply chain. Moreover, the presence of numerous actors makes this sector heterogeneous with one of the most extended and elaborate production chains.
Thus, the integrated and coordinated management in a supply chain represents a primary tool to ensure a winning service and to gain a competitive advantage through collaborative conduct and transparency, especially in an evolving market like fashion, with ever-higher levels of uncertainty and unpredictability.
This research was conducted according to two parallel axes: one leading to the historical link with the environmental sustainability of the district was carried out within the Datini archive located in Prato. The second is based on a field analysis within a sample of companies.
The analysis revealed that the coordination of the supply chain was often underestimated due to the lack of information shared between downstream and upstream companies. Moreover, the multiplication of competitive pressure requires companies to explore new areas for improvement within the individual company. The risk management shared between producer/distributor and shopkeeper resulted in being decided unequal.
Besides, the intense transformations undergone in the whole fashion sector is worth mentioning: it is possible to notice the growth of different consumption model generated by the social change. Examples can be found in growing attention to pollution and global warming issues lead by numerous campaigns such as "Fashion revolution" or the Greenpeace campaign "Detox my Fashion". The latter includes 80 worldwide companies committed in reduction of their environmental impact and use of chemicals in production processes. It is also noteworthy that among these 80 companies participating in the Detox campaign, 34 are in the Prato area, bringing out a deep-rooted awareness of the sustainability of the Prato textile district.
For decades we have witnessed the delocalization of production (mainly oriented towards the Asian continent), impacting significantly on the planet in terms of pollution and emissions. Many studies have focused on the social and environmental impact of the fashion and textile industry, (Boston Consulting Group, 2017, Claudio, L., 2007; Birtwistle, Moore, 2007), showing that the impactors elements are manifold and not exclusively linked to the production of raw materials.

Moreover, the fashion consumer nowadays is demanding, connoisseur, selective, and his/her buying habits are based on personal evaluation of the product, and therefore, challenging to permeate. As it happened with the customer-product, the relationship between client and brand is currently based on reputation and feedback, making the old fidelization methods ineffective.
This contribution has the aim to explore strategies for safeguarding and enhancing the Prato textile industry, through the proposal of a new model of traceability for products and processes. The aim is to trace and systemize all information regarding the supply chain: from raw materials to production and distribution processes. The result would reveal itself inviolably through a platform based on Blockchain technology.
Hence, this contribution intends to investigate transparency and traceability in the textile industry, with a specific reference to the Prato district. The output of this reflection is TRACE: the proposal of a traceability platform that aims to provide clarity to the customer, as well as guarantee the quality of Italian textile products throughout the supply chain.

2. Emerging scenarios: ethical fashion

Sustainability in the fashion system is an extended field of study that has evolved from a vision centered on purely ecological aspects to a global meaning concerned about how social and economic dimensions of supply chain can impact on the territory (MacArthur, 2013).
In the past few decades, the fashion industry has been one of the main driving forces for global development (Maloney, 2015). The scenario is changing; sustainability and responsibility issues have become central in the debates on the future fashion industry, mostly thanks to the change of a fundamental actor in the supply chain: the consumer (Choy et al., 2012).

2.1 Ethical fashion

Multiple realities compose the concept of environmental sustainability in the textile-clothing system. Sustainability concept is rooted in the longevity of the product and the possibility of a second life through the recycling of the fibers (Ricchetti, Frisa, 2011) as well as social impact of production processes. There are, therefore, multiple aspects that can be considered cornerstones of this theme, all strongly connected.
Information and communication technologies (ICT) nowadays drive industry competition, tending to reshape the nature of manufacturing and manufactured goods (Porter & Heppelmann, 2014). Moreover, information technology opportunities have led the consumers to become increasingly aware, demanding, and looking for transparent and traceable services and products.
Companies have perceived these changes in consumer behavior as a request to exhibit their social and environmental responsibility transparently (Brown, 2010). Hence, the "prevailing ideological system" (Fabris,1995) changes and significant new opportunities are emerging for design culture.
Sustainable fashion is a growing need, especially facing the critical issues that have emerged in the fashion industry in the last decades. The term Eco-Fashion means a virtuous circle that includes all the steps: the design of a more durable product, the choice of materials, production, and distribution of products, trying to achieve the minimum possible environmental impact.

Eco-Fashion has an excellent media response, is a communicative force for a new life approach that allows ideas for sustainable strategic design. The increasing presence of Eco Fashion collections on the market shows a growing awareness. It seems to be strategic and oriented towards more solutions made of transparency, traceability, certification, communication as a function of a possible recycling facilitation.
A sustainable system is not simple at all; one of the ways may concern the reduction of the consumption of primary resources (raw materials, energy) and the reuse as well as the recycling of materials. In other words, the goal is to be able to adopt an economic system whose mission is to reduce the waste generated during all phases of the product. Approaching sustainable management in the fashion sector inevitably means including the entire textile supply chain.
"The difficulty (in the fashion industry) is to see how all the suppliers of the individual components can be ethically secured and accounted for, together with the labor used to manufacture the garment, its transport from factory to retail outlet, and ultimately the garment's aftercare and disposal "(Beard, 2008).

2.1 Ethical consumer

Changes in consumer behavior actively contributed to the centrality of sustainability and responsibility themes in the fashion industry.
The new consumer is an active part of marketing strategies, compared to the past it is no longer faithful to a single brand, it is more selective and demanding and often changes consumption styles (Rinaldi, Testa, 2013).
Digital technologies are the main contributors to this change in dynamics. "In the digital age, people are used to commenting, documenting, and sharing their experiences online. Therefore, loyalty is also and above all, determined by advocacy, or by the willingness to recommend a brand to other people" (Kotler, Stigliano, 2018).
The current consumer, therefore, is an increasingly fluid figure, has multiple identities, and escapes traditional segmentation attempts. He is autonomous, informed, prudent.
Francesco Morace speaks of Consum-Author (Morace, 2016) as a subject who becomes the protagonist and "author" of his existence and his own consumer choices. It is a hybrid figure that wants to be involved and informed on both the genesis and the traceability of the product he/she buys. This phenomenon has led to an increasingly strong binding between being and buying, taking the path of critical and participatory consumption. As Francesco Morace (2011) wrote: "sustainability can be an element of differentiation and advantage of a product, but over the next 20 years being 'sustainable' will be a necessary feature that every product will have to incorporate in order to access the market ".
Thus, social and environmental issues are crucial, especially for young consumers, who through their purchasing habits by promoting brands aligned with their values. Nine out of ten consumers of generation Z believe that companies have the responsibility to address social and environmental issues (Cone Communication, 2017).
Being recognized individually and receiving an offer designed according to specific tastes and needs are fundamental prerequisites for establishing a lasting relationship between people and companies. In order for this bond to be established, it is necessary for companies to put customer-centered innovation processes into practice, one of the design capabilities of "Leading Business by Design" (Micheli, 2014). The company acquires value as much as the consumer participate in the corporate culture.

Consumers have created a more respectful buying habit. Specifically, the increasing amount of available information modifies the models of value creation. In this scenario, a designer can be a "creativity manager", assuming a vital role in the project of all product lifecycles, as well as in need to generate, or in some cases support, the conscious criticism of the contemporary user in this fashion sector.

4.Transparency and traceability

Transparency and traceability are now acknowledged as necessary to measure social and environmental sustainability in the supply chain of the fashion sector.
"Being transparent" in the entire supply chain is the result of work done on traceability and certification, guaranteeing ethical standards, respect for social criteria relating to workers' rights and respect for environmental criteria (water supply, energy recovery, polluting emissions into the atmosphere, production and management of waste, management of dangerous substances and materials).
the widely accepted definition of traceability is from the International Organization for Standardization (ISO), with the added key component of a sustainability focus:
Traceability: The ability to identify and trace the history, distribution, location, and application of products, parts, and materials, to ensure the reliability of sustainability claims, in the areas of human rights, labor (including health and safety), the environment and anti-corruption.
Being able to implement a traceability system means being able to map the operational and production flows, from the extraction of raw materials to the production of semi-finished products and parts up to the production of final products, retail, and possibly the use and reuse, in line with a circular economy.
Using this approach means involving all the players in the production network and educating them towards transparency; provide information that allows for a standard, transparent, and accessible understanding.
Educating the different actors of the supply chain means for companies to develop adequate design management capabilities connected to five factors: awareness, planning, resources, skills, and process (Kootstra 2009).
The theme of traceability is undoubtedly not a brand new topic, dealt with for years in the study areas linked to the dynamics of logistics and business management. Nowadays, the communicative aspects of traceability systems grow in importance as they represent an additional point of contact with the consumer.
A series of opportunities for design are grafted, also thanks to the technological advancement and, in particular, the most recent opportunities potentially offered by the blockchain.
Recent studies on the application of blockchain technology in the agrifood sector show that open-source, decentralized, distributed database for storing transaction information (Francisco, Swanson 2018) can ensure the accuracy of this information, such as product quality, safety, and labeling.
In the context of sustainability, traceability is a tool to ensure and verify the sustainability declarations associated with goods and products, guaranteeing good practices and respect for people and the environment along the entire supply chain.

5. Trace: the design of a traceability platform

Trace has the aim of providing transparency and traceability within the supply chain. The entire project was experimented in the Prato district, which represents "an exemplary history of Italy's districts" (Becattini, 2000)
Based on blockchain technology, this platform addresses its offer both to companies, suppliers of yarn/fabric, and to the consumer who will purchase the final product. The application of this technology within the textile supply chain becomes a strategic tool, suitable for enhancing the industry itself, optimizing production processes, and reassuring the consumer about the operations conducted by companies.
Moreover, blockchain technology ensures the integrity of the data when it is exchanged in a transition, allowing the elimination of intermediaries and simplifying the relationship between brand and consumer. In order for a transaction to take place, all the nodes (participants) must agree on the correctness of the data transferred.
Once the transaction is validated and inserted into the Trace platform, it remain unviolable and visible to all the network. This solution can guarantee reliability and security of the transferred data transparency (as every data is visible to all the actors of the network), thanks to the distributed database that allows establishing a new concept of trust.
The blockchain can guarantee a "digital" architecture capable of connecting and guaranteeing the exchange between the various players in the supply chain, stimulating them for collaboration.
Trace follows the product in every supply chain process, and thanks to the help of new technologies, information is collected quickly and intuitively. Each item in the production chain will be equipped with a "digital passport": labels, like a membrane, are applied to each piece of fabric. Labels are made of MINERVA PHA, a high-performance biodegradable biopolymer, in which a chip is inserted to assimilates step by step the information regarding the different processes.
All actors involved in the supply chain can view and approve the status of the article. In the final stages of production, the chip is extracted and inserted inside the tag that accompanies the garment in the stores.
The consumer, willing to know the origin of the garment, can trace the history of the product thanks to the chip and intuitively know exclusive content about it.
Ensuring a system based on traceability, thanks to blockchain technology, contributes to the enhancement and protection of a Made in Italy product. Collaborating in the creation of conditions of transparency and environmental protection, as well as increasing consumer confidence.
The opportunities of this platform have, above all, an ethical and social value. The conscience of the place is an intermediate step to regain social responsibility and can reopen the way for a vision of society that goes beyond the market.
Trace is based on a clear concept: production is a social fact and, therefore, a manifestation of cooperation between subjects. Thanks to Trace, Prato's textile product can have a new

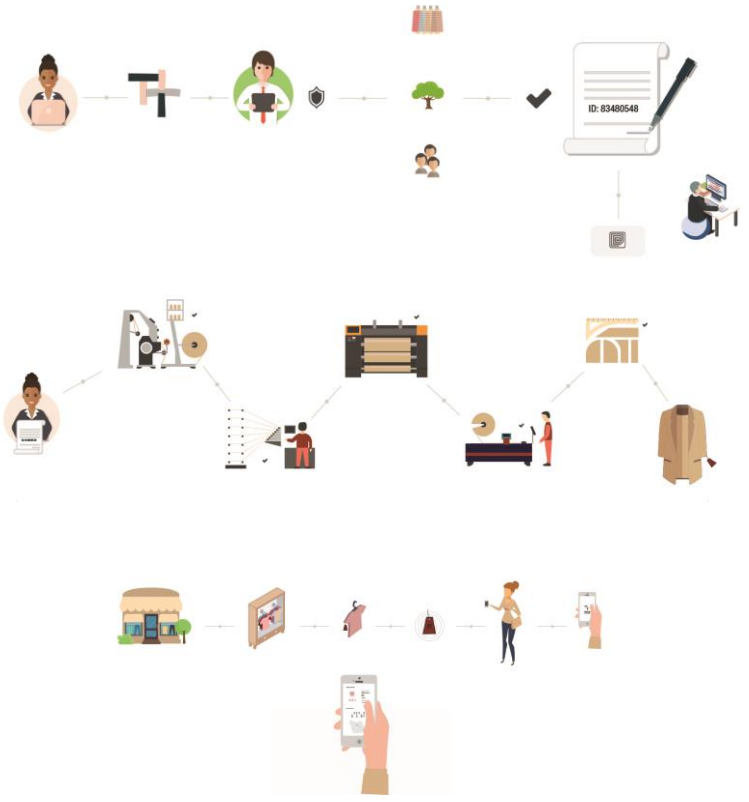

Figure 1. The TRACE process from both producers and consumers point of view.

strategic value that will allow it to diversify for international markets, where social responsibility offers a competitive advantage.
It is essential to make known products characterized by the imprint of a district that has undergone many transformations, strongly linked to tradition with a look at innovation and resource management. Social responsibility as a value but also as an identity. Trace allows to shed light on these issues and make all the information accessible to the final consumer.
Thanks to the design culture combined with opportunities led by recent technologies, tangible and intangible values are intertwined in Italian production, offering a new vision that communicates through a different perspective.

6.Conclusions

The fashion sector has one of the most complex supply chains, with collections that follow one another continuously imposing tight rhythms of development and lead times.
The structure of the Italian supply chain in the fashion sector is complete, with companies operating upstream producing semi-finished products for the subsequent phases (spinning and weaving) and companies downstream that market the finished product.
The sudden change in the market leads companies to choose a sustainable direction but in an ever shorter time. The adoption of an adequate Supply Chain Management tool that allows synchronizing all the operations of supply, production, distribution, and sale ensures optimal performance and savings in time and costs by promoting product quality.
The multiplication of competitive pressure obliges companies today to seek new areas for improvement within the individual company. There are very few companies in Prato that deal with the entire production process, ranging from fiber selection to marketing. On the other hand, there are many industrial companies that cooperate for the return to the end customer of a qualitatively valid product.
In this scenario, there is also an intensification of competition, which is associated with less accessibility not only to financial resources but also to raw materials, and these conditions have increased the competitive centrality of human capital, technological innovation, and efficiency in the use of resources. Moreover, the impact of the crisis has made it necessary to contain those phenomena - increasingly less sustainable - through social inclusion policies, the fight against poverty, respect for human rights, work, and the environment.
It is therefore possible to claim that the process of globalization and the economic and financial crisis have contributed to the growing idea that survival and future development presuppose balance and compatibility between three fundamental aspects: the achievement of financial results, social implications, and environmental impacts.
Companies are key players in the concrete implementation of this development model, which finds its synthesis in the concept of sustainability.
Hence, it is possible to elevate sustainability to a business paradigm, which includes the Triple Bottom Line model (Elkington, 2013): achieve Profit by respecting the environment (Planet) and People.
TRACE, in line with ethical and environmental values, represents a strategic tool, ideal for managing communication between the various players in the supply chain, guaranteeing information security and respect for production.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Walk the talk: Towards an ecological futures framework for our designed cultures

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Abstract | Based on the bleak trajectory of the near and far future due to climate change, this paper outlines some of the assumptions that makes relevant actions so hard to implement. We suggest a framework that enables us to radically rethink sustainability as well as both human and design agency. Based on a simple "Walk-the-Talk" model, potential actions are mapped for both (i) established and (ii) more alternative approaches. The former being the one espoused in today's discourse, while the latter seems to get surprisingly little support. By describing three concrete product concepts we illustrate how by shifting focus to more alternative approaches, we can precisely address the challenges that more traditional approaches have obviously failed to address. In order to find relevant leverage points for both design and required systems change, the paper finally discusses why the traditional approaches still are so dominant in our quest to address climate change.

KEYWORDS | CLIMATE CHANGE, DESIGN, DEVELOPMENT, LONG-TERM SUSTAINABILITY, SYSTEMS CHANGE

1. Background

Design has for quite some time been concerned about the changes needed in how we humans design, build and organize our sociocultural and techno-economic environment. An important insight from long-term sustainable systems is that they are typically characterized by cooperation and diversity. For many centuries, however, the western cultural sphere, with its initial European epicenter, has worked in the complete opposite direction. The hallmarks of this direction have been expansion, exploitation, competition and domination. It can be argued that it is primarily facilitated and accelerated by the global implementation of an economic and industrial 'monoculture' with infinite exponential growth as its primary and essential strategy for survival, which in turn is predicated on continually plundering the life-sustaining biosphere. This monoculture is contrary to everything we know about resilient and long-term sustainable systems. In this 'race to the bottom', the natural world is swept out of the way, as a mere externality.

Modern human civilisation has now arrived at an evolutionary cliff—towards a literal "hothouse" Earth (Steffen et al., 2018), stripping the life carrying capacity of the natural world (Ceballos et al., 2017; Díaz et al., 2019). It has been argued that it is a feature of our existing economic system tied to infinite growth which has historically *cheapened* the natural world in order to dominate and exploit it (Patel & Moore, 2017). However, in order to discuss the situation and its implications we first need to get some fundamental assumptions in place.

1.1 Rethinking Sustainability and Development

Sustainability as a concept has been frequently used, and probably also misused, since at least the late eighties when UN's Commission on Environment and Development (WCED) published 'Our Common Future' (WCED, 1987). A unique insight of the report was how it understood the environmental crisis as an interlinking of seemingly disparate systemic crises that could not be addressed in isolation. In particular, it had highlighted sustainability's relation to development, as it was explicitly written in both the commission's name and in their oft-quoted definition of *sustainable development*:

> "Sustainable Development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Generally speaking, sustainability can be described as the ability to 'exist constantly', while today it more specifically refers to the capacity for the biosphere and human civilization to coexist. One tension becomes highlighted when 'sustainability' is linked to 'development', as what is perceived as development today just as well could be unsustainable. If true, should one still try to sustain that development? It has even been argued that 'sustainable development' is an oxymoron as the development paradigm is possibly inherently unsustainable (Brown, 2015), which of course depends on what is meant by 'development'. With the hindsight of more than 30 years since the UN published their report, it is therefore

important to ask if it is development, as we know it today, or should we rather refer to a more 'terrestrial' (Latour, 2018) or 'regenerative' (Wahl, 2016) notion of the concept. Regardless, it is becoming increasingly obvious that what we today call 'development' is destroying the life sustaining biosphere, while both increasing the gulf between the few very rich and the many poor (Hickel, 2017) *and* exponentially increasing the extraction of resources and emissions (Martenson, 2011; Raworth, 2017).

The UN's attempts in the early 21st century to resolve this inherent tension between sustainability and development resulted in 15 years (2000-2015) of Millennium Development Goals (MDGs), but as an exercise, it nearly ended in complete failure (Hickel, 2018). Eventually, after some statistical maneuvers, which included moving the baseline year for measurement from 2000 to 1990, it was claimed that the goals had been more or less reached (Ibid.). Following this, 17 Sustainable Development Goals (SDGs) were announced, to be achieved within 15 years from 2016 to 2030. While it is still too early to know the exact outcomes of these goals, there seems to be consensus emerging on the *very* bleak prospects for our planetary future (Díaz et al., 2019; Wadhams, 2017). Especially as the SDGs still set the goal for economic growth (SDG 8), as a condition to solve the crises, which for many is the primary driver of the crises (Brown, 2015; García-Olivares & Solé, 2015; Hickel & Kallis, 2020). In figure 1, Rockström & Sukhdev (2016) sketch out how the SDGs link up to the 'biosphere' and 'human civilization', illustrated as 'society' and its 'economy', respectively.

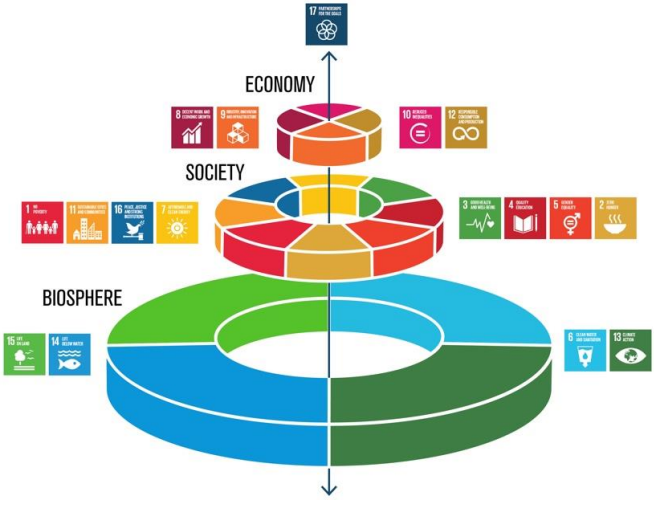
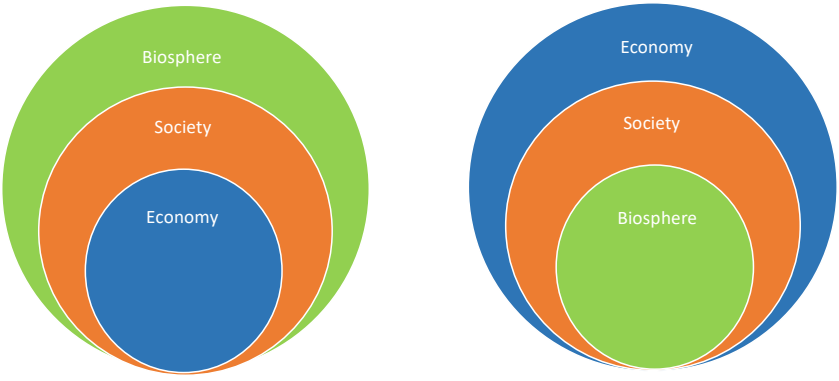


Figure 1. Rethinking and reconnecting the 17 UN SDGs with food. Credit: Stockholm Resilience Centre (Rockström & Sukhdev, 2016)

1.2 Rethinking Human Agency

The discourse surrounding both sustainability and sustainable development tends to be highly politically charged (Fry, 2011; Giddens, 2011; Latour, 2018). Much of that goes beyond the scope of this paper. However, we believe that figure 1 above at least needs to be clarified by adding the actual relation between the three levels at hand.

Below figure 2a illustrates how the entirety of our human civilization is a mere subset of the biosphere; completely dependent on and 'nested' within the Biosphere, what is typically termed as a 'nested system' (Capra & Jakobsen, 2017). This implies that the larger system of the Biosphere does not have the same kind of dependence to us humans. As long as we don't mess up the Biosphere, it's remarkably resilient. However, there is a limit to what it can take and many of these limits might already be on the brink (Steffen et al., 2018).



a) A Nested System relying on the laws of nature

b) A Nested System relying on the laws of economics

Figure 2(a,b) The nested systems model modified from Temesgen et al. (2019)

The biosphere, bound by the laws of nature, offers the bedrock from which society emerges and from within society, the economy emerges. Contrastingly, our present civilization seems to follow a completely reversed nested order as illustrated in figure 2b, implying that the 'laws of economics' set the limits to what can be done in the system. So arguably, in spite of the *talk* about what's required to restore and renew what human society has damaged, we seem to *act* as figure 2b illustrates, i.e., the complete opposite to figure 2a and by that challenging the laws of nature in favor of economically feasible solutions. Or as Naomi Klein puts it:

> "What the climate needs to avoid collapse is a contraction in humanity's use of resources; what our economic model demands to avoid collapse is unfettered expansion. Only one of these sets of rules can be changed, and it's not the laws of nature." (Klein, 2014, p. 21)

1.3 Rethinking design's agency

Design has been criticised for being a mere instrument for developing the consumerist 'wants' for sustaining economic growth, which the present system seems to depend on far more than the 'humans' that designers are told to be focusing on. Giving a "perception of designers as creative, capitalist nerds delivering sexy looking things" (Fry, 2009, p. 120).

The full enormity of the climate and ecological crises has brought us, a small international research group in design, to confront and deliberate on our role as designers as we look to change this bleak trajectory that is leading us towards the complete collapse of our life sustaining biosphere. How then do we as designers explore, develop and use our disciplinary tools and mindsets to address issues related to climate breakdown and comprehend the radical changes that are essential within nearly all levels of our society? Instead of looking from within a human centred point of view, in this paper, we will take a step out of most typical frames by asking what we, as the human species, need to do to better fit into the larger system of the biosphere that we both threaten and depend on. In this paper we'll therefore discuss what is required to *'walk the talk'* towards a more long-term sustainable trajectory.

2. The Walk the Talk Model

As discussed by Amsale Temesgen et al. (2019) it makes an immense difference whether we restrict our options and goals to be feasible within the present economical paradigm or not. In this paper we'll explore if this distinction can be generally useful in order to discuss the multitude of approaches available today, how 'densely they tend to be populated' in present day discourse and the leverage points (Meadows, 1999) to change the present system to a more 'long term' sustainable one. We'll do so by first establishing a rather simplified map illustrating the 'tension field' at play.

We call it the 'Walk the Talk Model', which first maps out different kinds of possible responses to global warming based on our actions and claims (i.e. walk and talk, respectively). In addition, it also makes a distinction between those that try to respond within the present mainstream system versus those who try to find solutions outside it. We follow it up by describing three illustrative cases relating to energy production. The model illustrated in figure 3 below shows how we do, or do not, *walk our talk in relation to climate change* (CC). Exactly how the different approaches are allocated on this, admittedly simplified map is a bit arbitrary and should only be understood as illustrations of what could be there. Illustrated by the tone of grey in the background, we argue that the lower right triangle currently dominates the present-day discourse.

The lower left quadrant is populated by those that neither walk nor talk in relation to CC. Lower right quadrant is populated by those that rather talk than walk, while the upper left is the opposite, consisting of the ones walking without talking about it; i.e. those communities

that just live and thrive in a sustainable manner. All these three quadrants relate in different ways to the approaches populating the upper right quadrant. The upper right quadrant, is also where both the tension and the contrast between the attempts to solve the crises *within vs. outside* the present system becomes most obvious.

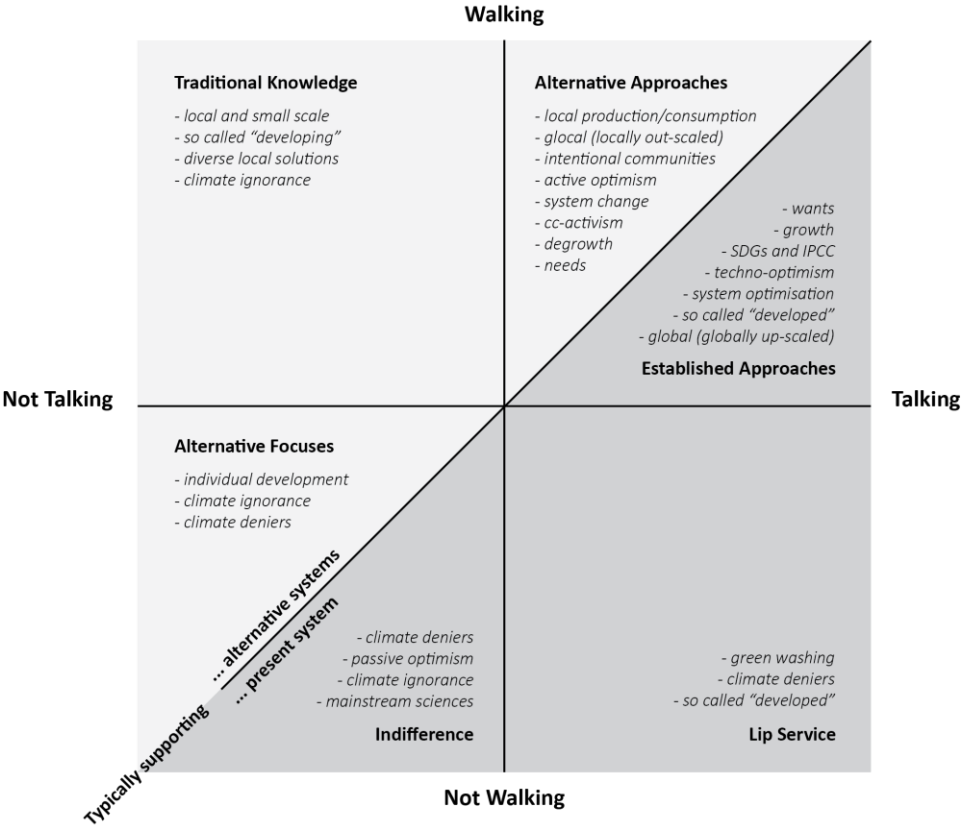


Figure 3. The walk the talk model. Credit: Authors

If one considers figure 3, an explicit tension emerges between the 'alternative systems' of the upper left quadrants and the established present system of the lower right triangle. If one assumes an '80-20' distribution, we note that while *most* of the world's population resides in the upper left triangle, they are continually impoverished yet much of the resources and energy are being consumed by those in the lower right triangle, by a privileged few. When we zoom in on the upper right quadrant of "walking-talking", this tension becomes even more apparent when talking about energy and resources allocated for climate action today. Essentially, we seem to avoid solutions that might disrupt our

present economic order, focussing much less on alternative 'Societal Transformation Scenarios' (STS) which might be especially relevant today for staying below 1.5°C (Kuhnhenn, et.al., 2020). We will expand on this tension further, explored through three cases that highlight the kind of additional solutions we might be able to create if we could dare to *walk* outside the hegemonic box of our present, growth-dependent economic system. What might happen if for a while we freed ourselves from the economic feasibility of the short term and screen new ideas and more thoroughly explore the long-term alternative approaches above the diagonal line in figure 3?

3. Three Illustrative Cases

The three cases, in 3.1 – 3.3 illustrate the tensions in how to address the daunting challenges we face today. The narrative today tells us that renewable energy is growing much faster and even becoming cheaper than the traditional fossil fuel sources used today (Gore, 2016). However, on scrutinizing figure 4 below, at least 3 problems of that story emerge:

1. In order to make the narrative compelling, it needs to compare relative growth instead of absolute growth. The present story becomes invalid if one compares the more important absolute growth.
2. In contrast to case 3.1, the narrative completely forgets that during the last few decades we have emitted more CO_2 than the whole of humanity, had ever done before that (Wallace-Wells, 2019). Due to the Climate system's inertia most of this CO_2 is still in the pipeline without revealing its final consequences today.
3. In contrast to case 3.2 and 3.3 the present narrative assumes that we can produce the required equipment for 'renewable' energy production, without using even more fossil fuels and minerals.

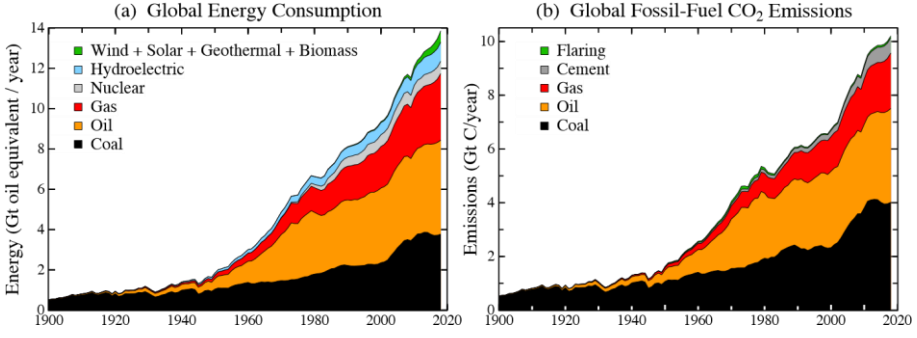


Figure 4 (a,b). Global Energy consumption and fossil fuel emissions. Credit: Hansen, (2020)

We will therefore discuss three different cases developed within design master program at AHO that can all be juxtaposed as 'alternatives' to the way we produce and use energy today. The design concepts themselves are all feasible in principle but haven't been able to scale *up* on the market yet. The first case is indeed used in certain niche markets, but far from what's required to unleash its CO_2-negative potential. The two other cases, are speculative concepts based on basic science, but as such get less attention than one would expect if one considered the urgency to *replace* and not add to the already extracted fossil minerals and fuels. The three cases are all divided in two subsections: 'How things are', which roughly represents the lower-right triangle of our 'Walk-the-Talk' model (figure 3). While the second subtitle, 'How things could be' goes on to illustrate possible alternatives that rather might appear in the upper-left triangle of the same model.

3.1 Reversed Carbon Emissions

How things are: from soil to atmosphere

Since the advent of industrial revolution, we have organized our societies and developed technologies, products and their production capacity around a seeming abundance of fossil fuels like oil, gas and coal. The social, technical and economic systems we live in today are typically so dependent on these resources, extracted from the deep soils of our globe, that the comparison to a severe drug addiction easily come to one's mind (Raworth, 2017). But just as with any other drug's immediate and addictive comforts, it also comes with severe negative, long-term consequences. One can argue that the most serious one, with numerous negative and cascading effects, is that it takes fossil carbon from the earth and in the process emits vast amounts of CO_2 that cause both global warming and acidification of the oceans.

How things could be: from atmosphere to soil

The pioneering book, *Biochar for Environmental Management, by* Lehmann & Joseph (2009) proposes reversing carbon emissions by utilizing Biochar. Since then, biochar has been discussed as a way of sequestering carbon from the atmosphere and by doing so *reversing* some of the devastating flow of carbon our society has produced (Bates, 2010). The idea is simple. Instead of burning biomass in air to ash, one burns it without oxygen into coal (as one fraction) and energy (as another). Thus, one ends up with both energy and carbon (or biochar), where the latter can be put back into the soil and make it more fertile. By this process the highly stable biochar, becomes a long-term carbon sink by circumventing biomass carbon emissions to the atmosphere. While promising, enthusiasm for biochar was initially hampered by the sobering fact that, as illustrated in figure 4, the sheer scales of carbon emissions are so immense. In fact, the accumulated carbon emissions turn out to be much more than what could be considered directly economically feasible to be useful for our soil. However, more recently Albert Bates and Kathleen Draper argue in their book *Burn-using fire to cool the earth* (2019) that this dilemma potentially can be resolved by utilizing carbon's inherent versatility and ability to replace fossil oil, not only as a fuel, but in all kind of designed products typically needed in our everyday life. They coin the process 'Carbon Cascading' as it can be used in series of different applications before it eventually ends up in

the soil again. Figure 5(a,b) illustrates a very simple concept for application of biochar where an energy loop is maintained by only using the gas produced from the feedstock to cook food and letting the remaining carbon go back to the soil thus enhancing its fertility. Furthermore, with a *cascading* approach one could let the Biochar produced pass several stages of other productive uses before it eventually ends up in the soil.

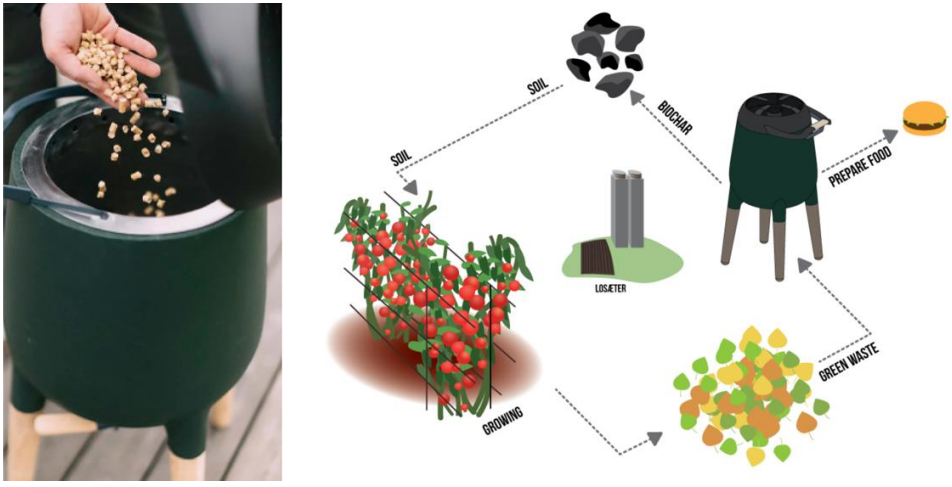


Figure 5 (a) the Emu biochar stove and (b) its systems of reversed Carbon Emissions
Credit: Benjamin Ngoma Rodahl.

3.2 Redistributed manufacturing

How things are: Centralized mass production
If biochar forms a closed loop of energy flow within a socio-technical system, then this might also drive the production model in a more generally sustainable direction. Although the centralized mass production model has become a mainstream economic development strategy and has contributed to the creation of economic wealth in many countries, this development has also brought us a series of negative effects, including the vulnerability and inflexibility of the system, resource exhaustion and environmental degradation, the barrier between consumers and producers, etc (Biggs et al., 2010; Johansson et al., 2005).

How things could be: from consumer to prosumer
Arguably, we probably need a more resilient and flexible distributed production model to drive the system from mere optimization to the kind of changes really required. This means that material extraction, manufacturing and other involved processes probably need to change too. Pure consumers could ultimately become more of “prosumers”, producing their own goods and services (Kotler, 1986). Instead of relying on infrastructure separated by thousands of kilometers, people could receive a greater proportion of both long-term sustainable products in general and even required energy from their own community or

home. The 3D-printer 'biomA' is a solution that aims to facilitate exactly that. It uses algae to 'grow' batteries (Figure 6a,b). This concept speculates about an alternative solution to lithium batteries by combining algae with chitosan biopolymer instead of the extracting minerals for batteries to accelerate the global transition to more long-term, sustainable and distributed energy production. Within such a distributed production network, all users are considered a localized open manufacturing node, or 'terminal', in a network with so called 'prosumers'. The 'prosumer' gets involved in both the production and the consumption of resources, goods, and services on which they depend. The node can therefore more efficiently reflect the scale and context of local needs, conditions and resources. In addition, the networking between multiple nodes can still enable sharing of the information, resources and knowledge required to reflect changes in the demand from individuals to communities, regions and countries. Or in other words, the main driver of the process might eventually move from the needs of our present system to more essential needs for both the user and the biosphere we depend on.



Figure 6 (a) biomA 3D prints organic batteries from algae and chitosan biopolymer. (b) Designed for local production and consumption with prosumers. Credit: Jomy Joseph

3.3 Renewed Energy production

How things are: Non-renewable, renewable energy

The share of, so called, 'renewables' in the global energy supply has never been higher (Figure 4a). However, it is being added over and above the already existing energy sources and not so much *replacing* the fossil fuels as promised but further *increasing* capacities for energy consumption. This compounds into a 'race to the bottom' where technology enables ever *newer* capacities for extraction and consumption in addition to what already exists (York, 2017). Despite offering some growth in the short run, it is estimated that these 'renewables' are on course to deplete global reserves of crucial resources such as copper, lithium and other rare-earth minerals given the inherently unsustainable rates of consumption today (García-Olivares & Solé, 2015). It seems that we are caught within a "double bind" where trying to reduce emissions through the present economic system could

end up creating even more emissions if we don't drastically reduce and rethink "civilizational wealth" (Garrett, 2012) as well as "green growth" (Hickel & Kallis, 2020).

How things could be: long-term renewable energy

Given what we know, distributed and scaled *out* nodes of global renewable energy infrastructure might need to be *decoupled* from existing "extractivism" and sourced, manufactured and powered renewably. Speculative Solar, in figure 7, is an alternative, 3D printed optical solar cell that harvests solar energy using optical structures coated with graphene solar inks from sequestered atmospheric carbon. The 3D printed optical structures coated with graphene propose to capture a larger spectrum of visible and infrared solar energy, vastly increasing energy efficiency and effectiveness within the same footprint. In combination with reduced energy consumption, these cells could potentially transform cities to become net generators of energy instead of net consumers, all within the existing frames of today's infrastructure. Designed for modularity and complexity, these solar cells are predicated on adapting to localised production and consumption for community needs rather than market needs, i.e., for scaling *out* rather than scaling up. If one were to carry forward the principles of distributed manufacturing, replacing fossil energy and combine with graphene made from sequestered sources, it might be possible to build a 'virtuous cascade' of renewable energy replacing and regenerating itself through other, locally produced, renewable production systems.

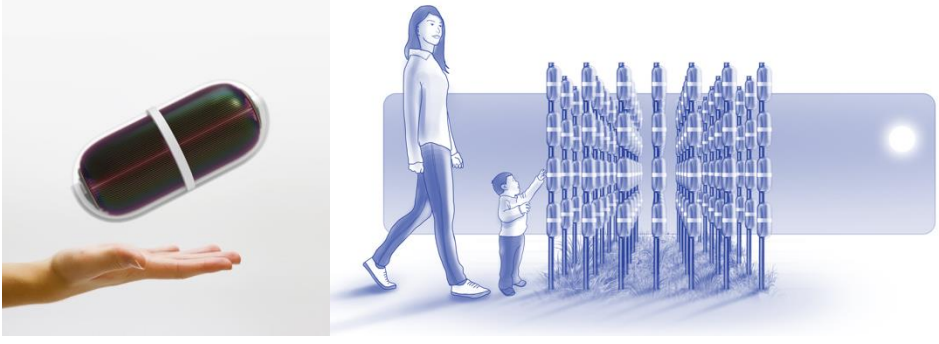


Figure 7 (a) 3D Printed Optical Solar Cell Concept. (b) Cells mounted on vertical structures and facades of buildings to capture reflections and scattered sunlight. Credit: Jomy Joseph

4. Discussion

In this paper we have tried to question some contemporary discourses, which typically seem to be 'marinated' with assumptions that are often taken for granted regarding sustainability and how to best combat climate change. Comparing some established and alternative approaches reveals to us that even the best of the more established sustainability interventions only does *less* damage yet receive *most* of the world's resources and

investment, but on the whole, leaves the damaging engine of infinite growth unchallenged. On the other hand, the kind of alternative solutions we briefly illustrate in our three product cases (3.1 – 3.3) could as a contrast, not only potentially *replace* existing technology, but even reverse some of the damage already taking place. However, these mostly remain relegated to the margins today, revealing the tensions as described in figure 2(a,b) and figure 3.

The upward trends of global energy consumption and CO_2 emissions (Figure 4) make it fairly evident that in the foreseeable future, it will not be possible to replace *all* fossil-based energy we use today with *truly* renewable alternatives. However, we are still asking ourselves why isn't more being done to start the seemingly most logical development trajectory to address this dilemma; i.e. (i) to develop solutions that facilitate a way of living that require radically *less* energy and (ii) to make sure that the energy sources really are long-term renewable. One quite obvious answer is that these alternative product approaches do not make 'economic sense' when the focus is on economic hegemony where cheap fossil fuels are preferred over renewables, scaling *up* over scaling *out*, centralised production and consumption over localised prosumers. One might also contemplate if there is an even more powerful, albeit also more hidden, reason behind this. Might it just be that the alternatives we sketched, being inherently small scale and local, also are too disruptive for a system that is built on gigantic, globally up-scaled solutions? Is it that these alternative approaches, in essence call for a fundamental rethink that challenge the established approaches of the 'laws of economics' (Figure 2b), where the biosphere is *not* a mere 'resource' waiting to be exploited for economic growth?

In this paper we have tried to illustrate how design's agency could be expanded to explore alternative climate solutions at the local level, in ways that could potentially help build resilience and be better suited to addressing the environmental and social crises due to climate change without resorting to the same historical vicious cycles of domination and exploitation of the natural world.

However, underpinned by our own frustration, we have also tried to understand why this is not an easy route to take. Even though many realize that human society might be at stake, we don't seem to address this serious challenge in the required way. One may ask why we don't do what is obviously needed to be done to rein in the worst possible outcomes of a system we still seem to support. Where are these leverage points of change in this system that we as designers might be best suited to address and, to get the required impact, how do we best mediate the work we do? However, in those efforts we probably also need to pay attention to Fredric Jameson's famous words:

> "Someone once said that it is easier to imagine the end of the world than to imagine the end of capitalism."

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Acknowledgements: This work has been made possible by the designBRICS network funded by the Norwegian Agency for International Cooperation and Quality Enhancement in Higher Education (DIKU) and support from the Institute of Design at the Oslo School of Architecture and Design, Norway. We are also thankful to Benjamin Ngoma Rodahl whose concept we have discussed in this paper.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Water infrastructure as leverage for resilient cities: a multi-scalar design perspective on urban flooding

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Abstract | Global and complex collective challenges such as climate change and its impact on weather patterns require answers across scales and disciplines. Exact spatial impacts are difficult to predict and demand resilient design solutions which incorporate a broad range of weather scenarios. However, due to a number of reasons, governments have repeatedly opted for the construction of large-scale engineered infrastructures that focus on a water defence strategy. Therefore, this paper aims to offer a multi-scalar perspective on urban flooding by illustrating the potential of local water infrastructure as a changemaker. It builds further on design-driven research of a flood permitting urban condition, illustrated by a case study at neighbourhood scale. A network of multiple urban design interventions is structured according to four strategies to deal with water: infiltrate, connect, buffer and protect. Findings explore the possibilities of expanding this designerly approach to other environments and challenges for a resilient urban configuration.

KEYWORDS | RESILIENCE, FLOODING, SUSTAINABLE URBAN DEVELOPMENT, URBAN DESIGN, MULTI-SCALAR APPROACH

1. Introduction

The presence of water has always been a determining factor to the settlement and expansion of urbanisation. Traditionally, cities emerged alongside rivers or coastal areas to have direct access to water as a basic need to inhabit and cultivate the territory, and to connect the agglomeration to the rest of the world e.g., think of the late-medieval water trade networks of the Hanseatic League in Europe. This clarifies the intense inhabitation of river deltas globally: they accommodate 500 million people while representing only 5% of the worldwide land area (Kuenzer & Renaud, 2012, p. 8).

The relation between water and urbanisation is not only one of synergy, but also one of conflict. Coasts and riverbanks were often naturally reshaped by temporary floods before humankind started mutating these natural flooding areas. Many natural flooding processes were disrupted over time due to extensive dredging operations and the construction of large-scale controlling infrastructure such as dikes and locks. These human interventions display an attitude of maximal resistance to the natural dynamics of water. The Dutch coastal works (Delta Works) are a prime example of a water defence strategy, while at the same time enabling Dutch companies to develop very specific technologies and methods which lead to economic benefits.

However, due to rapid urbanisation over the past centuries and its ecological impact, urban agglomerations are increasingly confronted with the complexity of water-related challenges (Flanders Environment Agency, 2020a, 2020b; Ritchie & Roser, 2018). Pressure on engineered structures such as dikes is increasing and there is a need to formulate sustainable alternatives in response to increasingly extreme weather patterns, consistent lowering of the groundwater level, sea level rise, and so on.

This paper builds further upon the master thesis project “Adaptive architecture and flood permitting cities. Urban flooding as incentive for incremental change.” (Leemans, 2019) and the eponymous paper presented at the 2020 SPACE International Conference on Sustainable Architecture Planning and Urban Design (Leemans, Van Daele, & Gheysen, 2020). The publications include a case study of the Brederode neighbourhood in Antwerp to explore how urban design on the intermediate scale (i.e., the scale between the architectural intervention and the urban plan) can influence a sustainable evolution of cities that are facing the threat of urban flooding. It is a research by design that imagines new urban configurations based on different water management strategies. As an addition to this research, this paper aims to reframe and position the case study of Brederode within the larger discourse such as infrastructural urbanism, multi-scalar infrastructural design and systemic design.

It begins by describing a number of concrete current collective challenges related to water on a larger scale (global and regional). The following section provides a rather theoretical background in order to frame these collective challenges as an opportunity to reshape urban areas. Subsequently, the paper provides a short overview of the design strategies and

infrastructural interventions proposed in the case study of Brederode. The paper concludes by putting the case study in relation with the theoretical reflections.

2. Water-related collective challenges

2.1 Global and transnational structures and challenges

The research by design discussed in this paper mainly focuses on collective challenges related to water that dense urban areas are facing nowadays. Many of these challenges are related to the impact of climate change, an issue that transcends borders of countries and cities. Therefore, it is important to shortly frame it in a larger and historical context. The greenhouse effect was first identified in the 19th century, indicating a global warming. It became clear that human activities were polluting and changing the earth's climate (Flanders Environment Agency, 2020a). In 1988 the Intergovernmental Panel on Climate Change (IPCC) was established to provide policymakers with regular evaluation reports on the state of knowledge about climate change. Other global initiatives are the 2030 Agenda for Sustainable Development with 17 Sustainable Development Goals, adopted by all United Nations members in 2015 and the yearly UN conferences (COP) to assess progress on climate change. These overarching initiatives have both the advantage and disadvantage of operating on a global scale.



Figure 1. In 1958, director Frank Capra explains the basics of climate change in a TV broadcast, warning for its catastrophic consequences. He points out that the melting of the ice caps could result in an inland sea in the Mississippi valley, leaving large urban areas permanently flooded. (Capra, 1958)

Challenges related to climate change are often seen as too big and impossible to solve, especially on an individual level. However, the consequences are a common issue and responsibility and therefore a collective challenge. This implies a mentality shift on all levels,

from nation leaders and policy makers to 'common' citizens. The perception and impact of projects on local level therefore is not to be underestimated and essential to complement the large-scale level decisions such as policy-making and legislation.

Increasing flooding in urban areas is a direct result of climate change. In most parts of Northwestern Europe, it is expressed by a rise in sea level on the one hand, caused by volume change of a water mass at changing temperatures, exchange of water mass with melting land ice and changing storage of water on land; and more extreme weather conditions on the other hand, in the form of wet winters with intense storms in combination with dry summers. Recent research shows that if we do not cut carbon pollution we could reach a 4°C warming with a sea level rise of nearly 2 meters this century (Strauss, Kulp, & Levermann, 2016). Since we already warmed the planet more than 1°C, we will inevitably experience serious consequences regarding flooding.

River deltas are usually highly fertile and thus some of the most densely populated areas. Because of their delicate position in relation to the sea as front lines, river delta cities will experience the effects of sea level rise and extreme weather conditions first and foremost. As a result, both the frequency and intensity of flooding will increase. This offers particular urban design challenges: areas will be exposed to water permanently and/or during specific moments.

The Rhine–Meuse–Scheldt delta covers 25,347 km^2, making it the largest risk zones for flooding in Europe and therefore a relevant case (Tockner, Uehlinger, & Robinson, 2009). The delta covers large parts of both The Netherlands and Belgium. Both countries are the two most vulnerable European countries for flooding caused by the rising sea levels: more than 85% of the coastal area lies below 5 meters of the sea level. In Flanders, about 15% of the surface, both the coastal zone and Scheldt polders, is situated less than 5 meters above the average sea level (Flanders Environment Agency, 2018). In addition to the threat of a rising sea level, a changing pattern of precipitation also increases flooding risk. Two types can be distinguished: on the one hand watercourses which flood as a result of persistent rain, and on the other water runoff in case of intense rain showers. This paper will mainly focus on the latter phenomenon, as it is directly related to urban design in terms of built density and soil sealing.

In general, the limited predictability of extreme extreme weather events such as severe rainfall and storms requires flexible infrastructural design. Instead of resisting the natural dynamics of water, a flood-permitting policy with specific interventions on multiple scales could offer a long-term sustainable strategy.

2.2 Regional challenges: Flanders' special spatial context

Flanders, and by larger extent an area reaching from Rotterdam (The Netherlands) to Lille (France) is characterised by a dispersed spatial structure (Gheysen & Van Daele, 2016). This is the result of a number of polycentric network structures (some natural, others manmade)

such as water, mobility and energy. This diffuse urban pattern has enabled interesting relational configurations and qualitative living conditions, but is at the same time facing, amongst others, water-related challenges.

An important contributing factor to flooding risks and the distorted dialogue between urbanisation and the natural territory is the continuous increase of hard surfaces or soil sealing. Based on data from 2015 it is estimated that 16% of the total area in Flanders is covered with non-permeable material, consisting mainly of buildings, roads and car parks (Statistics Flanders, 2019). Additionally, a doctoral study showed a possible increase of the built environment to 30 – 50% by 2050 (Poelmans, 2010). The degree of soil sealing is the highest in and around the largest cities (e.g. Antwerp and Ghent) and in areas characterised by spatial dispersion (e.g. the Kortrijk region). Where the soil is sealed off, rain water cannot infiltrate into the soil and consequently runs off and is disposed to the sewer system. Historically, rainfall was distributed evenly throughout the year, which induced the set-up of a refined network of drainage in order to keep the land dry for economic purposes of agriculture and building construction. However, due to changing rainfall patterns, the drainage system is no longer adapted to the current needs.

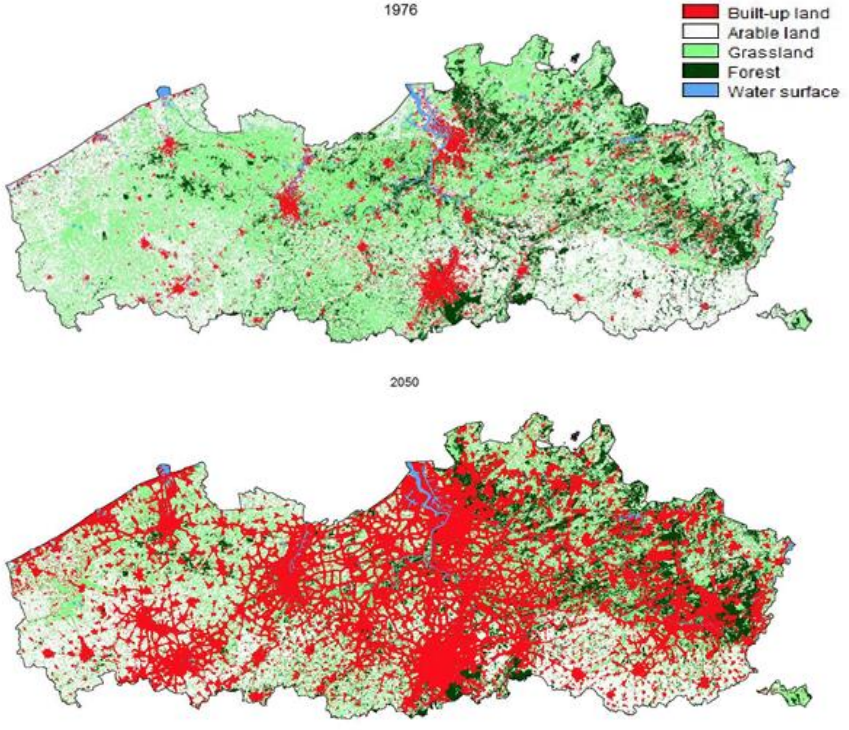

Figure 2. Land use in 1976 and 2050 is case of "business-as-usual" scenario: built surface could increase from from 7,2% in 1976 and 18% in 2000 to 41,5% in 2050. (Poelmans, 2010)

Additionally, decrees about water management in Flanders are quite recent, the first one dating from 2003. As a result of ambiguity on flood sensitivity, over decades new buildings were erected in water-sick and potential flooding zones. The Flemish Environment Agency estimated that as a result, currently approximately 36.000 to 56.000 buildings are located in flooding areas (Panorama, 2013). The combination of poor water management and increasing flooding risk induces a moment of crisis. It is clear that in particular in Flanders, a tipping point has been reached (Dehaene, 2018). The rural substrate is no longer capable of absorbing the ongoing urbanisation in a sustainable way. This leads to numerous unwanted effects of which several related to water management (e.g. flooding, drougths, ecological decrease). It is this urgency of transformation that requires us to rethink and adapt water-related infrastructure to be able to incorporate multiple future scenarios.

3. Infrastructure as an entry to address collective challenges

The architectural design and public spaces are generally considered crucial factors to urban areas. Infrastructure then is considered to be the supporting, if not carrying network that belongs to the separate discipline of the engineer, as at the same time technical infrastructure has become increasingly complex, too. However, this schismatic attitude has led to some extent to the concealment of infrastructure in urban design, as an invisible handyman working behind the scenes of a theatre that has become the city. Consider the term *illusielandschap* [illusion landscape] as an example, pointing at the hiding away of centralised energy production, far away from its consumption (Vervloesem, De Bruyn, Mabilde, & Dehaene, 2018, p. 37): the city as a vampire-like metabolism.

At the same time, issues related to infrastructure often appear to be a symptom of a malfunctioning larger system (e.g., traffic congestions in the dispersed territory of Flanders are not necessarily a sign of insufficient road infrastructure, but rather point at the unsustainable way living and working is organised; or flooding as part of a natural dynamic system). Therefore, intervening on the form (e.g., widening a road; or constructing a dike) instead of the underlying processes results in symptomatic problem-solving, rather than addressing structural change (Allen, 2003). Additionally, it is the “combination of local realities, conditions, and regional forces forged together to interact” which results in “more intelligent […] interventions” (Berger, 2009, p. 15). Therefore, this paper points at the importance of a multi-scalar approach of local (water-related) infrastructure as a link to address large-scale, complex issues such as climate change and to consider it as an assignment of the urban designer. A similar approach of multi-scalar infrastructural design can be found in the projects proposed for New York’s waterfront in the Rising Currents exhibition (Bergdoll, 2011).

Structural interventions on infrastructure networks are rather rare and often a matter of labour-intensive and technical work (e.g., the construction of a new highway or widening of a canal). However, it is at these moments in time that an opportunity for the urban designer

arises to intervene (Hauck, 2011) and go beyond technical symptomatic problem-solving, and to integrate the socio-spatial impact of the infrastructure with the urban fabric. In the particular example of local, water-related infrastructure, flood-permitting structures in cities such as basins and gutters in residential environments could contribute to incrementally transforming the way that water is dealt with in cities today and therefore inducing a mentality shift.

In order to highlight the impact of infrastructure as leverage for reshape urban areas, the historical example of the Great Stink is particularly interesting. In the middle of the 19th century, London faced a hygienic crisis which gave rise to an urgency that raised it to the level of an urban problem and therefore a collective challenge. This issue of severe pollution led to the construction of collector drains underground, and consequently introduced a new series of public spaces such as parks aboveground. It is this collective added value which illustrates the potential of infrastructural interventions to bridge the gap between engineering and urban design.

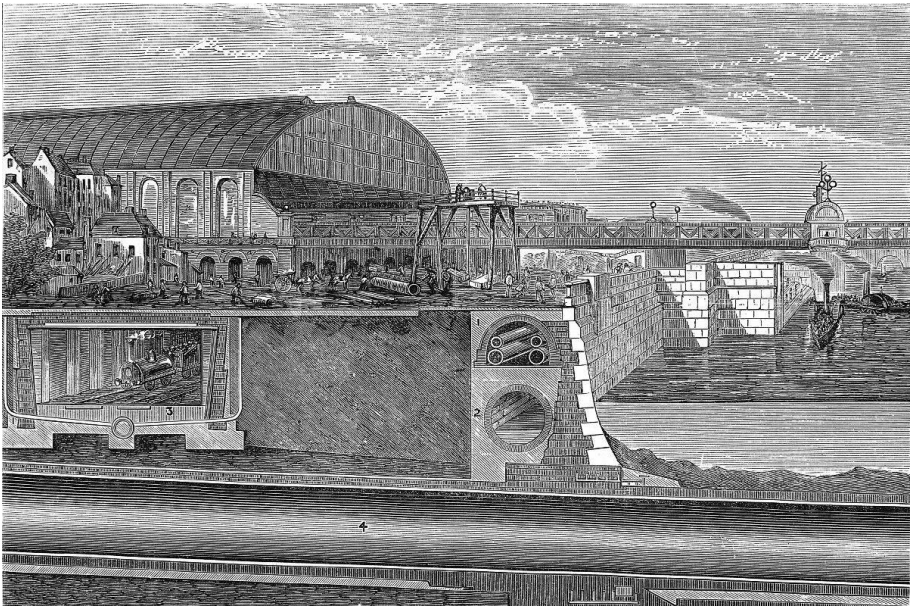

Figure 3. Section of the Thames Embankment displaying amongst others newly constructed sewage collectors. Source: Sir Joseph Bazalgette, Illustrated London News, Vol 67/1, 1867, p. 632 © Science Museum/Science & Society Picture Library.

Today, the era of large-scale, top-down, mono-functional, capital-intensive infrastructure is over (Orff, 2010). Therefore, there is a need for new approaches to deal with complex issues such as urban flooding, in order to combine infrastructural intervention with socio-ecological

added values. As a designerly exercise, this paper includes a case study of the Brederode neighbourhood in Antwerp, Belgium.

4. Local challenges: the case study of Brederode

4.1 The city of Antwerp and water: happily, ever after?

As indicated before, the proportion of hard surface in Flanders is problematic, and the degree of soil sealing in and around Antwerp is remarkably high. In order to get a clearer idea of the design challenges related to urban flooding, it is necessary to study extreme scenarios as they display the problems to face in a condensed way.

Due to limited predictability regarding future urban flooding, a city such as Antwerp requires to improve its resilience to water. Both the city itself and the federal government are already making efforts to do this. In the regional context, the Sigma Plan was set up as the result of a severe flooding in Ruisbroek in 1976. However, in programs such as the Sigma Plan (similar to the Dutch Delta Works), the incentive is mostly based on a defence strategy: a resistance to river flooding though the construction of walls, dikes or the reinforcement of quays (with the exception of few rural large-scale flooding zones). Despite the fact that it might seem to be an effective knock-on solution to flooding, in reality it disrupts the natural flooding process (Temmerman & Kirwan, 2015). A more sustainable approach would be to start from a flood-permitting incentive instead.

Data provided by the Flemish Environment agency display several high-risk zones in the city of Antwerp. The Brederode neighbourhood was selected as an exemplary case study, being located within the dense urban fabric of the city centre. The challenge is to rethink neighbourhoods such as Brederode in a way that they become resilient for increasing extreme weather scenarios. With its 0,72 km^2 and 11.722 inhabitants, Brederode is a relatively densely populated neighbourhood in the city of Antwerp (City of Antwerp, 2019). Additionally, it has little open public space available and at the same time houses many public facilities such as schools, care facilities, local shops and restaurants (Secchi & Viganò, 2009). The neighbourhood is somewhat isolated because of its infrastructural borders: the river Scheldt in the west, the Leien (an inner urban ring road) in the north and the motorway junction of the Antwerp Ring in the south.

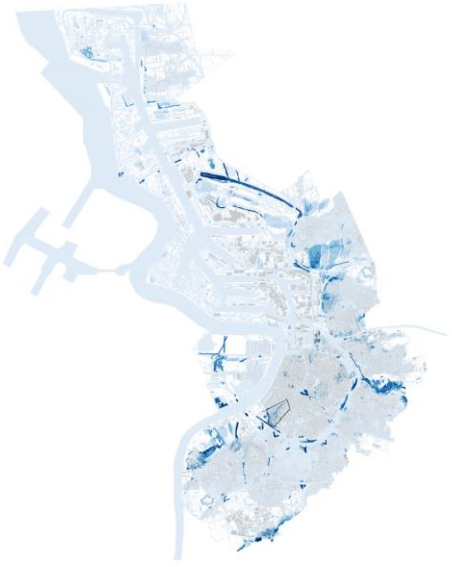

Figure 4. The water depth in the event of a flood with a probability of once every 1000 years in the city of Antwerp, Belgium including an indication of the Brederode neighbourhood. Source: Flemish Environment Agency. Elaboration: Leemans, 2019

4.2 Establishing a network of interventions on the intermediate scale

Neighbourhoods integrated in the dense urban fabric such as Brederode don't have open space available for large-scale infrastructural interventions. The architectural and urban context requires solutions at a smaller scale, and consequently, design-driven research resulted in a network of interlinked urban design interventions on the intermediate scale. This is the scale between the architectural intervention and the urban plan, moreover "the scale of the streetscape" (Scheerlinck, 2018). The proposed network finds its existence in the partial occupation both in in space and time of so-called niche space (e.g. basements, streets, empty lots) connected to each other through resilient structures. These interventions carry the function of links in a network to be switched on or off depending on the weather conditions. The proposal does not (only) aims to prepare the area for emergency scenarios, but above all aims to explore and highlight the positive effects of providing space for water. The implementation of these interventions generate possibilities for collective spaces by and for the inhabitants.

This case study research should not be considered as a solution, but rather as an resilient approach to urban flooding and an attitude of intervention to incorporate multiple scenarios. The interventions should therefore, to a certain extent be adaptive through space

and time. Complementary, it creates valuable space found within the existing urban fabric through double use.



Figure 5. (left) Water depth in event of a 1000-year flood in Brederode. Source: Flemish Environment Agency. Elaboration: Leemans, 2019 (right) Implementation of an adaptive water network of interventions on the intermediate scale. Source: Leemans, 2019

Four strategies of dealing with water have been tested. The most favourable way is to infiltrate as local as possible; the second preferred strategy is to transport the water to infiltration locations; the third strategy is to buffer certain amounts of water for drier periods; and the final option is to protect the weakest areas which could not be included in the previously mentioned system.

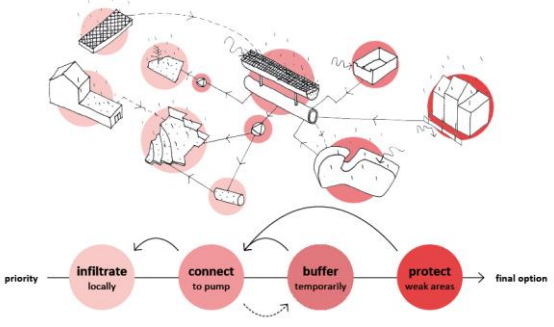

Figure 6. Systemic scheme of the proposed network structured according to four water strategies, each corresponding to different design interventions. Source: Leemans, 2019

4.3 Spatial translation of water management strategies

The following section contains a representative selection of urban design interventions in the proposed water network. The first intervention is linked to the infiltration strategy. Instead of collecting rainwater in sewage and transporting it elsewhere, here, it is collected in the inner space of a building block. It consists of an artificial landscape bordered by a retention wall of three metres high and two metres deep with openings and a levelled infiltration basin in the middle.

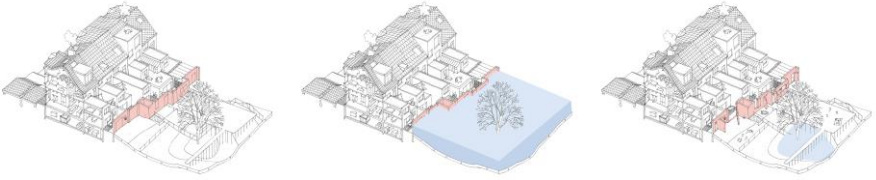

Figure 7. A section of the building block, displaying the retention wall bordering the infiltration basin. Source: Leemans, 2019

The second intervention is the construction of a multifunctional pump house at the border of the infiltration basin complemented by an aboveground network of open gutters as primary water cleaning and an underground network of pressure pipes running through the surrounding streets.

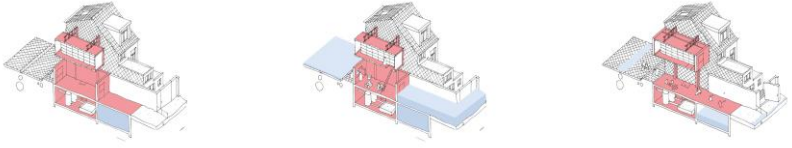

Figure 8. A pump house connects a network of open gutters and pressure pipes with an infiltration basin. Source: Leemans, 2019

The third intervention consist of a series of buffer zones to collect and retain larger volumes of water to bridge dry periods and reduce the impact of intense rainfall. The buffer zones are designed in such a way they are considered an added value to the neighbourhood in wet and dry situations. They can be located in public or private spaces, occupying small squares, (parts of) dead end streets, parts of non-through traffic streets, residual public space and so on.

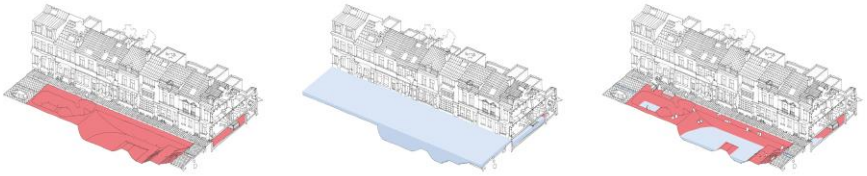

Figure 9. Buffer zones can take on different functions depending on the water volume they hold. Source: Leemans, 2019

The fourth intervention is aimed towards zones that cannot be incorporated in any of the previous strategies. It is a protective structure consisting of steel columns and hollow structured concrete slabs in between. These are invisible at street level as they fit in a trench between the road and the pavement. In case of severe rainfall and overflow of the existing sewage system, the cavity in between the concrete slab and the trench is filled up with water and subsequently pushes the hollow concrete slab upwards according to the Archimedes' principle. Therefore, the space in between the colonnade is filled up with water but the sidewalk and the buildings behind remain dry.

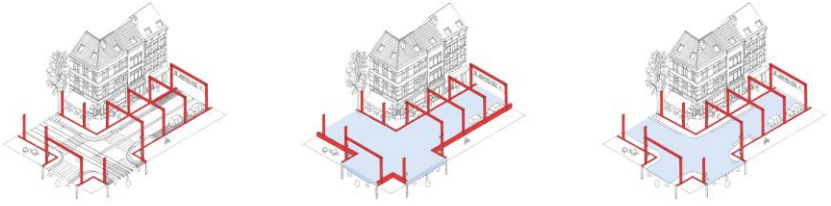

Figure 10. A protective linear structure prevents buildings from being flooded during severe rainfall. Source: Leemans, 2019

5. Conclusion

The present study evaluated the potential of water-related infrastructural interventions on the intermediate scale for future resilience while positioning it in a wider discourse of urban design such as infrastructural urbanism, multi-scalar infrastructural design and systemic design. It is crucial to recognise the importance of these small-scale interventions as changemakers to complement large-scale (physical and political or legislative) structures in order to induce mentality shifts.

Two findings from the study in this paper deserve further comment as they could be expanded to non-water-related infrastructure networks. First, infrastructure could to some extent, as a collective layer and carrying network become leverage to reshape urban

environments towards a more sustainable future. Second, therefore these infrastructural interventions should go beyond technical problem-solving and aspire to generate added socio-ecological values. Interestingly, this paper has shown that the rare event of infrastructural adaptations could be considered an opportunity for the urban designer to intervene in the underlying infrastructural networks.

A possible practical approach for infrastructural design emerges from this study: the drawing on the intermediate scale as a research tool because it is capable of exposing and addressing large-scale issues (e.g., urban flooding as a result of climate change) and at the same time revealing possibilities in local conditions and rendering possible realities (e.g., basements of town houses as temporary water buffers). Particularly the axonometric drawing on the intermediate scale is capable of transcending administrative borders such as plot boundaries and displaying interventions in a clear, concise and comprehensive way.

Despite these interesting insights, the following limitation of the study should be acknowledged. The design-driven researched focused on a case study that represented a dense urban fabric as found in several compact cities in Flanders. However, as previous studies have shown, critical contributing factors to flooding such as soil sealing are not only very high in and around compact cities, but also in the dispersed spatial condition distinctively found in areas such as South-West Flanders. Additionally, the research described in this paper mainly focused on the collective challenge of (urban) flooding.

Therefore, future research would benefit from on the one hand focusing on the urban condition of dispersion and on the other including a clearly articulated collection of future infrastructural challenges. In that way, a collection of comprehensive design strategies could be formulated in order to establish a more sustainable and resilient urbanisation of the Flemish territory.

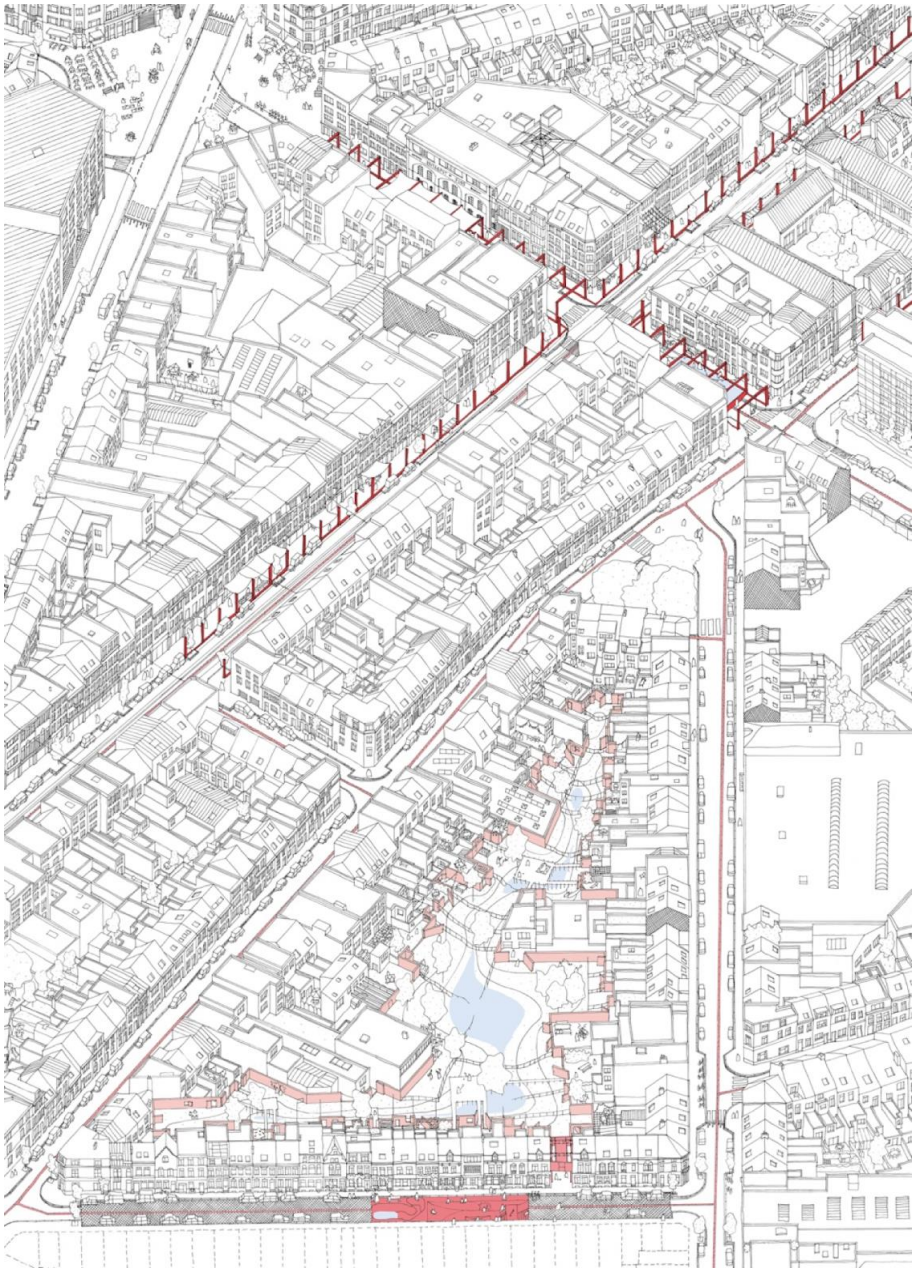

Figure 11. Axonometric drawing of the implemented network in Brederode. Source: Leemans, 2019

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Weaving the New Way of Making from the Andes

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Abstract | This paper tells the experience of a social enterprise in the middle of the Andes in Salasaka Ecuador that is changing passive observation into action with kindness and passion. Andes Materials challenges traditional romantic perspectives surrounding indigenous textile artisans in social sciences and critical theory. In addition, we analyze how market forces in our country have destroyed or reshaped our traditional knowledge and cultural links. Finally, we propose our case to use new social and economic scenarios as an alternative to the traditional fashion industry where human stories are not part of garment creation.

KEYWORDS | FASHION, HANDMADE, ARTISANS, ECUADOR, TEXTILE HISTORY

1.The Past

When thinking about artisans, TIME comes to mind. We think about them as mystic people, piers of our grandparents, surrounded by nostalgic scenarios filled with dust and vintage tools that no longer exist. Our current industrial world has accelerated the way many productive techniques are lost. In the Northern Andes, indigenous cultures and their local techniques did not match the timing of outside industrial processes of the 20th Century. Since the 60s, Latin America has been convinced that machine-made was synonymous with being modern and that traditional handmade crafts and goods were for second-class citizens. Latin America has had a continuous imbalance, importing more manufactured goods than it exports, leaving no space for the development of new products. In this context, we have not had the chance to improve traditional knowledge and thereby develop a Product Design Industry.

For our purposes, we want to talk about textile production. The Andes have had a long and creative history surrounding textiles. The oldest fabrics found can be dated back 6000 years and were used mostly as power symbols between religious and political elites. During the pre-colonial era of the Incas, clothing making evolved into FASHION with a sophisticated level of design, utilizing a huge variety of techniques, types of cloth and even accessories. The remains of these pieces show a refined control of the back-strap loom weaving: plain, tapestry and scroll fabrics were stitched together to create larger pieces. Fabrics were decorated with sophisticated embroidering details (Pillsbury, 2002), and many used pioneering techniques such as the triple and quadruple weaving. The use of very thin and dense yarn was remarkable with 250 to 500 wefts per inch on average (Lechtman, 1993).

The dyeing industry was very dynamic. It created a very broad catalogue of plant-based colours. Carmine red and violet became treasured because of the production of carmine, a pigment obtained from a cactus parasite known as cochineal. This insect was cultivated along the dry fields of the empire and became an important tribute in medieval Andean economies (Phipps, 2010). Its active components are very easy to cast inside the keratin and cellulose fibers of cotton and camelids creating thread, yarn and fabric with very bright tones.

Violet has been a highly valued color during history mostly because of the lack of a diversity of natural sources for the pigment. Lichen, blue azurite or lapis lazuli were used to produce tones closer to blue and the expensive murex, a sea snail found in the Mediterranean made royal purple possible (Phipps, 2010). The complexity of obtaining these tones made this color a luxury for the clergy and monarchy. With the discovery of cochineal by colonizers, a new industry was established in the Americas with big plantations of *Nopalea* and *Opuntia* cacti and this parasite spread across the dry areas of Mexico and South America (Gade, 1979).

During the colony, European fashion pushed away many of the previous fashion trends and industry leaving space only for techniques that could be replicated for the European vogue.

The introduction of the pedal loom made it possible to extend the length of fabrics but decreased the richness of the weft detailing. The introduction of Merino sheep in the sixteenth century (Phipps, 2010) set aside the fine alpaca fiber to create thicker and more protective fabrics.

During the Republic, the new nations kept alive many colonial production systems such as mercantilist textile mills (*obrajes*), workshops dedicated to textile production for the benefit of the Crown (Korovkin, 1998) and later the new republic feudal industry. At these places, indigenous communities became part of the inventory and were kept in slavery thanks to an endless credit system and no right to own property (Chandler, 1982). Each *obraje* was specialized in specific products and therefore the use of pre-colonial and colonial techniques that suited the demand. This knowledge went beyond production and was acquired by these groups to produce their clothing. For example, in Northern Ecuador groups such as the Otavalo were able to replicate the English cashmere: the women from Zuleta have admirable blouses decorated with exquisite embroidery and lace. In the south, the people of Salasaka produce wool felt for their ponchos that are used in rituals of manhood.

2.Resilience

During the colonial and republic eras, there was a contact component that shaped textile knowledge: trade. The production of textiles is very labour-intensive and therefore extremely connected to demand. Without its monetary or symbolic value, fewer people work on, learn or improve techniques. In the case of the town of Salasaka in Ecuador, this dynamic drastically changed during the 20th century thanks to new industrial processes, access to education, Mission Andina and the economic crisis at the beginning of the 21st Century.

In the 50s and 60s, the introduction of aniline erased most of the dyeing noesis thanks to stronger mordants and quicker processes in contrast to traditional techniques such as the cochineal that could take up to 3 days. One of the biggest losses during this time was the quality of ovine fiber because of the reduction of flocks linked to a lack of shepherds. Children were culturally accountable and when they started going to school, they learned to shepherd in the abstract as opposed to the original “learning by doing**”** (Tang 2016) model. This led to a decline in the genetic quality of sheep. Currently, the flocks have reduced to 2 to 4 animals per family, which retained production for domestic consumption with sporadic purchases of wool from other communities or even factories. With the changes in dyeing and sheep raising knowledge of the production chain, which used to happen internally in every family, broke into pieces.

In 1954, Misión Andina came into the equation with a mandate to “promote the development of indigenous communities introducing innovative technologies and new productive, organizational and trading approaches” (Bretón, 2000). The organization, in partnership with the Ecuadorean government, established education programs for

craftsmen. In the case of Salasaka, designers such as the Ecuadorean Hugo Galarza and American Charles McGee worked with local loom weavers to create new patterns for tapestry after understanding and improving some techniques (Burbano, 2020); and Dutch artist Jan Schroeder taught interlocking tapestry to communities in the mountains (Ucrós, 2015). According to designer and researcher Iván Burbano, the new items created by this initiative could not find a market to be sold; the group founded the store Tosca Originales (1) as an effort to generate income. Sadly, this store as other initiatives promoted by Misión Andina came to an end after economic, administrative and other scandals related to the neo-colonial views of that time. This failure was significant because once again, the artisans did not connect with the final buyers. However, the town of Salasaka kept the knowledge and started producing tapestry that was later sold by the nation of Otavalo. An example of this work is a fish pattern that is still around. Mentioned before, the Otavalos are an ethnic group located in the north of the country that is excellent international traders.

Thanks to the success of their cultural exportation, the Otavalos started traveling around the world playing traditional music. These shows were and are still common on many streets around the world. This artistic business is always displayed next to crafts manufactured in Ecuador. Salasaka supplied most of the tapestry for many decades until demand motivated the Otavalos to switch to a local maquila production. This change was exacerbated by the 2000s economic crisis and dollarization. The exorbitant inflation and conversion made tapestry a no profitable activity for Salasaka (Masaquiza, 2017). According to local artisans, labour and materials took most of the costs with insignificant and sometimes negative revenue.

During this time, Ecuadoreans were forced to migrate mostly to Europe and North America. Salasaka found a peculiar spot: The Galapagos Islands. With a registered population of 600 people and an estimated 400 illegal inhabitants by 2011 (El Telégrafo) and 600 legal inhabitants by 2018 (El Universo), Salasakans found jobs in construction, home caring, transportation, and tourism. This last activity represents a steady demand for tapestry with Galapagos fauna patterns woven on the continent and taken to the islands by travellers who go back and forth between the two places. During their time in Salasaka, they work on the loom and sell those products to thousands of tourists at extremely convenient prices.

Trading has shaped the textile heritage for Salasaka. Cultural changes in the last century have affected the core of the production chain, decreasing the quality or even erasing many techniques. However, the demand for goods and the local textile consumption have kept many techniques alive, all of them divided across the same geographical area.

3.Today

By 2020, the process of wool production into textile goods can be synthesized into 3 big categories:

Table 1. Summary of processes involved into yarn, thread and fabric making at Salasaka.

	1st process	2nd process	3rd process	4th process	5th process
Sheep Raising	Breading	Veterinary care	Wool Shearing		
Wool Processing	Washing	Cleaning	Carding	Hand Spinning	Wool ball and skeins
Dyeing	Plants	Cochineal			
Pedal Loom Weaving	Hurdida	Loom Weaving			

Sheep rising happens inside many families in Salasaka. They mostly own two to four animals, always including a female sheep, which is appreciated because of its reproductive capacity. The animals rotate wherever good grass is located and they are tied to a rope to keep them in the area. The fur is sheared one time per year and these fleeces are used to make clothing for the family such as ponchos, bayetas (shawls) and anacos (skirts) that are worn for *Día de Muertos* in November.

Sheep face two big problems: a lack of veterinary care and cattle theft. In the first case, the animals suffer from parasites such as ticks and amoebas and other conditions; sadly, their owners lack the knowledge to treat them properly that decreases their quality of life and health. Salasaka is also a victim of cattle theft; people avoid visible areas and rotate the animals constantly. However, most of the events happen at night and people feel hopeless for the help of the authorities.



Figure 1. Families in Salasaka own few sheep and the lack of care decreases the quality of life and health of the animals.

The fleeces are used for domestic consumption and they are processed inside each family. It starts by washing the dirty wool, which is very labour-intensive. Each fleece requires a lot of water from the river or water channel. The preferred soap for washing and whitening is *Deja*, an industrial detergent. The washed wool is hand-clean to eliminate any impurity, which facilitates the carding process. With the use of two combs, the wool is lengthwise aligned.

The carded wool is soft and ready to be hand spun. This technique is mostly done by women who carry a *carrizo* stick with a bundle of carded wool at one end At any free moment, women take these fibers and gracefully twist them to interlace the fur into fine thread or yarn. Each person has a specific and unique speed; pressure and consistency, which makes each, thread a fingerprint. Depending on the future use of the thread and yarn they became balls or skeins.

When required the thread can be dyed. The preferred colours in Salasaka are black for *ponchos* and *anacos;* and purple, dark green and pink for *bayetas*. The pigments available are artificial anilines, which are cheap and easy to use. For the wealthiest families, women appreciate carmine bayetas dyed with cochineal.



Figure 2. Manuel Masaquiza is waiving a media vara, the standard size of a bayeta. Traditionally, families own a pedal loom and use it to prepare clothing for domestic use.

Finally, the wool thread and yarn are prepared on the loom to later become fabric. The first step is the *hurdida* that is the preparation of the warp (lengthwise thread) on the loom that requires the finest consistency of material. After this three-day process, the artisan will start weaving the *trama* or weft (width wise thread), which can be plain color or designed. For traditional clothing, simple or lineal patterns are popular. In the case of tapestry, the designs have a broader variety of iconography, mostly animal and plant.

4.Design in Capital

While Salasaka has kept its textile knowledge divided between its inhabitants, the dynamics of the mestizo cities are different. In this context, in the capital of Quito, the inhabitants have western stories surrounding their clothing: they buy them from a store. Before the nineties, seamstresses and tailors were in charge of making people's clothing. With the boom of fast fashion, more and cheaper items are filling the demand for clothing leaving the old trades at the edge. More affordable fabrics such as industrial acrylic and cotton are now the preferred by the middle class.

In this context, textile design has had to find a space in the contemporary globalized world with a pioneering generation of designers/makers leading the change. They have understood the necessity of looking back at the origins: to the fibres and fabrics and who made them. These professionals come from high educational backgrounds; products of significant changes in the country's education system: The 2010s crisis in Argentina and the use of the American dollar as Ecuadorean currency made Argentinian art and design schools affordable for families to send their children abroad. On the other hand, scholarship programs sponsored by the local government allowed many students to study in the United States and Europe. All these people came back with knowledge and skills developed for industrialized countries.

Coming back home was a big challenge for these people since everything they learned was developed for another context: places where the industry and design have shaped the culture of creating. Fashion, product, and graphic designers brought back sustainability as part of their work, but faced the need to develop enterprises and not just creative projects.

Many designers started this path with sustainability as their main value. Designers are recycling and up cycling materials such as the case of Remu Apparel that reuses denim for their jackets or Allpamamas that give a second life to house fabrics. However, upcycling and recycling have limits for creative processes. Designing a collection requires specific, customized and new fabrics and this search have become a significant barrier. The manufactures of thread, yarn and fabric couldn't compete with fast fashion and stopped

producing locally. With a weak industry, the efforts to improve technology or even develop it never happened and sustainable textile supplies became almost non-existent.

In this context, the challenge of creating a sustainable collection is difficult as Remu Apparel tells on their commercial website:

> "…we realized the material we used for lining our jackets, while beautiful, was not made of sustainable materials in line with our production objectives. We were sourcing the lining for our jackets from local artisanal markets where the lining was labeled as alpaca or wool, but in reality it was made of acrylic fibers. We stopped production immediately and started looking for new direct suppliers to partner with." (Remu Apparel, 2020)



Figure 3. Remu Apparel decided to stop using acrylic fabrics. The linen of this jacket is made by Andes Materials.

The experience of Remu Apparel is shared between many who have taken a step back in order to start looking locally. In the context of Ecuador, that means looking for the indigenous artisans like those in the town of Otavalo. Sadly their traditional Plaza de Los Ponchos, stores and workshops (now factories) no longer prioritize sustainability. Acrylic became the first option for low effort, bright folkloric colors, and big productions. The initiative Allpamamas searched for the fabric in other communities of the country and found artisans such as Carmen Orellana in Bucay, Azuay province, who weaves a textile known as Makana made with silk and cotton with geometrical patterns. This enterprise also works with Matico, the last workshop dedicated to traditional loom weaving located in Peguche, Imbabura province (Allpamamas, 2020). Nevertheless, these companies have the demand for more fabrics thanks to their yearly collections, work and efforts. Creating the supplies is not their business.

5.The Opportunity

Ecuadorean Fashion brands are growing locally and internationally; they all need sustainable supplies with a traceable origin.

Salasaka's traditional ecological knowledge (TEK) related to textiles does not work around the dynamics of fast fashion. It actually hurts the local products that are made non-competitive due to a lack of reliance on modern procedures and technologies (Tang, 2016). At this specific moment in time, it is important to embrace the knowledge kept in oral traditions and creates the conditions to improve Salasaka's textile TEK. This is the beginning of Andes Materials.

This scenario turns out to be an opportunity for the researchers (us). The town of Salasaka hosts all textile processes from sheep to textile creation. Sadly, recipes and secrets have died off with the original artisans or got lost because they became literally useless for their families. We cannot shame them. If they couldn't sell what it took them so long to make, why would they keep on doing it?

Moreover, we realized the competitive advantage of having all the pieces of the value chain happening locally, which is a rare phenomenon in a post-industrial world. Usually, raw materials are located far away from the people who transform them into supplies and finally, the garments. This advantage helps us provide information of the whole process: From sheep to supply, everything happens in Salasaka.

We started improving the quality of the local fibber. In order to get results, we sample the fur of 46 animals and test different visual characteristics of the wool including color, length, density, breaking point, resistance, and crispness. As an average, the thickness of the local fiber is 24.13 um. which makes the wool medium quality (Rodriguez 2017). In order to improve the quality of the fiber, it needs to be thinner which will help decrease itching, and

make the wool softer and more resistant.



Figure 4. Wool samples were taken from 46 animals to test the quality of the local fiber. Sadly, the average quality was not the best which led us to design a strategy to improve the quality of the breed.

The veterinary recommendation was improving the genetic quality through reproduction. We identified a Uruguayan breed with amazing fiber qualities: 4M. The males rotate between families to fertilize female local sheep which facilitates the birth of new lambs and sometimes twins twice per year. This process is giving us better animals but not enough wool. As a solution, we have found and bought 4M wool from flocks in other indigenous communities in Chimborazo and Cotopaxi provinces, where people did not have a fair buyer.



Figure 5. The new generation of lambs are visible bigger and healthier than their parents.

Other recommendations of the study included food, medicine and veterinary care. This was approached in a practical manner: classes where people learned how to identify and treat common diseases. With an established calendar and constant supplies, the animals have improved their quality of life including the new generation.



Figure 6. Zoila is learning from the veterinarian Karla Rodriguez how to provide a vitamin shoot to her animals.

Shearing was improved as well, from scissor cutting, which used to hurt the skin of the animal, to mechanical shears with hair clippers that keep an adequate fur length to keep the animal warm. Because our products and processes are limited, we take time to shear each animal reducing the stress. When the fleece is ready to be washed, we use detergents free of phosphates. The clean and fragrant fleeces are now ready to be cleaned by hand and any impurities are discarded. The clean wool is ready for carding where fibbers are aligned and softened.

With good wool, we get an amazing thread by applying an ancestral technique. Traditionally made by women, hand spinning is the way of making thread and yarn. Women carry a *carrizo* reed with a bundle of carded wool at the end. The previously carded wool is transformed by twisting the fibers into a continuous fine line.



Figure 7. María and Francisca at the workshop of Andes Materials hand-spinning wool into thread.

The yarn and thread are ready to be sold as balls or prepared for the next astonishing phase: pedal loom weaving. With the feedback of fashion designers, we determined standard sizes to fit design and sewing needs. Our offer is versatile enough for patterning and products that use big pieces of fabric such as yoga rugs and linens.

Another significant upgrade is natural dyes, techniques that were lost in the minds of the grandparents of the present grandparent. We are using local plants and cochineal on written recipes that are a combination of oral tradition and modern improvements. Old recipes have lost ingredients such as the sneaky *Piedra Morocho* that was used to make black. Dyeing with cochineal used to take days with an excessive use of this precious insect. We have

reduced waste and standardize procedures and portions.



Figure 8. Part of the work on creating dyeing recipes includes looking for new recipes and adapting them to local plants.

The standardization provides us data about raw materials and processes. We now know how much resources are needed for every product we include in our portfolio. We have optimized our production dynamics to respect nature and set a comfortable working environment for people: our workshop is a place where people have the physical and motivation tools to revitalize their heritage.



Figure 9. The workshop of Andes Materials used to be a school that stopped working in the 90s. From the ceiling to the walls, the space has been upgraded to fit machinery and furniture.

Order, recipes and standardization are facilitating fair pay to our artisans in a timely manner. We have set prices with enough revenue to reinvest in the company and make a profit after investing time and resources to design a proper website and constant audio-visual material for promotion. We sell branded yarn and thread to stores, plastic artists, and other enthusiasts. Our more profitable product is fabric; with minimum orders of 10m, we are at a point where we can customize orders, experiment with patterns and materials. Salasaka and its textile knowledge are back on the market.

6.We are Equal

The experience of Andes Materials is part of our hearts; we connect Salasaka's textile knowledge to the new world of sustainable fashion without reliance on the bygone themes of nostalgia and romanticism. Since the beginning, we (the researchers from the mestizo world) decided to establish equality as our main value and go against the social and academic status quo. The indigenous communities of the Andes have been under-appreciated as "the other ''; their culture has been simplified as folklore by a "modern world culture characterized by constant change and whose forms were, as a result, ephemeral" (Diarmuid, 2014).



Figure 10. The Team of Andes Materials.

The dynamic is related to a narrative of observation and classification, not by the cultural actors themselves, but by the academic world. The world has looked at the indigenous people as classified objects, which reminds us of the taxonomic interest characteristic of colonialist Spain, at a time when the influence of the Swedish naturalist Carlos Linnaeus spread throughout Europe (Katzew, 2004)**,** giving rise to famous expeditions whose aim was to catalogue everything that was possessed. The new business world cannot follow the traditional ways of seeing the other.

We believe social entrepreneurship creates the conditions to improve local economies and therefore culture. Our portfolio and services provide construction materials for fashion designers, which allows them the freedom to create products without worry about where their materials are coming from. Our portfolio allows us to generate new conditions for the economic stability of family life in the Salasaka community.

The now obsolete critical theory of academia has been replaced with action. We do not theorize; we believe social entrepreneurship is changing our future.

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Acknowledgements: Thanks to my father Rodrigo Muñoz Contreras to connect a distant childhood trip to Salasaka to this wiser version of me. I recognize the support and engagement of our partners in Salasaka: Zoila Jerez, Juan Masaquiza, María Jerez, Francisca Masaquiza, Isabelita, Taita Matías, and María Jerez. Finally, I appreciate all the support from all the authorities at USFQ, they help us dreams and become very joyful designers.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Working with the United Nations Sustainable Development Goals in Design Education

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Abstract | This paper investigates how design schools within the fine arts can teach students to create sustainable transformation when working with the United Nations Sustainable Development Goals (UNSDG). The question is examined through a case at the Royal Danish Academy where third semester students engage in a project-based design thinking course focusing on how to increase biodiversity in Denmark. Data consists of the course material and 48 student team projects. The projects are organized in terms of the areas of design intervention and are applied to analyze how well the design methodology and course serve the objective. Findings illustrate that the applied design thinking approach is supportive to creating transformation at the scale of the UNSDGs, however, the student projects generally lack critical reflection on the correlation between challenge and solution and an assessment of the potential impact of the design proposal. Adjustments and new suggestions are offered for future courses.

KEYWORDS | DESIGN THINKING; UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS; BIODIVERSITY; ASSESSMENT; FINE ARTS DESIGN EDUCATION

1. Introduction

At the Royal Danish Academy (RDA) the United Nations Sustainable Development Goals (UNSDG) are included in the school's strategy. Consequently, students must address one of the goals in their BA and MA graduation projects, just as many research projects, the admission test and several design courses include working with the UNSDGs. The objective is twofold. The academy wishes to contribute to a more balanced and sustainable world by investigating and showing how design can contribute to the realization of the goals and to spur a new era of growth within Danish design (The RDA News site, 2016).

The present paper investigates how design education within the fine arts can teach students how to create sustainable transformation. 'Sustainable transformation' can be defined as creating change for future generations to be able to meet their needs, like we, living in the present, can meet our needs (Brundtland, 1987).

The backdrop is the planetary imbalance as expressed in the UNSDGs. Human beings are at the epicenter of the crisis: the human population growth, our ability and will to dominate, our unsustainable use of resources, and our general inability to change our ways before it is too late (Fry, 2012). We are producing results that nobody wants (Scharmer & Kaufer, 2013; Heller, 2018). Already in 1985, Papanek expressed his concerns about the role that design plays on the environment by creating incentives for increased consumption (Papanek, 1985; Csechin & Gaziulusoy, 2016). However, design professionals, educators and researchers have generally been slow to change our ways of thinking and acting in relation to environmental issues. There is much to learn about how design can contribute to creating sustainment.

The study is based on a case in which third semester students from 8 design disciplines participate in a six-week design thinking course working with the question of how to increase biodiversity in Denmark, mainly the UNSDGs #15 Life on Land and #16 Life Below Water (Sustainable Development Goals, 2015). Design thinking provides the underlying theoretical foundation for the approaches to be experienced in practice by the students. Data consists of the course material, e.g. course objectives, program and course layout, and 48 student team projects. The projects are analyzed and organized in terms of how they contribute to increasing biodiversity, leading to three areas of design intervention. Next follows the analysis of what can be learned from looking more closely at the student projects and how this reflects on the design thinking methodology and the course as means to teach students how to tackle large–scale, complex challenges.

2. Design Thinking

The theoretical foundation of the course is based on 'design thinking', a methodology for creative, collaborative, complex problem solving (Brown, 2008; Dorst, 2015; Liedtka, 2016; Thienen, Meinel & Nicolai, 2014). Design thinking was initially investigated as a particular cognitive ability among professional designers, the 'designerly ways of knowing' (Johansson-

Sköldberg, Woodilla & Çetinkaya, 2013). During the 1980s, a different discourse was introduced by practitioners and researchers within fields such as Design, Business Management, and IT, 'design thinking' now a strategy and a toolbox for addressing complex, ill-defined, interdependent challenges, transporting the designers' ways of working to new areas and disciplines (Johansson-Sköldberg et al., 2013). The present case is in line with the latter discourse, defining design thinking as a systematic, collaborative, future-oriented and iterative process enabling the inclusion of perspectives across disciplines, life worlds and allegiances such as knowledge, beliefs and social positions when creatively addressing open, complex, and dynamic challenges.

Central to the process is the framing and reframing of problems in parallel, applying abductive thinking to suggest potential ways of looking at a problem and generate novel solutions (Dorst, 2011). An integral part of design thinking is sketching, prototyping and other types of visualization to iteratively explore and experiment with new opportunities. The visualizations serve as vehicles for communication with oneself and others. It's a way of making external versions of experiences and ideas, and of testing possibilities (Coughlan, Suri Fulton & Canales, 2007). On a planet where disagreement and conflicts are prominent among humans, design thinking appears well-suited to working with the UNSDGs due to its focus on including diverse, sometimes conflicting perspectives in co-creative work (Thienen et al., 2014).

There is a wealth of visual design thinking models, providing participants with a shared process language and supporting the separation of content from process. Typically, the process is iterative and runs in loops between different activities such as a 'research' to investigate challenges, opportunities, underlying conflicts and paradoxes; 'ideation' – to imagine new possibilities and concepts, and 'implementation' – to refine, adjust and realize the designed solution (Friis, 2016).

3. The 6C Model

The design thinking course introduces students to a variety of design thinking and innovation theories while applying the 6C Model (Figure 1) (Friis, 2016) as a foundation for the layout of the course.

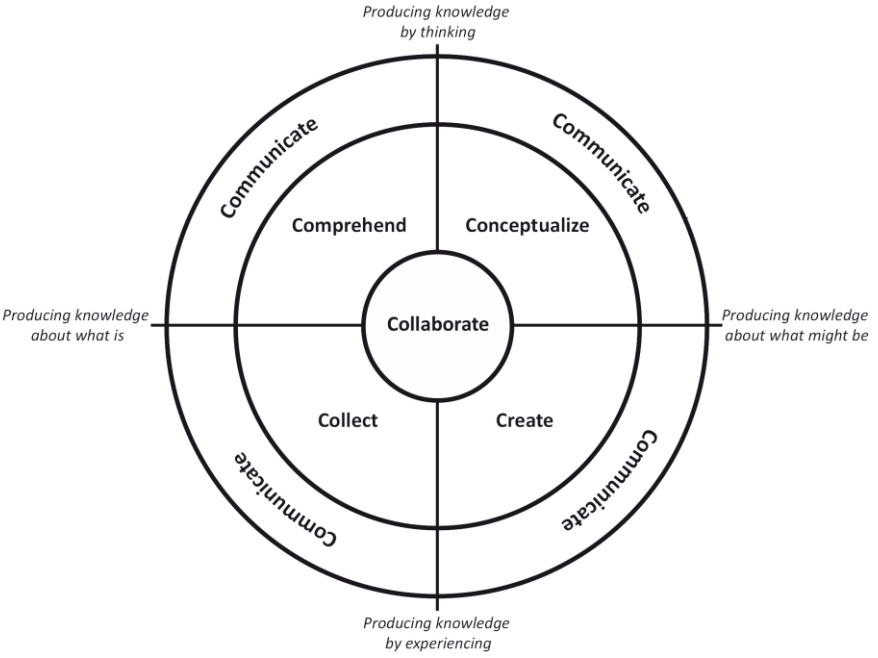

Figure 1. The 6C Model illustrates different approaches to knowledge production in a design thinking process, (Friis, 2016).

The 6C Model describes types of knowledge production in design thinking, e.g. how designers iteratively explore existing situations and possible futures by moving between experience–based and mental processes. The model is accompanied by a deck of 89 method cards, which offers a number of approaches within each of the model's six categories, which are 'Collaborate', 'Collect', 'Comprehend', 'Conceptualize', 'Create', and 'Communicate' (Figure 2).

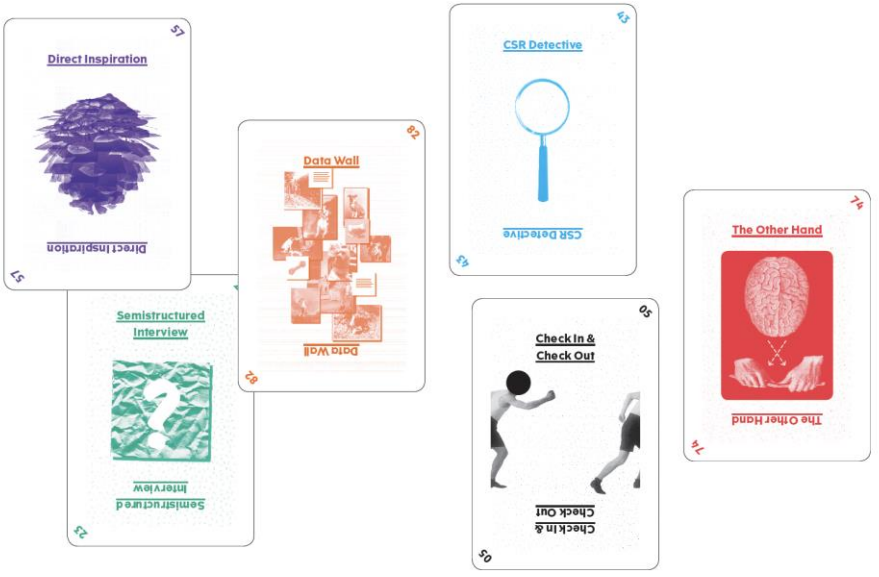

Figure 2. The Co–Creation Cards. Examples of a method card from each of the six color–coded categories, (Friis, 2015).

4. The Course Layout

The aim of the course is to teach the students design thinking and collaboration methods. The course, which has run for two years in 2017 and 2018, is experience and project based. Students work in teams of 4–5 students across design disciplines, which are fashion–, furniture–, game–, graphic–, spatial– and textile design.

At the outset of the course, external stakeholders come to the school to present a challenge. Six weeks later, they are presented with the students' projects and provide feedback on the identified challenges and proposals. The arrangement serves to underline realism and motivate the students to leave the studio and include real stakeholders in the process. In 2017 the UN City Copenhagen and the Danish Society for Nature Conservation (DN) were partners, posing the challenge 'How might we increase biodiversity in Denmark?' In 2018 there were three stakeholders, each posing a sub–challenge to the overall UNSDGs. DN asked 'How might we create space for large, wild animals?' A journalist at the Danish newspaper Information asked 'How might we provide space for bees and other pollinators in the city?' An independent biological consultant asked 'How might we create wilder private gardens?' Students could choose between the three options. Subsequently, a teacher formed the teams.

The categories and accompanying methods from the 6C model are introduced subsequently during the first 3 weeks, allowing students to experience approaches from each category by applying and experimenting with the methods. The 6C model isn't linear, one can start a design process in any of the 6 categories. The sequential approach is a pragmatic decision to avoid information–overload at the outset, and ensure students experience approaches within each of the categories.

Figure 3 provides an overview of the process in the present course which begins with 'Collaborate' for team members to get acquainted with the types of competences, preferences, and skills available in the team, and to adjust expectations in terms of levels of ambition and intentions. The 'Communication' methods are introduced early, since students need to communicate their process and produce material for their final presentation from the outset. Then follows the introduction to approaches and underlying theories in the Collect phase where students identify stakeholders, conduct interviews and experience different types of data production about the situation. In the Comprehend phase, students analyze data and identify insights and challenges. In the Conceptualize phase, they develop and evaluate possible solutions to one or several challenges. In the Create phase, students are introduced to prototyping techniques to further explore and test ideas. In the final week, they present their process, data, challenge and solution in the format of a 3 minutes long film.

Collaborate	Communicate	Collect	Comprehend	Conceptualize	Create
Week 36	Week 37	Week 38	Week 39	Week 40	Week 41
The course and tools, literature, theme, challenges, problem owners, making teams, collaborate methods	Creativity & motivation, film making 1, design thinking, gardening, collect, comprehend, and communicate methods	Pecha Kucha presentation 1, film making 2, DMS 17 presentations, project description, conceptualize methods, gardening	Prototyping, conflicts in creative teamwork, create methods, gardening	Pecha Kucha presentation 1, gardening	Hand in project description, presenting film 1 & 2, evaluation and celebration
Talks Introduction to the course, learning objectives and guidelines, to design thinking, the 6C Model and the Co-Creation Cards, to SDG # 15 Life on Land, to biodiversity & rewilding, to the 3 problem owners & challenges, to creative teamwork and to anthropological field methods.	Talks Introduction to creativity and motivation, gardeners, the film making process 1, design thinking & innovation, comprehend and communicate methods	Talks Introduction to the film making process 2, DMS 17 student presentations, introduction to conceptualize, intro to project description	Talks Introduction to prototyping, conflicts in creative teamwork		
Exercises Body Map, Work space, Creative Problem Solving Profile, Yoghurt exercise	Exercises Getting into the collect methods, experimenting with comprehend methods. gardeners exercise	Exercises Experimenting with conceptualize methods, gardeners exercise	Exercises Experimenting with collaborate and create methods, gardeners exercise	Exercises Gardeners exercise	Exercises Gardeners exercise, evaluation
Teamwork Reading and digesting the literature, choosing a challenge, making teams, experimenting with collaborate approaches, nature walk, getting into the collaborate methods.	Teamwork Collaborate, collect, comprehend and communicate in teams	Teamwork Collaborate, collect, comprehend, communicate, and conceptualize, presenting in a Pecha Kucha format	Teamwork Collaborate, collect, comprehend, communicate, conceptualize, and create	Teamwork Collaborate, collect, comprehend, communicate, conceptualize, and create, presenting in a Pecha Kucha format	Teamwork Hand in project description, finalize and present film 1, iterate, upload and present film 2
	Supervision Project supervision	Supervision Project supervision	Supervision Project supervision & film making supervision	Supervision Project supervision & film making supervision	Supervision Project supervision & film making supervision

Figure 3. *Overview of the six–week design thinking course (Friis, 2018).*

5. Empirical Data

The investigation is based on 48 student projects: In 2017 145 students were working on 29 projects. In 2018 there were 90 students working on 19 projects. The data consist of a 1–2 pages project description and a 3 minutes film from each of the teams.

Each project has been reviewed in order to record the challenge identified by the team, the designed solution and how the students think that the solution contributes to increasing biodiversity. Subsequently the projects have been clustered based on the intended effect, dividing them under three headers: a. Changing people's understanding, attitude, and behavior towards biodiversity, b. Creating physical space for biodiversity, and c. Cleaning up or preventing the pollution of nature – leading to better conditions for the ecosystems (Figure 4).

Areas of Design Intervention	Changing People's Understanding, Attitude and Behavior	Creating Physical Space for Biodiversity	Cleaning Up or Preventing Pollution of Nature
Design Projects	*Communication design:* campaigns (the majority with seed bags), folders, films, art installations, exhibitions, cook books, Go Cards, children's books with activities, websites *Interaction design:* board– and digital games, neighborhood competition games, websites, apps, plant calendar, interactive art exhibitions, pop-up events, nature school/lab, online fora and movements for action and information *Product design:* seed packs, plant sticks, shirts	*Landscape design:* floating island biotopes/island and bog modules on city lakes and in canals *Spatial design:* redesigning city spaces to include greenery, green parks in metro stations and along railways *Product design:* Green outdoor furniture for public squares and residential courtyards, drainpipes with greenery, planting box with toolkit for kindergartens, biodegradable planting modules *Service design:* personalized forest certificate, new burial rituals and –site *Multi–stakeholder business model:* marine sanctuary	*Service design:* coffee store concept for recycling, local distribution system for permaculture goods *Multi-stakeholder business model:* plantation of seaweed reefs

Figure 4. Three areas of design intervention to increase biodiversity (Friis, 2020).

The division of the projects cannot be considered complete. Firstly, there are types of projects that the students haven't considered, for instance design to handle invasive species (which might cause depletion of other species). Secondly, the projects can be further divided, e.g. transforming human understanding and human behavior can be related, but are separate objectives. Thirdly, most projects fit under two headers, for instance the design of

an informative book for children (changing understanding) with pages that can be planted (providing new habitat). Each project has been placed under the header where the students foresee the greatest impact. In the following, the areas of intervention are exemplified by student projects.

5.1 Changing People's Understanding, Attitude and Behavior

Twenty–five student projects focus on changing people's understanding, attitude, and behavior towards biodiversity, many based on the assumption that if humans are informed about the state of biodiversity and provided with suggestions for action, change will happen. This is exemplified in the following excerpt from a project description: '"Let it grow', [is] a game for grown-ups who can understand the more complex aspects of the issues concerning biodiversity and will potentially soon be in a situation where they can implement this new knowledge". Another project, 'Ferox World', intends to open the minds and hearts of children to wolves through a digital edutainment game. While large predators such as wolves have been found to significantly increase biodiversity within ecosystems, their presence is contested by many people who fear the animal. The design team discovered how peoples' perception is primarily based on myths rather than facts and decided to inform the young generations through the playful activity of developing biodiverse ecosystems in a Danish environment (Figure 5).



Figure 5. Ferox World. Illustration by design students Olsgaard, Bednarcikova, Andersen, and Kramer, 2018.

5.2 Creating Space for Biodiversity

Twenty projects focus on providing new habitat for wildland and wildlife, for instance by establishing new wilderness islands in Copenhagen's canals or lakes, by creating drainpipes with greenery or by distributing seeds for people to increase the number of pollinating flowers in Copenhagen. The project 'Grøn' (Green) focuses on one of the busiest and most polluted spaces in Copenhagen, Nørreport Station. 250.000 people pass by every day. The students decided to increase the vegetation on the roof surfaces to provide nourishment for pollinating insects and make it visible from the street (Figure 6). In addition, greenery is expanded to the ground level by creating furniture with spaces for plants and flowers, e.g.

benches, poster stands, and columns and a visual campaign disseminating seed bags and information about the importance of wild nature.



Figure 6. Grøn. Illustration by design students Stibolt, Sloth, Gammelgaard, and Holmegaard, 2018.

5.3 Cleaning Up or Preventing Pollution of Nature

Three projects focus on preventing pollution or cleaning up ecosystems, for instance through a new transport system for distributing permaculture goods and design to expand seaweed plantations in the waters surrounding Copenhagen where biodiversity suffers due to low oxygen levels (hypoxia). Seaweed can reduce environmental hypoxia while it is also edible and nourishing to humans. Hence, the team decided to increase the demands for seaweed among Danish households by designing a series of traditional dishes with seaweed, for instance 'Burning Love' (mashed potatoes with bacon and onions) and 'Fish and Chips'. The final proposal 'Weed this Together' (Figure 7) is a multi–stakeholder collaboration between the municipality of Copenhagen, Copenhagen restaurants, and the upstart company 'Nordic Seaweed'. In addition, the team offers the layout for a campaign and a website to promote seaweed to Danish families.

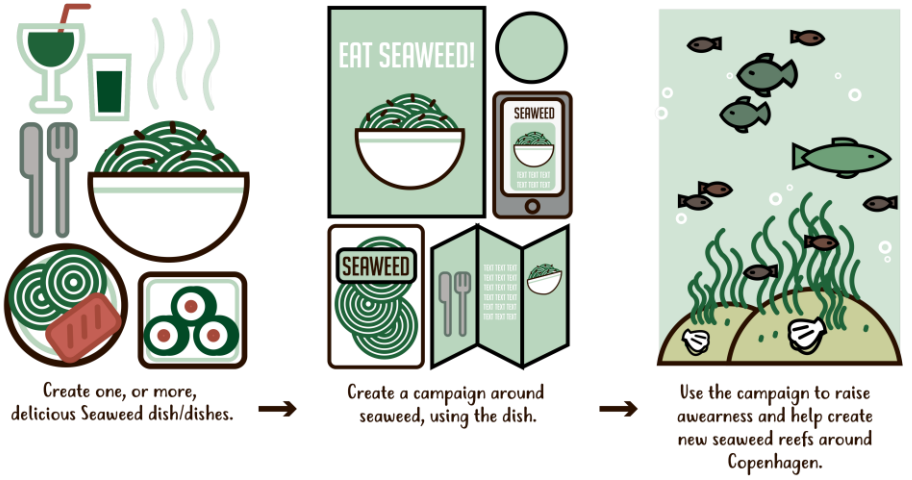

Figure 7. Weed this Together. Illustration by design students Abildhauge, Morille, Nørgaard, Sindler, and Øster, 2017.

6. Analysis

In the following, the student projects and the course design behind the students' results are examined to throw light on how well the design course succeeds in teaching students how to tackle the large–scale challenges expressed in the UNSDGS.

6.1 From Abstract Challenges to Concrete Solutions

In general, the students are able to familiarize themselves with a new and complex topic through the application of design methods. Within six weeks, they identify relevant challenges and come up with novel project proposals. Some proposals represent incremental innovation, for instance board games to teach particular target groups about the significance of biodiversity. Other projects exemplify radical innovation, breaking away from present solutions, for instance the NJORD Turbine Sanctuary for sea mammals, established as a multi–stakeholder collaboration between the turbine manufacturer, the municipality, and an NGO where students provide new designs for the creation of turbine pillars supportive to biological diversity under water. This means that students are able to move between the abstract, higher level of unframed challenges, as presented by the problem owners, to the plain of concrete challenges and solutions. In addition, most teams succeed in telling the story of how they worked their way forward – the methods and approaches applied, the insights gained, and the final proposal, providing a window to the process for others and themselves to comment on, learn, and reflect. The students are thus able to visualize, not only the result but the road travelled and the insights and decision–

making points along the way. These are important skillsets that designers can bring to the table when working with large–scale complex challenges.

6.2 The Connection Between Challenge and Solution

While promising that the majority of student teams identify a relevant challenge and create a design proposal, the relationship between the two is rarely investigated in depth. Will street art change private garden owners' perception of bees and gardening practices? Will offering a personalized forest certificate in return for a donation succeed in attracting 'buyers' and thus save forest? Will a coffee store concept with a reusable cup and a return system be a viable alternative to single-use coffee cups and lead to less pollution of nature? In some instances, the intuitive answer is a 'no', in others a 'yes' or 'maybe', however, the answer is not based on a clear process for evaluating the connection between the two.

Looking at the design thinking course, teachers must find ways to more systematically guide student teams to critically evaluate and question the relationship between the identified challenge and the proposed solution during supervisions and presentations. For instance, by applying the categories of the 6C Model as a visual mapping– and dialogue tool, posting and comparing the types of information and challenges from the existing situation (Collect and Comprehend) to the proposed solutions (Conceptualize and Create). During this process, which should take place early, before design students become too attached to particular ideas (Coughlan et al., 2007) the students and teachers can take on the roles of different stakeholders and critically reflect on the correlation between challenge, solution, stakeholders, context etc. to (re)formulate solutions and challenges.

Also, students should be provided with approaches for early testing of the challenge–solution–outcome correlation in practice, for instance through prototyping. Coughlan et al. (2007) describe how prototypes support learning faster by shifting the creative process from discussion to creative action and by failing early through many rough models that can enable the inclusion of multiple stakeholders such as future users, experts etc. This early type of iterative approach would probably energize the students and their process, as it would be more active and playful. It implicates that the sequential layout of the course – starting with collecting information, moving on to comprehending the challenges before moving into conceptualizing opportunities and creating new proposal – be changed and organized in shorter, iterative loops in line with the tandem framing and reframing of problems and solutions as suggested by Dorst (2015b). It's likely to provide students with insights that can confirm and disconfirm assumptions and thus support the making of credible ties between the challenge and the design proposal. For instance, in the case of Grøn, the student team could have made rough mock-ups of pieces of green, urban furniture, a poster, and seed bags, to observe and interview people passing by Nørreport, discerning the effect that the different elements have on them, leading to new insights and adjustments.

6.3 The Expected Impact and Negative Side–effects

Another insight surfaces when analyzing the student projects: The expected impact of the design proposals (including the negative side effects) is not deliberately assessed or discussed. For instance, what's the expected effect of a set of biodegradable modules with soil and seeds, making it easy for garden owners to provide bees with nourishment –and what might be the negative side effects? Will the solution lead to an increase in biodiversity or does it, in itself, represent a challenge to biodiversity? Is what we create worth what we destroy? (Fry, 2014). We don't know. This is not the design students' fault. Investigating the expected impact, positive and negative, is not explicitly addressed during the course.

One could argue that embracing uncertainty and taking risks is part of design thinking. Says Kolko: "Transformative innovation is inherently risky. It involves inferences and leaps of faith; if something hasn't been done before, there's no way to guarantee its outcome" (Kolko, 2014, p.7). While this is an important argument and part and parcel of creative endeavor, critically assessing the impact of a proposal is central when working with the UNSDGs. Otherwise, we risk repeating the sins of the past by designing solutions – and teaching students to design solutions – that will only make the situation worse by wasting energy and resources on fruitless or harmful efforts.

As it happens, the 6C Model and the Co–Creation Cards provide approaches for evaluating proposals, for instance in the methods 'CSR Detective', 'The Whole House', and the 'Success Criteria Grid' (Friis, 2015), but they are not enforced and likely not adequate for supporting the wide variety of estimates that working with the UNSDGs require – going beyond the present case, the 17 goals address issues in relation to poverty, health, gender equality, clean water and sanitation etc. And subordinated the overall goals are a vast array of problems and opportunities. Alas, a first step is to increase the focus on assessment in the learning objectives, in lectures, and during supervision. The following are suggestions, for how this might be done.

6.4 Knowledge and Perspectives from Stakeholders

Since the student projects address many different challenges, individual considerations are needed regarding what is to be assessed and measured, how, with whom and to which end. In all likelihood, assessments will require the skillsets of different disciplines and different stakeholders at different points during the design process. For instance, a team working with the creation of wild gardens in apartment housing will at the outset need to include the knowledge and perspectives of e.g. architects from the municipality's planning division, biologists, and the inhabitants. Once the team has a solution proposal, in one case a novel type of drainpipe with bowls for growing flowers and housing insects, new knowledge and perspectives from other stakeholders must be included e.g. residential housing architects, landscape architects, engineers, producers of drainpipes, biologists, potential users etc. At each stage of the design process, from initial investigations over concept models to high–fidelity working models, the team must identify the stakeholders able to help them critically

evaluate the possible impact on biodiversity in Copenhagen, the consequences to the inhabitants, the city, and the side-effects of the product, for instance in terms of production, maintenance and recycling. Thus, stakeholders must be included, not only at the start of the process, during the 'Collect' phase (Figure 2), also in the later phases when challenges and solutions are developed.

6.5 The Assessment Tool

To bring attention and focus to the assessment process, it might be helpful to include tangible tools such as The Assessment Tool by Lykke Bloch Kjær at Laboratory for Sustainable Disruptions, Design School Kolding (Kjær & Friis, 2016) which is based on the work by John Elkington (Elkington in Kjær & Friis, 2016). The tool consists of a large circular map (Figure 7) on which participants place the idea to be assessed in terms of its social (people), financial (profit) and environmental (planet) consequences.



Figure 8. The Assessment Tool by Lykke Bloch Kjær, Design School Kolding, (Friis and Kjær, 2016).

Participants ask 'what's the best imaginable consequences?', 'what's the worst imaginable consequences?' – and 'what is missing from the idea to achieve the best possible impact?' The tool provides the students with an experience and understanding of the importance of deliberately assessing and discussing the possible consequences and facilitates dialogue and collaboration, for instance by including real and role-played stakeholders.

6.6 Cross–Institutional Collaboration

A final, more comprehensive approach is to establish cross-institutional collaborations with other universities, e.g. anthropology–, biology–, business–, engineering–, and psychology students. This would increase the complexity of the process, however, also provide teams with a broader set of skills to apply diversified measurements, careful reflection, and the access to networks within different knowledge domains, raising the likelihood of different perspectives and experts being included throughout the process.

7. Conclusion

Six weeks is a short time period to teach design students how to create sustainable transformation at the level of the UNSDGs in practice. It is thus gratifying to see that many things in the present course appear to work well. Provided with a shared, visual design thinking model and accompanying methods for collaborating, communicating and producing knowledge about the present and future situation, the third semester design students generally succeed in familiarizing themselves with what is to many new and complex territory, identifying a relevant challenge and design proposal and narrating the story of their design process.

With this said, further examination of the student projects in conjunction with the course layout reveals the need for additions and adjustments, more specifically in terms of students learning to critically reflect on the correlation between the identified challenge and the design proposal and making assessments of the estimated future consequences of the design proposal. Assessments and measurements are typically not areas that have received much attention within design thinking. The paper provides suggestions for ways to more systematically include methods for assessment in future courses, for instance making space for trying out prototypes with stakeholders, including different stakeholders throughout the process and applying visual models to critically compare and discuss the relationship between the identified challenge and the design proposal.

Working with the UNSDGs in practice in design education is a big mouthful. However, even though everything is not in place we shouldn't wait. The way forward includes doing many different things in the short term and learning from it.

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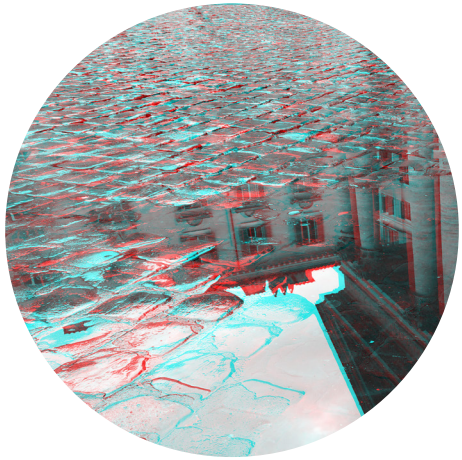
Acknowledgements: Thank you so much to the students in the three teams for letting me share their work: 'Ferox World' is by Freja Olsgaard, Katarina Bednarcikova, Erik Andersen, and Mads Kramer, 2018. 'Grøn' is by Andreas Stibolt, Emma Sloth, Noa Gammelgaard and Maria Holmegaard, 2018. 'Weed this Together' is by Cille Rosenørn Abildhauge, Julie Morille, Tiril Nørgaard, Jan Sindler, and Simone Øster, 2017. Also, a heartfelt thanks to designer and co–teacher Lykke Bloch Kjær, for critical comments and inspiring conversations.

DESIGN CULTURE(OF)

REVOLUTION

CRITICAL THINKING
DISRUPTION
CHANGE



TRACK CHAIRS

DESIGN CULTURE (OF) REVOLUTION
CRITICAL THINKING | DISRUPTION | CHANGE



Hélène Day-Fraser,
Emily Carr University of Art + Design, Canada
“Revolution - what goes around comes around? Design as needed provocateur and catalyst. Seeking contributions that address our relations and open up new alternatives. How do we reconfigure the assumptions that trap us? What does it mean to confront our disquiet with the world-as-it-is?”



Alastair Fuad-Luke,
Free University of Bozen-Bolzano, Italy
“Design activism constitutes specific design actions that critically transform raising awareness and vigilance of our societal condition into socio-political actions, individually and collectively.”



Stefano Maffei,
Polytechnic University of Milan, Italy
“Complexity is change. Design has to deal with the transformation of the species, of the environments, and the societies. A new posthuman design perspective is needed. The future is unwritten.”



Betti Marenko,
Central Saint Martins, University of the Arts London, United Kingdom
“How do we design critical interventions that resist capture, propose alternatives, activate change? By design as a problem-finding, world-making, terra-forming, future-crafting strategy that acts in the present to shape tomorrows”

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Alternative narratives data visualization archive

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Abstract Nowadays non-expert groups use data to collaboratively create alternative narratives that challenge those imposed by power institutions. Data visualization is an adversarial tool for bottom-up counter communication. This paper offers reflections on bottom-up practices around the creation of alternative narratives that use data visualization. It is based on the preliminary results of a research project that aims to create an online archive of digital projects dealing with data visualization for alternative narratives. The collection of projects allows for an overview of the diversity of actors involved, the issues addressed, the aesthetic characteristics of the visualizations, and the characteristics of the data practices and sources. The re-appropriation of digital languages, platforms, and formats emerge together with diverse visualization techniques as new proposals to counteract information hegemony. While most projects follow the open-source ethic, greater openness in working with data for alternative narratives from bottom-up needs to be promoted.

KEYWORDS | DATA VISUALIZATION, ALTERNATIVE NARRATIVES, ARCHIVE, DATA ACTIVISM

1. Introduction

This paper provides a reflection on bottom-up practices of data-driven alternative narrative. It draws on the preliminary results of a research project aimed at creating an archive of online projects dealing with data visualization for alternative narratives. Data-driven alternative narratives shape the facts that take place in a story not told by the dominant power, with the aim of making visible and evident issues for the audience to reflect over and continue questioning it (Briones, 2019). The archive is proposed as a way of approaching three relevant aspects in the context of data design: 1) promote critical thinking by designers and "consumers" (Tufte, 2006) of data visualizations; 2) raise knowledge and awareness about the type of projects and who mobilizes them, the issues they address, and the ways in which they work with the data; 3) promote the use of data for activism in the design and related communities, serving as a source of inspiration and dissemination. The archive provides an overview of the state of data visualizations used for alternative narratives, revealing aesthetic aspects characteristic of this type of data-driven counter-narratives that are different from other types of data-driven narratives. Presented in the context of a master's degree course in communication design, the archive is an educational and reference-consulting tool for students.

1.1 Emerging technologies and bottom-up data practices with visualizations

The digital sphere has profoundly changed the way people access and share information. In the last 15 years, the production of data has been exponentially increasing. Emerging technologies present new opportunities as well as new challenges. The informational power relationship of governments and corporations that provide homogeneous and opaque methods of access, manipulation, and communication of data, and the increasing cost entailed in personal data (i.e. surveillance and profiling) are two of the many reasons why it is critical to decentralize the ability to produce data-driven narratives. Modes of access and tools to manipulate data have brought marginalized actors to collaboratively create alternative narratives to those delivered by dominant power structures. Non-profit organizations and activist groups increasingly base their campaigns on data, using visualization as an agency tool for change.

Within the network society (Castells, 1997) citizens are now abler than ever to access information and know how public institutions exercise their power. Skepticism towards the dominant power has been installed as a verifiable possibility. On the other hand, individuals and networked communities are seeking to counteract online mainstream information channels, creating new sources and tools of information, often generating alternative channels (e.g. Mastodon platform (https://mastodon.social/about), OpenPod (https://openpod.abbiamoundominio.org/). These practices resonate with the concept of technopolitics, which refers to "the articulation between the strategic use of communication technologies for action and collective organization" (Toret, 2015, p. 51). Bottom-up techno-political practices show how the use of technologies and data is promoting social change,

opening spaces for the creation of new narratives. This article understands that data visualization is a tool and a techno-political bottom-up practice when framing alternative narratives.

The repertoires of action in the uses of data are increasingly amplified due to the access to tools for extraction, analysis and communication of data to lay people; and are "constituted from a group of people articulated together through a diverse set of social and technical means" (Sack, 2011) self-organizing and gathering hybrid profiles that produce new visions of the world. The many online tools for data extraction, manipulation, analysis, and visualization allow one to work with data from the beginning to its communication. Working with data is no longer only for data experts but for a mixture of profiles from different disciplines and skills. The diversity of perspectives and situated knowledge of those who are working with data as a techno-political bottom-up practice is precisely one of the richest bases of the process and result of data visualizations for alternative narratives and that dissociates them from traditional data visualizations.

Although the expertise needed to work with data is no longer the domain of experts alone, there is still a great lack of data literacy among individuals in the datafied society. Designers who work with data visualization, among other profiles such as hackers, are data intermediaries (Baack, 2015) who do the work of bringing data closer to people's experiences (Mauri & al, 2019). In this sense, the communication designer who works with data assumes an active and political role in the information society.

The appropriation and détournement of digital tools and platforms is another aspect of data practices around alternative narratives. As referred to in section 3 of this article, it is remarkable how several of the projects collected in the archive show a disruptive approach to reusing visual and interactive resources to present data visualizations in alternative narratives.

1.2 Data activism and adversarial design

Data activism is a type of activism that takes a critical approach to practices around data and technologies (extraction, production, collection, analysis, communication among others) for challenging existing power relations seeking for social change.

> “It involves a series of practices at the intersection of the social and the technological dimension of human action, with two aims: either resisting massive data collection or actively pursuing the exploitation of available data for social change.” (Milan and Gutiérrez, 2015, p. 122).

Data activism builds on the work of subcultures that precede it, taking main inspiration from hacker ethics and open-source movement that has emphasized the use of data in activism by opening, sharing and modifying them, generating knowledge to seek social change (ibid.). One of the main objectives of data activism is to remove individuals from passivity in the face of data. In this way, data activism will seek to inform how the mechanisms by which

power institutions control individual's data. It will also seek to open up knowledge about technical and ethical practices with data, promoting training instances.
Data activism finds a close relationship with communication design with data through design activism and in particular with adversarial design. Design activism is described as

> "design thinking, imagination and practice applied knowingly or unknowingly to create a counter-narrative aimed at generating and balancing positive social, institutional, environmental and/or economic change" (Fuad-Luke, 2009, p 27).

On the other hand, adversarial design is a type of political design whose emphasis lies on the agonizing qualities by provoking conditions of disagreement and confrontation.

> "adversarial design does the work of agonism means that designed objects can function to prompt recognition of political issues and relations, express dissensus, and enable contestational claims and arguments" (DiSalvo, 2012, p 12).

Design activism directly seeks to empower people to take action in the ongoing processes of social change, while adversarial design seeks to be a proxy for this action. In other words, it is the understanding of conflict that mobilizes action, not the action itself.
Although both concepts point to the active and critical action of individuals seeking to promote change in relationships with dominant power, a closer relationship is identified between adversarial design and data activism. The latter seeks to challenge hegemonic power by pushing society to be actively critical of data and technology and their implications. The above concepts resonate with the role of data visualization as a decisive adversarial tool (DiSalvo, 2012) for data activism. Translating data into visual representations for alternative narratives is an activist practice that requires a critical approach to data to make a political position evident and coherent.

2. The alternative narratives visualization archive

The Alternative Narratives Visualization Archive is an open, ongoing, and collaborative archive that collects and maintains over time digital online projects which use data visualization as a tool to support alternative narratives to the ones from dominant power. The archive aims to raise knowledge and gather the design expertise on the relevant task of portraying evidence to not visible or alternative social issues that aren't been told by the main power institutions. It seeks to encourage the creation of other narratives to those that dominate and to promote discussion of existing ones. At the same time, the archive aims to bring to the fore discussion and awareness on the political role of designers when designing with data. Three main tasks that the archive performs in terms of knowledge construction around data-driven alternative narratives are: the need to create new ways of telling alternative narratives; the bottom-up approach of data to people's experiences around social issues; and the preservation in time of the cases collected.

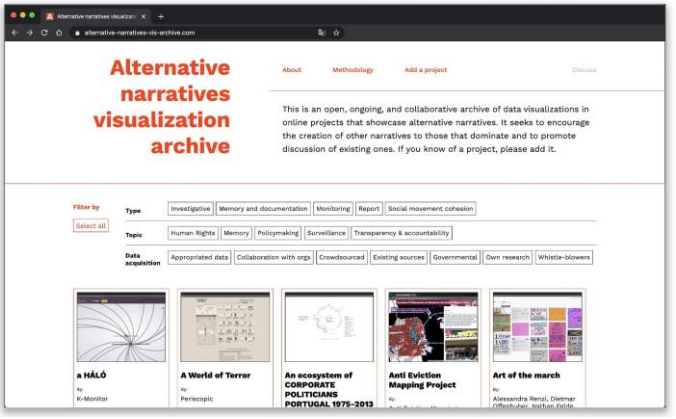

Figure 1. Home page screenshot of the online archive.

Narration is part of human self-creation. To create alternative realities, it is necessary to tell stories that subvert the imposed ones and that above all represent the multiple possible worlds. The projects collected through the archive are examples of how these narratives can be addressed through data bringing new ways of engaging with social issues, and at the same time bringing data closer to people's experience. The archive is intended to be a source of inspiration for those seeking to imagine ways of telling alternative narratives with data. On the other hand, many of the projects collected online are outdated and have been lost over time. The archive seeks to preserve the fragile digital material for future research.

The archive currently boasts a collection of 65 projects, most of which are still online. Each project is categorised according to the way in which the data was acquired, the topic covered, and the type of project based on the purpose of each project. The definition of these categories was based on the project's information generally provided in the "about" or "methodology" section. However, this information is not always present in the projects of the collection, making necessary deeper research on the actors behind and over the situated context of each topic.

The archive is part of an academic research being presented in various didactic experiences in the context of a master's degree course in communication design at the university. During the course experience students are asked to design alternative data-based narratives, designing communication artifacts that invite the public to reflect over social issues. Throughout the research and design process, students consult the archive and use the collection of cases as references for their projects. In this way, the archive turns out to be a tool that inspires the students' project work, while promoting a critical look at the relationship of the themes of the archive projects and the work with data. Therefore, the archive is a didactic tool for the teacher who makes the spectrum of the projects known, and

for the students who consult it looking for references. The filters proposed in the archive conduct the consultation promoting a critical look at the work with data that each project circumscribes.

The archive has also been presented to diverse activists in informal and non-academic contexts, receiving recognition particularly in two respects: 1) exposing the potential that exists in the work between communication designers and activists; 2) and showing a variety of designerly means - which are not always easily imaginable by activists - when envisioning the possibilities of communicating with data. However, it remains to be systematically observed how the archive is an inspirational tool for activists.

Some ways to observe the success or appropriateness of the archive approach might be through interviews with activists who use the data in communications projects. Also, follow up on collaborative work between designers and activists who create alternative data-driven narratives by observing how they consult the archive and practice critical approaches to working with data such as those in the archive.

3. An overview of data-driven alternatives narratives with visualizations

Data-based narratives that use visualizations are the result of a series of practices mediated by various data structures and which need closer observation. To this end, we provide an overview of the projects based on the information that was possible to collect. Following a feminist approach to data visualization (D'Ignazio & Klein, 2016), the project collection is analyzed in four aspects: Who are the people behind the projects? What are the themes they propose? What kind of data sources and data structures do they work with? What are the aesthetic practices that they try to engage audiences with through the data? These questions are more concerned with practices associated with bottom-up production than with data or visualization itself.

3.1 Actors and topics addressed

The collected cases include projects that have to do with social objectives that seek to engage audiences through the communication of alternative visions of the world using data in digital platforms. All projects were developed by independent and mainly bottom-up organizations such as self-organized citizen groups, NGOs, independent civil society organizations, researchers. They are non-profit, not private or business sector-oriented. Each project focuses on a particular topic. Topics were manually classified by defining a macro topic and related sub-topics. The five major topics are: Policymaking, Transparency and accountability, Human rights, Memory and archives, and Surveillance. The following diagram maps according to your topics, subtopics as well as representing the number and type of organization involved in each project. observed how the subtopics overlap and cross

one topic with another. This classification seeks to give more entry points to the reading of the projects and how they represent conflicts.

3.2 Data sources and data practices

Assuming that the visualization of data for alternative narratives should promote a critical reflection on the data, it is relevant to observe what practices are embedded in the "social context where data are produced, consumed and circulated" (Gutiérrez & Milan, 2019). Of course, not all practices are visible in the visualizations, but it is possible to deduce the origin of the data (from official sources, collectively elaborated, among others) or the publication of the methodology and the database used.

The archive emphasizes observing how visualization projects for alternative narratives work with the data. There are several questions that can be asked, from do they contain a methodology section that explains how you worked with the data? Do we know who created that data and how? This classification deals with understanding and showing how the data was acquired in each project. Based on the Mirén Gutiérrez classification published in his research Data Activism and Social Change (2018), the following categorization is proposed:

- **Appropriate data:** it's about grabbing existing data from other platforms from which there is no access. Scraping is one of the most used techniques.
- **Own research:** from research results that can be measured in data. For this, they use all the creativity in using and creating forms of measurements and measuring devices such as self-built sensors, homemade photo balloons, etc.
- **Existing sources:** produce new analysis from available, but unrelated and unexplored, datasets.
- **Collaboration with other organizations:** collectives, foundations, organizations among others.
- **Crowdsourced:** generate the means to crowdsource citizen-contributed data.
- **Whistle-blowers:** organizations or individuals are recipients of data via whistle-blowers such as leaks.
- **Governmental data but not public:** data delivered directly by an entity such as the government to a particular organization for restricted purposes.

Many of the projects state principles such as transparency and accountability, disclosure of power relations, or the right to open information. It is striking, however, that the vast majority of cases do not put much of these principles into practice through their own data visualizations by means that they don't release the databases used in the visualizations, among other practices. From this can be inferred:

- The weak relationship of open data culture linked to data visualizations.
- The incoherence in the discourse of institutions that use data visualization to subvert the opacity of information by institutions of power.

- The deliberate will not to share data due to other reasons not explicit in the projects.

All three are fairly generic conclusions but they provide first lines of action to foster a critical data culture. The archive aims to contribute from design to a more critical and knowledgeable data culture, so it points its efforts to the first of these stated observations. How design can you contribute to a more critical data culture?

4. Aesthetic practices of alternative data visualizations

Working with data for alternative narratives brings with its aesthetic practices that reformulate the way data is visualized by moving away from the traditional way. A new paradigm aesthetic that seeks to promote questions not only from the final output of the visualization but also from how they are constructed. They expose not only the conflict but also the ways in which the conflict is perceived by disrupting visual components of digital interfaces to propose a new reading in their use and meaning.

Visualizations follow an aesthetic of digital disruption through the re-appropriation and détournement of graphic elements (e.g. use of the pixel), digital languages (e.g. emojis, links, gifs), and re-use of platforms for other purposes (e.g. use of Twitter to create a bots that reproduce a database). These new expressions and ways of counting on data move away from traditional graphical visualizations, proposing more elements that involve the audience with the narratives.

The projects in the collection present a well-defined point of view in relation to the subject matter, which is not always contrary but inquisitive to the hegemonic narratives. There is no intention of being neutral in the way the data-based narrative is approached. The vast majority of the actors behind these projects lucidly assume that the data are not neutral, and neither is their representation. In other words, working with data from its interpretation, representation and communication intentionally moves away from a pure neutral aesthetic that advocates efficiency and parsimony linked to statistical graph design. Visualizations in alternative narratives do not follow Tufte's proposal that 'the design of statistical graphics is a universal matter [...] like mathematics' (Tufte, 2001, p. 10). Instead of proposing a purely analytical representation, they integrate other aspects to narration and representation such as the emotional and playful dimensions. These variables are materialized in the use of visual variables in addition to interactive variables (animation, activation of filters, etc.).

The aesthetic practices of disruption that are observed also integrate an open approach to the representation of uncertainty, to the unfinished, and to the disclosure of how the visualization components. It approaches the aesthetics of imperfection (Saito, 2011), by declaring the appropriation and articulation of meanings, languages and visual tools. These

characteristics that are observed from the visual aesthetics of digital projects are often confirmed by the methodological statement of the projects.

Several of the visualizations in the collection assume hybrid aesthetic characteristics that combine different components: in part it is possible to find characteristics of analytical visualization, in part it is possible to find characteristics linked to an aesthetic of artistic information design, as well as components that come from other areas such as oral history and data journalism.

The projects presented below exemplify the aesthetic practices of appropriation and détournement, disclosure and the unfinished, and uncertainty and imperfection by means of narratives.

4.1 Appropriation and détournement of the digital as a means of new languages

Alternative narrative that proposes the use of digital platforms or the lexicon of a digital platform, to give it a twist and say something completely unexpected. With this kind of narrative there is a double meaning: the alternative story, and what the medium that is being re-proposed means. The contrast of the two is what enhances the irony and the subversion of this type of narrative.

This type of alternative narrative brings together socio-political and techno-political elements. As mentioned above, the re-appropriation and re-proposal of digital tools are practices that have been carried out in social movements in recent years. They are also directly related to the principles of open-source culture and tactical media.

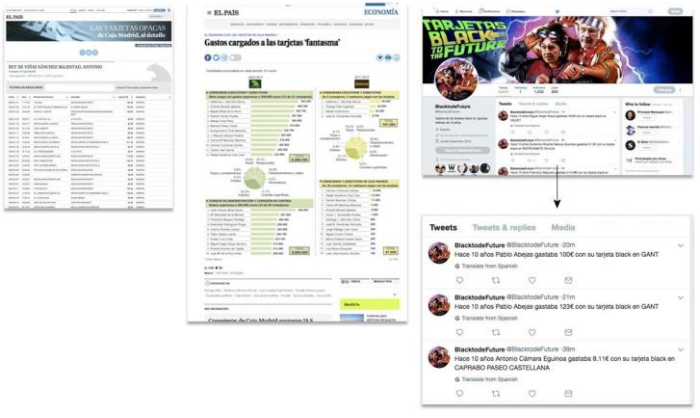

Figure 2. Tarjetas Black to de Future: A Twitter bot that tells micro stories of the executives of Caja Madrid-Bankia through the expenses made with Black cards 10 years ago. Each tweet

is a story. Instead of doing charts or aggregating data they use an existing platform (familiarity) for publishing the unduly expenses of the politicians.

Within the context of Spanish 15M, a leak was revealed with information of embezzlement and public money by Spanish politicians. The leak was a large database detailing which politician spent how much, where and when. Montera34 developed a Twitter bot (@BlacktotheFuture) which tweets every time one of the directors spent money using the black cards 10 years ago. People who follow the account could receive a Twitter notification of one of these stories. The project's aim is to reveal the cheekiness use of black-not transparent money by the authorities through a "in a day like today, 10 years ago" narrative which helps people to realize the lifestyle and irresponsibility of their actions. Dosing the contents of the leak in a time frequency frame that the audience could associate to everyday life actions, increases the sensibility of the crime. The choice of Twitter as the medium increased the "everyday life" perception of a crime that happened 10 years ago as something normal. Instead of analyzing aggregate data, Montera34 chose a different approach to data: small data in doses to reveal the silent crime (small data for mini-narrative in a one tweet dimension).

4.2 Disclosure and the unfinished

"El caso Ayotzinapa" is a project by Forensic Architecture, Equipo Argentino de Antropología Forense, and Centro Prodh. They reconstruct spaces of conflict using the residual evidence of the intense destruction produced by explosions, bullet holes in walls, images captured with closed-circuit TV cameras, amateur and professional photographs and videos, audio recordings and the architecture of the city among other things as pieces of evidence. Their work follows a forensic aesthetics and methodology using a "raw" visual language leaving the same modelling tools with which they reconstruct their research. There is an evident intention not to make up or perfect the technical elements used, making the process of creating the visualization transparent.



Figure 3. Screenshots from the "Plataforma Ayotzinapa" exploration interface. Data and evidence was positioned in time and space. The interface allows the user to navigate through time filtering by victims, security forces, government workers, alleged organized crime members, among others. There are also filters to highlight actions, objects and scenes. Retrieved from www.plataforma-ayotzinapa.org in June 2019.

As a result, narratives present an alternative to those constructed by the dominant power structures using data. "Plataforma Ayotzinapa" like other Forensic Architecture projects, is first and foremost a tool that takes a side in the conflict itself, meaning that its political stance includes the redistribution of power by giving knowledge back to individuals who previously were relegated to just being spectators. Once the spectator gains knowledge they become the audience, taking a position on the matters exposed. The visual models that reconstruct and reshape the data are the political tools that turn the spectators into the audience.

4.3 Uncertainty and imperfection

"U.S. gun deaths" in 2010-2013 is a project led by Periscope in which depicts a database of victims in the United States dead by gun accidents. In orange their lifelines are represented and in grey the hypothesis about how long they would have lived. Visualization is not intended to be an analytical representation, nor does it hope to demonstrate a pattern in the victims' deaths. It proposes to visualize with uncertainty how many years of life were lost by the victims, reinforcing the emotional aspect of what the data represent.

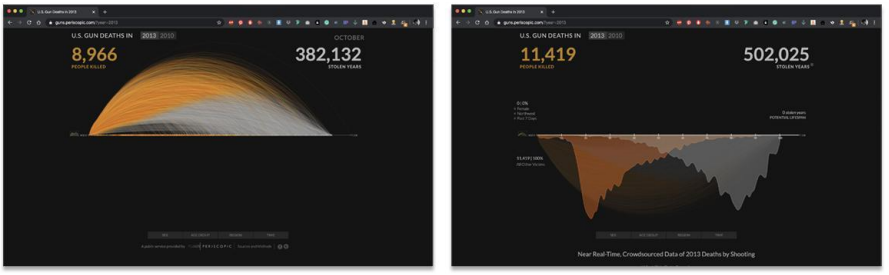

Figure 4. Details from screenshot of the "U.S. gun deaths in 2010-2013" project by Periscope. The visualization shows a hypothetical timeline for the bullet victims. The line is a hypothetical that reinforces the years of life lost. Retrieved from https://guns.periscopic.com/ in June 2019.

5. Conclusions

The paper presents the archive as a way of presenting the state of the art of bottom-up practices of data-driven alternative narratives, raising knowledge and awareness about the type of projects, actors who mobilize them, the issues they address, and the ways in which they work with the data. It seeks to serve as a source of inspiration and dissemination for designers and activists by promoting critical thinking over data when it comes to design data-driven alternative narratives. The archive reveals aesthetic practices, characteristic of this type of data-driven counter-narratives that are different from other types of data-driven narratives.

The paper also highlights how alternative data-based narratives dissociate themselves from traditional analytical data visualizations, proposing new ways of storytelling. Based on cases from the archive collection, it shows how data practices from below are promoting new aesthetic practices that address unconventional aspects in data visualization design. The representation of what is uncertain, of the hypotheses propose new readings to the data bringing them closer to people's experiences, incorporating emotional components to them. Appropriation practices are also an invitation to rethink what is or is not a data visualization that allows audiences to become involved with the phenomena represented. Finally, the design of an uncanny aesthetic emphasizes content and process rather than layers of makeup that hinder understanding in the construction logics of visualizations.

Therefore, it is urgent to start creating a data culture that is conscious of the politics that surround data. It is essential that as data users we start being aware and more critical of the top-down structures that manage, control and collect huge amounts of data and information from the datafied society. Bottom-up structures (individuals, collectives, civil organizations) need to begin to shape knowledge and take control of the implications of data. It is also

important to encourage the alternative use of data, questioning the modus operandi of things, creating spaces of confrontation that promote the active participation of individuals in democracy.

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Becoming Lost and Found in Translation

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Abstract | Becoming Lost and Found in Translation is a participatory co-designed research project involving university art and design students and staff investigating how acts of translation can enhance learning and critical thinking. Using our collaboratively constructed design school manifesto as a starting point it has been translated into over 45 languages that are spoken at our university. This paper outlines the initial findings of this project and how it can be used to think about ideas of meta cognition in learning, transitions from one state to another, liberating and decolonising curricula and how translation itself advances thinking in design education.

KEYWORDS | TRANSLATION, COLONIALISM, LANGUAGE, COLLABORATION, META-COGNITION

1. Becoming introductions (Diventando presentazioni)

> "The question arises, therefore, how far the difference can and must extend - how large? how small? - in order to remain within the limits of the concept, neither becoming lost within nor escaping beyond it." (Deleuze, 1994 pp. 29-30)

Salman Rushdie (1991) asserts, "It is normally supposed that something always gets lost in translation; I cling, obstinately, to the notion that something can also be gained." Lost and Found in Translation is a project run by students and staff from our university, that has used our co-constructed design school manifesto as its starting point to investigate what it means to learn, to translate and be in transition (p. 16).

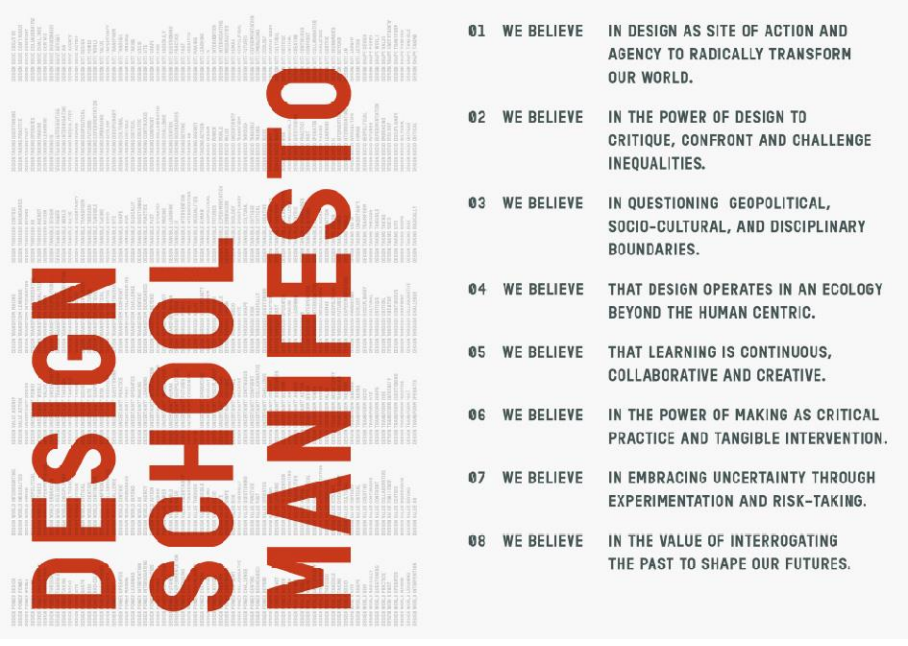


Figure 1. Design School Manifesto, London College of Communication, UAL. (2018)

This paper deals with the origins and continuing evolution, and becoming (Semetsky 2006), of the Lost and Found in Translation project as active participatory co-designed research. It will focus on ideas of critical thinking, meta-cognition and inclusivity and how all student's voices and thinking should be heard and acknowledged in the production of new work about inclusion and social justice. (Bhagat & O'Neill 2011, Freire 1990, Richards & Finnigan 2015).

The project stems from a university funded teaching scholarship I initiated, called “Thinking Design”, which aimed to investigate ideas of meta-cognition in university art and design education. This is outlined in section 2, *Becoming meta-cognitive*, which argues that when acts of thinking are contemplated by the learner then a greater understanding of the processes of learning can be achieved (Livingston, 2003), (Hargrove, 2011), (Ingham, 2012)

In section 3, *Becoming translators in transition*, I describe the development of the project from my initial conversations with students about why our design school’s manifesto was only displayed in English. They pointed out that over 35% of our student cohort are speakers of languages other than English. These new students were in transition from one state; Further Education, undergraduate studies, other parts of the UK or from multiple other countries, to our university, a place they mostly only knew by reputation (Field & Morgan-Klein, 2010), (Land, 2014). This moment of crossing a threshold and to find a place to belong, became central to is project and is developed further in this section (Sabri, 2014).

Section 4, *Becoming pedagogies a concluding becoming*, maps ideas of meta-cognition, translation and transition onto how they could enhance our transformative teaching and learning practice and thinking at out university. From a lecturer translating academic design briefs, so it becomes something that is productive for the student’s learning, to the student making the brief into a physical from, material, writing, or even another idea. This section acts as a conclusion to this paper.

2. Becoming meta-cognitive (메타인지되기)

> “On the one hand, it is apparent that acts of recognition exist and occupy a large part of our daily life: this is a table, this is an apple, this the piece of wax, […] But who can believe that the destiny of thought is at stake in these acts, and that when we recognise, we are thinking?” (Deleuze, 1997 p. 135).

2.1 Beginnings (Początki)

> “…continual beginning afresh.” (Dewey 1916/ p. 417)

One of the precendents of the Lost and Found in Translation project was a two year University funded pedagogical enquiry during my “Thinking Design” Teaching Scholarship. My research aim was to look at the possible value of metacognition in university design and design studies education. I wanted to go beyond the contestable ideas of ‘learning styles’ (Curry 1990), and look more deeply in to the ways we, as educators, can think about and use meta-cognitive ideas of learning, to help our leaners learn better.

For the purposes of the enquiry metacognition referred to “…higher order thinking, which involves active control over the cognitive processes engaged in learning.’”(Livingston, 2003, p. 2). It theoretically investigated ways we can help students, at all levels of knowledge acquisition, to understand how they think about their learning. As Ryan Hargrove (2011)

suggests, “The area of metacognition can be the scaffolding for future problem solving, as the goal remains to enable designers to utilize creative design thinking/processes with optimum efficiency.” (p. 9)

This enquiry had a number of theoretical frames (Bal, 2002). One being a philosophical approach, using key concepts, as discussed by Gilles Deleuze (1997) in Chapter 3, *The Image of Thought,* of his 1968 book Difference and Repetition. This illuminating and complex philosophical tract has been used successfully by some of my PhD, postgraduate and undergraduate students when they have started to question their own thoughts about the way they think about their research. By questioning what we think thinking is, or philosophical has been thought of as thinking, these students, after an often-fraught initial conceptual wrestling match, gained a much better understanding that we cannot base thinking on the concept that just because, “*Everybody knows, no one can deny”.* (Deleuze 1997 p. 130).

2.1 Images of Dinosaurs (Imagens de Dinossauros)

> “The thought which is born in thought, the act of thinking which is neither given by innateness nor presupposed by reminiscence but engendered in its genitality, is a thought without image. But what is such a thought, and how does it operate in the world?” (Deleuze, 1997, p. 167)

One example of this philosophical meta-cognitive strategy was used by Abigail Buchan, a final year Graphic Design undergraduate student, who wanted to explore the representation of dinosaurs. She investigated how we can know what dinosaurs appeared to be like and how past illustrations of them have influenced our thinking about what they might or might not have looked like. Dinosaurs do not look like the ones in Crystal Palace Park or even Jurassic Park, she argued, but they create enduring images that a hard diverge from.

She developed the concepts explored in her written thesis into a practice-based investigation for the ‘Dissertation Transformation Exhibition’ displayed in our college galleries. Abigail set up a wall with the simple instruction, *draw me a dinosaur,* (figure. 2) (Buchan, 2015).

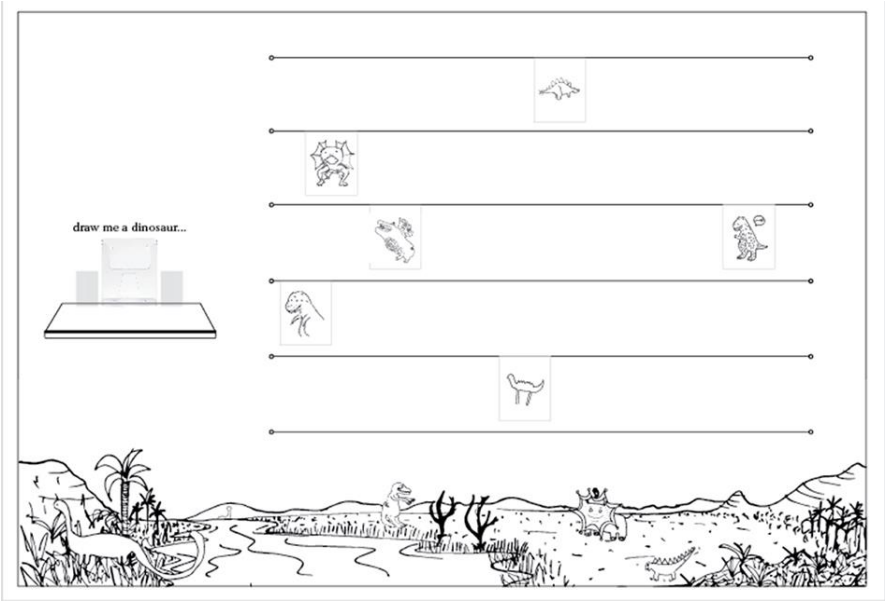


Figure 2. Abigail Buchan's. ''draw me a dinosaur…'. Wall drawing in the 'Dissertation Transformation Exhibition' at London College of Communication, UAL. (Buchan, 2015)

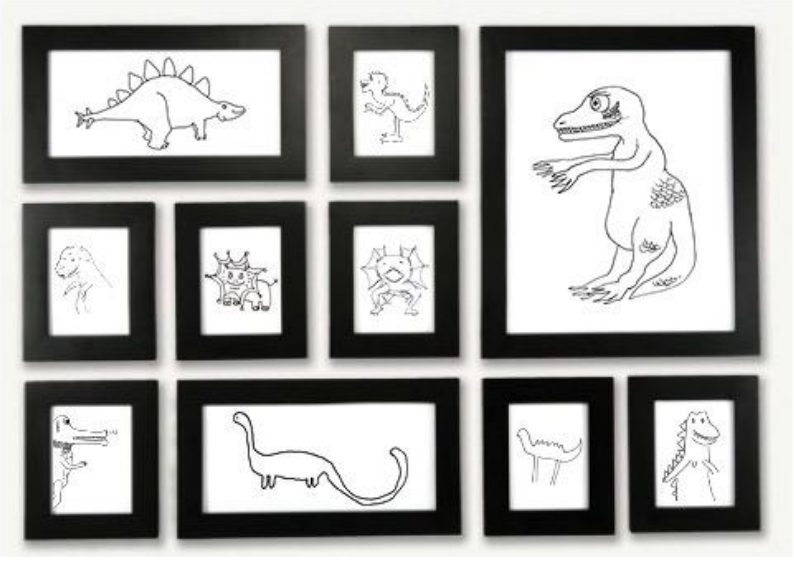


Figure 3. 'draw me a dinosaur…'. Drawings of dinosaurs from the 'Dissertation Transformation Exhibition' at London College of Communication, UAL. (Buchan, 2015)

This practice-based research demonstrated that when we start to think about something, as seemingly simple as what a dinosaur might have looked like, and then be asked to translate this into an image, we often rely on what we already think we know about the object we are trying to translate. The act of translation in this case involved a fun element, but the participants did start to realise that it was not as easy as they first thought and their thinking about what to draw was based on previous encounters with images of dinosaurs.



Figure 4. 'draw me a dinosaur…'. Participant's drawings of dinosaurs during the 'Dissertation Transformation Exhibition' at London College of Communication, UAL. 'draw me a dinosaur…'. (Buchan, 2015)

These moments of metacognition were seen even more acutely when students were asked to translate our design manifesto. Often the initial response was, yes that will be quick and easy, to slowly recognising that the process would take longer and involve more thought and often dialogue with others. Participants went from states of eagerness to ones of contemplation and even mediation, to help and try to make the translations as accurate as possible. It made them aware of the deeper meanings of the manifesto and made them aware of their own learning processes.

3. Becoming translators in transition (Convirtiéndose traductores en transición)

> "…if there is language, it is fundamentally between those who do not speak the same tongue. Language is made for that, for translation, not for communication." (Deleuze & Guattari, 2005, p. 430)

Following on from the theoretical research carried out during the 'Thinking Design' project and after I had taken a teaching and learning sabbatical, I returned to our university and decided to become more nomadic in my thinking and teaching (Semetsky, 2008). I decided not to have an office but work in spaces that were free or were the most appropriate for the circumstances I found myself in. Wanting to reconnect with as many colleagues and students as possible as quickly as possible, this seemed to be and ideal way of being openly visible and available (Ingham, 2019).

3.1 Becoming nomadic (खानाबदोश बनना)

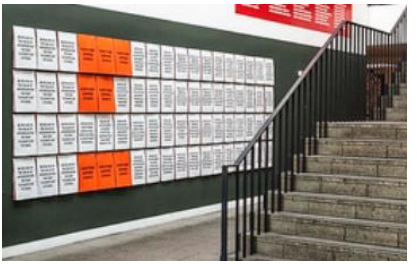
> "The nomadic – smooth – space is an open territory, providing emancipatory potential to those who are situated in this space in contrast to striated, or gridded, space…" (Semetsky, 2008, p. vii-viii)

The department I work for presents work during the London Design Festival each year and was holding its annual public programme exhibition when I returned to work. A number of tables and chairs had been set up in one of the galleries as a space for workshops to be held. I decided to inhabit this space and use it as an 'office'. For LDF18 and our public programme I ran a project called 'Mapping Strange Assemblages' (2018) which involved a number of students and alumni carrying out performative research as gallery guides, and where,

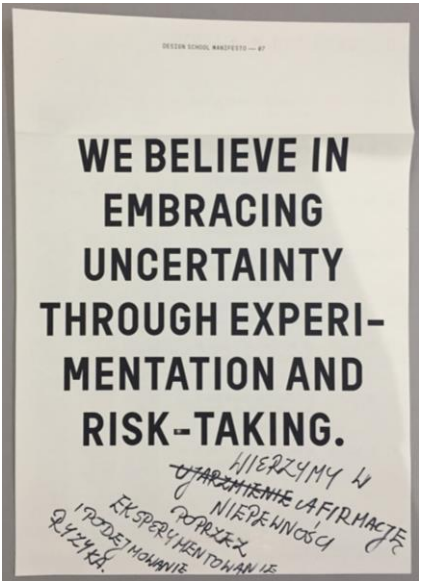
> "…"probe-heads"; […] (becoming) cutting edges of deterritorialization (that) become operative and lines of deterritorialization positive and absolute, forming strange new becomings, new polyvocalities." (Deleuze & Guattari, 2005. p. 191)

Working in the galleries enabled me to be an integral part of these interventions. This had a number of very productive consequences. One being that I became a 'guide' to lost new students who could not find their classrooms or where intrigued by the exhibition. One topic of conversation that reoccurred was our LCC Design School manifesto (2018) displayed at the entrance to the ground floor galleries (Figure 6). The students on the whole where very taken with it and we started to discuss ideas of belonging and language. One question cropped about why it was only in English as there were a large proportion of students for who it was not their first language.





Figures 5 & 6. Manifesto having been translated and displayed at London College of Communication, UAL. (2019) based on how it was displayed in LDF18 at LCC. (2018)





Figures 6 & 7. The Design School Manifesto starting to be translated and altered. London College of Communication, UAL. (2018)

As the idea of translation had always been at the heart of the 'Thinking Design' Scholarship project I decided to do an email call out to students and staff to ask them if they would help translate the manifesto into another language. This was sent out on the first day of the new academic year 2018/19. Within two days we had over 40 responses and the manifesto had been translated into 25 different languages. The feedback was remarkable. The students said the exercise made them feel they belonged to the school and had been given an immediate investment in its ethos and future. The idea of translation was also taken into the

formal lessons of the students by colleagues in the department. (Freeman, Anderman, and Jensen 2007).

> "…this is just to let you know that DBS students loved Manifesto translation exercise. They found all sort of ways to do it: the English speaking students used child's voice, school French or street language and the students who have English as the second language worked on interpretation of the sentences as they quickly figured that it cannot be literal. I used the difficulty around the translation to explain how we write in a different voice than how we speak and how academic writing is developed similarly (they are submitting their first assignment next week so this was a timely exercise). It will also allowed me to situate them within this institution and speak about the community of practice – lovely." (Milic, 2018)

3.2 Becoming visible (变得可见)

> "To hear each other (the sound of different voices), to listen to one another, is an exercise in recognition. It also ensures that no student remains invisible…" (hooks, 1994, p. 41)

Below is a sample of responses given by the students when they sent in their translations to me. These and the face-to-face conversations I had with numerous students made me aware of the importance of visibly showing new students that they are welcomed at their new university (Freeman, Anderman & Jensen, 2007). Translating the manifesto helped with enabling the students to feel actively connected to the department and started to help them to feel they belonged in and with the college. It also shows that it had made them think deeply about acts of translation (Field & Morgan-Klein, 2010).

- "I have translated the rest of the "We Believe" into Chinese and make some changes on the manifesto I translated last week. They are not perfect, but I hope it helps." (Helen 2018)
- "I've translated to Portuguese (from Portugal, not Brazilian...). I am not 100% sure about one of the sentences, I wrote in the doc which one it was and why the uncertainty. Hope it helps!" (Benedita 2018)
- "Please find attached the Arabic translation of the Design School Manifesto. I see it as a work-in-progress as I feel like interpretation of text is always subjective. Please keep me posted on any communication regarding the working design group. I'm still very interested in being part of it." (Yasmeen 2018)
- "…please find the translated table, there are some phrases that don't fully satisfy me, I might need another Italian person to compare the translations. It's very hard to translate while trying to keep it consistent and readable." (Pietro)
- "I translated it into Polish. I did it to my best knowledge and qualification but I am not a translator so I hope it's all correct and carries the meaning :)" (Dominika)

We now have over 40 different languages translations, translated by 60 students and staff at our university. We have started to translate the manifesto into Sign Languages and Braille. The student group, Lost and Found in Translators (LaFiTers), are recording these translations into sound and video works to be put on social media platforms like Instagram. These recordings (Audio Lost In Translations, 2019), have developed into students talking about their own cultures and ideas of serotypes (Osborne, 2007).

3.3 Becoming collaborative (Stát se Spolupráce)

> "Something in the world forces us to think. This something is an object not of recognition but of a fundamental encounter.' (Deleuze, 1997, p 139)

From this initial flurry of activity, a group of students and staff at our university was formed (the LaFiTers). We decided our terms of reference were to explore ideas of; social inclusion (Cameron, 1992), social justice, (Smyth, 2011), culture shock and belonging (Burke & McManus, 2009) and transitions (Sabri, 2014). These would be through ideas of what it means to translate something from one state to another and to be in transition.

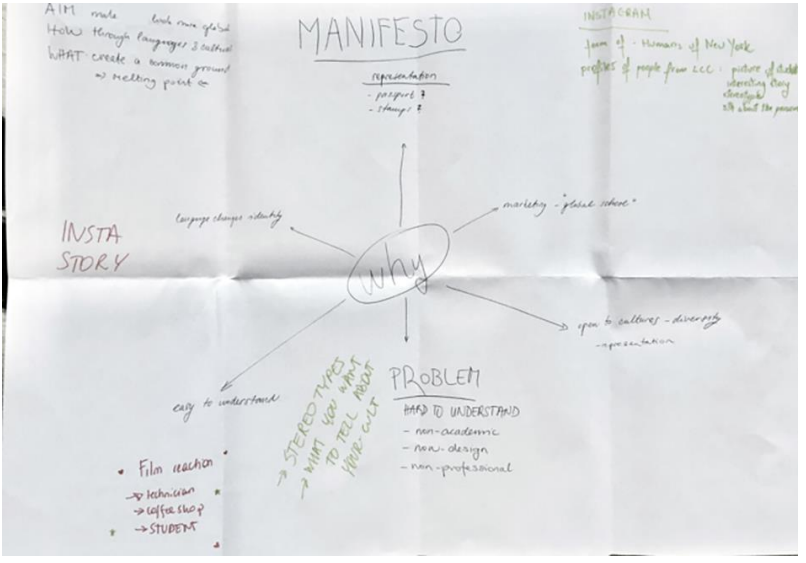


Figure 8. Drawing by the LaFiTs group showing how the Manifesto could be translated and developed. London College of Communication, UAL. (2018)

The students in the group have creatively and gainfully fused written, oral, visual languages, to create new kinds of thinking about the manifesto, with and for our multicultural students

at our university (Healey, Flint and Harrington, 2014). From our first meeting the students came up with a set of initial ideas,

> "… to film or to record students and other people that are involved in the school. The results would be then put as an Instagram story on the university account. This medium reaches a great amount of people that are somehow involved with the school." (LaFiTers, 2018)

3.4 Becoming critical (Att bli kritisk)

> "The point is rather to elaborate the theoretical, critical, and textual means by which translation can be studied and practiced as a locus of difference, instead of the homogeneity that widely characterizes it today." (Venuti, 2004, p. 42)

Inclusivity and critical thinking are central to this project as its aim was to give a sense of belonging and ownership to the students at our university (Freire, 1990, hooks, 1993). After the initial translations were completed, criticisms emerged and were voiced by the students in the group. There were a number of critiques of the manifesto, the students saw that it was about design, "...but as one of its principles is communication, some of the sentences were not clear and hard to understand." (LiFiTers). They saw is as not being democratic, as it was made by tutors. Their solution was for the content of their audio/visual recordings to come from asking questions about the manifesto, to criticise it, to ask people to translate them on the spot, ask them about their culture, stereotypes. (Cowden & Singh, 2013)

3.3 Becoming inclusive (Incghọ nsonye)

> "I share as much as possible the need for critical thinkers to engage multiple locations, to address diverse standpoints, to allow us to gather knowledge fully and inclusively." (hooks, 1994, p. 91)

They decided that they liked the act of recording and came up with the following ideas. To make a podcast that would consist in recording conversations. The recordings would be conducted by the people leading the projects. They would then take the material and find different topics within the conversation and make theme-based podcasts (Ibid). They came up with these set of questions and prompts.

- Does your language change your identity: who are you in English compared to you mother language?
- Any stereotypes? Ask people to tell what they think about x culture and then show to someone from the actual culture and see how they react and respond.
- What do you want to tell about your culture?
- What does the manifesto mean to you?
- Say "Hello how are you" in your language?
- Do you have an accent within your language, how complex is it?

- Ask someone to translate it – write down as you hear it – let someone else read it out loud.

> "[A] few conversations about the manifestos were recorded to see what the effects would be and what kinds of answers we would have. 'It turned out to be interesting while interviewing someone the surrounding friends wanted to be involved in the debate.'" (LaFiTers, 2019)

One aim of this project was about the transition for our new students into the diverse communities at our university. To then help create a sense of belonging for all our students at all stages of their engagement with the institution. This includes all students who may feel 'othered' when entering Higher Education, whether that is to do with race, gender, sexual orientation, transgender, religion/belief or any other protected characteristics and including class (Equality Act, 2010). As Janey Hagger, Karen Scopa and Christabel Harley state in their chapter 'The Art of Smooth Transition' (Cited in Bhagat & O'Neil, 2011 p. 126).

> "…the transition into the culture of HE was challenging for many, in the crucial first stages of study. The challenges experienced by students could be identified as those related to adjusting to the HE culture(s) and environment, (such as), Integration issues for mature students, Introduction to diverse languages and cultures, Awareness of different social and educational backgrounds." (Ibid)




Design School Manifesto We believe in design as site of action and agency to radically transform our world. 我們相信設計能為世界帶來革命性的改變。 We believe in the power of design to critique, confront and challenge inequalities. 我們相信創作能批判、對抗、質疑不公。 We believe in questioning geopolitical, socio-cultural, and disciplinary boundaries. 我們嘗試衝破地緣政治、社會文化和單一學科的界限。 We believe that design operates in an ecology beyond the human centric. 我們相信設計不只是以人為本。 We believe that learning is continuous, collaborative and creative. 我們推動終生學習、共同學習、創新學習。 We believe in the power of making as critical practice and tangible intervention. 我們相信創作能引起批判性討論和產生有效的干預。 We believe in embracing uncertainty through experimentation and risk-taking. 我們從實驗和冒險中擁抱未知。 We believe in the value of interrogating the past to shape our futures. 我們相信審視過往，能塑造未來。

Figures 9 & 10. One of the first translations by Helen + her complete version. London College of Communication, UAL. (2018).

At this stage the project made us aware that the more students are involved in the conception and production of objects like our manifesto the more a sense of belonging starts to happen (Freeman, Anderman & Jensen, 2007). We also noticed that the very act of translation, which is a daily part of a lot of our student's lives, became legitimised in a world that was communicated predominately in English. It became away to opening out the discussions about what the manifesto was trying to mean and how it could be reinterpreted through translation to be clearer and even more meaningful.

4. Becoming pedagogies (Farîĝante pedagogioj) a concluding becoming.

> "We learn nothing from those who say: 'Do as I do'. Our only teachers are those who tell us to 'do with me' and are able to emit signs to be developed in heterogeneity rather than propose gestures for us to reproduce." (Deleuze, 1994 p. 23).

Pedagogy according to Gilles Deleuze (1997) amongst others, is not something that is "done to one" or "is done by one to others,". It is something that one participates in, it should be a mode of co-construction, teaching and learning become fused, one is opened up to the future, and one is better able to question knowledge construction as such (Cole, 2016). This project continues to be collaborative, cooperative and contestable. Its aim is to create new concepts and new ways of thinking about inclusion and diversity. (Steventon, Cureton, and & Clouder, 2016). From this project a number of key concepts have created 'lines of flight' and made us think differently about the creation of such objects like our manifesto.



Figure 11. Participatory installation, Translation table(s) in the 'Education in Progress Exhibition,' Smith (2019) at LCC UAL, performed by Ingham et al. (2019)

4.1 Becoming language (تصبح لغة)

> “Intralingual translation interprets linguistic signs by means of other signs of the same language (Derrida, 1985, p. 173).

We interrogated the use of the English language as a part of an ongoing colonisation of the world by its seemingly increasing domination of world languages (Cameron 1992, Phillipson 1992, Rihane 2018). Alison Crump (2014) argues for “...an emerging theoretical and analytical framework…” called LangCrit, or Critical Language and Race Theory. Crump “..urges language studies scholars, both within the field of English language teaching and beyond, to continue to look for ways in which race, racism, and radicalisation intersect with issues of language, belonging, and identity.” (Crump, 2014:1)

The Lost and Found in Translation project has opened up the idea that English itself is a colonising force. The project feeds into and supports the liberating and decolonising curricula project at our university (Panesar, Patel, & Jethnani, 2018). It continues to interrogate ideas of cultural Imperialism and linguistic imperialism. Robert Phillipson professor of international language studies, defines English linguistic imperialism as,

> “…the dominance of English... asserted and maintained by the establishment and continuous reconstitution of structural and cultural inequalities between English and other languages.” (Phillipson, 1992:36).

English is often referred to as a global "lingua franca", but Phillipson argues that when its dominance leads to a linguicide, it can be more aptly titled a “lingua frankensteinia.’ (Ibid).

This project has put into question the dominance of English in UK art and design academic institutions. The paradox of English being a ‘common ground’ and common meeting place for all our students and at the same being a barrier to learning for some has not been lost on the students. It has put into focus the way language is privileged in some academic discourses and disciplines, yet is often not taught or discussed at any productive or significant level. Our hope is that this project has started to forefront the use of translation as a way of creating a better sense of belong for our students and to help in the way they learn. Our recent postgraduate show’s publicity included, for the first time, translations of a welcoming message from the university (LCC PG Shows, 2019).

> “Translations can be creative. New pure regimes of signs are formed through transformation and translation.” (Deleuze & Guattari, 2005. p. 136)

This project has continued with two public expositions. One being in the exhibition Education in Progress (2019) (Figure. 11) and the other in the London Design Festival 2019. These both produced new translations and renewed interest in the project from incoming and continuing students, who have started to create visual translations of the manifesto (Figure. 11). Funding was received to, conceive, codesign and coproduce with students and a translation expert, Dr Emily Salines, an interactive work book that would include all the translations so far. This notebook with blank pages for further translations would have given

to all incoming students at the beginning of the 2020/19 academic year, September 2020. Due to the UK Lockdown this project has been turned into and online interactive project using the Instagram *bla.bla.bla.translation*, in conjunction with a Padlet site Becoming Lost and Found in Translation at: https://bit.ly/2Sgx8Fi

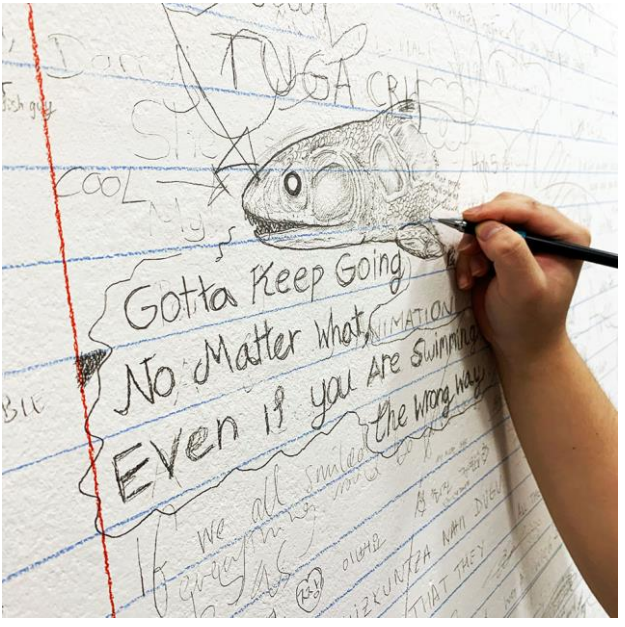


Figure 12. Design School Manifesto being translated and redrawn on walls in a corridor at London College of Communication UAL during the London Design Festival created by Ingham et al. (2019a)

I believe that as Athelstan Suresh Canagarajah (1999), a Tamil-born Sri Lankan linguist, argues "The way forward is to promote the 'pluralistic identities and hybrid discourses' desired by (our) communities." (p. 173). The power of language, both as a way of building shared communities, and as a colonising force will be explored more deeply in further iterations of this project. As in when bell hooks (1994, p.172) encourages her students to use the vernacular in her classes and to give students the space to translate form their own language, this project questions the ideologies of translation. It aims to deterritorialize translation's flows (Deleuze & Guattari, 2005) so that the power of dominant languages to become colonising forces is contested, challenged and resisted. We want to create a resistance against the standard, to resist the major (ibid) and to become liberated in translation.

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Acknowledgements: Dr Nicky Ryan, Dr Pratap Rughani, and Jason Copley for their unwavering=ng and continuing support for this project. I have received funding form the LCC Teaching and Learning Innovation Fund and UAL's Teaching and Learning Fund, without which this project would not have been as successful. The students of the Lost and Found in Translation group (The LaFiTers), especially Lola and Dominika, and the students involved in the Becoming Lost and Found in Translation project (The BLaFiTers), Ana and Marta, who have produced an interactive Instagram bla.bla.bla.transaltion. Without these and the hundreds of other students involved in this project along with the myriad of LCC and UAL staff this project would not have been possible. Special thanks go to Dr Emily Salines who has driven the ideas of what translation is and can be. Finally, without Susan Papas, my proof reader, who patiently untangles my sentences and corrects my dyslexic spellings, texts like this one would be no more than gobbledegook and gibberish.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

CULTURE (OF) REVOLUTION. Critical Thinking in fashion design education – New learning approaches for a systemic change in the fashion industry

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Abstract | While sustainability related issues are more pressing today than ever before, the global fashion industry is still one of the most resource hungry and harming industries for people and planet (Fashion Revolution, 2019). Designers' work starts at the very beginning of the supply chain of products (Tischner & Charter, 2001) hence fashion design can have an enormous impact on sustainability in all stages in the lifecycle of clothes. Simultaneously, there is also an opportunity for designers to reinterpret the understanding of design and thus create a more sustainable and holistic approach (Ehrenfeld, 2016). However, in fashion design curricula in higher education in Germany, this is not visible. Therefore, a new set of competencies for sustainable thinking and acting, like Critical Thinking, is needed for fashion designers to be also incorporated in their education. Only then there is the potential to transform the fashion industry towards a systemic change.

KEYWORDS | CRITICAL THINKING, FASHION DESIGN EDUCATION, INTERDISCIPLINARY LEARNING, SUSTAINABLE DEVELOPMENT GOALS (SDGS), SYSTEMIC CHANGE

1. Introduction

Sustainability related issues are more pressing today than ever before. We are exploiting resources of any kind beyond earth's carrying capacity. And even if we will only use renewable energy and recycle all our resources in the future, we will face an increased use of resources yet alone due to the forecasted increase in global population. Therefor the United Nations have proclaimed 17 Sustainable Development Goals (SDGs) to be delivered within a "decade of action" also calling for action from businesses (United Nations 2019).

The fashion industry is one of the most resource hungry and polluting industries on the planet (Global Fashion Agenda, 2017; Obregon, 2012). It overwhelmingly promotes and "feeds an ever-accelerating consumption culture predicated upon a TAKE > MAKE >WASTE model" (Ellen Mac Arthur Foundation, 2020). Like other industries, it is far away from being a circular industry (Circularity Gap, 2020). When aiming to make a contribution to the SDGs by the fashion industry, besides the often-criticized supply chain, this also relates to the ways fashion items are designed and produced. In the fashion industry, designers are working at the beginning of the lifecycle of a garment, hence they have a great impact on the garment-related sustainability issues, including the respective supply chain (Fletcher, 2014; Charter & Tischner, 2001). As Tham (2008) succinctly puts it:

> "Making good decisions already at the design stage makes cleaning up further along the line redundant." (Tham, 2008, p. 27)

According to Charter and Tischner (2001), at least 80% of a product's subsequent social and environmental impacts are determined at the design stage. Fashion designers therefore can have an impact in every single step along the fashion and textile supply chain (Fletcher, 2014; Tham, 2008). Simultaneously, there is also an opportunity for designers to reinterpret the understanding of design and thus create a more sustainable approach (Ehrenfeld, 2016). Based on the current situation in the fashion industry with all its so-called "wicked problems" (Tulder, 2018), it is important to start at the origin of these problems in familiarizing future fashion designers with the possibilities of sustainable action within their studies and future careers. Fashion design education today must use its transformative role to move from a focus on aesthetics, optics and haptics demanded by individual target groups and the industry (Faerm, 2012) to include aspects of sustainability and responsibility (Edelkoort, 2016; Tham & Fletcher, 2019), digitalization and automation (Freyer, Noel & Rucki, 2008). Within this approach a new set of skills and competencies is needed not only of fashion designers but in education for fashion design. This discussion is also been developing on a global scale recently (Union of Concerned Researchers of Fashion, 2020). Whereas in Germany design research and design education research are relatively new fields of study (Joost et al., 2016; Jonas et al., 2016) and research in fashion design education is almost not visible in these movements (Banz, 2016).

The aim of this research is to derive a didactical proposal of learning approaches for an interdisciplinary course concept for sustainable fashion design to be developed for the

University of Applied Sciences in Berlin (HTW), Germany. Since the 2000s key competencies are discussed intensely in social sciences as a required framework for monitoring and assessing learners´ development (Arnold, 2008; de Haan, 2007) as well as in human resource development for measuring competencies for job profiles (Rosenstiel et al. 2017; Erpenbeck & Sauter, 2011). Competencies are abilities "to successfully meet complex demands in a particular context through the mobilization of psychosocial prerequisites (including cognitive and non-cognitive aspects)" (OECD, 2005, p. 4). Within this, various concepts of key competency frameworks for sustainability (de Haan, 2007; Wieck, Withycombe & Redman, 2011; Riekmann, 2018) have been proposed over the last years. Key competencies are defined as overlying competencies with a broader focus, and not only for a specific context (Rychen & Salganik, 2005). Therefore, learning approaches within this proposal are based on key competencies for sustainable development referring to competency frameworks for Higher Education for Sustainable Development (HESD) (Wieck, Withycombe & Redman, 2011; Rychen & Salganik, 2005). In every framework Critical Thinking has an established and broad role. It is understood within different definitions, as a basic competency or even a key competency, and at the same time as a valid overlying teaching and learning approach for all learning movements (Chatfield, 2017; Wieck, Withycombe & Redman, 2011; Moon, 2008). Hence, a focus of the envisaged didactical proposal will be on the successful implementation of Critical Thinking.

2. Theoretical context

2.1. Learning approaches and key competencies for HESD

Learning approaches as defined within Education for Sustainable Development (ESD) and HESD are an overall objective rather than a defined body of information and knowledge (Hopkins, 2012). The UNESCO outlines:

> "ESD empowers learners to take informed decisions and responsible actions for environmental integrity, economic viability and a justice society for present and future generations, while respecting cultural diversity. […] ESD is holistic and transformational education which addresses learning content and outcomes, pedagogy and the learning environment. It achieves its purpose by transforming society." (UNESCO, 2020)

Since the late 1990s and within the Bologna reform of Higher Education (United Nations, 2003), the discourse on education has shifted from an input orientation, focusing on lists of essential educational content, to an outcome-based competency approach (Giangrande et al. 2019; Wieck, Withycombe & Redman, 2011; Godemann, 2006). These outcomes include enabling people to engage effectively in this increasingly complex world and contribute to transforming its structures. Therefore Rieckmann et al. (2018) outline: "There is a general agreement within the international ESD discourse that the following key sustainability

competencies are of particular importance for thinking and acting in favor of sustainable development" (Rieckmann et al., 2018, p. 39):

Table 1. Competencies in HESD for sustainable development (relating to Rieckmann et al., 2018).

Systems thinking competency	**Ability to recognize and understand relationships, analyze complex systems, deal with uncertainty**
Anticipatory competency	**Ability to understand and evaluate multiple futures – possible, probable and desirable - create one´s own visions for the future assess consequences of action**
Normative competency	**Ability to understand and reflect on norms and values that underline one´s actions and negotiate sustainable values, principles, goals and targets, in conflicts of interest**
Strategic competency	**Ability to collectively develop and implement innovative actions that further sustainability at the local level and afield**
Collaboration competency	**Ability to learn from others; understand and respect the needs, perspectives and actions of others (empathy); understand, relate to and be sensitive to others (empathic leadership),**
Critical Thinking	**Ability to question norms, practices and opinions, reflect on one´s own values, perceptions and action**
Self-awareness competency	**Ability to reflect on one's own role in the local community and (global) society, continually evaluate and further motivate one's actions, and deal with one's feelings and desires**
Integrated problem - solving	**Overarching ability to apply different problem-solving frameworks to complex sustainability competency problems and develop viable, inclusive and equitable solution that promote sustainable development**

Concerning the development of didactical-pedagogical concepts, this approach of teaching means it is less about "WHAT we teach and more about HOW we teach" (Howlett, 2016) to offer learning situations that enable these competencies to trigger the desired effects and reactions in learners (Howlett, 2016; Ehrenfeld, 2008; UNESCO, 2006). Accordingly, forms and fields of learning as well as methodological-conceptual approaches are needed that support a self-determined, active, but at the same time also reflexive and social learning. Previously, investigated learning approaches in ESD and HESD with a high value of interpersonal and personal action and reflection are:

- Social learning (see Bandura, 1971; Wals, 2010; Wals & Jickling, 2002)
- Collaborative learning (see Dillenbourg, 1999; Strijbos & De Laat 2010; Zhang Ayres & Chan, 2011)
- Interdisciplinary learning (see Rieckmann, 2016; Adomßent & Michelsen, 2014; Leal Filho et al., 2009)
- Participatory learning (see Reid et al., 2008; Tsien & Tsui, 2007)

- Transdisciplinary learning (see Rieckmann et al. 2018; Sipos et al., 2008; O´Sulivan, 1999; Wals, 2011)
- Project-based learning (see Kaliva, 2016; Gudjons, 2008)
- Critical Thinking (see Rieckmann et al., 2018; Wieck, Withycombe & Redman, 2011; Kruse, 2009; Moon, 2008)

This list is not intended to be exhaustive regarding general competency-promoting teaching concepts or forms of learning for sustainability. It leads to an approach which implies more 'thinking' before starting to create, which is also relevant for applied studies like design. This seems to be especially of interest when dealing with the wicked problems (Tulder, 2018) of sustainability. For students this also means that design solutions for the unsustainable practices within the fashion supply chain as discussed earlier, are not easy and fast to find. More time is needed here to think, discuss and reflect before going into prototyping and design processes (Pasricha & Landgren, 2011). Within that context Critical Thinking can foster to act critically in personal and interpersonal spaces, but also "to seek professional success, and to become a member of a smart society" (Halpern, 2014).

2.2 Critical Thinking

The necessity of Critical Thinking and the resulting reflexive action is clearly emphasized by Rychen (2008) as a competence for ESD and justifies this in the constantly changing requirements for learning in times of social and technical changes. However, there is no uniform definition for Critical Thinking (Moon, 2008) and it is discussed as a competency (Wieck, Withycombe & Redman, 2011; Chatfield, 2017; Kruse, 2009) as well as a learning method or learning process for sustainable development (Rieckmann et al., 2018) and responsible personality formation (Moon, 2008; Paul & Elder, 2003). The adjective critical implies not a negative (criticize) way of thinking, but a thinking thought out and carefully considered out of facts and not of own emotions, attitudes and biases. Critical Thinking is important not only for carrying out daily professional activities, but also for enabling people to raise reasonable, critical questions leading towards the best solutions (Paul & Elder, 2003). It supports being able to reflect on their own and other people's activities, and for understanding the importance of their personal impact to the development of organization, society and the planet (Wieck, Withycombe & Redman, 2011; Scriven & Paul, 1987). The learning approach of Critical Thinking is highlighted in this research, because it is a competency which is being required of students not only in their personal and professional life but is also referred to ESD and HESD as a key competency (Rychen, 2005) and as a basic competency (Wieck, Withycombe & Redman, 2011) for sustainable thinking and acting in the reviewed competence frameworks in this research. This paper will give an overview of didactical approaches and within that the competencies needed to implement sustainability in the fashion industry for a systemically change.

3. Methodology

The research presented in this paper is based on a preliminary qualitative analysis of five curricular for Bachelor (B.A.) Fashion Design to generate a first overview concerning the status of sustainability. By 2019, fashion design can be studied in Germany at eleven public institutes for higher education. Within this research, the five analyzed curricula are the ones who are publicly displayed by the respective institutions (HTW Berlin, 2015; UdK Berlin, 2013; HAW Hamburg, 2011; HS Trier, 2013; HS Weissensee, 2012). The selection of the curricula from these institutions of the preliminary analysis was based on an internet research and the available list of fashion design schools at the German associations of fashion designers (VDMD, 2020; German Fashion Council, 2020).

Table 2. Overview and main characteristics of the analyzed institutions.

	HTW Berlin	UdK Berlin	HAW Hamburg	HS Trier	HS Weissensee
Established in	**1994**	**1875**	**1905**	**1884**	**1946**
University of Applied Sciences	**x**		**x**	**x**	
University of Arts		**x**			**x**
Background	**Engineering**	**Fine Arts**	**Engineering**	**Arts & Crafts**	**Arts & Crafts**
Public University	**x**	**x**	**x**	**x**	**x**
Focus of program	**technical**	**artistic**	**technical**	**technical/ artistic**	**artistic**
B.A. Fashion Design	**x**	**x**	**x**	**x**	**x**
M.A. Fashion Design	**x**	**x**	**x**	**x**	**x**
Semester of study	**6**	**8**	**6**	**7**	**6**
Ø Students in 2019	**59**	**31**	**36**	**N/A**	**14**

The aim of the pre-analysis is to derive a first insight on the status quo of fashion design education in Germany concerning aspects of sustainability, especially ascertaining a competency-based approach for sustainability or topics related to that content in any module or course. The curricula as well as module manuals were analyzed by keywords and coding of sustainability related content like “sustainability”, within that sub-keywords like “sustainable design”, “sustainable textiles” or “circular design” as well as keywords like “social competency” regarding a deliberate competency-orientation of studies.
Furthermore, after this a qualitative literature review on ESD and HESD was conducted to derive relevant information on latest adequate requirements of learning for sustainable development (as proclaimed by the SDGs) concerning relevant learning approaches and underlying competencies for the to be developed course concept. The literature review is supposed to identify learning methods and approaches for sustainable development in ESD and HESD and learning approaches and application for Critical Thinking in ESD and HESD.

4. Findings

4.1. Sustainability in fashion design curricula in Germany

A first sampling in the preliminary analysis shows: The category "competency" is either not mentioned in the prescriptive curriculum published (HAW, 2011), is defined only in the context of professional competency in a module manual (HS Weissensee, 2013, HTW Berlin, 2015) or is vaguely defined as “discussion compentency” (HS Trier, 2013, p. 20). Only one institute mentioned “social competency” (UdK, 2013, p. 15) as a learning approach within “cooperation with partners”. Categories like “learning approaches” within “interdisciplinary”, “social” and “personal” competencies that could function as validation not only for “learning outcomes” as acquired of the Bologna Reform for Higher Education (see United Nations, 2003), but also as an aspired competency enhancement for students towards a sustainability approach, are only mentioned in one curriculum (UdK, 2013). Furthermore, sustainability-related categories (for example “sustainable thinking”, “sustainable materials”) were not found in four out of five analyzed documents. Only one mentioned “ecology” as a topic in a module about fibers and textiles, where as ecology was also addressed in a module referring to an own design project on collection development (HTW Berlin, 2018). Innovative strategies like “circular design”, although widely discussed in fashion research and the industry as a concept to approach fashion supply chains´ sustainability issues (Earley, 2017; EllenMacArthur Foundation, 2020) are not mentioned in any of the analyzed curricula. This relates to the assumed that the subject of fashion design is predominantly still mainly taught as the classical profession of an industrial designer as it was 20 years ago (see Obregon, 2012; Fletcher & Grose, 2012; Fletcher & Williams, 2013; Faerm, 2011). It is clearly highlighted in four out of five module manuals, that the modules are mostly oriented towards professional competency. The category of “Critical Thinking” as a competency or as a learning approach is not mentioned in any curricula. Triggered by the quest for sustainability, a holistic or systemic turn is demanded vigorously by international design researchers, not only in the profession of fashion designers and the industry, but also in education (Goldsworthy, Earley & Politowicz, 2019; Fletcher, 2014; Ehrenfeld, 2016). This need for a systemic change is not yet represented in fashion design education in the analyzed module manuals and curricula. Naturally, this preliminary analysis cannot reflect all learning and teaching scenarios of fashion design and instructors´ individual course plans or projects (HTW, 2019). But it can be summarized that on an organizational level sustainability in fashion design as well as the corresponding learning approaches and competencies for HESD are not base of any of the analyzed curricula so far.

4.2. Main areas of learning

When starting to engage, reflect and discuss deeply within the topics of sustainability, students firstly need a strong and expanded knowledge in terms of an Ecological Literacy as

Orr (1992) stated. To adapt this term to sustainable fashion education, students need not only knowledge in sustainable design strategies, materials and fibers, but also in sense of sustainable values and attitudes (Fletcher & Tham, 2016; Fletcher & Grose, 2012). This more holistic approach is guiding towards a "Sustainability Literacy" for fashion design (Ermer, 2019). Decision-making for designers and interventions of designers can only be integrative, future-oriented and sustainable, if the design strategies are thought through. This refers to the impact these decisions will have on other people and the environment, affected by or integrated within the respective supply chains (Fletcher, 2014; Fletcher & Tham, 2016). It orients towards a learning approach of *social learning* (Bandura, 1971; Wals, 2010; Wals & Jickling, 2002), that both characterizes and contributes to a learning system in which people learn from and with one another and "collectively become more capable of withstanding setbacks, of dealing with insecurity, complexity and risks" (Wals et al., 2009, p. 11). Social Design for example, "a design that attempts to fill the deficits of political commitment, to step into the gaps left by the state or government in its constant withdrawal from social responsibility for society, for its citizens" (Banz, 2016, p. 15), refers directly to these insecurities.

Accompanied by a disposition to learn to live with the uncertainty of the future under these circumstances, rather than to reduce uncertainties in pedagogical discourse there is seen a need to accept vagueness and emergence as essential properties of sustainability (Wals & Rodela, 2014; Kagawa& Selby, 2012). Seeing the aspects of a design process as several small different possible connected processes (e.g., choice of fiber, purpose, colors, production steps etc.) *collaborative and interdisciplinary learning* settings come to focus which also highlight especially personal and interpersonal competencies as important for students in future working situations (Sterling, 2011; Rieckmann et al, 2018). Collaborative learning is achieved within a joint development of a task (Zhang, Ayres & Chan, 2011). All group members contribute their own specific knowledge and skills equivalent at all stages of the work. These multi - stakeholder approaches (Tulder, 2018) are mostly benefitting when coping with the wicked problems, that can occur within non-sustainable situations. Hence, not only *interdisciplinary learning*, but a *transdisciplinary learning* (Rieckmann et al., 2018; O´ Sullivan, 1999) is required, that refers to all these different stakeholders along the supply chain, which means also farmers and textile workers as well as the consumers ("users") of fashion. Since this also implies a project-based learning, it is a learning close to real life working scenarios (Kaliva, 2016; Gudjons, 2008). Fashion design students often are familiar with project-based learning typical for design thinking processes, but not in sustainability related contexts (Faerm, 2012). It is an action-oriented form of learning that is geared to the interests of the learners in terms of content. It offers them a social learning environment, in which they can work out problem solutions in a self-organized manner and realize them in the form of artefacts or concepts (Kaliva 2016, p. 12). Therefore, the aim for this didactical proposal for fashion design studies is to collect as many different equitable perspectives, information and skills as possible within envisaged learning processes (fig. 1):

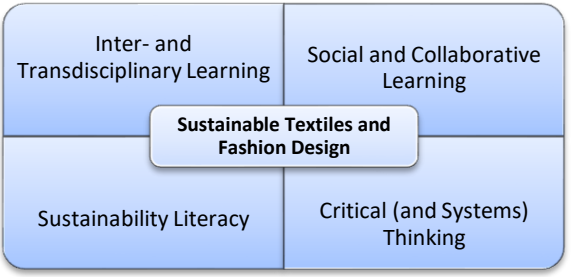

Figure 1. Main areas of learning for sustainable fashion design studies.

Within project-work the collaboration could be of academia and industry, but preferably also of different cultural, professional and personal backgrounds of students (Fletcher & Tham, 2019; Earley, 2017; Fletcher, 2014). For educational learning approaches this also means, learners should be able to take on different perspectives and thinking beyond their own disciplines, as well as including intercultural and international aspects in problem-solving approaches and decisions (Wals, 2010) for a "Sustainability as flourishing" (Ehrenfeld, 2016, p. 62).

The learning areas of the course concept refer to a multiple competency approach (see tab. 1). Critical Thinking has an established role in the various reviewed competency frameworks (Rieckmann et al., 2018; , Wieck, Withycombe & Redman, 2011; Rychen & Salganik, 2005), within which it is understood as a basic competency or key competency and as a valid teaching and also a learning approach for HESD (Moon, 2008; Chatfield, 2017).

Table 3. Key competencies for HESD (Rieckmann et al., 2018) and learning areas for a course concept "Sustainable Textiles and Fashion Design" (HTW Berlin).

Key Competencies (C.)	**Learning areas of the course**			
	Inter-/transdisciplinary	**Social/ Collaborative**	**Sustainable Lit.**	**Critical Thinking**
Anticipatory C.	**x**	**x**	**x**	**x**
Strategic C.	**x**	**x**	**(x)**	**x**
Normative C.	**x**	**x**	**x**	**x**
Critical Thinking	**x**	**x**		**x**
Systems Thinking	**x**	**x**	**(x)**	**x**
Interpersonal C.	**x**	**x**		
Intrapersonal C.	**x**	**x**		

4.3. Topics of intervention and learning for fashion design

Based on the findings within the literature research for competency-based learning approaches in ESD and HESD relevant for the course concept, topics of interest are built along the single steps of the circular fashion supply chain (fig. 2). Today it is assumed (Ellen Macarthur Foundation, 2020; Nicoletti, 2018; Smith, Baille & Hattie, 2017) that the circular supply chain must replace the linear supply chain for a sustainable and resource saving approach in fashion (see Ellen Macarthur Foundation, 2020; Cradle to Cradle, 2020). The single phases of the circular supply chain are (fig. 2): design strategies, textiles and materials, production and manufacturing, distributing and sales, the use phase of products and the phase of discarding, recycling or prolonging the use phase through different kind of "second life" or "third life" concepts (for example upcycling or sharing).

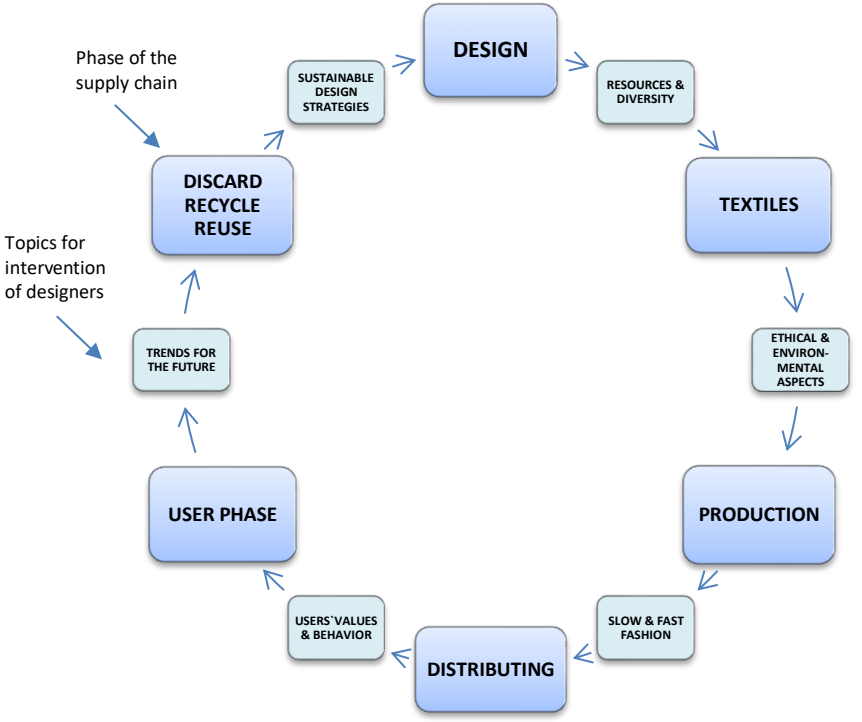

Figure 2. Fashion Supply Chain and relating topics of intervention for the proposed course concept (simplified, own representation).

Not only the topic of sustainable design strategies, but also all other proposed topics are in need for interdisciplinary discussion and work in class. For a holistic approach all topics are subject of discussion (Fletcher & Tham, 2019; Ermer, 2019; Hasling & Ræblid, 2018; Fletcher, 2014). In sense of a circular design approach, this supply chain can have multiple more and also different circles (Earley, 2016). For example, design a product for several uses or users to prolong the lifecycle of a product. At last, regarding the acclaimed systemic change of the fashion industry also the behavioral mindset, views, assumptions, and attitudes not only of designers, but also of users of fashion have to be taken into account for a critical discussion for new solutions in fashion design studies (Pasricha & Landgren, 2013).

5. Discussion

The first finding within the analysis of the five curricula for the Bachelor program fashion design showed that not one single institution has integrated sustainability-related topics in their curricula neither as relevant sustainability - related key competency nor as basic learning approaches towards HESD. Only in one curriculum it was referred directly to aspects of sustainability (HTW, 2018). Although this analysis cannot display the overall situation thoroughly, e.g., specialty Master programs were not observed within the analysis and extracurricular projects within sustainability related topics are not displayed, it gives a first insight into foundational studies. Furthermore, it can be stated, within comparison to fashion design education research in other European countries like Finland, Great Britain or Denmark, Germany is clearly lacking behind (Earley, 2017; Hasling & Ræblid, 2018; Aalto University, 2020).

The literature research showed, to start with Critical Thinking at the beginning of a course can help students to get out of the phase of helplessness (Ermer, 2019; Moon,2008; Armstrong & LeHew, 2011), that can evolve naturally during project-work (Conner, 2012) and especially in regard to sustainability related topics (Ermer, 2019, Hasling & Ræbild, 2018), However, it takes time to introduce and practice Critical Thinking and within a course concept for example for just one semester, as estimated for “Sustainable Textiles and Fashion Design” at HTW Berlin, there might be not enough time to process and practice this new and systemic way of thinking as to establish a new routine (Armstrong & LeHew, 2011; Paul & Elder, 2003). The integration of Critical Thinking in fashion design studies on a long term can be seen as a clear benefit not only for students´ personal development, but also for a sustainable future-orientation of their work. Thus, it is rather recommendable to integrate it in all design studies starting already within the first semester to get used to the specific way of thinking and reflecting. Simultaneously, students can get used to discussing design ideas more broadly within this interdisciplinary or transdisciplinary approach. They can learn to empathize with colleagues and different kind of stakeholders along the supply chain through these collaborative learning movements. Especially when diving deeper into the difficult sustainability-related topics of fashion, Critical Thinking can also offer students new

ways of thinking into a very objective and factual view, to come from feeling into thinking and acting (Moon, 2008). The point here is not to change or improve the uncertainties, students are going through in their learning processes, but rather for them to accept and to adapt to these uncertain situations (Wals, 2013). At the same time, it is of importance that these educational spaces "should build a culture of learning awash with uncertainty and in which uncertainty provokes transformative yet precautionary commitment rather than paralysis" (Kagawa & Selby, 2010, p. 243).

6. Conclusions

It can be stated, although there already exist various reliable competency frameworks for HESD, that could support fashion design education to adapt the requirements sustainability asks for, the implementation into curricula is not yet accomplished. Thus, regarding movements towards the integration of the SDGs into the fashion supply chain, also fashion design education in Germany currently lacks behind. In reference to the "decade of action" (United Nations, 2020), an immediate need for action to integrate sustainability in the respective curricula is required. A systemic change of the fashion industry is without alternative and within the last few years the global fashion industry seems to have noticed. In Germany, there has been a rise of governmental and institutional coalitions recently to engage more in sustainability-related issues, e.g., towards a sustainable supply chain (Lieferkettengesetz, 2020) or to enable more transparency within the supply chain for users of fashion (Grüner Knopf, 2020). Within learning processes taking in all stakeholders around a product of fashion, a noticeable move not only towards the integration of sustainability in education, but also for the industry at large can be created. Therefore, next to the need for a competency-based education, a beneficial implication can also be seen by the authors in a much closer collaboration within transdisciplinary projects of organizations within industry and academia to move towards the successful integration of sustainability.

Competency-based frameworks for sustainable thinking and acting are valuable proposals that can offer a starting point for a new didactical focus of learning in fashion design education. A learning model integrating *Critical Thinking* as well as *Sustainable Literacy, Collaborative and Social Learning* and *Inter- and Transdisciplinary Learning* can support a holistic set of learning approaches for fashion designers that is not only beneficial on a professional and personal level, but also regarding a call for action for sustainability in fashion.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design as a methodological stance in interdisciplinary research

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Abstract | Design methods are increasingly used by multidisciplinary teams to tackle complex issues within the public sector through participatory approaches of codesign to gather information and create innovative solutions. However, can we categorize these projects as research projects or as design projects? These questions echoed following a multi/interdisciplinary research project (design, nursing and psychology) with the codesign of a tool for future nurses that was translated into the prototype of a portfolio fostering a reflexive nursing practice to improve patient safety competencies. However, diverging views of design research between these disciplines emerged and highlighted ambiguity regarding the operational nature of design, where focus is put on design practice rather than on its ability to produce knowledge. Considering this, it seems relevant to think that design research needs a clearer scientific positioning to be recognized by the healthcare sector before claiming to revolutionize it.

KEYWORDS | PUBLIC SECTOR, HEALTHCARE, INTERDISCIPLINARY RESEARCH, DESIGN RESEARCH, DESIGN METHODOLOGY

1. Introduction

Design research is still at its early stages and questions remain regarding its objectives, methodologies and impacts in knowledge creation and in knowledge application, especially in interdisciplinarity research projects. In other words, what is design research, how and why is it conducted within multidisciplinary contexts? Is the objective of design research to produce knowledge or to create products and services? To this extent, design research needs to be discussed and this discussion is particularly needed in interdisciplinary research where some confusion seems to remain as to the contribution of design in terms of knowledge production within the scientific research project.

Design as a research methodology can be understood as an active, situated and engaged project type research which some call project-grounded research where the design project is equivalent to the research field of social sciences, like action research, or to the laboratory of experimental sciences (Findeli, 2004). This is particularly true when design methods are used by multidisciplinary teams to tackle complex issues within the public sector through participatory approaches of co-design with stakeholders in order to gather information and to create innovative solutions (Bisson & Gagnon, 2005; Côté, Bélanger & Gagnon, 2017). In that sense, Sanders and Stappers (2008) remarkably illustrate the distinction between the use of design methods for a design project and its use for a research project. For instance, the end result in a design project usually takes the form of a product and/or a service unlike the ones pursued by a research project that are directed at the production of scientific knowledge relying on the thoroughness of the social sciences approaches (Bisson & Gagnon, 2005; Gagnon, Côté & Barré, 2012). More importantly, this distinction is significant because the scientific knowledge production is then clearly situated within the design research project where it can support informed decisions and actions.

However, these distinctions can sometimes be blurry in interdisciplinary research practices, especially when the research team members rely on different disciplinary epistemologies. Nevertheless, the validity of the different paradigms is to be accepted in order to produce knowledge for all disciplines involved in the research (Findeli & al., 2008; Morse & al., 2007. In Nimkulrat & al., 2020). These reflexions echoed following an interdisciplinary research project (design, nursing and psychology) aiming at a smoother transition from academic to professional contexts in nursing practices. The project was developed around the codesign of a tool for nurses that could be translated into the prototype of a portfolio fostering a reflexive nursing practice to improve competencies regarding patient safety (St-Germain & al., 2019; St-Germain & al., 2020). Misconceptions about the object of design research emerged within the research team and highlighted the misperceptions regarding what design research is really about and how to distinguish it from design practice. Hence, in this particular case, research and practice cultures are different: the healthcare field is dominated by a research paradigm relying on evidence-based practices (Chamberlain & Craig, 2017), whereas the design research field can be associated with research *on* design, *through* design or *as* (for) design (Frayling, 1993; 1999; 2015). Design research *on* design is

conducted from a historical or sociological perspective regarding design-related productions. This is perhaps the easiest way to get scientific recognition since the subject of the research concerns design culture interpretations which can simply be associated with an evidence-based practice paradigm. However, it is less easy to arbitrate between the other research approaches introduced by Frayling, research *through* and *as* design. Research *through* design is what Findeli (2004) claims to use within project-grounded research, which is situated in the research-creation perspective of Stévance & Lacasse (2013; 2018) and more broadly, to action research in social sciences. In that respect, design is used to study a research problem through the action's context (i.e. design project) in order to identify contextualized interpretative elements that are otherwise difficult to obtain and then, contribute to the production of knowledge. Design *as* research is certainly the most controversial of design's research approaches because it situates the creative process as the research itself, an epistemological stance that should be shared by the design research team from the onset to the extended research team in order to fully embrace the potential of multidisciplinary views. In this paper, we discuss issues and challenges associated with design research through a case study from a healthcare context involving a multidisciplinary team where misconceptions towards design research led to misunderstandings. Moreover, the paper illustrates the challenging conciliation of innovation through design within a project-grounded research paradigm (Findeli, 2004; Verganti, 2009; Gagnon & Côté, 2016a; Gagnon & Côté, 2016b). In other words, if this kind of design research strives to be recognized and transform the public sector, it still needs to better define and communicate its knowledge production within its proper epistemology and methodologies, especially in multi-interdisciplinary research settings like in the public healthcare system.

2. The INSÉPArable project

The Canadian healthcare system faces difficult challenges in relation to an excessive workload for medical staff and hospitals often ill-adapted to the changing realities of patients and caregivers. In fact, a large-scale survey with Canadian nurses (O'Brien-Pallas, Tomblin Murphy & al., 2005) and the work of Alderson (2010) highlighted the hardship and even the distress that nursing staff increasingly has to deal with in its workplace. However, it is the lack of workforce that is most concerning in Quebec (Canada) because it could imply that its healthcare services may have fewer nurses willing and/or able to work in these conditions resulting in a possible degradation of the quality of care. In other words, the tenuous nursing workforce combined to a more complex healthcare system (i.e. aging population, rising technology use and interdisciplinary work advocated by management) could lead to considerable and avoidable errors regarding patient security (MSSS, 2015). Therefore, how could nurses feel less tired, stressed, distracted and overworked in order to favour a patient safety culture guided by multifaceted bioethical values?

The INSÉPArable project stemmed from this context, where the French acronym can be broken down into: IN (infirmier/ère – i.e. nurses), SÉ (sécurité – i.e. security), PA (patient – i.e. patient) forming an *inseparable* unit for the elaboration of a tool; a reflexive portfolio for tomorrow's nurses aiming at the consolidation of their patient safety competencies (St-Germain & al., 2019; St-Germain & al., 2020). This tool is intended as a support in patient safety training for nursing students and also for employed nurses who are looking to improve their competencies through continuous learning. Moreover, in Quebec, the professional order overlooking the nursing profession requires, from its working members, a professional continued education portfolio to maintain their skills as well as to ensure safe and high-quality caregiving (OIIQ, 2012). Currently, this portfolio is essentially used for an annual update of the hours its members devoted to continuing education and consequently, if they reached the minimum training required by the Quebec's professional nurses order. However, according to St-Germain & al. (2019; 2020), the transformative power of the actual portfolio is limited in its actual form because it does not engage nurses in a reflexive approach where they are invited to reflect on changes in their practice following a training, nor does it support them in achieving real personal and professional development that would lead towards a more humanistic caring perspective and better partnership with patients and their family. Therefore, the INSÉPArable project aimed at bridging these gaps in the professional portfolio by endowing nurses with a tool that fosters knowledge acquisition and thrives to maintain patient security competencies no matter the management and environmental factors found in their workplace. This kind of professional portfolio would allow nurses to continuously acquire and update their competencies in order to develop a safe and sound practice from the outset as students, to practitioners in the healthcare system. The reflexive practice, based on the learners' cognitive, functional, personal and relational as well as ethical skills (Chanel, 2013) and called for in the INSÉPArable project, should then enable nurses to have a better understanding of who they are as practitioners to ensure high quality care by meeting the patients' needs adequately throughout their careers.

In order to elaborate this kind of professional portfolio, the INSÉPArable research project relied on a design research approach which was similar to Julier & Kimbell (2016) standpoint on how transdisciplinary design research could allow a socially oriented co-production of knowledge shaping and informing change. In that context, Julier & Kimbell (2016) argued that research guided by design could favour a mediation between the observed realities and the projected possibilities by documenting public issues through the study of ambiguous places and/or events in order to highlight the differences between improvement and innovation. Thus, the design approach in the INSÉPArable project was clearly developed as a methodological stance that was based on the study of the relationships between physical and emotional environments, of the nurses' and patients' experiences as well as of the issues related to security in order to explore possible solutions suitable for the public sector. In that way, the conclusions drawn from design research could be translated into new spaces, products, services and systems as well as into new users, organizations and contexts

not only to improve the actual reality, but also to transform its material, virtual and organizational forms (Julier & Kimbell, 2016; Côté, Bélanger & Gagnon, 2017). This posture is quite close to the reflection of Stévance & Lacasse (2013) on research-creation as a space for dialogue and exchange between scientific research and creative practices based on applied discursive strategies. In other words, a research-creation project is a research approach established *from* or *through* a creative process resulting in a double dissemination: a creative production and a theorical discourse (Stévance & Lacasse, 2013: 122). Thus, the INSÉPArable project planned to adopt a research-creation approach or, as Findeli (2004) defines it, a project-grounded research approach where the expected end-results were not only intended to take the form of a reflexive tool for nurses but also a contribution to scientific knowledge for public design in healthcare systems, especially regarding design's input for reflexive nursing practices in their actual work environments.

3. The methodology

The INSÉPArable project, within a project-grounded research perspective, called for an inductive methodology that was translated into an ethnographic qualitative research which enabled the collection and analysis of data from the healthcare experiences of patients and nurses as well as to the documentation of the nurse's work environment (spaces and tasks). In that respect, the methodological strategy was based on 4 types of data collection as well as the prototyping of the portfolio (*Figure 1*):

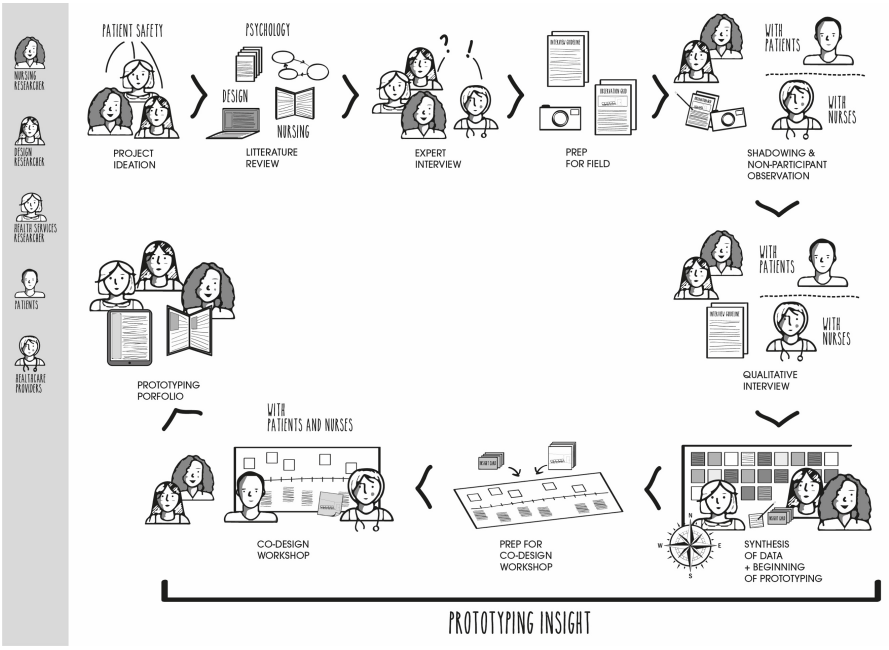

Figure 1. The initial INSÉPArable project methodology diagram

1. **Literature review and expert interviews** to understand the transition between academic and professional settings in the nurse's training as well as the interdisciplinary relation between nursing and design disciplines in research projects. This first phase prepared the immersive data collection (observations and interviews) regarding the interactions between patients and nurses as well as the interactions between nurses and their work environment.
2. **Non-participatory and participatory observations** of the context and of the interactions within the context of care units were conducted to obtain in-depth information. Four observations were made in acute care units (general medicine) and six in long-term care units (rehabilitation). Moreover, the observations were planned to cover the different working shifts of the nurses (day, evening, night and weekend). In terms of non-participatory observations, the data collection was made through space mapping, objects and medical equipment inventories and human interactions recording within the care units. Furthermore, a second type of observation took place using a shadowing technique consisting of a participatory observation which allowed the researcher to follow a nurse during a 2 to 3-hour period and document his/her journey through spontaneous qualitative interviews, notes and sketches/photographs of the caregiving experience in context (*Figure 2*).

3. **Semi-structured qualitative interviews** of approximatively 1 hour followed the shadowing activity among participating nurses and patients. A total of 20 qualitative interviews were completed in order to identify weaknesses and/or flaws in patient safety, incidents and/or accidents and perceptions of the caregiving experience as well as the healthcare environment (*Figure 2*).
4. **Codesign workshops** were introduced to validate the data collected through visual communications (i.e. personas, storyboards, etc.) and the design of a tool, the professional portfolio, with the intention to create a prototype. Carried out by the design team, the data analysis from the observations and interviews were conducted by 2 postgraduate students (one from nursing and one from design) as well as 2 design researchers to develop an initial prototype that evolved during the preparation of the final codesign workshop. Moreover, it should be noted that the design team interpreted most of the data to facilitate the development of the prototype and to integrate the material dimensions needed to situate the nursing practice and to understand the complexities and the interrelations with patients in the healthcare environment. During that time, the nursing team produced an interpretation of the data that focused only on the nurses' experience that was not intended for the prototype development but for a theorical construction of nursing practices. Therefore, two interpretations of the phenomenon were developed in parallel. The nursing team conceptualized one with a focus on the nurses' experience as an iceberg/sphere model where the nurses' work is sometimes visible (i.e. technical care, physical safety, etc.) and sometimes invisible (i.e. patient partnership, caring relationships with patients, etc.), the portfolio was then intended to help make visible the invisible part more consciously. The other interpretation was proposed by the design team and took the form of a portfolio prototype to be validated through a final codesign activity that brought together a wider audience of 16 participants from diverging backgrounds (nurses, healthcare managers and patients). The activity took the form of a 3-hour workshop accompanied by research assistants (postgraduate students from nursing and design) as well as facilitators (product design undergraduate students) who animated the codesign activities where participants tested the prototype and commented on its validity and on its relevance to nursing practice realities.
5. **Portfolio design iterations** were drawn from the first and second codesign workshops by 4 undergraduate product design students and two design postgraduate students under the supervision of the principal design researcher. These iterations were also punctuated by a few meetings with the nursing team to adequately integrate all of the data.

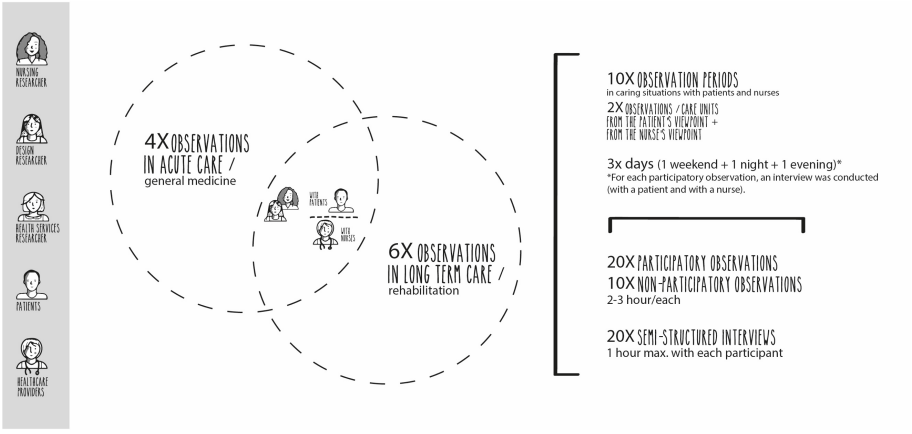

Figure 2. The INSÉPArable project immersive qualitative data collection

4. The results

In the pre-analysis stages of the research, design researchers created the first prototype with a design and a nursing research assistant who collected the data. This initial prototype was inspired by the idea of a compass indicating the course towards patient safety that emerged from the pre-analysis of the field data. As illustrated in *Figure 3* centre, two main axes divide the compass; the vertical axis modulates the levels of awareness needed in nursing practice from little to considerable and the horizontal axis, the levels of empathy from functional to relational. Moreover, this first data synthesis also allowed the elaboration of an earlier version of the nurses' and patients' persona profiles. This initial prototype was then refined by the design team where the data analysis of all the interviews and observations allowed the production of nurses' and patients' experience summaries. Consequently, in the light of this more in-depth data analysis, illustrations of the healthcare work environment for nurses were created in the form of typical situations and personas encountered in the nursing practice. Thus, the prototype includes not only an improved version of the compass but also (*Figure 3*):

- 8 profile cards (4 nurse and 4 patient personas)
- 16 situation cards from caregiving experiences and work organization (simple, complicated and complex caregiving situations)
- 1 board for problematic and risky situations with solution proposals
- 1 notebook for nurses

Furthermore, the analysis of the nurse's work contexts, tasks carried out as well as material and spatial realities of the units' environment helped to acquire a better understanding of external factors pressuring their work (i.e. built environments and work organization).

Following the realization that patient safety far exceeded the nurse's sole responsibility already occupied by numerous tasks, it felt important to shed light, through the portfolio, on the units' physical and material environments as well as on the work organization issues that can affect patient safety. Finally, the analysis of the last codesign workshop clarified the usefulness of the tools included in the prototype which should be intended for nurses as training tools to foster reflexive practices regarding their work. In fact, the analysis of the discussion themes that took place during the final codesign activity made it clear that the portfolio could be beneficial in academic contexts as well as in continuing education activities. However, a number of questions were raised regarding its utility for nurses' daily practice. For instance, some stakeholders mentioned the opportunity to use the portfolio as a managerial tool, but this questioned the original intent of the project concerning the objective related to fostering a reflexive nursing practice and the need for more data of that particular managerial context emerged, as well as the need to address it in order to improve the portfolio.

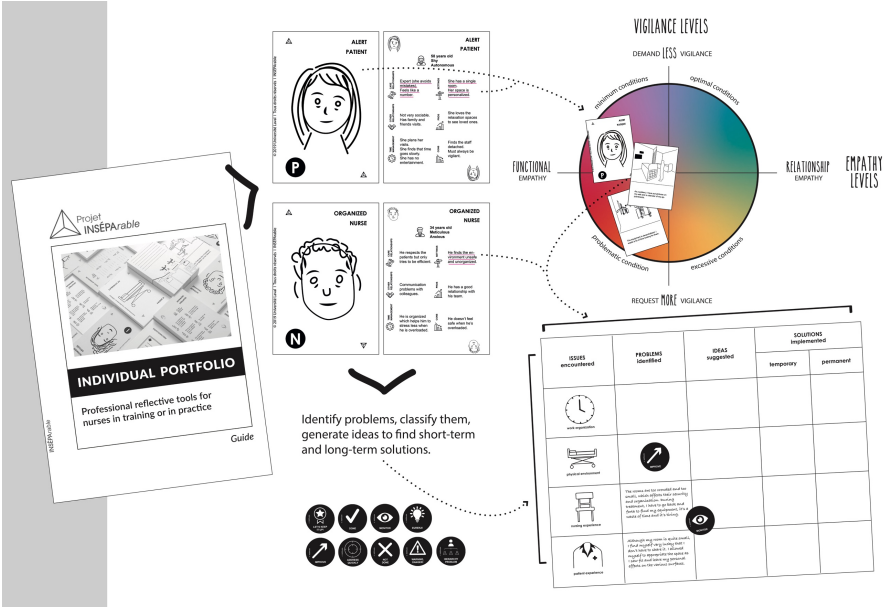

Figure 3. The INSÉPArable design project prototype: an illustration of its tools

5. A priori, learnings and limits of the INSÉPArable project

From a design perspective, the portfolio prototype in its actual version can be viewed as a materialized hypothesis which should be further tested in healthcare settings. On the one hand, the analysis of the last codesign workshop brought to light the need for iterations in

the portfolio's actual form in order to be of use in its application as well as to present a genuine solution to the raised issues that stemmed from the problematic. On the other hand, the portfolio's development conditions suggested a methodology review to better define design's contribution to knowledge production, to interrogate the interdisciplinary context of the project and thus, to mitigate the research project's results according to respective disciplines. Finally, the dual objective of the project-grounded research (i.e. design project and research project) can lead to some confusion regarding design's contribution to knowledge production, at least in this case. Moreover, it can be tricky for less versed researchers in research-creation or project-grounded research to understand the prototype as a situated knowledge production formalizing nursing practices as a conceptualized comprehension similar to a theorical model construction. In this sense, references to the conceptualizing categories of Paillé and Mucchielli (2012) can be of use to illustrate that the compass concept mobilized in the prototype development belonged to this kind of categorization. Understandably, it may be tempting to consider the portfolio as a finished design project, even in its prototype form, to be solely used as a tool for nurses. Hence, the discussion will focus on these matters.

5.1. The design project's limits and design's contribution to knowledge production

The main limit of the approach used in the INSÉPArable project is associated with how the final hypothesis (i.e. portfolio prototype) relates to the complexity of its objectives and of its data collection. Given the needed resources and time required to produce the portfolio, the first two prototypes were mainly based on the formalization of the nursing practice and patient safety issues through a series of tools: a compass, patient and nurse profile cards (persona) and problematic situation illustrations of work organization and healthcare spaces. The project development did not focus on reflexive learning strategies, strategies that could have helped further development of the portfolio through situational validations. One workshop with nurses and patients was insufficient to validate such ambitious tools as well as to support consequent and iterative design work. Ideally, discussions with a broader set of stakeholders involved in the nurses' work organization and environment should have taken place in order to investigate more thoroughly patient safety issues. A better understanding of training contexts could also have allowed greater achievement of the primary objectives, even though the codesign workshops were positive in regard to their application in training contexts. Nonetheless, validation tests should also be considered in order to improve its understanding as well as to allow design adjustments. In short, the analysis conducted by the design team allowed to identify problematic elements in nursing practice through the combination of experiential and material data. So, beyond the patient-nurse care relationship, the prototype illustrates how the work and spatial organization are crucial external factors in patient safety issues. In other words, with regards to the data collected and the limits associated with the research methodology, the prototype helped to conceptualize the patient-nurse care experience partially, but enlighteningly.

5.2. A methodology tested through interdisciplinarity

The research question was initially situated in a nursing context while the methodology was mainly based on a project-grounded research approach (Findeli, 2004). The conjunction of these two approaches aimed at some form of innovation through its data collection and its participatory methods coming from codesign workshops. The prototype production as a research result should have brought novelty to the healthcare field, which is not accustomed to this type of formalization. Furthermore, the methodological stance implied a strong connection to a collaborative approach where the interdisciplinary work should have led to integrative knowledge production supporting the design project (Findeli & al., 2008). In this light, it seems important to address the challenging interdisciplinary work of the INSÉPArable project. The research process of the project remained sequential and disciplinary putting interdisciplinarity to test mainly because traditional ways of working prevailed on both sides. On the one hand, the general research context was characterized by formal meetings, work in consecutive stages and analyses coming from disciplinary frameworks. On the other hand, a more iterative design approach combining qualitative analyses to visual representations as well as to spatial and material data was difficult to share between researchers from such different disciplines, resulting in an asymmetry in the analysis tools used by the research team. As Stévance and Lacasse (2018) point out, a research-creation project must favour a synergy among the researchers involved which is not always easy to create. Furthermore, Sanders and Stappers (2008) highlight «gaps» in interdisciplinary teams as symptoms of the expert mindset where each member then feels the need to defend his-her discipline to avoid misunderstanding or even, just to be heard.

It is, therefore, hardly surprising that joint analyses were difficult to obtain and that a research protocol better suited for this type of approach should have been conceived from the start in order to facilitate internal collaborations. Consequently, the knowledge production was generally accomplished in a disciplinary and independent manner (*Table 1*): the nursing team came up with the iceberg/sphere model concept, while the design team developed the compass concept.

Table 1. «Disciplinary integration in research» (In Nimkulrat & al., 2020, p.272)

	Multidisciplinary	Interdisciplinary	Transdisciplinary
Level of interaction	Team members cooperatively conduct research in parallel	Team members coordinate frequently and consistently throughout the project	Team members act, plan, and combine research as a collective
Problem definition	Usually guided by one disciplinary paradigm and often	Mutually developed by researchers from multiple disciplines	Transcends disciplinary boundaries; context-specific with multiple

	framed by lead discipline		stakeholder perspectives
Epistemology	Team members rely on disciplinary epistemology, but of differing paradigms.	Team members may rely on disciplinary epistemology, but must accept the validity of different paradigms.	Team members rely on a transcendent or common epistemology that reflects the nature of the problem.
Design research questions, methods and theory	Team members use traditional disciplinary approaches; research questions and scales are framed by the discipline that defined the problem.	Team members coordinate research design, questions, methods, and theory; temporal and spatial scales and conceptual frameworks are synchronized.	Team members develop new conceptual frameworks that transcend disciplinary boundaries; research design, questions, methods, and scales are collectively developed.
Knowledge generation	Knowledge created within disciplines, but conclusions may generate research questions that are applicable to other disciplines.	Knowledge created that may impact knowledge structures in all disciplines; conclusions generate new types of interdisciplinary research questions.	Knowledge restructured through the creation of new shared knowledge; conclusions drive new theorical frameworks and areas of research.
Products	Disciplinary or summary of combined disciplinary findings for disciplinary journals.	Joint synthesis manuscripts; for interdisciplinary journals.	Joint synthesis manuscripts that transcend disciplinary orientations; for interdisciplinary journals.

Moreover, the iceberg/sphere model concept was mainly based on the nurses' interviews whereas the compass concept attempted to integrate all the collected data. However, it seems important to emphasize that these two models have their own value and complementarity which deserve to be better articulated. Hence, the INSÉPArable project was generally conducted through expert, even disciplinary, approaches where interdisciplinarity turned out to be a challenge. Therefore, it would be more appropriate to qualify the project as based on a multidisciplinary approach, useful for nursing in one way and useful for design in another (*Figure 4*).

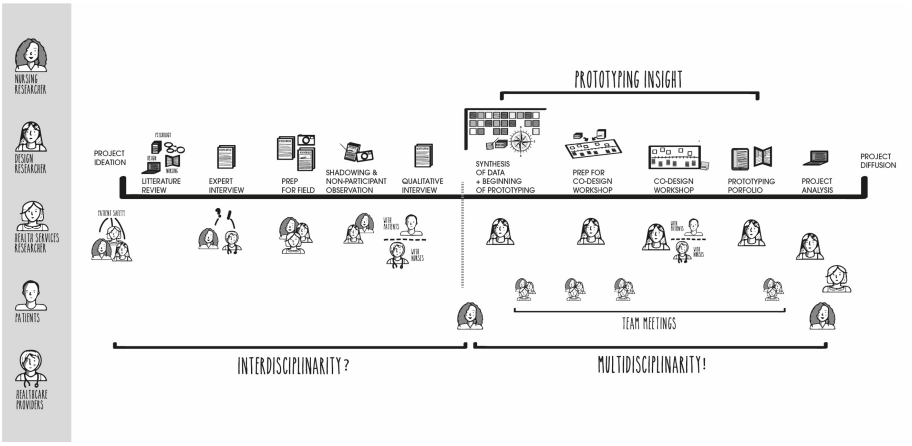

Figure 4. The INSÉPArable project, a multidisciplinary project: A revised research approach

5.3. A dual purpose to discuss

This situation is certainly common to several projects which claim to be interdisciplinary, but this research project questions the mutual understanding of the research cultures specific to each discipline involved. The dual purpose of the design approach certainly brings its share of confusion precisely because the design project carried out (i.e. the portfolio prototype) offers potential applications which can limit the perception of its interpretative value as well as the scientific rigor on which its production is based. Moreover, it may also seem difficult to clearly distinguish the different design research approaches, their particularities and epistemological stances. Frayling (1993; 1999; 2015) was one of the first to point out the ambiguous nature of design research through a categorization (i.e. research *on* design, *through* design and *as* design). Thus, if the design research paradigm *on* design is easy to articulate as the production of knowledge on design, it is still difficult to award a contribution to knowledge production within the research-creation/project paradigm or *through* the design project as defined by Frayling (1993: 1999; 2015; Bisson & Gagnon, 2005; Findeli & al., 2008). Finally, the most contested approach is certainly where design, as a creative process, is considered research in itself (Frayling, 1993: 1999; 2015; Bisson & Gagnon, 2005). Consequently, it goes without saying that the design research team shares Frayling's reservations towards design *as* research, whereas the design project should not be considered as scientific research *per se.* Therefore, as seen with Sanders and Stappers (2008) as well as with Kimbell and Julier (2016), it now seems clear that the chosen approach in the INSÉPArable project was based on a rigorous qualitative methodology leaning on Findeli's (2004) project-grounded research model and on Stévance and Lacasse (2013; 2018) research-creation definition while using the conceptualized data collection methods for design research from Bisson & Gagnon (2005). To conclude, it is precisely this epistemological stance that should have been better defined and communicated within the

INSÉPArable project in order to avoid misunderstanding regarding design's contribution in knowledge production. The impression of operationalization and/or hegemony of design could have been avoided to make way for a real interdisciplinary collaboration with the objective of shedding light on knowledge creation and application for each and every discipline involved in the research. Lesson learned.

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Acknowledgements: This research was supported by the Social Sciences and Humanities Research Council of Canada and by the Bureau de la recherche et de la création de l'Université Laval (University Laval's research and creation office, Québec, Canada). Special thanks to all members of the research team and to all participants of the codesign workshop.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design for Fast Track Democracy.

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Abstract | This paper explores if and how mechanisms from economical and design strategies could be transferred into political structures to fasten up processes for representative democracies in order to react to matters like climate change in time. We filter and summarize helpful cases to transfer their success principles to representative democratic systems in Europe. This happens from an analytical and design research point of view. Concluding this paper, the insights are used to propose extensions for the current representative system with new approaches to tweak it to enable a faster and meaningful change, which is urgently needed against the backdrop of an increasing number of worldwide challenges.

KEYWORDS | DESIGN AS POLITICS, DESIGN AND DEMOCRACY, DESIGN STRATEGIES, CLIMATE CHANGE, REPRESENTATIVE DEMOCRACIES, DISRUPTION FOR CHANGE, TRANSDISCIPLINARITY

1. Introduction

Processes of the representative democracy are solid but at the same time often painfully slow. Change often takes a long negotiation process that is conducted between the different stakeholders of these processes. The results are often long-term outcome-focused plans including objectives, budgets, and measures. These plans are then implemented into the operative decision making and administration structures of the democratic system which is creating additional lag due to their bureaucratic logic. This makes sense for working out agreements in large scale long-term policy-making amongst different actors with different political agendas and diverging views and values where time is no critical factor.

When the rigid system of representative democracy is faced with wicked problems (Rittel, Webber, 1973) like the acceleration of digitalisation or the exponentiality of growing issues regarding climate change, fast decision-making to reach meaningful action seems almost impossible. Politicians appear hesitant in their reactions towards a seemingly overwhelming demand for change. With small steps, the giant system slowly moves towards a direction, but change is barely recognizable.

Challenges for the political actors are the multiple, diverging interests of citizens (cf. Mulder 2011), accompanied by the parallel fear of politicians to cause imminent societal divisions and growing tensions in society when change is happening too fast for those in economically weak situations and places.

There are the progressive actors, fighting for actions to defeat the multiple crisis (Brand, 2016), and pushing for significant change within the near future. And there are individuals and groups that are caught in the structures of the current system and are not able to transform easily or only with a tremendous financial effort towards sustainable action – like the farmers trapped in the conventional agriculture system.

In this tense situation, the question arises, how a transition phase can be developed by utilizing elements and mechanisms for acceleration to reach e.g. a zero-emission industry in Europe within the coming decade.

Coming back to the need for rapid change-making in representative democracies the central question of this paper is: what processes and principles of economy and design can be extracted to speed up sustainable and social change in representative democratic structures?

The approach of this paper is to extract mechanisms that can be used to extend and enhance the present structures of the representative democratic system with flexible, innovative approaches from the economical and design sector. This bears the potential to make the political system more agile and prepared for increasing complexity and societal divides.

We extract principles and tactics with potential for experimentation, providing new perspectives – always respecting the requirement and objective of a representative democracy to fulfill and moderate the demands of a heterogeneous, open and diverse society (cf. Putnam et al. 2001, cf. Sennett 2012).

We are aware that economical processes are faster, because the degree of freedom to come to a decision more quickly, is higher within commercial entities because fewer values and diverging interests need to be accounted for. We are aware that this paper describes the domains of economy and politics only in a broad outline. Additionally, we recognize that our perspective is written from a European centric perspective and therefore also from a privileged point of view.

2. Design of Democracy

When reflecting on the model of Manzini/Margolin (2016) named "Design of, for, in and as Democracy" this paper mainly focuses on a Design of Democracy, which aims at "improving democratic processes and the institutions on which democracy is built". The other paradigms – the Design *for*, *in* and *as* Democracy – play an important role as well, because this paper explores worlds of interdisciplinary knowledge exchange (as) and asks how to revitalize democratic structures through experimentation, which allows for more stakeholders to participate and active citizens to be part of those mutual actions (for, in).

3. Strategy towards the Future – Don't let the past shape the future

Our basic hypothesis is that current representative democratic systems underline and maintain the status quo, instead of looking at future opportunities. As a consequence, the current actions are only aligned towards a strategy based on the paradigms of the past. But it's not the past that is going to save us from the current crisis, instead, it is the future. Today many people have future angst and lean towards a past that has created a lot of the problems of today. We should better give these people an idea of favorable futures to prevent further populist ingratiation. We have to shift our focus from re-action to action.

Even if lately actors in the political domain decided to make a big step towards the future, to tackle the next phase of technological development in Europe (e.g. the Decode research consortium[1] or the Diem25 European Movement[2]), we would like to give one example,

[1] decodeproject.eu
[2] diem25.org

which shows the lag with which the representative democratic system is acting when it comes to fast and decisive action:

In 2019 the French government offered a 5,5 billion US dollars fund for digitalization and innovation for their entrepreneurial scene (Dillet, 2019). After a year of talking about initiating a similar fund, the government of Germany is still in the planning phase of a "Future Fund" of 1,2 billion US Dollars (Sigmund et al, 2020). An example from the private sector in comparison: Between 2017 and 2019 the Japanese Softbank offered 200 billion US dollars in their so-called Vision Fund (Brien, 2019).[3]

This demonstrates the disproportion between the determination to act (and the need for action) in the public sector on the one, and the private sector on the other hand. This can also serve as an indicator for the difference in degree of optimism and faith when it comes to strategizing for future developments.

4. Think beyond the crisis

Thus, we claim a *Politics of the Future* that should act as a flexible, evolving and adaptive practice serving as a bridge towards new, alternative systems which will enrich the existing structures.

We propose the introduction and implementation of additional parallel structures that accompany and inform the traditional organization of democratic decision making. These structures would utilize the quality and potential of design as a way of thinking and focus on forward-looking action towards more sustainable and integrative scenarios for the future.

In order to create preferable futures (Hancock & Bezold, 1994; Dunne & Raby, 2013), we have to overcome our limited view of the status quo as one of crisis and challenge. We have to widen our view and set sight on the shores of a new system we imagine to be better for more people and the planet. We have to undertake the creative effort to integrate new and old, future and past against the background of opportunities created by new knowledge, new technologies and a rising motivation for change.

5. Design as translator between different disciplines

Within this approach, design has the ability not only to take on the role of an adaptive facilitator between disciplines, domains, and systems but can also work as a translator for languages and taxonomies of different systems and is able to organize the inter- and

[3] 2017 93 billion and 2019 200 billion Euros

transdisciplinary processes due to its disciplinary openness and adaptability (Findeli et al., 2008).

Design as a discipline is able to dive into the terminology, habits, and frameworks of other disciplines (Park, 2010; Jonas, 2010). Through its openness it can adapt its methodology and processes to a certain context and mediate between different actors and "life-worlds" (cf. Brandes et al, 2009, cf. Joost et al, 2014). At the same time, it is capable of tackling multi-disciplinary challenges, which is relevant for an increasing number of issues that need to be considered. We want to use the power of design to translate and mediate between the economical and the political field and look through the lenses of design methods and business strategies towards politics, strengthening the approach towards an extendable representative political system.

6. Principles

As a first step towards a design-driven Politics of the Future, we have identified and formulated six principles. We use examples of economic strategies and design practice to illustrate these principles. We then come back to the initial question of "How to accelerate current democratic processes by applying these principles?"

[MINIATURISATION] Downsize the scope – Embrace experiments

Idea: Create a frame that is feasible to allow for quick and secure modelling and testing of possible solutions.

Strategic perspective with aspects from economy and design:

Building a Framework for experimentation and temporarily decoupling it from the existing system frame that has hindering regulatory paradigms.

Companies often test new systems or processes in a scaled-down version like a pilot plant or test-pilot a project with limited scope before scaling the system or implementing it company-wide. Risky or experimental solutions are often tested in safe environments or laboratory settings (sandboxes, testbeds). Successful test-pilots then have the power to generate great stories which make it easier to gain buy-in from investors, corporate sponsors or important stakeholders.

Example:
Eskilstuna, a Swedish industrial town of 65.000 inhabitants, is a leading role model in the circular economy. Based on the initiative of a group of local politicians they developed a visual, user-friendly system for recycling their daily garbage. Under the provision of free garbage bags in seven different colors, the citizens can establish an intuitive recycling system

at home. Through a visual detection system, the recycling facility automatically sorts the garbage and reaches a really high recycling rate.

But this is not the only systemic solution this Swedish town has implemented: They also initiated “Retuna” (retuna.se), the first worldwide recycling shopping center. Opened in 2015, by the Initiator Anna Bergström, the center has already reached break-even after three years. Owners of 14 shops can draw on the collection and storage, filled with donated secondhand goods of citizens. The shop owners are using the donated material to upcycle it into new products or for the repair of bikes or audio equipment (Wagner, 2017; Ammar, 2019; Stadter, 2020).

What did we learn for the Design of Democracy:
After testing an experimental framework which proved as working (as in the example of the Swedish town Eskilstuna) an up-and cross-scaling process could be the next step (cf. Schubert & Uğur Yavuz, 2020). After another iteration, a transfer to several similar sized towns in the same or other cultural contexts could take place, always planning for a phase of adaptation to the specific localities and their respective conditions. If scaling up on a regional level generates positive outcomes, the approved system could be scaled up on a national, European or international level. Thus, a higher impact will be created, and the adapted system will run more smoothly because it was iterated several times in a smaller scale before expanding it as a more standardized concept. The quality of design enables understanding and easy adoption of verified systems by making complex interconnections apprehensive through the use of designerly means like interfaces, blueprints or visual manuals.

[PARALLELISATION] Simulate zero gravity – create environments with less friction

Idea: Create parallel structures outside the existing ones to avoid bureaucratic friction.

Strategic perspective with aspects from economy and design:
To build parallel tracks outside of the institutional structures.

More and more companies found innovation units, collaborate with or act as venture capitalists, form (or participate in) incubators and accelerators to circumvent their own bureaucratic culture and procedures. They shift to funding initiatives round-per-round after successful results and proof-of-concepts instead of budgeting on a per-year basis. They scale promising projects fast and stop the failing ones early.

If we look at other areas where institutions are challenged by disruptive forces like the digital revolution, a growing number of private commercial institutions understand that their traditional top-down, plan-based, step-by-step way of working and controlling is not always

feasible when it comes to dealing with fundamental shifts in the way businesses operate and customers consume.

Example:
Organizations and companies like Google (e.g. Google Ventures, Google X) have spear-headed a whole new way of developing products and innovation initiatives by introducing new problem-solving and innovation strategies and added them to their existing portfolio of instruments. Many companies have built parallel tracks outside of their corporate structures (or only loosely associated with these) to short-cut their own bureaucracy, gain speed and flexibility when exploring new business and technology landscapes. BMW for example is involved in the car-sharing service *Drive Now* as is Mercedes in *CarToGo*. Cannibalizing their company's traditional business model of selling cars would not have been this easy or even possible inside the company's own structures. Today companies and products are often developed in “incubators” and scaled in “accelerators” without their origin companies intervening much in the decision making or business operations.

While observing that governments and municipalities initiate formats like think tanks, future labs, or citizen assemblies, the outcomes are not really recognizable due to the lack of scaled implementation. There is a need to integrate newly established structures and insights back into the “bigger system” in order to create a long-term impact.

What did we learn for the Design of Democracy:
When governments and municipalities have capacities to initiate parallel, innovative endeavours, a “back coupling” to the existing system is needed. The reconduction and refeeding of the insights is necessary to innovate for the bigger picture and create real impact. For a meaningful back coupling, designerly approaches like *infrastructuring* (Star & Ruhleder 1996, Ehn 2008) – combined with visual means – can support the integration.

[PROTOTYPING] Always-in-beta – Use iterative prototyping to find “market”-fit

Idea: Create a very basic solution that you then continuously improve with feedback from the target users or groups.

Strategic perspective with aspects from economy and design:
Using Rapid Close Loop Learnings for problem-solving and continuous improvement of the beta-solution.

Design thinking focuses on the iterative approach of testing assumptions and failing early while learning and improving the solution, service or product with each cycle. Innovation strategies like the *Lean Startup* idea focus on rapid iteration, solution-testing and continuous improvement cycles towards a scalable product-market-fit solution.

In the challenging race to new markets, start-ups around the world are abandoning traditional waterfall-processes in favor of agile product development methodologies and many organizations strive to implement innovation ecosystems utilizing a scaled-agile approach at enterprise level. Product-market fit is reached by following a quick test-based development process where mistakes are made early and cheap. Several interrelated issues are explored and coordinated in parallel while constantly synthesizing basic testable working solutions and prototypes. The insights and ideas from constantly testing and evaluating prototypes are then fed back into the process and continuously improve the solution with every cycle in consequence.

Example:
Tesla first tested their product – an "improvised" EV sports roadster (a remodeled lotus elise) – with a small target group of prosperous clients. By improving their expensive niche product step-by-step with less financial effort than if done for a mass market vehicle, Tesla learned everything they needed for the later scaling-up phase when targeting a broader mass market. What they learned in their small-scale project had tremendous impact when building huge production streets like the GigaFactory (Musk, 2006).

What did we learn for the Design of Democracy:
Many current administrative procedures are really painful and time-consuming experiences both for employees and for citizens. At the same time each administration unit provides an ideal testing ground for innovating bureaucratic procedures. Successfully tested innovations could then be applied on a much bigger scale.

Through integrating prototyping strategies into the development of services and processes a market fit is iterated step-by-step. Through constant improvements and adaptations to different contexts and user needs, the developed system is open and flexible. This principle could be transferred to new political agendas. Through an iterative "always-in-beta" status, agendas can span a range of diverging citizen's living conditions and can react more easily to changing environmental and societal parameters.

When it comes to dealing with pressing complex issues like the climate crisis that have to be tackled immediately and with dedication – a wicked problem which cannot be addressed without accounting for its multi-dimensional, interrelational and fuzzy nature – one important approach is fast closed-loop learning, adoption and constant solution-modelling.

A learning system with the right feedback loops in place can continuously improve itself and offer new ways of working till the right fit with the changing context and its shifting paradigms is accomplished.

[ANTICIPATION] Anticipate futures – Make “bets on the future”

Idea: Look at current developments (like demographics in western countries or decreasing price and increasing capacity of micro-computers) and start building solutions based on your projections of these prospects.

Strategic perspective with aspects from economy and design:
Cost-curve analysis and Scenario Modelling.

Strategies that use anticipation as their principle, focus on the future intersection of a business (in development) and a certain technological trend or dynamic trajectory (economies of scale, network effects, cloud computing, mass-adoption of certain behaviors). These strategies often include portfolios of multiple innovation initiatives, big bets as well as pipelines of ideas and flexible resource allocation frameworks.

Example:
When Netflix was a DVD rental business, they saw that prices for mobile bandwidth were coming down and smartphone distribution and bandwidth speed was accelerating. They figured that in the future people would be able to watch video content by streaming it on their mobile devices (cf. Oomen, 2020). After modelling this scenario, they decided that it might be smart to start building a platform around this anticipated business model. Had they ignored this or not tried to predict developments related to their industry this opportunity would have been a bigger threat to their existing business model than a new business opportunity.

Tesla's success was based on one big bet that the cost of batteries would come down so fast that electric cars would become affordable to the masses. This could be demonstrated with a simple cost-curve analysis. But acting with dedication based on this model afforded a lot of courage.

What did we learn for the Design of Democracy:
Anticipating future developments like the development of prices (of batteries or solar panels for example) or demographics and courageously acting upon these projections gives us the opportunity to create better futures because we learn to anticipate them and act on the basis of various forward-looking models. We can avoid a purely reactive mode relying on data from past developments.

Design approaches for projecting and forecasting the future (Jonas, 2007; Hanock & Bezhold, 1994; Dunne & Raby, 2013) can enable courageous and forward-thinking concepts. It can enable political stakeholders to switch from a reactive to a proactive mode and position themselves as proactive drivers.

[NARRATION] Create powerful narratives – Focus on story and experience

Idea: In order to get buy-in for change you can leverage the power of story-telling and the intuitive human relationship with visual language to bridge imagination gaps and stop purely theoretical discussions.

Strategic perspective with aspects from design and economy:
User Experience Design, Storyboarding and Narration Frameworks, Critical Design.

Designing and implementing strategies for large organisations often involves a large amount of storytelling to get ideas across towards employees, stakeholders and customers. Persuasive narrative structures are used in presentations, marketing and pitches to bring ideas to life and convince stakeholders and decision makers to take action towards realizing the described and visualized scenario (Boudens et al 2019).

Example:
When AirBnB tried to imagine their service, their business model and their customer experience as one coherent system they asked a former animation artist (Pixar) to help them storyboard their room-sharing service (Akkawi, 2018).

What did we learn for the Design of Democracy:

By taking advantage of the immediacy and emotional quality of (visual) narratives you can make it easier for people to comprehend complex interrelations and to get them motivated for action and behavior change. This also works vice versa by creating dystopian narratives (using the critical design approach for example) that then show scenarios that could evolve when we do not act or act in non-sustainable ways. Effective storytelling can help to enable game-changing decision making (e.g. through movies like *An inconvenient truth* by Al Gore).

Storytelling puts information into a semantic, sequential and digestible order. Thus, it becomes efficient as it is now more comprehensible and recognizable. This tactic is not so often used in political discourses probably due to the fear of being recognized as unprofessional or superficial, but it sure would help to make political agendas better accessible to a broader public.

[HACKING] Hack the System – Create informal solutions & “make” politics

Idea: Learn from the example of hackers and subversive artists and improve the system by breaking it in ways that help to create better versions of it.

Strategic perspective with aspects of design and economy:
Use re-framing techniques, mash-ups, up- and recycling, a tinkering mindset.

Thinking of alternative uses for existing solutions and tinkering with combinations and re-

configurations is part of technology innovation and product development in smart organizations (3M for example “invented” the post-it accidentally when they found a “hacky” way to re-use one of their glues that had failed at the originally intended purpose). Having laboratories, cross-industry collaboration and open-source projects often leads to unintended successful innovations for corporations.

Example:
Developing smarter ways that short-cut or re-frame current systems, we might be better able to reach our goals and improve the system at the same time. If you make policies that increase the costs of driving cars within the city limits, you allow rich people to live out their convenient unsustainable lifestyle while forcing behavior change onto people with less income. But if you make the streets smaller and allow for more bicycle space (as it was implemented in Bogota or Brussels in Covid-19 times) you make it more painful for everyone to drive a car in the city – especially bigger cars – and at the same time you reward people for riding the bicycle in the city.
When the city of Copenhagen was planning to build their new waste-to-energy plant in the middle of their city to limit traffic and emissions from transportation they asked the architects to come up with a proposal that would help the citizens to perceive and experience the new power plant as an improvement in living quality rather than a necessary evil. The architects found a very bold mash-up solution by adding a skiing slope on top of the building allowing the citizens to use “their'' energy plant for recreational activities (Murray, 2019). The re-framing of a utility building shows how powerful designing-out-of-the-box is when you have the courage to realize such projects.

What did we learn for the Design of Democracy:
The Copenhagen example shows that questioning the existing, enables new transformative thinking, imaginations and alternative realities describing a preferable future. When politics moves beyond a reactive mode, it is also possible to think and act beyond the existing and learn how to add, alter and combine existing solutions into something new.

7. Conclusion

From a design research point of view, this paper addresses new ideas and perspectives for the extension and improvement of representative democratic systems by borrowing from other domains like economic strategies. We extracted and condensed several principles to be utilized for acceleration and creative problem solving. These principles can be applied as stand-alone approaches or be combined as a strategy.
Decoupling processes from existing frameworks offers the advantage to think and make in new ways. The challenge lies within the re-integration of new models and approaches into the existing system. It is this translation procedure that calls for further research and investigation.
Maybe there could be some overarching, interdisciplinary political entity as a horizontal

interface in between the different departments with the objective to address such issues of synchronization, scaling and implementation.
The key benefit from the dialectic working of traditional representative democratic processes on the one hand and innovation strategies on the other hand combined in one approach, for a faster and more agile change-making agenda, would be that the democratic system itself could become more resilient during times of crisis. Looking back to the described need for new approaches in design of democracy (Manzini & Margolin, 2016), this paper describes pragmatic and supplementary approaches for finding ways of addressing complexity.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Disrupting governance by Systemic Design and co-creating the public value

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Abstract | Massive transformations characterize our current era at a multidimensional level, and our governments worldwide are facing the urgency to translate this complexity into a manageable common strategy. Strong synergies and cooperation on a quadruple-helix model are identified as primary conditions to build value for society. In that view, systemic perspectives and participatory methodologies - which Systemic Design combines - can trigger innovative processes of sharing knowledge and experiences among different stakeholders and can build innovation in the public sector. This paper investigates how Systemic Design methodology can be used for a governance "paradigm shift" for value creation, on a long term perspective. Such a method opens the way to a more adaptive and co-creative innovation in policy-design processes, by exploring new ways and tools provided by design, which enable broader and collaborative access to public governance. Applying a systemic perspective into those strategies means to favor a type of governance, whose outcomes are iterative and autopoietic, creating endurable public value.

KEYWORDS | SYSTEMIC DESIGN, POLICY-MAKING, CO-DESIGN, GOVERNANCE, VALUE CREATION

1. Introduction

Massive transformations characterize our current era at a multidimensional level. From the environment and climate change to market instability, towards waste pollution and enormous production, these are just a few examples of the complexity and "wickedness" of nowadays. Such trivial and interconnected phenomena cannot be solved with the traditional linear and analytical method of problem-solving, but they call for a radical shift in policy regulation around the world.

Even if there is an increasing acknowledgement of the systemic nature of global challenges, however, it is still a significant challenge for the different governments worldwide to translate this complexity into a manageable common strategy to address present and future transitions (EEA, 2019). Such wicked scenarios are often promoted and reinforced by a linear model of governance, which encloses problems into "silos", and limits the understanding of the bigger picture (Head and Alford, 2015).

The need for quick response has brought to a "reactive policy-making" that contrasts with a model based on the generation of value in the public sector, which inevitably requires a long-term perspective. Moreover, this bureaucratic model rejects external views on topics and policies which are often generated "behind closed doors", favoring a perceived sense of opaqueness from the outside and minimizing people participation. For this reason, there is an urgent need to disrupt these silos and to shift towards a more adaptive and collaborative policy framework.

Such system transitions in governance disrupt the established investments, jobs, behaviors, knowledge and values. The aim is to constraint governments to impose policy instruments that are consistent with long-term environmental goals, as Sustainable Development Goals. On that long-term perspective, how to build value in governance? It is necessary to change the conception of "value creation", which is used and abused in our current economy, and which is mostly absent in the public sector (Mazzucato, 2018). In that view, the first condition to reach sustainable development is to build strong synergies and cooperation between the socio-economic components of the system. By providing a common understanding of complex problems and sharing responsibilities to cope with change, participatory approaches enable adaptive governance and resilient systems.

To approach such complex relations in governance and their wickedness, we need systemic and interconnected solutions (Brown T., 2011). In the last decade, Systems Thinking has provided practical approaches for raising social awareness about interconnected societal complex systems (Jones, 2018) and Systemic Design has shown the means and knowledge to navigate these wicked scenarios aiming to maximize the value of government.

Design practices like participatory design and co-design (Bødker & Grønbæck, 1991; Manzini & Rizzo, 2011) are born from this approach, and they all share a systemic perspective (Bødker, 1987). This one has been instrumental in the definition of a new role of design

inside complex social systems and set up the bases for social innovation as a space for design thinking and research (Jones, 2014). Design for policymaking has opened the space for design practices to be involved in the construction of policies addressing designers' skills and knowledge towards higher goals like sustainable behaviors and development (Kimbell, 2015). These practices have been vital in the development of the discipline and have helped designers to move from the production sphere, leading them to become significant actors of social transformations (Buchannan, 1992).

From that view arises Systemic Design, which approaches and tackles problems on a systemic and complex level through the creation of strong and synergic linkages among all the stakeholders involved. This co-creation process favors and reinforces the socio-economic systems connected, on a long-time perspective. Nevertheless, we must acknowledge that design is not yet "completely" inside the governance culture, even if there are examples around the globe of design-gov cooperation through the so-called "innovation labs".

This paper aims to explore the Systemic Design methodology for a governance "paradigm shift" towards collaboratives approaches for value creation. Such methods in policy-design processes explore new ways and tools of an adaptive and co-creative innovation. This opens doors for everyone to access public governance, while directly and effectively responding to people's needs and governments future trajectories.

The paper is structured as follows. In the first section, the research frames the understanding of the wicked problems' nature in the public sectors. The following section introduces the main challenges that our current governments are facing when approaching today's challenges. It reflects the importance of participatory approaches, on which design leverages, to build innovation and create value for policymaking in the public sector. Finally, the discussion is narrowed, explaining how systemic design can unveil the hidden assets of a context underlining its strengths and threats in a policymaking scenario.

2. Wicked problems and current state of the art

The last century, our extractive society model has brought irreversible impacts on ecosystems at every scale. Such problems are associated with climate change, pollution, chronic diseases, unemployment, poverty and corruption. The interactions between them are classified as the so-called "wicked problems". These, defined by Rittle and Webber (1973), are represented by their complexity, uncertainty, interdependence, and highly interconnected social-ecological systems. Later on, Martin (2009) reframed the wicked problems identifying them in four dimensions:

First*, causal relationships are unclear and dynamic.* Suggesting that the causes and effects of wicked problems are complicated to identify as their complexity makes them ambiguous. (Roberts, 2000). This uncertainty can also be considered political in a public sector context when it is overseen in the causes and effects of such wickedness. For example, is climate

change a problem or just a manageable consequence of the quest for growth? (Bason, 2018). A current example of such a situation in 2020 where the wildfires in Australia: was the government more prepared on preventing them or into fixing the consequences?

Second, *the problem does not fit into a known category*. The wicked problems undertake interconnected and overlapping challenges, and characterized by cutting nature over several policy fields and levels of governance. This cross-cutting nature means they are embedded in other problems like economic development or environmental preservation (Weber, 2008), increasing the levels of uncertainty (Van Bueren, Klijn, and Koppenjan, 2003). This interpretation of the problem presents a significant limitation to the managing authorities as their notion of problem-solving is "evidence-based policy", which intends that those policy decisions are based on reliable information of "what works". (Bason, 2018)

Third, *attempts at problem-solving change the problem*. Such dimension is related to the linear approach on problem-solving and how the reactive nature of it has perpetuated the wicked problems over time. In the case of governance, this is reflected in the classic top-down dynamics where the inflexible system only allows "one-shots solutions" for potential ideas, plans, laws or initiatives. From that perspective, wicked problems require more iterative and nonlinear ways of addressing problems (Halse et al.; 2010).

Fourth, *there is no stopping rule.* As wicked problems cannot ever truly be solved, there are no criteria to know if they have ever been addressed, meaning they imply a no "stopping rule" (Rowe, 1987) (Ritchey, 2011). Such argument comes from the assumption that every solution proposed can always be upgraded and improved in an iterative process.

In that view, understanding the nature of wicked problems can allow us to comprehend the nature of the current issues on the governments which address such problems linearly.

3. Governance challenges and decision-making

The current system at the moment addresses problems into "solving" and "fixing" with reactive formulas and not considering that our complex situations are not something we can rationally analyze and 'solve' in predictable ways. The current practice of our governments to usually enclose problems into closed-off "silos", limits the understanding of the bigger picture (Head and Alford, 2015), by generating a clash among policy planners and policy implementers (Bason, 2014). Indeed, environmental challenges are a perfect example of wicked and complex problems: ambiguous and unstructured, overlapping in their impact on different domains, not entirely and forever solved so this requires a continuous and iterative process of trying, learning and monitoring (Bason, 2018).

Indeed, in exposing the complexity, uncertainty and no-linearity of wicked problems make it clear that transitions towards particular sustainability outcomes cannot merely be planned and implemented. That means the public sector needs to comprehend the nature of wicked

problems to be able to generate systemic solutions towards long-term environmental and socio-economic goals. Moreover, to address increasingly globalized environmental challenges, active cooperation on a quadruple helix model (governments, industries, communities and research institutions) is needed. This introduces two key concepts of this paper, closely linked one to each other: on the one hand, the shift from “government” to the broader concept of “governance” and on the second hand, the practice of co-design in policymaking.

Firstly, with the term of “governance”, is intended "the totality of interactions in which government, other public bodies, private sector and civil society participate (in one way or another), aimed at solving public challenges or creating public opportunities" (Meuleman, 2008). Consequently, this implies the shift in the role of government: from acting as a pilot with the knowledge and tools to steer society towards sustainability, to act as an enabler of society-wide transformation processes (Bason, 2018). Such argument leads to the second concept of co-design. An appropriate definition of co-design methodology in policy-making delivered by Blomkamp E. (2018) who describes it as a design-led process, in which different kinds of people and knowledge cooperate in public problem-solving, guided by creative and participatory principles and tools.

It is a matter of fact that nowadays almost every government worldwide, especially in Europe, is facing the urgency to shift towards sustainability. In fact, the newborn *European Green Deal* (which aims to make Europe the first carbon-neutral continent by 2050), as well as the *New Circular Economy Action Plans* (which focuses on the use of sustainable resources, especially for high-impact sectors) and the broader and global SDGs, they all witness the willing to cooperate for a more sustainable future.

Nevertheless, the clash between wicked problems and traditional problem solving, together with the shift from government to governance represents a significant reframing of Europe's sustainability challenges and response options. Even if it is acknowledged an urgency shift towards sustainability, however, implications for public policy and institutions are mostly unexplored.

As pointed out by the European Environmental Agency (EEA) the complexity of sustainability transitions opens the way to additional governance challenges, especially in terms of directionality, coordination and the management of unexpected consequences.

Governments deliver the “Directionality" by defining visions, pathways and targets. Such action implies inevitably for an articulation of alternative futures and how to get there. Fundamental on that sense is specific normative choices, underlining the importance of public engagement and deliberation.

The different activities and the diversity of actors across sectors and scales of governance creates the need for coordination. Public institutions have a crucial role to play in ensuring horizontal coherence across policy areas, as well as vertical coherence between local, national and international levels.

Finally, new emerging issues implies a need for both analytical approaches (e.g. horizon scanning) and adaptive governance approaches, grounded in monitoring and learning, that enable the timely reorientation of transition processes. The table below presents the main governance challenges and how they relate to the characteristics of sustainability transitions.

Table 1. Characteristics of sustainability transitions and their governance implications. Retrieved at European Environmental Agency report 2019.

CHARACTERISTICS OF SUSTAINABILITY	GOVERNANCE IMPLICATIONS
Multidimensional Changes in Socio-technical Systems	Policy mix approach that goes across environmental, industrial, sectoral (mobility, energy, food, housing), tax and educational policies. This is important to achieve horizontal policy coordination.
Multi-actor Multi-scalar Process	Multilevel governance allows top-down guidance and funding as well as local policy experimentation. Such polycentric governance involves flexible and self-organising activities by non-state actors.
Mission Orientated Targets	Indicators about the governance direction (e.g. through financial incentives, regulation, targets) and more specific indications about innovation pathways (through roadmaps and foresight exercises).
Disruption and System Reconfiguration	Stimulate sustainable innovations but also engage incumbents and potential losers (via compensation or reorientation policies).
Promoting Transformative Innovation and Experimentation	Portfolio approaches, project-based learning and experimentation, especially with radical innovations (social, technical, business models)
Risks, Unintended Consequences and Adaptive Governance	Monitoring and adaptive governance, to ensure directional flexibility and address side-effects.
Urgency and Acceleration	More robust innovation and diffusion policies. Phase-out and innovation policies (through bans or stronger environmental regulations).

Nowadays, despite the significant investments of money and resources in tackling our current major challenges, it seems that most of them are just superficially solved (e.g. plastic pollution). While these problems continue to be a source of expenditure in the public policies agendas, new ones seem to emerge, increasing the pressure.

The aforementioned demonstrates again that wicked problems cannot be addressed as our institutions are used to - with a linear approach -, but it calls for a change in directionality - in a more systemic way -.

4. Co-creation for value creation

So how to address the wickedness in the current governance challenges?

Mostly the wickedness of our current scenario comes from the lack of value creation. On that view, value intends the wealth creation or the benefits that society obtains from the system - and vice versa -: provisioning services (e.g., food), education institutions, health and social care services, housing, social security, infrastructures, energy, water and waste system, regulating services (e.g., flood control,) and cultural services (e.g., recreation) (Cole and Parston, 2006). These categories of the public value are a way of measuring countries' progress towards the achievement of societal goals - such as the Sustainable Development Goals -.

Through this paper, we aim to expose furthermore an idea of innovation in which public policy actively shapes and co-creates services that drive more sustainable and inclusive forms of welfare and growth in our current system (Jacobs et al; 2016). From that perspective, we intend co-creation as a collaborative design process among public sectors, private sectors, research institutions and civil society. In this scenario of collective policy design, all the actors involved, including citizens, are all intended as equal partners in design and delivery, and people are assets and not just subjects of policies (Sanders and Stappers, 2008; Gillinson et al., 2010).

Certainly, this type of model faces several barriers:

- **the current reactive policy-making** which is more focused on fixing the market failures and re-distributing wealth among other value-extraction activities (Mazzucato, 2016);
- **a siloed-shaped public bureaucracy** which rejects external views on topics and policies, minimizing people participation;
- **lacking consciousness**, public servants are not even aware that there is a different way to develop new approaches (Bason, 2014);
- **lack of tools and platform** to conduct co-creation in practice (workshop, toolboxes, innovation labs).

Nevertheless, it is crucial to underline that input from a diverse group of stakeholders is needed to effectively incorporate both social and ecological dynamics in environmental decision-making processes (Irvin and Stansbury, 2004; Reed, 2008). Indeed, by confronting their different sets of values and world-views, a much broader scenario is analysed from the beginning. More specifically, including different stakeholders can contribute to:

- **a deeper knowledge on different scales**, which has a central role in order to support adaptive governance and ecosystem-based management programs (Gadgil et al., 2003);
- assure higher quality and an **endurable decision making** towards environmental challenges (Millennium Ecosystem Assessment, 2005);
- **make the implementation processes smoother**, saving time and money on political wrangling (Pahl-Wostl and Hare, 2004).

Besides the benefits brought from a diverse stakeholder engagement, participatory and co-creative approaches reinforce other social aspects necessary to address wicked problems:

- the enhancement of social learning and capacity building;
- the increase of transparency by building trust;
- the mediation of power through cross-sector collaboration.

By providing a common understanding of complex problems and sharing responsibilities to cope with change, participatory approaches enable the first conditions to build adaptive governance and resilient systems.

5. Systemic Design as leverage for policy-making and value creation

As our system challenges have turned into more wicked, the design discipline on its problem-solving nature has broadened its approach to services and systems (Ceschin & Gaziulusoy, 2016), by extending to a wider network of actors and co-design practices. That evolution of the discipline has brought to a considerable growth of the policy design field.

On that view, there is an increasing amount of literature on design in policymaking, which examines the use of design approaches in policy making teams or “policy labs” (Kimbell, 2017). Nevertheless, to clearly understand the relevance of the design discipline in the policy field, Bason (2014) explains that design provides a diverse way of understanding policy problems. In his view, design is intended as a hybrid blend of research methods from different disciplines like anthropology, systems thinking, and data science, through cooperation among different stakeholders. Other authors like Christiansen and Bunt (2014) make a similar affirmation defining the usefulness of design to cut the distance between policy and implementation (Mintrom and Luetjens, 2016) (Hobday, Boddington, and Grantham, 2012).

For a Policy Design practice, it is imperative to address the before mentioned pressing issues on value creation in our system. Moreover, it requires to implement a method that allows the combination of technology, design, business and social organization. On that view, systemic perspectives and participatory methodologies can trigger an innovative process of sharing knowledge and experiences among the actors mentioned above. To tackle such wickedness globally means that "Systemic and interconnected problems need systemic and inter-connected solutions" (Brown and Wyatt, 2015). To address that among the design methodologies is the Systemic Design (SD) which approaches the complex phenomena on a systemic level through design tools. This expertise provides a method that is focused on the holistic analysis of territory, allowing the design discipline to serve as a mediator among technicians, economists, humanists, and others (Celaschi, et al; 2013), generating autopoietic open systems based on contextual values. Furthermore, this method merges human-centred design inside complex, multi-stakeholder systems (Jones, et al; 2018) which can highlight the potential opportunities for value creation, delivering new collaborative relations among the local actors and entities (Barbero & Fassio, 2011). Jones (2014) also underlined that SD combines designer skills such as research, reasoning methods and visualization practices, creating innovative reconfigurations for complex services and systems.

The capabilities of SD can serve effectively to the components of participatory co-design that Policy Design processes require. On that view, SD favours the visualization of opportunities for value creation, enhancing the active collaboration between stakeholders, and boosting locally-based value chains (Barbero, 2012). To understand its implementation in a policymaking scenario, it is furthered explained its 6 main steps (Battistoni et al., 2019):

- **Holistic Diagnosis (HD)**: Composed by a desk and field research, which scopes out the system context on the economic, social and environmental perspectives, taking into account the flows of energy and matter;
- **Definition of problems and leverages for change**: taking the framework established by the HD, the system connections and patterns are examined to highlight the possibilities for value creation and threats that inhibit it in future scenarios. The challenges and opportunities are regarded as leverages for change from which the new system strategies can be defined and initiated;
- **Design the system**: A new system model is designed whose aim is to create value in an autopoietic way and tend to zero emissions by optimizing energy and material flows and by valorizing resources;
- **Outcomes Evaluation:** assessment of the environmental, economic and social advantages that comes from the new model of value creation (production);
- **Implementation:** the execution of the new designed system for the specific scenario, considering an estimation of the new business plan feasibility;

- **Results analysis and feedback:** assessing the executed system and unlocking more opportunities, to make the system autopoietic.

Through these steps, SD unveils the hidden value of the socio-economic assets of a territory, creating new valuable relations and synergic linkages, in a long time perspective. Indeed, design capabilities reveal more about the individual and their context and can encourage civil servants to unlock opportunities for an iterative creation of value on a contextual level.

Based on the previous, we suggest SD as a useful method to translate the political vision into executive actions (policies) through the integration of SD steps into the so called policy cycle (Birkland 2001; Raulik-Murphy & Cawood 2009; Hobday et al., 2012). In both the processes, stakeholders and their relationships cover a central role in the socio-technical system targeted for the policies implementation, and they both acknowledge the iterative nature of the process itself. In 2008, Knill & Tosun elucidated the five main steps that constitute a policy cycle, namely: 1. agenda setting, 2. policy formulation, 3. policy adoption, 4. implementation, and 5. evaluation. A policy cycle starts with the problems classification and the priority setting in the policy agenda. It follows a draft of the policy proposals which will be later assessed and implemented. Ultimately, policy impacts are measured, evaluated and reformulated iteratively. This means that the policy cycle is constant and infinite (Maffei et al., 2013), and subject to continuous improvements.

The table below shows which SD's step can be integrated into each policy cycle step and its potential impact per phase.

Table 2. Integration of the systemic design steps into the policy cycle.

POLICY CYCLE STEPS	SYSTEMIC DESIGN STEPS	POTENTIAL IMPACT
1. Agenda setting	1. Holistic diagnosis 2. Definition of problems as leverage for change	HD highlights the hidden resources of a territory and helps police-officers in identifying more effective targets to address their policies, also leveraging on the criticalities and opportunities raised through the HD
2. Policy formulation	3. Design the system	Based on the holistic review of policy strategies, SD supports the policy formulation by designing a new and more resilient system based on the local assets
3. Policy adoption	4. Outcomes evaluation	A jointly and broader feasibility evaluation is given taking into consideration the environmental, economic and social benefits, implying a governance foresight vision

4. Implementation	5. Implementation	SD supports the policy cycle in developing programs to execute short and long term policy plans for a local value creation
5. Evaluation	6. Results analysis and feedbacks	SD supports the assessment of the implemented system, by measuring its resilience under the economic, environmental and socio-technical lens

SD methodology has already some implementation cases, on a policy design level, in projects or regional initiatives. For example, the Design School of the Politecnico di Torino has experimented the methodology both in European projects (e.g., RETRACE Interreg Europe project and ProGIreg H2020 project) and collaborative studies with industries (e.g., Agrindustria Tecco s.r.l., Luigi Lavazza S.p.A., and Groupe Poult).

Even though design has still a long way to be recognised as a powerful means in a governmental environment, there are examples of innovation agencies worldwide that have similarities with the design approaches, at different governance levels. Among these:

- **MArs solution lab (social innovation lab):** Based in Canada, brings together governments, industry, non-governmental organizations, academia, and community to assess complex problems from the citizens' view. They collaborate with multiple stakeholders to develop, prototype, and scale new solutions, and create opportunities to learn how to shift the system and local policies.
- **The Finnish Innovation Fund - Sitra (National Agency):** is a future-oriented organisation that promotes Finland's competitiveness and the well-being of the Finnish people. It's aimed at anticipating societal change, fostering innovative models and boosting business that aim at sustainable development. Sitra focuses and assesses the social change and their impacts on Finland's policies.
- **OECD- Observatory of Public Sector Innovation (Intergovernmental Agency):** It is focused on assessing and reviewing examples and shared good practices of public sector innovation to deliver practical advice to governments on how to make innovations work.

These examples illustrate how the systemic approach is delivered in similar ways at different scales. Also, they prove there is ample room for SD to grow in the policy design field: by integrating it into governmental agencies, SD can have an impact on the policy at a micro and macro scale. These increasing practices aim to shift the role of public investment generating policy imperatives for governments seeking smart growth and wealth creation.

6. Limitations of the approach: challenges to establish a value creation model

Such approaches, as SD for the generation of policies towards value creation, deliver an extensive and holistic research background. Nevertheless, it is likely to point out some constraints related to the SD methodology which have been introduced at the research phase.

One of the main challenges on tailoring SD for different scenarios is the accessibility to database consultation. In the early research phase, this challenge is widespread as database platforms in each country have different units, language, and update status. In most cases, the critical point is to find an average amount of available data, to make a holistic diagnosis properly. Moreover, this process of quantitative and qualitative data collection, requires a robust cooperation between stakeholders and managing authorities, which is limited by the siloed-shaped bureaucracy, as previously explained.

Secondly, to approach policy design processes with SD, it is required a direct engagement with civil servants, industry, and community representatives which allows increasing awareness on local resources, opportunities, and challenges. Unfortunately, the bureaucratic cultural paradigm, strongly fixed into a top-down approach, limits cooperation among all the actors. That is why this is recognised as a critical point for SD to enable a quadruple helix approach, which is needed for adaptive governance.

To overcome such barriers, SD has a system visualization component that eases the decision-making process. This one delivers a broader perspective for all actors and allows more enriching feedback from all the participants. The idea is to stimulate participants in the policy design process to think holistically.

Lastly, another crucial factor is the time frame that managing authorities need to establish in a Policy Design process: in many cases there is a fixed period to execute specific actions for which a specific budget has been already defined. In that frame, SD has to come with actions that only serve on a current scenario and for an immediate change, which is not possible because policies have effects after several years the policies are released. For the same reason, SD effects are complicated to measure because they are designed on a long time perspective. This means that the impacts must be planned with a foresight vision on short, medium and long term views, in order to address the change and a broader value creation.

7. Conclusions

Today, to address the wickedness and the creation of public value, governments are focused on reaching targets such as the SDG by 2030. Even if those targets seem broad, governments' efforts must address them with a sufficient directionality. Nevertheless, in the

majority of the cases, policy servants can feel lost from the broadness of these concepts. Even if there is an increasing acknowledgement of the systemic nature of global challenges, however, our governments persist in using a linear approach to tackle those problems. It is still a significant challenge for the different governments worldwide to translate this complexity into a manageable common strategy to address present and future transitions (EEA, 2019).

As widely discussed in this paper, the first condition to reach sustainable development is to build strong synergies and cooperation between governments, institutions, businesses and citizens. In that view, this paper has discussed how collaborative policy design processes, developed among different stakeholders, are essential to move towards value creation in a long-term horizon: they enhance social learning and capacity building, they build trust, and mediate the power through cross-sector collaboration.

Systemic perspectives and participatory methodologies - which SD combines - can trigger innovative processes of sharing knowledge and experiences among different stakeholders and can build innovation in the public sector. Applying a systemic perspective into those strategies means to favour adaptive governance, whose outcomes are iterative and autopoietic, creating endurable public value.

Following this, SD can act as a mediator in those policy-design processes that address complex problems and deliver new solutions. Indeed, SD favours the visualization of opportunities for value creation, enhancing the active collaboration between stakeholders, and boosting locally-based value chains (Barbero, 2012). On that purpose, systemic design can unveil the hidden assets of a context as shown in projects and regional initiatives such as RETRACE Interreg Europe project, ProGIreg H2020 project and many collaborative studies with industries.

Nevertheless, we must recognize that systemic design is not yet “completely” inside the governance culture, even if there are examples around the globe of design-gov cooperation through the so-called “innovation labs”. These agencies are approaching the public value at different levels and, even if the number is gradually increasing, it currently amounts to 162 spread around the world (http://publicsector-map.designforeurope.eu/en/). However, these innovative experiments certainly require fundamental changes in our current governance and economic system works.

This momentum must not be missed, expertises such as SD need to be at the forefront of a governance culture to unlock the generation of new public value and public policies that create and shape a different economic future.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Disruptive technologies and behavioural change: Design fiction as trigger for critical thinking.

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Abstract | Design research and practice are increasingly interested in critical theories and practices, especially when it comes to the use of disruptive technologies (i.e., wearables, artificial intelligence, etc.). These technologies can support users in changing behaviours towards societal issues (i.e., environmental sustainability, health, safety, etc.). This paper reflects on how Design Fiction discipline can trigger critical thinking toward the use of disruptive technologies, considering its societal and ethical values, for designers and researchers dealing with design for behavioural change topics. The case study of this paper shows the results of the workshop held with design researchers and aimed at developing the near-future scenarios for the technologies able to tackle behavioural change related to the specific societal challenge; this, supported by the use of several existing tools found in the literature. We will discuss and make some suggestions that emerged from the results of the new approaches for the design for behavioural change research and practice

KEYWORDS | DESIGN FICTION, CRITICAL THINKING, DESIGN FOR BEHAVIOURAL CHANGE, DISRUPTIVE TECHNOLOGIES

1. Introduction

> "Our world is increasingly involved and engaged in complex […] debates and experiments. […] design researchers should adopt practices, methods and tools to reason about futures' scenario relevant to nowadays debate." (Grand and Wiedmer,2010)

Building on this, the design and HCI community are increasing their interest in critical theories and practices, especially when it comes to disruptive technologies. These technologies are changing the way people behave, act, interact and think, they can be powerful tools to support the user in changing behaviours towards societal issues such as environmental sustainability, health, safety, etc.

In this paper, the authors analyse the current design for behavioural change research and practice and reflect on how Design Fiction can help designers and researchers trigger critical thinking when using disruptive technologies. Authors suggest that the Design Fiction approach might help designers and researchers be more critical toward the societal and ethical issues and the role of behaviour and technology. (Rapp, 2019) Design Fiction with its principles may indeed be, considered an alternative approach for behavioural change researches and practices. As Tanenbaum (2014) explains:

> "Design fiction [...] allow us to adopt a range of different intellectual commitments and values about the future and explore the consequences of those commitments […]".

This paper describes the first findings and results of on-going doctoral research aimed at suggesting the new approaches for the design for behavioural change research and practice, based on design fiction principles as a way to trigger critical thinking regarding the ethical and societal issues when dealing with disruptive technology. To better understand the influence of design fiction on design for behavioural change research and practice, we set a workshop (case study), addressed to design researchers. During the workshop, we decided to evaluate several design tools aimed at developing envisioning future scenarios about the technological artefacts able to tackle the behavioural change, starting from the societal challenges while using design fiction-based approach.

Through this workshop, we observed and analysed the impact of design fiction principles, such as envisioning storytelling, and the influence of Science Fiction (SCI-FI) films on creating scenarios about the technologies able to tackle behavioural change.

In conclusion, we will summarize the results gathered from the workshop and discuss the further steps of the research.

2. A potential meeting for critical thinking

Innovation in the technology sector makes new technologies rapidly disrupt the previous one. The disruptive technologies may change entirely both how we use the technology and design artefacts able to influence human behaviour. Said so, the role of disruptive technologies considers a larger context, such as its impact on the individuals, society, and environment.

These technologies can motivate the user through engaging interaction modalities and forms that can reach the user in a non-intrusive way, but also as Goodwin (2008) explains:

> "Any disruptive technology that enables entirely new behaviour can cause fundamental changes in how people see the world."

When designing disruptive technologies, there is a high demand for ethical and societal issues. It is crucial to guide human behaviour ethically and sustainably and understand the impact of human behaviour and the use of technologies for the future.

Several tools have been designed with a purpose to help designers in creating technological artefacts able to tackle a behavioural change, such as Design for Sustainable Behaviour (Loughborough University), Design with Intent Tool (Brunel University), Behavioural Design Toolkit (Doblin & IIT University), Brains, Behaviour & Design Group toolkit, etc. By analysing them, we realized that these tools often draw upon the traditional design principles, suggesting the established strategies and solutions, rather than stimulating critical inquiry about the future behaviours and the impact of behaviour on the outer world. In regard, Ilstedt and Wangel (2014) explain:

> "Sustainable lifestyles are today, however often depicted through a sacrifice-based cultural narrative […] These ideas, or expectations, about the future thus provide an opportunity for intervention."

For this reason, we decided to introduce the critical practices, with a particular focus on design fiction as a way to reflect on design for behavioural change research and practice, and imagine the future of technologies. Rapp (2019) is proposing the design fiction as a possible alternative tool for designing for behavioural change:

> "Design fictions […] could represent a tool for reasoning on how current behaviour change designs embed values, opportunities and threats […]."

Based on this ground, we introduce experimentation on how design fiction can trigger critical thinking in design for behavioural change research and practice dealing with technologies.

3. Case study

The experimentation object of this paper investigates the influence of design fiction principles, such as “what if?” scenarios, with a focus on the narrative dimension of design fiction and its potential to trigger critical thinking. The experimentation was carried out with nine participants actively involved in design research, six PhD students and two Research fellows, coming from different fields of design (smart materials, digital manufacturing technology, interaction, and experience design, industrial design, fashion for sustainability, cross-cultural teamwork in design-based learning). The objective of this experimentation was to produce a near-future scenario that describes the context, the role, and the shape of a technological artefact - considering its material properties and the experiences related to the interaction modalities, semantic, social, and ethical values - able to tackle the behavioural change. Here and after, we will introduce the method used in the experimentation and describe the activity (workshop).

3.1 Researching through the critical inquiry: Methodology

This workshop was founded on the use of the PPPP (Dunne and Raby, 2013) model, which stands for Present, Plausible, Possible, and Preferable future, and it aims at defining the different kinds of potential future. The reason for this choice was to facilitate the journey from the present to the preferable future in production of the near-future scenarios. For the experimentations, we created a fit on purpose format for which we assigned existing tools to different stages on the “P” scale. (see Fig. 1)

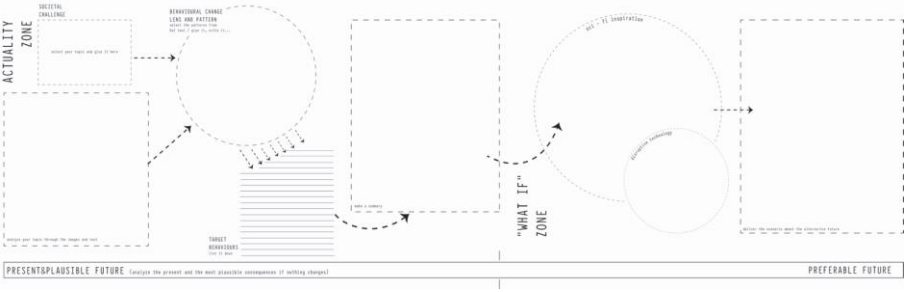

Figure 1. Application and formating the PPPP model according to the tools used in the experimentation.

A format proposed in this workshop is a linear approach to designing, where the “present and plausible future” encompass the topic of the Societal Challenge, the human behaviour (DwI Tool), and the setting of the design brief. Just after, comes the “What if?” zone that leads to the construction of the near-future scenario (preferable future). The participants were, indeed, asked to develop a near-future scenario (considered as intangible explorative

artefact) to envision a “preferable future” in which the protagonists are the not-yet-existing technological artefacts.

Summarizing in one day workshop, we asked to develop a near-future scenario in a format of narrative story through stages organized within PPPP Model, by using the following support tools:

1. Present and Plausible stage: Explore the Societal Challenges Topics

For setting societal challenges topics, we took as a reference the Loughborough University research about the design for behavioural change as a driver for sustainable innovation: Environmental sustainability, Health and Wellbeing, and Safety. Table 1 below shows how we categorized the societal challenges in macro-topics and sub-topics within these.

Table 1. Societal challenge topics.

Macro topic	Topics
Environmental sustainability	Air pollution (1), Waste management (2), Energy saving and pollution (3), Water saving and pollution (4)
Health and Wellbeing	General health prevention (1), Worker’s health (2), Ageing (3)
Safety	General citizens safety (1), Cyber safety (2)

2. Present and Plausible stage: Analyse the behavioural matter (Design with Intent Tool)

The second element of the experimentation is the Design with Intent tool (DwI), found the most suitable for our experimentation, for creating the Design for Behavioural Change brief. We used it as a tool to help researchers describe the target Behaviours and strategies for influencing behavioural change. DwI tool is based on eight lenses and several patterns within each lens, proposing a different strategy for designing the products and services able to tackle the behavioural change. In our experimentation, we narrowed the selection of the lenses and patterns to five. (see Fig. 2)



Figure 2. Selection of five (5) DwI lenses with patterns for our experimentation.

We set the Cognitive, Perceptual, and Machiavellian lens as mandatory to use, or combine, while the use of the Ludic and Interactive lens was facultative. (see Table 2)

Table 2: Selection of the lenses in relation to their principles.

Lens	Principle
Cognitive lens	Takes inputs from the behaviourist economy and cognitive psychology
Perceptual lens	Combines the concepts of gestalt psychology and product's semantic
Machiavellian Lens	Proposes solutions based on the thought that "end justifies the means."
Ludic lens	Proposes the strategies that can engage the user long in time.
Interactive lens	Uses the interaction modalities and interfaces to stimulate the user's behaviour.

3. "What if zone?": Exploring the fictional worlds (Tech Inspiration Cards - TICs)

This tool has a purpose to help participants in giving a shape to the technological artefacts, inspire on the not-yet-existing technologies and near-future worlds, within SCI-FI films. In specific, understand how diegetic prototypes are contextualized within the fictional historical, social, and political sphere, and as a consequence open a discussion and critical reflection about the disbeliefs and collective imaginary about the future, and inspire the imagination when it comes to exploration of the new forms, interactions, materials,

applications, and others, but also to take into consideration possible ethical and societal implications. For building this envisioning tool, we analysed which disruptive technologies will be the most suitable to tackle behavioural change in the next 15 years. As support, we used the Seealsology tool that collects data from the Web and classifies data on different levels. What emerged from this analysis is that disruptive technology appears in many different levels of application and forms, but taking into consideration our application, we realized that we could narrow the classification of disruptive technologies on four macro categories: Artificial Intelligence, Simulated Reality, Wearables, and Smart Materials. According to these latest tendencies in the technological sphere, we started research for SCI-FI films that represent these technologies in the future. Data extracted in Seealsology were transformed into keywords and helped to the creation of the tool "TICs": a selection of cards containing the film's title, images, and plot. (Fig. 3)

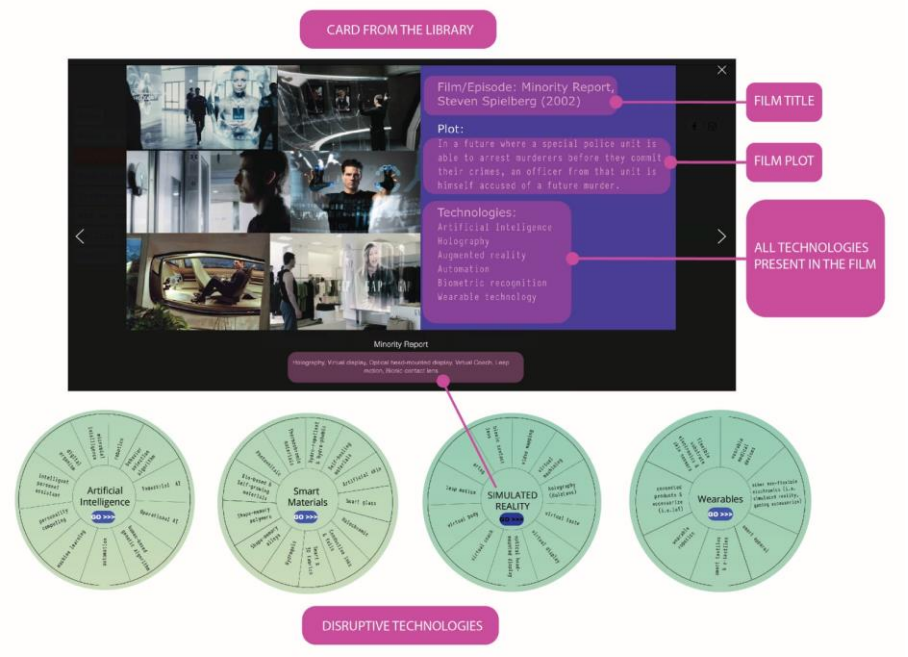

Figure 3. Tech inspiration cards: design fiction support tool for envisioning the near future technologies through the SCI-FI films.

4. Preferable Future stage: Analyse the potential role of the technology (Fogg's Triad) and production of the Scenario

At this stage, the participants started to reason about the not-yet-existing technological artefact. Firstly, the participants selected a disruptive technology to implement in the

artefact they want to design. Then, they reasoned on how this technology may influence human behaviour. To facilitate this phase, we introduced Fogg's Functional Triad (2008), for defining and describing the role of technologies on three levels: technology as a Medium (provides the experience), technology as a Tool (can increase the capability), and technology as a Social Actor (creates the relationship). (see Fig.4)

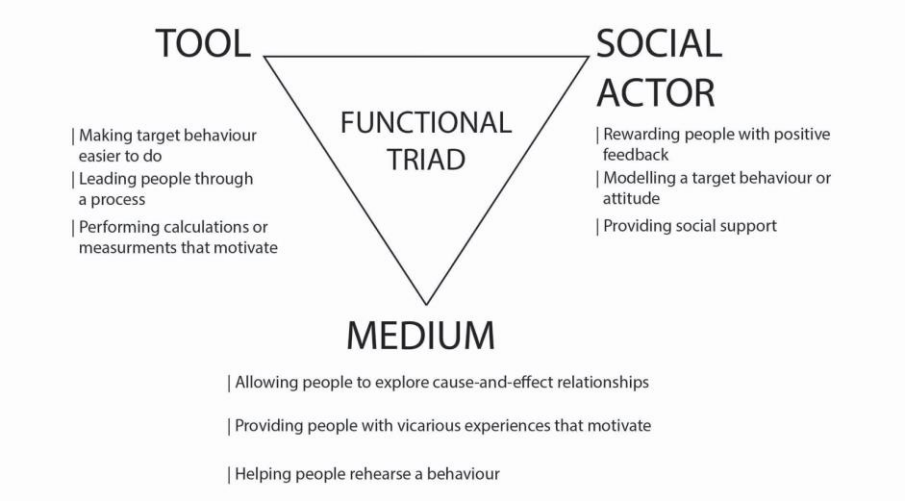

Figure 4. Fogg's functional triad describing the role that technology can have in persuading the users.

The Functional Triad was used just as a support tool here, after the TICs, to help the participants start reason on a not-yet-existing technology in a functional sense. They were not limited to this. The development of the scenario contextualizing the technological artefact had to contain the inputs from all the activities of the workshop.

3.2 Activity

The experimentation lasted one day, split into two sessions. The morning session was framed into three activities: (1) Selection and analysis of the Societal Challenges' topic; (2) Use of the DwI tool for defining the behavioural issue and target behaviour; (3) Definition of the General brief. The afternoon session was framed into two main activities: (4) Take inspiration for technology from the SCI-FI films for identifying, and (5) imagine how these will evolve 15 years from now, in terms of applications, interaction modalities, aesthetics, etc. As a support tool to help in describing the potential of the technology to influence human behaviour, we provided Fogg's functional triad. Here, we describe the outputs.

Group 1 selected the topic Cyber Safety, focusing on digital assistants - control and management of personal data. They identified a lack of awareness when dealing with these devices due to the poor comprehension of data. The results of the use of DwI tool and selection of the strategies are in the table below:

Table 2. Group 1 selection of the DwI lenses and patterns, and they purpose.

DwI Lens	DwI Pattern	Target behaviour
Interactive	Tailoring, and Summary Feedback	(1) Inform the user about the relationships, activities and functions of the digital assistant, (2) Monitoring of the collected data, (3) Acting pro-actively toward the data collection, (4) Communicating with the assistant in a uncomfortable, intentional and unconventional way.
Perceptual	Metaphors, Possibility trees, and Transparency	
Ludic lens	Unpredictable reinforcement	
Machiavellian	Degrading performance	

Table 3 shows the brief set by the participants, and how they explored the SCI-FI films and selected the technologies to use in their designs in regard.

Table 3: Relationship between the Brief – SCI-FI title – Selection of technology – Role of technology (Group 1).

Brief	Selection of SCI-FI titles	Selection of technology	The role of technology
Design a solution able to increase the awareness and agency related to the use and expectations we have from digital assistants, where the concept of "tailoring metaphors" for data storage, and transparency concerning user - assistant.	**"Her", "The Entire History of You" and "Nodesive" (AI).**	**AI**	**Technology as a tool able to increase the capability of the user by improving the comprehension toward the use of device and management of personal data.** **Technology as a social actor because it aims at improving the communication between the user and the device.**

Their scenario is about the personal assistant as a digital organism that expands regarding the users' needs. In the year 2035, data will become recognized as the property of the user, and he will be able to decide when and how much data to provide through different "metaphoric profiles" (i.e., relatives profile, secretary profile, partner profile), manipulated through different interaction modalities.

Group 2 selected the topic of health prevention related to eating habits and food quality, focusing on bad eating habits. The strategies and target behaviours defined through the use of DwI tool are represented in the table below.

Table 4. Group 2 selection of the DwI lenses and patterns, and they purpose.

DwI Lens	*DwI Pattern*	*Target behaviour*
Cognitive	*Habits, Emotional engagement, Personality, Scarcity*	*Eat earlier, Balance diet, Change the way of cooking, Foresting sociality, dimension of eating, cooking and sharing; Create good eating conditions.*
Perceptual	*Fake affordance, Mood, Nakedness*	
Machiavellian	*Worry resolution, Serving suggestion*	

Table 5 shows the brief set by the participants, and how they explored the SCI-FI films and selected the technologies to use in their designs in regard.

Table 5. Relationship between the Brief – SCI-FI title – Selection of technology – Role of technology (Group 2).

Brief	Selection of SCI-FI titles	Selection of technology	The role of technology
Design a technological product able to prevent the users from eating late in the evening and change their attitude toward healthy food through enriching the social dimension and suggest new cooking techniques.	“Little Joe” (olfactory stimulation technology) “Strange days”, “Arkangel”, and “Black Museum” (behaviour control and surveillance), “Her”, “Hang the DJ” (OS-human relationship and personalization), “Gattaca” (bioengineering technologies)	AI, Smart Materials, and Wearables	The technology is a medium because it provides the experience able to influence the positive attitude toward the healthy food. It has a role of a tool because it suggests a new technique for cooking. It has a social actor when it wants to enrich the social dimension.

This scenario is about a man, tired to cook in the evenings and needs to acquire healthy eating habits. At the moment he tries to reach a "fast food", the item starts to look spoiled. At the same time, the "healthy choice" reminds John to eat healthily. The scenario describes some smart cooking tools that activate chemically and change the food properties; an automatic cooking machine and wearable able to track the health and user's needs.

Group 3 started with the topic of Air pollution. They identified negative behaviour emerging on two levels: (1) the industries, waste management, and transportation, and (2) the use of chemicals at home. The table below shows how they used the DwI tool:

Table 6. Group 3 selection of the strategy for behavioural change and identifying of the target behaviour.

DwI Lens	DwI Pattern	Target behaviour
Cognitive	Habits, Social proofs, Emotional engagements, Community and Consistency	Avoid misuse of chemicals in everyday life that harm health and pollute air.
Perceptual	Colour association, Fake affordance	

Table 7 shows the brief set by the participants, and how they explored the SCI-FI films and selected the technologies to use in their designs in regard.

Table 7. Relationship between the Brief – SCI-FI title – Selection of technology – Role of technology (Group 3).

Brief	Selection of SCI-FI titles	Selection of technology	The role of technology
Design a solution able to persuade people to use chemicals properly in everyday life.	"Existenz" (simulated reality, organic technologies and materials), "Hitchhiker guide to the galaxy" (materials and flexible technologies), "Her" (OS).	AI, Smart Materials, and Wearables	The technology is a medium because it has to provide the experience able to increase awareness toward the use of chemicals. It becomes a tool because it is supposed to enhance the human capability of surviving in a polluted world.

The scenario is about a polluted world where people need to wear protective equipment continuously. The rich people wear artificial skin suit while the poor people wear the DIY (Do It Yourself) equipment, made of living organisms stored in living organisms' banks. Before going out, it is necessary to measure pollution. They wear the organic head accessorize that indicates the level of pollutants through the change of colour, a helmet for data collection, and a protective mask. These artefacts purify the air too.

4. Discussion

The experimentations provided useful insights for the research, and we were able to find out whether the tools we selected for the design of near-future scenarios were purposeful or not in trigger critical thinking. We evaluated this through (1) observation of the performance of each activity through pictures and notes, (2) analysis of delivered scenarios, (3) questionnaire submitted to participants. We realized that the participants got very engaged in analysing the topic, negative behaviours, and the most plausible futures. (fig.5)

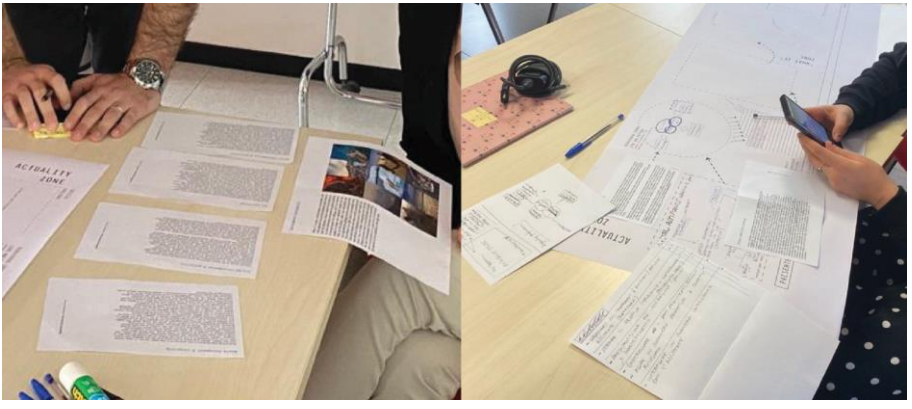

Figure 5. Participants involved in the first activity: Selection of the societal challenge topic.

From the results emerged, that all groups were capable to analyse critically different topics, and use independently the DwI tool. At this stage, they started already to think about the possible design solutions. In the afternoon the participants started to use the SCI-FI Tech inspiration cards and library. (Fig. 6)

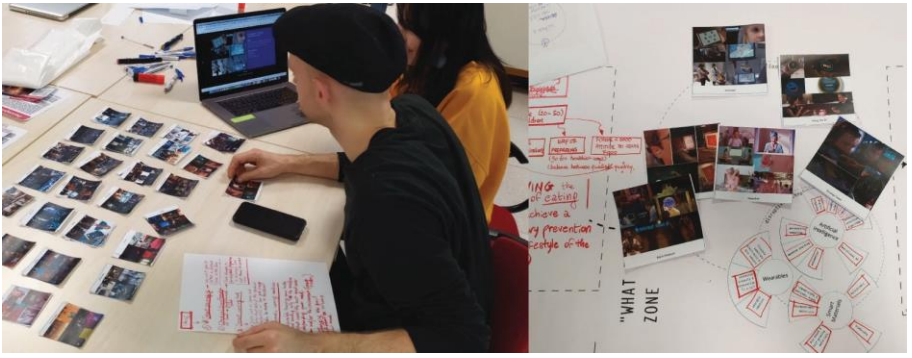

Figure 6. Participants using the SCI-FI cards and library and defining the technology from which to start the scenario.

While discussing proactively with the participants, we found that Group 1 and Group 2 approached insecurely to TICs, and they tended to select those films that they were familiar with, which prevented them from thinking critically on technologies. They also claimed a lack of time to explore more contents and go on-line for videos. While facing difficulties, Group 2 inverted the stages, by trying to define the technology for the scenario first, and then explore the SCI-FI, but they stated that this inversion made the process even more difficult.

About the scenario, we realized that participants produced very different scenarios, using mainly the text, while some of them used the sketches and user journey. (Fig.7)



Figure 7. Participants while producing the scenarios.

Group 1 introduces the near-future scenario as a world in which are established new laws regarding the use and management of data, but they do not consider behavioural aspects. They suggest a new interaction modality, still describing them poorly, and TICs did not help them much in envisioning the not-yet-existing technologies.

Group 2 focused on the performances of near-future products and technologies, but they lack an explanation of how human behaviour changes. They missed the detailed description of context and why the user should change his attitude toward the food in the near- future.

They make a wide selection of film inspirations, but it's difficult to identify what they inspired on.

The scenario of Group 3 was the one that moved more toward the near future compared to others and that succeed in creating the story through analysing the context and socio-political implications. Although they do not specify behavioural aspects in a sense how the technology supports the changes. Yet, they explain well the adaption of the human to new climatic conditions and development of new habits and behaviours. The solutions they propose are envisioning, and the inspiration taken from the films is evident.

The third method we used for evaluation is the questionnaire, based on open questions and the qualitative evaluation of the experience, transformed in qualitative data. The questionnaire was divided, into two main sections: (1) General information and (2) Activity. From the General information, we collected some data regarding the participants' previous experience with the topics and comprehension of the relation between the fields of Societal challenges, Design for behavioural change, and Design fiction. Less than half of the participants have already used the Design for behavioural change tools and strategies (Fig. 8).

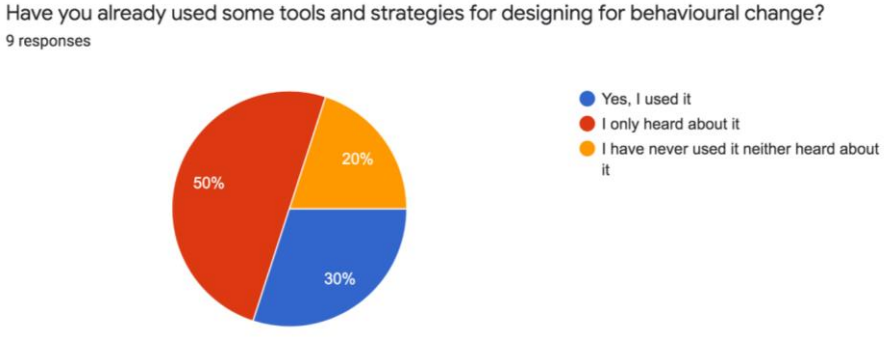

Figure 8: Chart showing the participants' familiarity with the Design for Behavioural Change field.

Additionally, we were interested in understanding whether the participants were able to understand the relationship between different topics tackled in this workshop, and the answer was generally positive, although some of the participants, suggested thinking about inverting some tools or introducing them in the beginning, such as TICs. (Fig. 9)

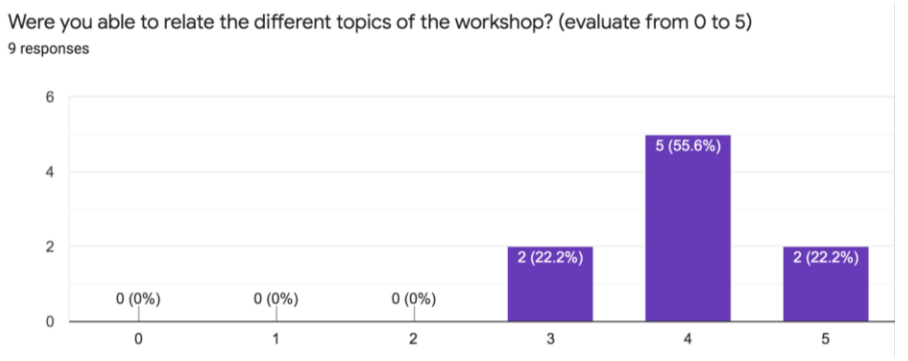

Figure 9: Chart showing the comprehension of the participants in finding the relationship between different topics of the workshop (SCs – DfBC-Technologies).

The participants believe that the near-future scenarios may help in designing critically, although they experienced some difficulties while dealing with it. Participants stated that the use of DwI helped in triggering critical thinking for behavioural aspects. While for disruptive technologies, the Tech library was evaluated as less triggering by the participants. The use of Societal challenges as a starting topic was not motivating enough for participants. Finally, emerged that in this experimentation, critical thinking was more triggered for behavioural issues than for disruptive technologies. (see Fig.10)

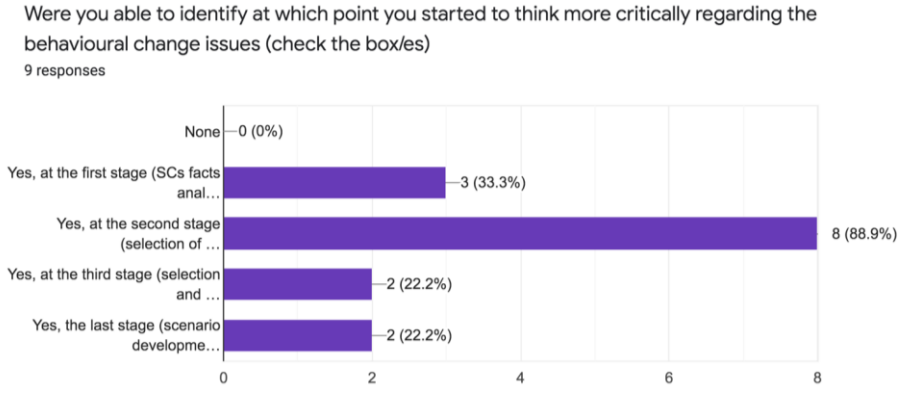

Figure 10: Chart showing how the participants evaluated the critical thinking in relation to the stages of the workshop.

5. Further development

This experimentation helped us understand the effectiveness of selected tools in developing a near-future scenario. The DwI tool was well used and useful for the purpose. The same happens with the Functional Triad. TICs need refinement, such as a platform that enables participants to navigate easily through the tool by having a clearer image of the technologies in films and how these are related to the fictional context. We noticed that the current format was incomplete as representation and the relation to the societal and ethical dimension wasn't perceptible enough.

Additionally, we noticed that final scenarios neglected some aspects of behavioural change, and the description of not-yet-existing technologies and the world construction were a bit bland. The protocol based on the PPPP model at this stage of the research was useful to understand the strengths and weaknesses of relating different theories and tools, but it won't be purposeful to continue this doctoral research. Based on the results that emerged from experimentation, we will set the new protocol. The new protocol will aim at relating the proposed theories and tools in a better way by expanding the social, ethical, and behavioural dimensions and build stronger relationships between these elements and the design of technological artefacts. The protocol with TICs will be subsequently applied and tested in two different institutions, one is the academic contest with design researchers, and another is the educational context with students, to tailor the approach for designing consciously technological artefacts able to tackle the behavioural change.

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Acknowledgements: We acknowledge all the colleagues from Design Department of Politecnico di Milano that participated in our workshop and gave their precious contribution: Barzilai Gabriele, Bolzan Patrizia (PhD), D'itria Erminia, Ammer Harb, Mattioli Francesca, Parisi Stefano, Pollini Barbara, Varisco Laura (PhD), Zhou Ziyu.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Does design thinking matter? Empirical study and survey on the effectiveness of design thinking

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Abstract | While design thinking has been broadly integrated into design education, it can also be deployed in any discipline's curriculum. However, without measurable validation, it is challenging to advocate the effectiveness of design thinking. This article introduces experimentation in design thinking to a group of Journalism and Mass Communication major students as a case study to examine the impact of design thinking on non-design major students' empathy and creativity development skills. In fall 2018, the student group participated in a design thinking workshop. Through the workshop, the participants' competencies in empathy, storytelling, attention to detail, and personal approach to the users, significantly improved: 53.41% on average. A significant difference also emerged in the type of emphasis on the participants' concepts. Compared to the concepts from the pre-workshop assignment (53%), the concepts from the post-workshop assignment emphasized how people's everyday life would change more than the functionality of the product (93%).

KEYWORDS | EFFECTIVENESS OF DESIGN THINKING, DESIGN THINKING FOR NON-DESIGNER, MEASURABLE VALIDATION OF DESIGN THINKING, EMPATHY MAP, DAILY JOURNEY MAP

1. Introduction

Design thinking is a people-oriented problem-solving method that prioritizes one's empathy building process for users and creativity. Ever since IDEO brought design thinking to the mainstream design industry in the early 1990s, it has been a popular problem-solving method in contemporary design pedagogy. (Decker, 2019) While the method has been broadly integrated into design education, it also has significant possibilities to be deployed in any discipline's curriculum. However, the effectiveness of the design thinking methodology for students is still questionable. Despite the amount of literature in design thinking, it is challenging to find any research in the evidence-based validation of design thinking. Furthermore, it is also ambiguous how design thinking is beneficial for a certain type of learning factor(s). In this article, storytelling refers to the ability to embellish narratives in order to communicate the core message more effectively. (Decker, 2019)

Without evidence-based and measurable validation, it is challenging to advocate the effectiveness of design thinking. This article aims to broaden the educational application of design thinking to the non-design field by introducing experimentation with design thinking on a group of non-design major students. In the Fall 2018 semester, fifteen senior journalism and mass Communication major students participated in a design thinking workshop in their message development class. The workshop included two exercises: empathy map and daily journey map. The effectiveness of the workshop for those students was measured in two ways: a comparison study of pre- and post-workshop assignments and a post-workshop survey. In this article, this experimentation is adapted as a case study to examine the impact of design thinking on non-design major students' empathy and creativity development skills.

2. Background

2.1 Empathy and Creativity in Journalism and Mass Communication

Among the many advantages of design thinking, empathy and creativity represent some of the most well-known learning components of design thinking. In this article, empathy refers to the ability to understand and feel from the users' point of view. (Empathy, n.d.) This has been a critical element for designers in search of pursuing the human-centered approach. According to Tim Brown, the chair of IDEO, "Empathy is at the heart of design. Without the understanding of what others see, feel, and experience, design is a pointless task" (Brown, 2020).

Empathy has also been a crucial element for non-design fields, such as journalism and mass communication. Empathy is one of the core skills in journalism, as it enables journalists to understand people's biases and also drives meaningful storytelling (Smith-Rodden, 2019). For reporters, empathy factors into the interviewing process as it fosters mutual trust and negates stereotypes (John, 2019). In her book, Pursuing an Ethic of Empathy in Journalism,

Janet Blank-Libra also states that the "core principles of empathy are directly relevant to journalism, particularly to the reporter who uses a narrative approach to storytelling" (Blank-Libra, 2016).

Empathy in design thinking enriches one's creativity (Carlozzi, Bull, Eells, & Hurlburt, 1995) as it facilitates "a mindset of curiosity and a posture of discovery when faced with adversity" (Perry, 2017). In this article, creativity refers to a structured and systemic problem-solving ability with unique ideas (Fyffe & Lee, 2016). Creativity has been not only a core competency in the design field, but also in the non-traditional creative fields. Journalism and mass communication education emphasizes creativity (Buckingham, 2013) as creativity fosters entrepreneurial journalists (Hunter & Nell, 2011) and media entrepreneurship (Ferrier, 2013).

Research confirms that creativity should be a critical component of journalism education as journalists need to practice their creativity to discover "deep meaning rather than superficial actuality" when they witness events. (Liao, Chang, Liang & Liang, 2016) For instance, in mass communication education, advertising major students benefit from creative excellence to develop better portfolios for their first jobs. (Windels & Stuhlfaut, 2017) This paper aims to evaluate how design thinking, a methodology that is known to enhance one's empathy and creativity, can also be used with non-design major students through the following experimentation.

2.1 Experimentation Background

In the Fall 2018 semester, fifteen senior journalism and mass communication major students participated in a design thinking workshop in their Message Development class at the University of Kansas. The students developed marketing strategies to promote a denture adhesive product, Poligrip. The workshop took place in the early phase of the project. The participating students had completed initial market research and defined targeted consumer demographics, yet they had not started developing marketing plan. The students had never been trained in the design thinking process. The workshop took approximately 40 minutes and consisted of two exercises: A. Empathy map and B. Daily journey map.

3. Methods

3.1 Experimentation method

The workshop started with an empathy map exercise. An empathy map is a type of character developing tool that allows one to synthesize one's observation on the users and draw unexpected insights. The design thinking workshop integrated a modified version of *Bootcamp Bootleg*, a working document published by the d.school, Stanford University

(Baggereor & Both, 2013). The students engaged in the exercise in groups that consisted of four or five students. The exercise took approximately 25 minutes.

1. Each student team received a large sheet of brown paper (approximately 4ft. in length and 3ft. in height) The Participants drew a circle in the middle of the paper.
2. Based on the user demographics which the participating students had defined prior to the workshop, each student team created a simple persona inside of the circle. The persona included a sketch of the user's figure as well as the user's name, age, occupation.
3. Each team created a four-quadrant layout around the persona. The four sections represented the following. Does: What would the profiled user do related to her/his denture? Says: What would the profiled user say related to her/his denture? Thinks: What would the profiled user think related to her/his denture? Feels: What would the profiled user feel related to her/his denture?
4. Each team wrote as many action items on Post-It notes as possible for all four sections.



Figure 1. Empathy map example

As soon as the participants completed the empathy map exercise, their next exercise included a daily journey map which allowed participants to map their targeted user's

everyday lifestyle as a narrative of daily activities. The participants visualized a timeline that depicted a typical day of their targeted user from the moment he/she wakes up to the moment he/she goes to bed. This exercise is inspired and modified from the customer journey map. Often referred to as a user journey map or journey map, the customer journey map provides a visual depiction of the timeline of a user's interaction with the product in order to understand the relationship between the product and its users (Kaytes, n.d.) (Rosenbaum, Otelara & Ramírez, 2017). It is a widely used tool for understanding user experience. While the customer journey map entails the convergent variations of the timeline that focuses on the user's interactions on the particular product, the daily journey map for this workshop entails the divergent variations of the timeline that encompass all of the daily activities of a user.

The exercise intends to allow the participants to understand the users as people, not merely customers. By portraying the daily journey of the user and including daily activities that are not relevant to the product, the participant could also capture unexpected inspirations. The participants continued to work in groups which they formed during the previous exercise. Following are the steps of the exercise:

1. Each team received a large sheet of brown paper (approximately 4 ft. in length and 3 ft. in height). The Participants drew a circle in the middle of the paper.
2. Based on the persona that the team created during the empathy map exercise, the students mapped a morning-to-bedtime journey of the character. Students were encouraged to draw images where applicable. As an option, students could re-draw the simple persona inside of the circle with more details if needed.
3. The students moved the relevant Post-It notes from the empathy map to the appropriated locations in the journey narrative to reflect the correlation between the two exercises.



Figure 2. Daily journey map example

When the participants conversed with their team members during the exercise, they were required to embody a first-person perspective. For instance, instead of saying, “I think she wants to eat lunch,” they said, “I want to eat lunch,” as if they were the user.

3.1 Evaluation method

The process included two types of evaluations: A. Comparison assessment of pre- and post-workshop assignments, and B. Post-workshop survey.

A. Comparison of pre- and post-workshop assignments: Before the workshop started, the students were asked to write any marketing concept for the denture adhesive product that they could rapidly ideate in 5 minutes on a letter-size paper. After the workshop, the students were also required to repeat the same task with different concepts. The participants’ submissions from these assignments were evaluated based on the following four attributes: empathy, storytelling, attention to detail, and personal approach to the users.

a. On a scale of 1 (strongly disagree) to 5 (strongly agree), the participating students’ pre- and post-workshop assignments were evaluated based on the following criteria.

- C1. The concept shows an empathic attribute of the users.
- C2. The concept demonstrates a storytelling attribute.

- C3. The concept captures the details of the user experience.
- C4. The concept contains a personal approach to the audience.

b. The assignments were also evaluated on whether the concept is focused on the product (C5) or people (C6).

B. Post-workshop survey: After the workshop, the students participated in a survey reflecting their perceptions about the workshop and learning outcomes.

On a Likert scale from 1 (strongly disagree) to 5 (strongly agree), the first part of the survey asked how the workshop helped the participants' understanding on the users and concept development.

Following is a list of questions:

- Q1. The workshop motivated me to understand my users.
- Q2. The workshop helped me to build the goals of the concept.
- Q3. The workshop helped me to come up with strategies to attract my users.
- Q4. The workshop helped me to come up with different concepts/ideas than what I initially thought or planned.
- Q5. The workshop helped me to be more empathetic to my users.
- Q6. The workshop improved my brainstorming skills.

The second part of the survey consisted of three free-response questions that asked the participants to share the least and most valuable aspects of the workshop as well as suggestions for improvement.

Following is a list of the questions.

- Q7. What is the least valuable learning outcome about this workshop?
- Q8. What is the most valuable learning outcome about this workshop?
- Q9. How would you improve this workshop?

4. Results

4.1 Comparison assessment of pre- and post-workshop assignments

Table 1 indicates the results of the evaluation method A-a from the pre-workshop assignment.

Table 1. Results of the evaluation method A-a: Pre-workshop assignment.

PRE-WA	C1	C2	C3	C4	C5	C6

P1	2	2	1	2	•	
P2	3	3	2	3		•
P3	1	1	1	2		•
P4	2	1	2	1	•	
P5	1	3	1	1	•	
P6	3	1	1	2		•
P7	1	1	1	2	•	
P8	3	1	2	3		•
P9	1	2	1	1	•	
P10	3	1	3	2	•	
P11	4	2	3	3		•
P12	2	1	2	2		•
P13	2	1	2	1		•
P14	3	3	3	3		•
P15	1	1	1	1	•	
Total	32	24	26	29	7	8
Average	2.133333	1.6	1.733333	1.866667	Percentage: 47%	Percentage: 53%

Table 2 shows the results of the evaluation method A-a from the post-workshop assignment.

Table 2. Results of the evaluation method A-a: Post-workshop assignment.

POST-WA	C1	C2	C3	C4	C5	C6
P1	3	4	3	3		•

P2	5	4	4	4		•
P3	2	1	1	2		•
P4	2	1	2	1	•	
P5	3	1	2	2		•
P6	4	4	3	4		•
P7	3	3	4	3		•
P8	3	2	3	3		•
P9	1	2	2	2		•
P10	3	3	4	3		•
P11	3	2	2	2		•
P12	4	1	1	4		•
P13	4	5	4	4		•
P14	did not participate.					
P15	3	2	3	4		•
Total	43	35	38	41	1	13
Average score (excluding P14)	3.071429	2.5	2.714286	2.928571	Percentage: 7%	Percentage: 93%

Table 3 addresses the improvement of the criteria since the workshop.

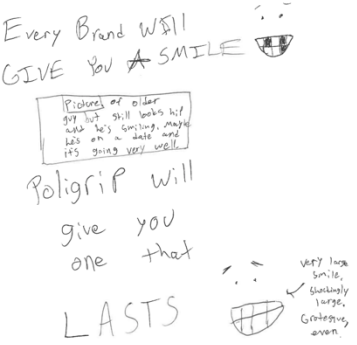
Table 3. Comparison of the evaluation method A-a results between pre and post workshop assignment.

	Pre-workshop assignment average score	Post-workshop assignment average score	Impact of the workshop

C1	2.1333	3.0714	Improved by 43.97%
C2	1.6	2.5	Improved by 56.25%
C3	1.7333	2.7143	Improved by 56.59%
C4	1.8667	2.9286	Improved by 56.89%

Compared with the pre-workshop assignment outcomes, the outcomes from the post-workshop assignment demonstrate a dramatic improvement in all of the four criteria: empathy, storytelling, details of user experience, and personal approach. For instance, Table 4 is one of the outcomes from the pre- and post-workshop assignment.

Table 4. Example of the pre- and post- workshop assignment outcomes

	Pre-workshop assignment (A)	Post-workshop assignment (B)
Scanned image of a handwritten/ drawn answer		
Typed answer from the scanned image	Flexodent still puts zinc into several of its products (An image of sad face) #1 worst company!	Every brand will give you a smile (An image of smiling face with decayed or missing teeth) Picture of older guy but he still looks hip and he's smiling. Maybe he's on a date and it's going very well. Poligrip will give you one that lasts (An image of smiling face with healthy teeth) Very large smile, shockingly large. Grotesque even.

*Competitor's product name

Compared to the pre-workshop assignment, Pre, the answer from the post-workshop assignment, Post, in Table 4 is more elaborated and descriptive. The answer from the Pre empathizes the negative aspect of the competitor's products that have zinc as one of the ingredients. The Post embellishes the message with a specific user scenario and implies how the product can assist the user's everyday life. The Post demonstrates much stronger empathic and storytelling attributes, details of the user experience, and personal approach to the audience. Furthermore, while the Pre focuses on the product, the Post focuses on the user.

4.2 Post-workshop survey

Table 5 shows the results of post-workshop survey from Q1 to Q6.

Table 5. Post-workshop survey results from Q1 to Q6

	Q1	Q2	Q3*	Q4	Q5	Q6
Average Score	4.0769	4.0769	3.4167	4.3077	4.3077	4.3077

*One participant did not participate in this survey.

The average score for all the questions was 4.0823 (4:agree); thus, the participants agreed that the workshop helped them to understand their users, build goals of the concepts, ideate strategies to attract their users, ideate different concepts/ideas than what they initially thought, be more empathic to their users, and improved their brainstorming skills. The survey results suggest that the workshop was most helpful for ideation, empathy, and brainstorming, while it was least helpful for coming up with strategies to attract users. The Q1, Q3, and Q5 are relevant to the empathy competency, while Q2, Q4, and Q6 are relevant to the creativity competency. The survey also revealed that the workshop was slightly more effective for creativity (average score: 3.9338) than empathy (average score: 4.2308).

The feedback from participants – the answers from Q7, Q8, and Q9 – on the design thinking workshop was positive as the participants recognized the benefits of the workshop. The participants defined embodying themselves in the user's shoes and impromptu brainstorming as the most valuable learning outcomes that they gained from the workshop. They also suggested having more time to complete exercises, more classroom space for the teams, and more examples of the exercises.

4.3 Observation

Besides the formal evaluation, there were other noticeable differences in the following area from the comparison studies of pre- and post-workshop assignments. The concept statements from the pre-workshop assignments showed more ambiguous and high-

sounding terms such as “Joy” and ‘Beautiful,” while the ones from the post-workshop assignments reflected more engagement with the daily life of the users.

After the first exercise, the empathy map, the students referred to the user in their persona as “he” or “she,” which created a distance between them and the user. After the workshop, students expressed enthusiasm for having more confidence to ideate more user-centered marketing concepts.

5. Conclusion

Through the design thinking workshop, the participants’ competencies in empathy, storytelling, attention to detail, and personal approach to the users, significantly improved: 53.41% on average. A significant difference also emerged in the type of emphasis on the participants’ concepts. Compared to the concepts from the pre-workshop assignment (53%), the concepts from the post-workshop assignment emphasized how people’s everyday life would change much more than the functionality of the product (93%). The post-workshop survey results revealed that the workshop was most beneficial for the participants in generating various concepts, becoming more empathic, and improving brainstorming skills.

“Journalists tell stories based on facts, but stories cannot be told without imagination” (Liao, Chang, Liang & Liang, 2016). Empathy and creativity have become core competencies in non-traditional creative and artistic fields, such as journalism and mass communication. This article examines the effectiveness of the design thinking on non-design disciplines through experimentation using the design thinking method with a group of journalism and mass communication major students. The experimentation results indicate a significant possibility that design thinking can be integrated into non-design education. Specifically, the experimentation demonstrated how design thinking could cultivate a deeper understanding of the targeted users and enhance their creativity. By engaging with the design thinking exercises, the participants contextualized themselves as the users and captured the details of their users’ everyday lives. The details they recognized organically emerged as inspirations for potential creative and storytelling solutions.

Reflection on the experimentation directed the following additional studies. The experimentation can be assessed with a wide range of non-design disciplines to strengthen the argument of the effectiveness of design thinking. A long-term component of design thinking’s effectiveness can be measured and compared with its short-term effectiveness. The design thinking process consists of five vital phases: empathize, define, ideate, prototype, and test. This experimentation mainly focused on the ‘empathize’ aspect. Further testing that includes the other four phases can broaden the spectrum of the study.

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Acknowledgements: The author would like to thank Professor Yvonne Chen for inviting the author to her class for this design thinking workshop as well as the Journalism and Mass Communication major students who participated the workshop. This research is supported by the School of Architecture and Design, University of Kansas.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Education formats to integrate Design with Humanities, Politics, Social Sciences & Education.

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Abstract | The paper looks at future forms of university education in Italy, especially regarding traditional non-design disciplines, such as humanities, politics, social sciences and education, to explore how design can contribute and be enriched by the integration with them. Graduates from these areas of study are hardly satisfied with the professional skills acquired during their studies while employers complain about graduates' deficits in terms of soft-skills, which are conversely part of the design competency framework.
Hence, design can play a catalyst role in challenging these disciplines to close the skill gaps and to explore future scenarios.
The paper introduces a blueprint with four semester-long elective courses coupling students from design and the aforementioned disciplines. *Design Debates* combines design and philosophy, S*ensemaking* design and sociology, *EducationXEducation design and e*ducation. *Society Prototyping* design and political sciences.
These proposals are meant to invite universities and design institutions to imaginatively reconsider traditional curricula.

KEYWORDS | EDUCATION, SPECULATIVE DESIGN, HUMANITIES, SOCIAL SCIENCES, POLITICS

1. Introduction

The paper intends to look at future forms of university education and to explore how traditional disciplines such as humanities, politics, social sciences and education can be enriched by the integration with design in higher education in Italy. The objective is to discuss four innovative educational formats where students from these fields collaborate with design students.

The paper reviews the situation of higher education in Italy in terms of employment prospects and graduates satisfaction with a particular focus on adults with tertiary education in humanities, social sciences, education and design.

1.1 Higher Education in Italy

According to the latest OECD report (2019) on education in Italy, the employment rates in Italy - compared to the OECD average - are comparatively low while the rates of competences' mismatch are higher than on average among participating countries.

Tertiary educational attainment is increasing for younger generations, even though the share of tertiary-educated 25-34 year-olds is still relatively low at 28%.

Higher education is offered by three types of institutions in Italy: universities (including polytechnics), arts, music and design higher education institutions and higher technical education institutions.

In Italy, 88% of tertiary students are enrolled in public universities generally with open admissions. Only some tertiary programs have limits on the number of students, though this is not the case for humanities, social sciences and education.

The unemployment rates for adults with a tertiary qualification are relatively high. The rate for adults graduated in the fields of STEM (science, technology, engineering and mathematics) is close to the OECD average. Instead, the unemployment rate for adults with a tertiary education in arts, humanities and social sciences is relatively low at 23%. Nevertheless, these fields remain popular among younger generations as 31% of graduates are enrolled in arts, humanities and social sciences programs.

In Italy, adults with a tertiary qualification earn 39% more than those with a secondary education, which is a low value compared to the OECD average.

At the same time, Italy has one of the highest rates of NEET (neither employed nor in education or training) among OECD countries. 23% of tertiary-educated 25-29 year-olds are NEET compared to the OECD average of 11%.

Lower earnings and limited employment prospects are critical factors that hinder equal access to tertiary education and social mobility in Italy.

1.2 Graduates Satisfaction

According to the latest survey of the University graduates' employment conditions in Italy (Almalaurea, 2019), a large share of Bachelor's degree graduates from humanities and social sciences are hardly satisfied with the effectiveness of their degree in terms of employments prospects and adequacy of the competences acquired during their studies.

81% of the graduates with a Bachelors' degree in Philosophy state that the on-the-job use of competences developed during their degree is limited to nil. The share is 85% for graduates in Political Sciences and Sociology, 45% for graduates in Education and Design.

75% of graduates in Philosophy are minimally satisfied to totally dissatisfied with the professional skills acquired during their studies, compared to 74% of graduates in Political sciences and Sociology, 42% in Education and 45% in Design.

42% of graduates in Philosophy state that their degree was neither required nor useful to perform their current job, compared to 34 of graduates in Political Sciences, 37 of graduates in Sociology, 10% of graduates in Education and 22% of graduates in Design.

1.3 Skill gap analysis

The latest QS global Employers report (2019) shows that, beyond field-specific knowledge, there are deficits in fresh graduates' training in terms of workforce readiness. The most desirable soft skills are: critical thinking, complex problem solving, written and oral communication and teamwork.

In Italy, more specifically, employers state that there is a major disconnection between the education system and the labour market (OECD, 2017). The separation between education providers and organizations is rooted in the principle that schools and universities should be independent from the industry, even if there is an increasing attention towards the so-called "Third Mission" of university, which is described as the "propensity of structures to open up to the socio-economic context" and is one the quality evaluation criteria of the Italian National Agency for the Evaluation of University and Research Institutes.

Traditional educators generally stand for theoretical teaching over competence development, despite a general agreement on the importance of transferable skills, which are indeed strongly demanded by the employers, who report the graduates' deficits in terms of team-work, flexibility and organization skills.

Beside this, many fresh graduates enter the labour market without any previous work experience, which, on the contrary, is highly valued by employers' hiring managers.

2. Design education competency framework

Contemporary organizations are facing ever-changing and complex challenges that require a broader range of competencies. Hierarchical and silo structures, which were perfect to address complicated problems, have been overtaken by horizontal and matrix structures, where teams are increasingly multidisciplinary as multiple expertise, skills and perspectives are required to allow the organization to tackle complex problems and strive. The prevalence of this not-so-emerging work approach requires some particular soft skills: critical thinking, complex problem setting and solving, and effective verbal, visual and oral communication (Reuveni & Vashdi, 2015).

In Italy, where soft skills are hardly nurtured in traditional university pathways, employers would still expect to find certain ones (problem solving, communication, organizational and management skills) as part of the graduates' background, while the organization still holds the responsibility to transmit its value system (Mangano, 2017).

Hence, the lack of professional competences and soft skills is a crucial challenge, especially for students enrolled in humanities, political sciences and sociology programs, as it is apparent from the graduates' employment rates, conditions and salaries.

On the other side, the competences highlighted above are considered the key elements of the design attitude (Boland & Collopy, 2004), and the pillars of the holistic framework of design competence. (Gribbin et al., 2016).

Furthermore, another approach can be favored to leverage the theoretical knowledge of humanities and social sciences curriculum and the methods and competences of design education: speculative and critical design (Dunne & Raby, 2013). This approach entails envisioning tactics to explore possible and preferable futures through scenarios and physical prototypes.

2.1 Design attitude and competency framework

When Boland and Collopy (2004) describe the approach of 'Managing as Designing', in terms of Design Thinking, they recommend managers the adoption of the so-called design attitude, which refers to a particular mindset and approach to problem solving that designers develop to create meaningful designs for products, services and processes. The assumption is that designers are meant to face problematic situations as opportunities, starting from a proper investigation, questioning the conventional options, and inventing also higher-risk alternatives, whether they are recognized as the most appropriate ones and they can be exploited thanks to the team capabilities (Dunne & Martin, 2006).

Gribbin and others (2016) focus on specific competences to define a holistic approach to design competency, reinforcing the definition of design attitude thanks to the integration of cognitive competences, meta-competences, functional competences and social competences. Again, teamwork, context assessment, problem setting and solving,

visualization, communication and presentation are some of the skills inscribed in this framework (Hummels & Vinke, 2009). Hence, the design attitude is a feature that can differentiate design from other disciplines, even if it can be a valid element in any competency framework.

Design scholars are increasingly critical towards Design Thinking, despite the wide diffusion of it among non-designers, as it suggests a distinction between thinking, on one side, and action on the other one (Kimbell, 2011). Kimbell, in particular, use practice theories to analyze design activity and designers' expertise, proposing a pair of concepts, design-as-practice and designs-in-practice, to acknowledge the impact of the context, stakeholders and end-users. This approach surely questions the central role of designers and the opportunity to identify specific designers' cognitive styles, yet it recognizes that design practices tend to be rule-based, routinized and embodied, which can lead to tentative generalizations.

The idea of expanding the domain of designing to non-professional designers is also at the core of Design for Social Innovation, as described by Manzini (2015). He distinguishes between two different meanings of design: 'diffuse design' and 'expert design'. The first refers to the design that can be performed by everybody and the latter stands for the design performed by those who have been trained as designers. While it is assumed that the design attitude and specific competences can be cultivated outside the domain of design learning, it is crucial to recognize that design experts can trigger and support impactful social projects by actively interacting with experts from the fields of humanities, social sciences and education.

Along with these perspectives, Relational Design puts the focus of design practices on the occurrence of human and non-human inter-action and intra-action within situated social contexts. This approach calls for a mutual and respectful 'relationality' among all actors, blurring the boundaries between professional designers and so-called 'complementary relational designers', and stresses the value of a socialization of designing. This angle also implies the analysis of four relationalities, listed as philosophy, 'diverse capitals', alternative economies and poly-disciplinarity (Fuad-Luke, 2014).

Within this social turn we see a shared discourse about the necessity for the design practice to create a social economy for the public good, with a central involvement of non-design professionals and citizens, whether this is driven by government and service providers or grass-root innovators, which require an effective development of trans-disciplinary knowledge and capabilities.

2.2 Speculative and Critical Design

While Design Thinking has been crucial to expand the adoption of a design attitude to other domains, and Social Design and Relational Design have adopted a more open and inclusive approach about design practice to seek ecological, social and economic alternatives to

respond to communal contingent situations, they still operate within the boundaries of reality as it is, usually dealing with specific market or situated community issues.

The potential use of the 'vocabulary of design' can be further explored to break the limitations given by reality, and pose provocative questions to inspire new possibilities altogether. This parallel design channel can take specific forms of speculative and critical design (Dunne & Raby, 2013). This approach celebrates the realm of possible, plausible and preferable futures. It provides a space to speculate and experiment with 'what if' scenarios and how things could be. They deal with the exploration of ideals, ideas and fictional objects to create visible projections of the future.

Speculative and critical design practices offer a space to imagine and discuss alternative possibilities, and help redefine the relation to reality itself. Design is the medium, through its imagination and critical approach, to trigger future thinking, grow socio-cultural awareness, raise questions, move to action, and to explore alternatives that challenge today's world (Auger, 2013).

Speculative design in its various forms, namely Conceptual Design, Design Fiction, Design Futures, Adversarial Design, Critical Practices and Near Future Design, is adopted as a pedagogic practice in design education (as currently surveyed by SpeculativeEdu, the education project funded by ERASMUS+), to help students develop a set of skills and behaviors (narrative construction, user interactions, implication assessment, communication and contextualization), by reflecting on the dynamics of today's world and equipping them with an open mind-set to manage and reinvent their role in a complex, fast-changing world (Ward, 2013).

In the last ten years, several higher education institutions that have explicitly introduced speculative design courses in their curriculum. Among them, there are: Parson's The New School (USA), UC San Diego (USA), MIT (USA), Royal College of Art (UK), Goldsmith's University (UK), Edinburgh Napier University (UK), the University of Split (Croatia), the Institute for Transmedia Design (Slovenia), Madeira Interactive Technologies Institute (Portugal), Design School Kolding (Denmark), Australian National University (Australia).

3. Four hybrid education formats

Historically, Italian universities keep humanities, politics, social sciences and education separated from design, and higher education institutions dedicated to design don't offer humanities and social sciences 'degree programs. Hence, there is minimal interplay between students and faculty from philosophy, sociology, political sciences, education, and design.

It's important to highlight that most Bachelor and Master programs in design have already incorporated courses of anthropology, psychology and sociology in their curriculum to help students deepen their user research and analyze the social transformations at a global and local scale, and some of them even act as social innovation incubators, like the MA in 'Eco-

Social Design' at the Free University of Bozen-Bolzano and the MA in 'Advanced Design: Services' at Bologna University, just to name two programs currently offered in Italy. These programs officially welcome applicants from a wide range of fields, but they generally belong to the respective design departments only.

On the other hand, humanities, social sciences, political sciences and education very rarely offer any design learning experience.

What is proposed here is to encourage the interaction between students and scholars who are currently teaching and learning humanities and social sciences with those who are in the field of design. The assumption is that design and, in this case, a speculative and critical design approach might play a catalyst role in challenging the aforementioned disciplines, addressing the workforce needs, closing the skills gaps, while facilitating alternative visions of the future.

This paper represents an exercise in 'university making', by imagining four bi-disciplinary distinctive courses, to invite education leaders from the fields of humanities, social sciences, education, design - and not only - to reimagine the way the university works. These four courses are intended as feasible, practical ideas to perform speculative multi-disciplinary projects drawing knowledge and competences from the existing curriculum.

Universities must move quickly to abandon the antiquated system of discipline silos to one that connects all disciplines through faculty and students thanks to integrated classrooms (Park & Benson, 2013).

3.1 Design Debates

Design Debates combines the fields of design and philosophy. Students are taught to think in future scenarios, as plausible and preferable alternative ways of being. The course takes inspiration from the interaction between philosophy and architecture pursued by Jacques Derrida, Peter Eisenman and Bernard Tschumi in the 'Chora L Works' project (1982) to translate the principles of deconstructionism to architecture (Derrida & Eisenman, 1997). While their cooperation is considered troubled and the design has never been executed, it probably remains one of the most significant examples of the possible collaboration between the philosopher's reasoning and the designers' interpretations (Derrida & Hanel, 1990).

In the academic world, Carnegie Mellon University has been experimenting for ten years with BXA interdisciplinary programs. The Bachelor of Humanities and Arts degree, for example, allows students to combine their concentration in Design with a concentration in a discipline from the College of Humanities and Social Sciences, such as Philosophy. In this case, students have to take a minimum of nine courses in this field, thus interacting with Philosophy-major students. On top of this, in their 'Capstone Project', students have to demonstrate the extent of their interdisciplinary work also through experiments and team-work projects.

The course of Design Debates aims to explore new philosophical constructs to speculate about different distinctive social practices to explore scenarios through the design and prototyping of objects (Bleecker, 2009).

For the course of Design Debates students are asked to write philosophical theories in the form of manifestos and narratives, which are, at the same time, an outcome and a medium to speculate about the future. Students are also tasked to design fictional products to explore applications and implications of new philosophies and ideologies. These constructs can speculate about plausible, original situations that are represented by the fictional objects. Students are invited to raise questions about the socio-cultural, economic and ethical implications and effects of their ideologies.

The objects embody these speculative constructs and act as science-fiction props to provoke the critical thinking of the students, who play with probable benefits and pitfalls and engage in wider conversations about the society and their future.

3.2 Sensemaking

Sensemaking explores the collaboration between design and social sciences (Staley, 2019). Starting with readings from information design and visual sociology (Pauwels, 2000), the course entails the collection and analysis of complex data about the society to discern patterns and meanings, to develop sociological frameworks, and to create visual narratives to make them more understandable for policy makers.

This course learning is based on futuring techniques, such as cross-impact data analysis, Delphi forecasting techniques, expert interviews and focus groups, information design methods and tools. Students are taught to scan the environment (across the STEEP domains: Society and culture, Technology, Economy, Environment and geo-Politics) to acquire data, translate them in viable information, assess the potential implications, infer the possible ramifications of them on a broader social context, and eventually to use visual design tools and artifacts (conversation subjects, conversation prompts and experience enablers) to trigger and consolidate the outcomes (Manzini, 2015).

A meaningful example of such combination can be found in the Master in Urban Planning and Policy at Northeastern University (US), a program combining political sciences subjects with design and planning ones. In particular, 'Information Visualization Principles' and 'Practices and Information Design Critique Seminar' are two core modules for all tracks, including Urban Analytics, where the capstone project is in partnership with a local, state, or federal agency or nonprofit institution and the scope is to assess a local problem, visualize and present recommended solutions.

Going back to the Sensemaking course, the objective is to help students identify their own anti-thinking attributes, stereotypes, certainty bias and fears that might hinder their

information gathering. Students need to learn how to become deeply aware of the information filters, in terms of source of the information and in terms of content of the information they collect and use to analyze the context and make their recommendations to potential policy-makers.

3.3 Society Prototyping

Society Prototyping is an evolution of platforming and role-play practices (Staley, 2019; Duchatelet et al., 2019). Platforms, simulation gaming and other low-risk immersion experiences help individuals actively prepare for the future (Johansson, 2007). Building a platform belongs to the futuring techniques and offers a variation of the current economic and social activities, to change the organization culture and design more sustainable products and services (Fry, 2008).

Examples of social prototyping are widely present in design academia, for instance the 'Social Innovation Journey', an action format to engage communities developed by Polimi DESIS Lab at the Politecnico di Milano. According to the described practices, design students are meant to collaborate and design with citizens, experts and other stakeholders (Fassi et al., 2013). These participatory experiments are particularly meaningful because they have a direct and concrete impact on real situations, on the other side, for the same reason, they imply a serious commitment, risk assessments should be carefully carried out, and the design outcomes must be feasible.

The Society Prototyping course intends to work on a different level; it's a staged activity and it's enacted in the safe space of the classroom; design and political sciences students can dare to promote bolder rules and initiatives, as their choices don't have an impact on actual communities, except their own.

In this course, the students from these two fields collaborate to build small scale experiments or even full-scale pilot projects where they get a first-hand, tangible experience of what a scenario could be like - within the protected environment of the university - to incubate societies-in-miniature. Society prototypes begin as projections of the future. Students can prototype mini utopias or even dystopias. They can define the features and the rules of their own micro society as a living laboratory. The students enact their scenario and pretend to be resident of their imagined environment. For example, they can set a new tax, a privacy surveillance system, or abolish private means of transportation. Students interact with each other, design new products and services that allow the execution of the scenario, explore how the infrastructures and the manufacturing system might change, and investigate how socio-cultural dynamics might evolve.

The course learning is based on trend analysis, systems thinking, and scenario building. Students are invited to explore issues, such as ethics, sustainability and responsibilities of further development of the prototype. Students shape how they might want to live with

each other in future, practice public participation, policy making and democratic decision making.

3.4 EducationXEducation

EducationXEducation entails the development of pedagogies and pedagogical approaches to create new learning experiences. This course is not strictly related to graduates' dissatisfaction with their studies nor to the deficits identified by the employers. Nevertheless, due to the general considerations regarding youth employment and skill gaps, this course is proposed to address current technical needs, adaptive challenges and possible future scenarios for the labour market.

This course revolves around the principles of teaching as a science, and more specifically covering the practices of learning through inquiry, learning through discussion, learning through practice and learning through collaboration (Laurillard, 2012). It elaborates on the artistic pedagogical experiments by Bruno Munari and the structural ones by Enzo Mari (Branzi, 2015) to imagine alternative didactic formats. An example of this combination is represented by 'EDDES Educating Through/With Design', a research cluster created by the Faculty of Design and Art and the Faculty of Education of the Free University of Bozen-Bolzano, starting with the education-focused studio in Visual Communication (Camuffo & Dalla Mura, 2017), which has eventually originated the joint Academic Master program 'Design for Children' dedicated to both designers and educators to rethink the learning experience at different levels.

For the EducationXEducation course, the intention is to use future thinking and imagine possible teaching and learning scenarios. The course requires a methodical process which seeks long-term trends in the education and professional environments. These methods include the access to trend data, comparative analysis techniques and scenarios building exercises to enact the imagination (MacLean & Scott, 2011).

Education and design students collaborate to develop new pedagogies and education formats for any level of education, from kindergarten to tertiary education. Students can elaborate on new pedagogical approaches and are tasked to design both spatial environments and key tangible artifacts to make the learning experience complete and effective.

4. Conclusions

These proposed course descriptions can be read as four ideas to integrate humanities, political sciences, sociology, education and design in Italian universities, and break the traditional academic 'silo' system. The 'studio' can be adopted as a course environment populated not only by design students but also students from other other areas of study, thus nurturing their critical thinking, complex problem solving, written and oral

communication and teamwork skills, and anticipating what happens in professional environments.

In the introduction the problematic status of tertiary education in Italy is briefly discussed. Universities are often described as “ivory towers into smithereens”(Moscati et al., 2010), and there is a growing public view that questions the belief that everyone who is willing should pursue higher education and recommends that only disciplines that lead to employment should be promoted.

The paper, on the contrary, assumes the crucial role of traditional fields of study but invites academic leaders to reimagine the scope and the teaching methods that these disciplines can adopt to work on projects that go beyond commercial endeavors and contingent social issues, through trans-disciplinary team-work and alternative education formats.

In particular, the four courses proposed in this paper imply a bi-disciplinary approach, as a starting point that combines only one discipline from the humanities/social sciences array, with design, and specifically through a speculative and critical approach. It is understood that these proposals can be seen as fairly timid and limited. At the same time, as the examples suggest, its implementation is rather feasible and only two departments need to agree to overcome predictable academic obstacles (learning requirements, number of credits/hours, teaching setting, budget). Hence, it is meant as an initial blueprint, a marginal development of existing education practices, to influence further development and experimentation while contributing to a wider debate on the evolution of higher education and challenging universities and design institutions to reconsider their curriculum and their instructional design approach.

Speculative design scholars often cite this quote from ‘Dark Horizons’ by Tom Moylan (2003): “The transformative potential of Utopia depends on locating it in the future, on thinking through the process of transformation from the present, and identifying the potential agents of transformation”.

Education leaders are encouraged to speculate about the future of the society, imagine preferable scenarios and adopt a critical design approach to define the agents of transformation and implement these experiments where the same speculative design approach can be embedded into students learning experiences.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Experiments on complex systems mapping around materials

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Abstract | Nowadays, information about almost every topic are connected, accessible and not only bounded into the academic, "disciplinary" field. The need of keeping trace of the collection and elaboration of those information has been manifested through the years by the development of a plethora of different tools, methods and strategies. The proposed RTD experiments have been built upon a common design tool (the mind/concept map), but with a different, lateral approach to the mapping activity itself. By mixing common design tools (maps) directly with "extraneous" platforms to the research practice (social networks), the authors propose an experimentation to keep the mapping activity an iterative, context-dependant and updated tool. Three different experimentations on mapping material related frameworks are presented and discussed, trying to identify a new disruptive approach where people can easily participate into the debate.

KEYWORDS | RTD EXPERIMENTS, GIGA-MAPPING TOOL, SOCIAL MEDIA, COMPLEX SYSTEMS, ITERATIVE MAPPING

1. Introduction

Nowadays, information about almost every topic are connected, accessible and not only bounded into the academic, "disciplinary" field (e.g. the incremental push from European commission in spreading the knowledge towards Open Innovation, Open Access and Open Science pillars[1]). In order to pursuit a *design task* [2] (of every nature: project, research, activity…), the need of keeping trace of the collection, elaboration and interpretation of those information has been manifested towards the development of a plethora of different heuristic and pragmatic tools, methods and strategies (Dorst, 2019). All of these tools are connected by the ultimate goal of bring some order into this complex environment from which design activity takes inspiration (Kolko, 2010), so that it will be easier to organize, manage and re-elaborate those collected information.

This need for information organization and management is directly conductible to a tradition of design reasoning that we can easily synthesize, at its first stage, with the activity of *framing the design task* itself. This framing activity usually considers all of the following criteria: the disordered nature of design problems (Rittel, 1988); their embeddedness in cultural and social processes (McDonnell, 2015); their dependence of contextual variables that are going to be important to frame the design task (or not) (Dorst, 2018).

Because the ultimate intent of the designers is to control the scope of what they have to deal with, the designer reasoning process of task framing cannot be made in one single step, but by its nature is forced into an *iterative*, *long* and *variable-dependent creative process* (Dorst, 2019; McDonnell, 2015).

So, framing a design task of each nature into a complex context is characterized by the ability of the practitioner in organizing, managing, elaborating a potentially huge amount of information into a context-dependent environment. And this is impossible to make in one shot, an iterative approach is compulsory.

Due to this context/time/social-dependency of design activity, the proposed work will focus on observing if it is possible to collect information for a design task framing by mixing academic and non-academic sources, in order to profit from a complex scenario instead of trying to make order in it, trying to update one of the existing tools.

[1]Further information on: https://ec.europa.eu/info/research-and-innovation/strategy/goals-research-and-innovation-policy_en

[2] We use the locution "design task" instead of design problem because of the co-evolution of problem and solution concepts in the design activity (Dorst, 2019; McDonnell, 2015)

2. Methodology

2.1 Research through design (RTD) approach

Research Through Design (RTD) approach, is based on the assumption that a typical design activity may play a significant role in generating knowledge (Stappers & Giaccardi, 2017).

It tries to employ methods and processes from design practice as a legitimate method of inquiry, presenting the intrinsic ability of converge different information together through a process of composition and integration (Zimmerman, Stolterman, & Forlizzi, 2010).

With this approach, 'doing design' is a part of 'doing research' because of the realization of prototypes (usually artifacts) that promote the birth of new interactions, engagements and interrelations that would be otherwise not easy to emerge.

Assuming that the prototype should not be necessarily a physical product, but more a source of data to be analyzed and observed (Savic, Selena Huang, 2014), the proposed experiments have been built upon a common design tool, born and developed with the role of enlightening new interactions and interconnections: the mind/concept map.

2.2 Mind and concept mapping as a design tool

Displaying complex information is an old practice that can be traced back to the '70s (I. Nassi, 1973) and '80s when flow charts and other visual models (Tufte, 1983) were developed.

Mapping, as a qualitative visualization tool (Eppler, 2006), has become a common practice in the design field. Mind maps, concept maps, (Eppler, 2006) (Davies, 2011) system maps and journey maps (ServiceDesignTools[3]) are just a few examples of types of node-links maps that could be applied in the design process.

According to Eppler's classification, the *mind map* is a radial diagram that represents semantic or other connections between portions of material, while the *concept map* is a diagram showing the *relationships between concepts*, including cross-connections among them.

If the mind map could be intended as a note-taking instrument, the function of concept map is to foster learning or knowledge sharing in a constructive and systematic manner.

However, in the field of service design, mind maps are used to support unconstrained thinking starting from a topic, idea or problem put at the centre of a blank surface.

[3] Further information on the website *https://servicedesigntools.org/tools*

2.3 GIGA-maps: an overview

While the aforementioned examples are characterised by clear and defined shapes and patterns, the structure of the GIGA-map is less rigid, tailored to each specific case.

To introduce the concept of GIGA-mapping, authors rely on the thinking of Sevaldson and his framework of systemic design (Sevaldson, 2018).

GIGA-mapping is one among the System Oriented Design (SOD) methodologies that have been developed in the Oslo School of Architecture and Design (AHO) since 2005. Such practices have been introduced in order to cope with the need of teaching design students how to investigate design problems in a systemic way.

Similar systemic methodologies are very useful in design practice, because they help in framing problems that are complex and context dependent. The same problems described in the introduction.

In fact, one of designers' main challenges of these times is certainly the fact that they have to learn how to leverage "causes and effects, trends and dynamics, requirements and parameters" (Sevaldson, 2018) that influence the design process. This is also due to the fact that resulting outcomes, namely products and services, become part of a globalized world where cultures and technologies are in rapid development.

In order for projects to be successful, a consistent inquiry needs to be conducted in collaboration with experts, users and stakeholders. GIGA-mapping emerges organically as a tool for carrying out this *systemic co-inquiry*.

Differently from other analytical tools with systemic purposes, like the ones developed and used in system engineering or in hard system models, GIGA-mapping draws from design and theory of constructivism (Hein, 1991).

In reaction to a specific problem, it doesn't simply help in understanding the world 'as it is'. Instead, GIGA-mapping is most profitable in pursuing *'what ought to be'* and in understanding which are those "courses of action aimed at changing existing situations into preferred ones" (Simon, 1969).

GIGA-maps need to be designed according to the specific situations; therefore, they can present custom and heterogeneous forms. Being visualizations, they usually exploit known models based on hierarchy, time, space/geography and intensity or concept maps, but then GIGA-maps reinterpret such base-layers, mixing them between each other's and providing, for instance, *blends between quantitative and qualitative information* (Sevaldson, 2011) - Figure 1.



Figure 1. Example of many different GIGA-maps available online. Each one presents a tailored form. Their purpose is process visualization, not visualization for communication.[4]

In fact:

> "the format of the GIGA-map, allowing and encouraging the mix of differing categories, graphic expressions, media, and mixed methods approach, results in a very resilient and adaptive mapping model because they are design constructs and not obliged to follow predefined rules" (Sevaldson, 2018).

It is important to emphasize that the produced visual artifact is just the tick of the iceberg. The most of the value of GIGA-mapping resides in its capability to assist the group of people involved into the mapping with the achievement of new composite understandings and perspectives.

They are result of negotiations and balancing among point of views belonging to people with different backgrounds. Empathy based on knowledge of other perspectives is the precondition for dialogue and the prevention of destructive conflicts. GIGA-mapping helps in building such requirement, by leveraging system thinking with intuitive and flexible visual tools.

[4] For high resolution images go to http://bit.ly/gallery-GIGA-maps or https://archive.is/MQASD.

While describing GIGA-maps, Sevaldson mainly refers to experts, users and stakeholders as the people who take part into the process. Epithets of those actors are already clues of the reasons behind their selection. However, the mapping could certainly benefit from the involvement of a critical mass of contributors that are not directly selected by the leaders of the inquiry and that can help in overcoming the saturation of topic that is naturally reached in later stages of the process.

Furthermore, it could be especially useful when dealing with design problems that tackle debated topics. In such cases, important insights derive not only from the understanding of the problem itself, but also from how the general public acknowledge and interact with it.

However, the involvement of such a large public requires explanation of the tasks and other work of communication design. Up to the moment of writing, GIGA-maps do not cope with any of those.

In fact, as described, GIGA-maps proved to be a successful practice, one that is capable of leveraging huge amounts of information. Yet, to accomplish such results, GIGA-maps "break the barriers of information quantity by separating the process tasks and the communication tasks" (Sevaldson, 2011). If the GIGA-map is meant to be understood by its creators only, how can any general public intervene on them?

The presented contribution wants to further explore on the practice of GIGA-mapping by considering it as a hybrid form of mind and concept map applied to the design practice and customized for a research-trough design experiment. In doing this, the authors tried to set up the conditions useful for extending the mapping also to a general public.

In the following experimentation, the GIGA-map, likewise a prototype, is then considered as the expedient also for overcoming natural limitations that concerns to a mapping activity and, more in general, to design task framing:

- Saturation of the contents due to the number of people dealing with the task framing
- Saturation of the contents due to time available for the framing activity
- Saturation of the physical space available to collect, manage and organize all the information necessary to define the frame.

Those limitations will be better presented in the following paragraphs, strictly related to the task framing activity towards the GIGA-map tool.

3. RTD EXPERIMENT ON GIGA-MAPPING

A general approach to the generation of GIGA-maps was introduced during a doctoral course on designing RTD Experiments. In this course, only the first activity was set: the choice of the ideal type on which to set the display. Afterwards independently, different groups of students approached the mapping activity.

In the specific case of the authors, the activities that have been carried out, the results and findings to which they have led will be described below. As previously mentioned, the group's approach to GIGA-mapping has to be considered as an RTD experiment. The main objective of the experimentation was not to provide a complete fulfillment of the concept framing itself, but mostly to explore how to overcome natural limitations of the GIGA-mapping activity.

3.1 RTD experiment activities

- Activity 1: Choosing the ideal type

The base-step to start mapping a concept or framing a task is, for sure, to define the starting point: the ideal type. The ideal type is defined as: “social constructs for empirical investigations” (Fox and Alldred 2017). It must be a single concept idea, without any positive or negative connotation from which expand the knowledge. So, in order to produce a nice amount of information and push the mapping activity to the limit, the authors choose a quite controversial design-themes: plastics, bioplastics and materials selection. In fact, to monitor the evolution of the map itself, the authors tried to choose an ideal type for the map that could be interpret on several, multiple layers and commonly easy to understand.

The following activities have been set up and defined by performing them during the very first experimentation upon the “plastic” ideal type and then they have been repeated for the subsequent two ideal types (bioplastics and material selection).

- Activity 2: Ideal Type Review

The mapping experiments are intended to monitor the gravitating concepts around three ideal types taken from the authors' research areas that can be easily identified as complex systems related to materials. In fact, the choice of the ideal types was made on research topics of which the authors were experts, to facilitate the research of initial information and data and to analyze with a critical lens the subsequent collected information. Then the literature, the state of the art of research and the market have been reviewed and grouped, ready to be disclosed. The activity was carried out until a feeling of saturation was reached.

- Activity 3: Map fulfillment

As the map started to be populated with several keywords, authors experienced the incoming of the first limitation of the mapping tool: the number of people involved in the

map fulfillment income into a 'content-saturation', where new keywords proposed were related to already written ones - Figure 2.



Figure 2. Image of the pilot mapping activity made by the authors on the "Plastic" ideal type.

To overcome this first limitation, authors choose to place the ideal type at the mercy of more people, trying to establish co-design and co-building activities.

Authors have not provided pre-knowledge or rules to the new participants to maintain no judgement approach. The activity was carried out within the authors' home university with the involvement of about 40 students of master course about material selection - Figure 3.



Figure 3. Ideal types at the mercy of the students.

- Activity 4: Clustering/Layering

A "critical" review of the information collected in Activity 3 was therefore made. Thanks to the knowledge base (Activity 2) and the map enlargement (Activity 3), authors were able to cluster, organize and manage the new information coming from the previous activities - Figure 4.



Figure 4. Clustering and layering activity by merging authors' previous knowledge of the themes and the new information acquired by the co-mapping activity.

Each information collected was therefore clustered in specific thematic areas and subsequently clustered, based on the perceived meaning of the expressed keyword (positive or negative) and the ability of that punctual information to generate debate.

- Activity 5: Design of digital contents

Once that the map reached a new level of "saturation", due to space and time available to fulfill the map, the enlargement of the map has been promoted by introducing the activity on non – academic social networks. Respecting the approach of mixing sources of information, as suggested by the GIGA-mapping approach, a digital content based on the revised map has been generated.

Social networks allow a diffusion and sharing of contents over space and time. In the academic field, are considered good tools for engaging with one's peers, enhancing awareness and developing professional connections (Kelly, 2018). In order to exploit those platforms to enrich the GIGA-map complexity and interconnection, authors started to design digital contents specifically for a non-academic social network, taking its formats and potential. In this way, three GIGA-maps profiles have been activated: Giga.Plastic (first), Giga.Bioplastic and Giga.MatSel (then) - Figure 5.

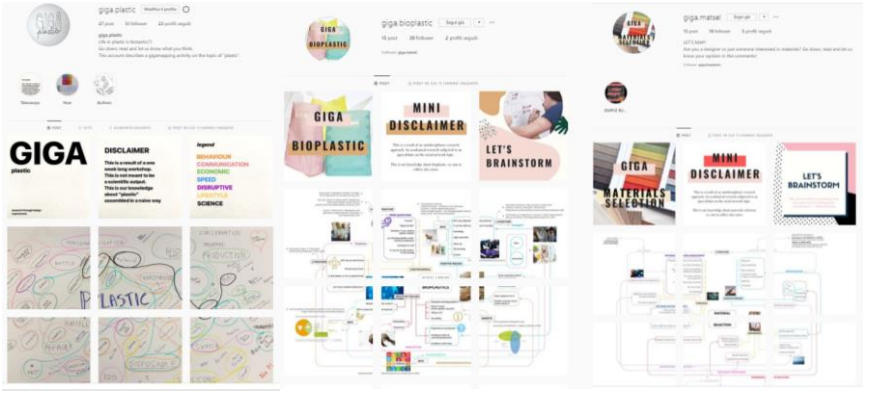

Figure 5. Overview of the GIGA-maps profiles.

- Activity 6: Call to social debate

Above all the contents, the main *triggering* keywords have been extrapolated to create debate and interest. Thanks to the enlightenment of the most suitable keywords that could provide a debate, audience has been called to comment with several unstructured stratagems (tagging profiles, sharing instantaneous contents and spreading profile contents). The social channels (one for each ideal type selected) periodically disseminated to different communities and checked to manage the debate.

- Activity 7: Update social debate

The profiles are still monitored and an update is planned in the following months to respond to the most active debate topics, so that the GIGA-map can grow exponentially.

In Figure 6 are portrayed the planning of the different actions, stakeholder involved in each, and a flow representing the amount of people called into action for each activity.

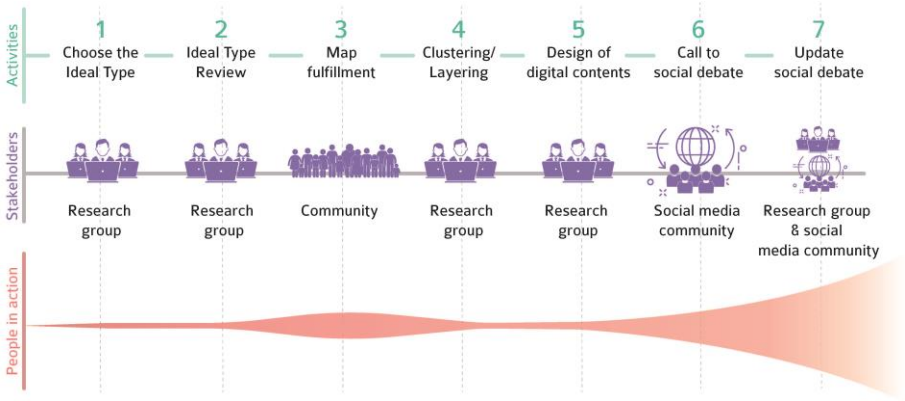

Figure 6. Schematisation of the performed activities, in correlation with the stakeholders and the people in action.

3.2 RTD experiment dimensions: overcoming the mapping limits

In Figure 7 it has been illustrated how passing through the different activities can help practitioners to overcome the limits of GIGA-mapping. The *first dimension* of GIGA-mapping is considered as the starting one, in which a certain individual or research group worked for the visualization of data in an established place and time frame.

Through the third activity proposed (increasing the number of people fulfilling the map) it was possible to overcome the limit of the people involved in the research by bringing the mapping activity to a social level. A *second dimension* can therefore be reached, it enriches the panorama of possible arguments and expands the mapping point of view.

In Activity 6 (call to social debate), in addition to the limit of people, further exceeded, it can be seen how the space variable can also be surpassed. In fact, there is no longer a defined and controlled space where the debate takes place, but it is a multimedial and potentially infinite space. In this way, the *third dimension* of mapping can be reached, which goes beyond the context-dependent limits (people and space available).

The *fourth dimension* can be reached by going beyond the time limit. With the last activity, the seventh, and therefore with an iterative updating of social debating/map-building, the fourth dimension of mapping can be reached. Thanks to this, the mapping can continue to evolve, and it is possible to create and share new contents, strictly dependent and updated to the tenor of the debate aroused or the new research carried out.

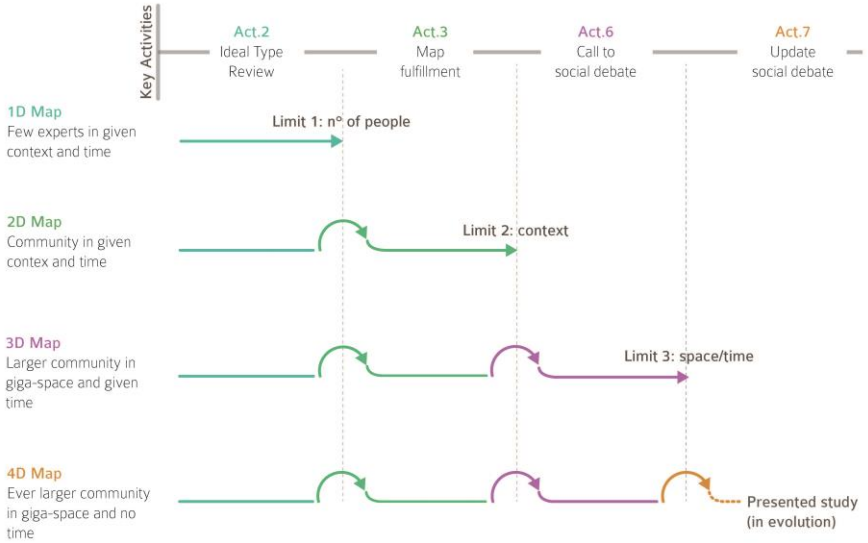

Figure 7. Schematic view of the limitation overcoming by dimensional evolution of the map.

3.3 RTD experiment reliability

Therefore, embracing the iterative nature of the design activity and overlapping this iteration with the dynamic environment of social networks, the authors' objective has been to provide a possible new hybrid scenario. This experimentation opens a view on how to create a dynamic design task framing, by mixing common design tools (maps) directly with "extraneous" platforms where people can easily participate into the debate (social networks). In fact, in potential, the "social-network GIGA-maps" can provide an evolving, context-dependant and updating mapping activity.

In order to maintain a certain rigour and to mediate all the possible information incoming in the social network environment, it is not possible to by-pass the intervention of competent people to have a certain level of contents reliability.

The Figure 6 also focuses on how authors developed the experimentation pinpointing precise moments of review and reflection upon the collected information. In Activity 1, 2, 4, 5 and 6, have been established moments of definition, clustering and mediation of the contents in order to avoid unstructured or too vague information and set the point only on usable concepts. By doing this, all the potential discouraging information can be easily managed by the competent-on-theme people (in this case authors) and the conversation can be carried out by maintaining a neutral view (as much as possible).

4. RESULTS

The presented work has been carried out, however in a limited time span, due to the commitments time span. Nevertheless, with the potentiality offered by platforms such as social networks, it can be easily carried on for a longer time.

So, starting from the main concepts expressed in the Introduction:

- design tasks usually drive practitioners towards a disordered environment and there is a need to put order in it by collecting and elaborating information;
- the embeddedness of design activity into social and cultural processes is something compulsory in the design activity;
- the interdependency between the design activity and its context naturally links to a time-space dependant dimension;

the authors found in the social networks platforms a fertile soil for reinforcing existing tools commonly used by designers to frame their tasks.

One of the most interesting findings of this activity has been to translate the perceivable frustration incoming from the early saturation of the task framing activity into a catchy and amusable one, by using platforms normally addressed to spare time purposes.

In order to maintain a certain rigour and to mediate all the possible information incoming in the social network environment, it is not possible to by-pass the intervention of competent people to have a certain level of contents reliability and some content reviewing and updating steps. So, the social GIGA-map is not an independent reality and must be curated.

The participation to the debate coming from people with unknown and different backgrounds permitted the arising of audience's doubts and concerns related to the topic. This is a very interesting point in order to familiarise and moderate the communication of design research activities, to promote an efficient divulgation that normally follows research advancements – Figure 8.

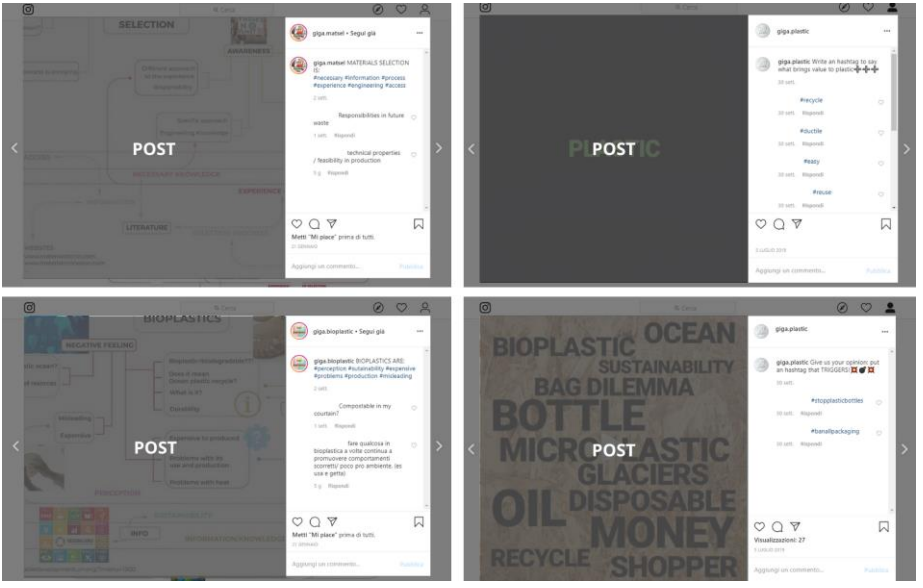

Figure 8. Examples of the audience interaction with the social GIGA-map.

The overall audience reached at the end of the expected time necessary to report the results of this experimentation into this context was of about 121 people and 38 new interactions have been registered to the three profiles.

The profiles will be monitored in the next months to understand also if a more-intense intervention about the social media contents could catch the audience attention and inspire a more intense debate on the defined topic.

5. DISCUSSION

In the presented work are still present some limitations and further adjustments are required.

- Some topics are more suitable than others

In example, the first main limitation may occur on the topic definition: in average, in the GIGA.plastic and GIGA.bioplastics profiles audience was more reactive and curious about the topic itself by suggesting new keywords but also expressing several doubts about it, probably because of the contemporary debate upon those topics also on other levels (newspapers, new government directives, etc.).

The audience stops to interact with the map when the topics are more related to a sectorial public (e.g. GIGA.matsel on material selection) and they limited themselves just to observe the phenomenon.

We can assume then that already engaging topics are more suitable for this kind of approach, because the chosen channel is addressed to an unknown public.

- Engaging a well-defined public should be done before spreading the social profile

All along the experimentation, authors found that to address the profile to a '*probably interested*' public could be more convenient in order to collect a good amount of information. Even if the main objective of this work was not directly linked with the complete framing of the research topics, authors should affirm that the potential of this new approach could be empowered by an accurate a-priori selection of the addressing public (e.g. interacting with already existing platforms that work on dissemination).

- It is necessary to update and constantly nurse the profile itself

It has been noticed during the experimentation that audience reaction was more evident in the immediately following of an updating activity. Exploiting the possibility offered by the social network to post some 24h-lasting contents, authors tried to catch the audience attention by renovating the call to action from time to time - Figure 9.

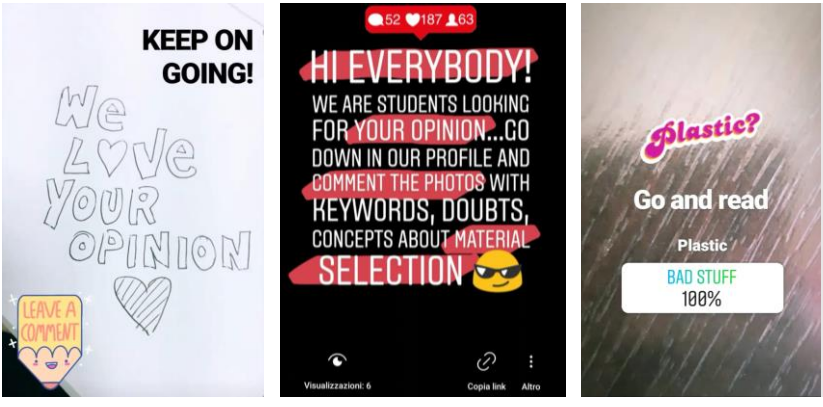

Figure 9. Examples of 24h-lasting contents to keep the audience focused on the topic

By doing this, it has been possible to enlighten an increasing activity of the audience in completing the map; so the suggestion is to structure the introduction of new contents also in terms of time, considering that the audience attention must be kept high on the debate constantly. Those are for sure only preliminary observations about the results, due to the acerbic state of the experimentation itself, being it a first attempt.

Further works and further experimentations are certainly needed in order to establish if the proposed work could set up the basis for a new methodological approach for exemplifying the design task framing activity, exploiting the mixture of several tools.

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Acknowledgements

Authors want to thank professors of "*Designing RTD Experiments Summer School"* at Politecnico di Milano for introducing the GIGA.Maps tools. Another special thank goes to all the students and the community that took part in the completion of the Instagram GIGA.Maps.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Exploring visualizations of design processes from a design activist perspective – a scoping study

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Abstract | The purpose is to investigate how design processes are visualized in research, with the overall aim to highlight dominant structures from a design activist perspective. The method used is a scoping review of literature and a visual content analysis. The results show that there is no established standard for visualizing design processes. The visualized models are often implicit, creating difficulties regarding the validity and effectiveness. The linear model is the norm when presenting design processes visually. The design requirement of attractiveness in the visualizations seem to be closely linked to the individual expression of the researcher. From a design activism perspective, there is a potential for disrupting existing power structures in design processes by questioning how they are visualized. There is a need for more sophisticated user-centered methodology in order to gain insights from the models presented.

KEYWORDS | DESIGN + PROCESS + METHODOLOGY + DESIGN ACTIVISM

1. Introduction

In this paper, we draw on the design activism perspective representing design's central role as raising awareness about values and beliefs (Markussen, 2013). Through this theoretical lens, we want to question how design processes are visualized in order to evaluate the effectiveness of the visualization of the research results and their comprehensiveness. In accordance with previous researchers, it is important that visualizations of design processes can be understood cognitively, otherwise it does not generate insights and knowledge of the recipient (Schreder, Windhager, Smuc and Mayr, 2016).

Recently, there has been a wide interest in design methodology and processes (Faiola, 2007; Hall, 2011; Walker, 2017). However, the development of methodology for design-oriented research has been rather limited (Verschuren and Hartog, 2005). Although, in 2010 scholars argued that the transfer from theory to designedly methods had not been fully realized yet (Bredies, Chow and Joost, 2010). Here, Morelli (2011), claims that methodological frameworks inherited from industrial production are adapted to new situations which generates rapidly changing methodological perspectives. In addition, Walker (2017) argues that the research field is well-established, but there remains potential for the development of methods and frameworks. Hence, additional studies in this field are needed (Koskinen et al, 2011). Also, techniques for evaluating the effectiveness of design methodology and visualizations could be improved to provide stronger evidence and validity for models used (Agrawala et. al., 2011). In accordance, scholars argue that design scientists must propose new methods and tools that guide and facilitate innovation processes (De Rouvray, Bassereau, Duchamp, Schneider & Charbonneau, 2008). Therefore, it is interesting to raise awareness from a design activist perspective.

In alliance with Escobar (2018), this papers view is that design affect people's way of being, knowing and doing. From an ontological perspective, design matters. How we design affects how we live our lives, consequently it is relevant to investigate how we design our design processes. By having a critical thinking view, this paper strives to raise awareness about values and beliefs on how we present knowledge, to contribute to a disruptive way of thinking regarding accessibility and meaning making.

Against this background, this paper investigates how design processes are visualized in research, with the overall aim to highlight dominant structures from a design activist perspective.

2. Theoretical background

Traditionally, design activism mainly originates within the design field where the solution is an artefact (Bichler and Beier, 2016). Today, contemporary design activism is part of a progress including social design, community design, participatory design and critical design (Julier, 2013). Design activism can be about disrupting existing power structures by

questioning the ways of being in the world (Markussen, 2013), and in some studies, design activism is referred as a design movement (Cetin, 2016; Clarke, 2013; Julier, 2013). According to Seliger (2014), the definition of design activism stands for responsible design. Design activism has been a topic of growing interest and research throughout the past decade (Aiello & Parry, 2019; Escobar, 2018; Markussen, 2013). For example, scholars suggest that design research needs a new framework based on the notion of design activism as a disruptive aesthetic practice (Markussen, 2013). In accordance, we argue that design activism should be seen as having an aesthetic dimension, along with its political dimension.

By designing meaning is created (Ehn, Nilsson & Topgaard, 2014; Escobar, 2018). In this sense, design is closely related to culture (Balsamo, 2011). When we design something, for example visualizing results and design processes, cultural meanings and perceptions is created. A decade ago, Fällman (2008) presented a model of classification of design research, arguing that methods and structure are the heart of the understanding and practice of design. This classification is related to Fraylings' (1993) three concepts: research *on* design, research *through* design and research *for* design as a way of understanding the field. In accordance, this paper contributes to research *on* design.

To give a brief overview on the topic, the first generation of design methods were based on systematic and rational 'scientific' methods and the second-generation methods moved towards recognition of appropriate solutions where designers were partners with the problem 'owners' (Cross, 2007). In the 1960s, the development of design methods borrowed approaches from engineering and during the 1980s, important sources of the social context of design were social science, cognitive science attend anthropology (Bayazıt, 2004). Also, the 1980s was the establishment of design as a coherent discipline of study in its own right with its own things to know and ways of knowing them (Cross, 2007).

Additionally, the purpose with design methods are to improve design performance, as a reminder including essential steps with the aim to help the designer to structure the thinking (Daalhuizen, 2014). Studies within this field often have the purpose to model the design process and/or to develop design methods (Tromp and Hekkert, 2016). Visualisation of design methodology is done through models used to clarify results, and thus can be seen as mediators of knowledge (Eppler and Aeschimann, 2009). Models visualizing the design process are usually essentially linear, reflecting goal-oriented problem solving (Ingram, Shove and Watson, 2007). Cross (2007) points out, that design research is struggling to move away from that linear design thinking. Although, it is the model of information transmission by Claude Elwood Shannon (1949), that has influenced design theory mostly, and criticisms of this model have also been developed to several models of design and human communication (Crilly, Good, Matravers and Clarkson, 2008). In 1949, this model was extended to include pictorial arts and more text (Shannon and Weaver, 1949).

Models, which are mental or physical structures, influence our thinking and acting, consciously and unconsciously and describe arrangements of components and their representation within larger systems (Davis, 2012). Furthermore, models are tools that allow us to

communicate abstract concepts and the actuality of using models shows our increased awareness of models' influence and how people make sense, they can also be a basis for what theories that are important for design as a discipline (Ibid). For example, design principles are essentially models predicting how different visual techniques affect cognition and perception (Agrawala, Li, and Berthouzoz, 2011). From a critical aspect, Agrawala et.al (2011) point out that models often are implicit, and it is not easy how to control validity and effectiveness.

In accordance, there are many fundamental design requirements involved in the visualization development of the design methodology to be presented. This paper draws on the theoretical contribution by Vande Moere and Purchase (2011) presenting The Vitruvius triangle including: *Utility* – described as functionality, usability and effectiveness, *Soundness* – concerning quality and reliability (for example the visualization technique of the three-map can be seen as robust as it has been widely used), and *Attractiveness* – which is about the aesthetic of the visualization or the appeal of a given solution. Furthermore, attractiveness is not just about the visual form, it can also apply to the methodology or structure of the solution itself (Fishwick, 2006). As in most design-related fields a balance between the aspects of utility, soundness and attractiveness is sought (Vande Moere and Purchase, 2011).

3. Method

This study draws upon a scoping review of literature and a visual content analysis resulting in a concept map using both quantitative and qualitative approaches (see Figure 1). A study of literature is conducted to identify knowledge gaps and thus motivate researchers to close these holes as well as to create an overview of previous research (Webster and Watson, 2002). According to Mays et al (2001) scoping studies are used to rapidly map key concepts with the aim to explore complex research areas, particularly areas that have not been properly reviewed before. Arksey and O'Malley, (2005) argue that the method is useful when mapping fields of study where it is difficult to visualise a range of material. In the search strategies, the keywords “design + methodology” were used to search and systematically cover the number of models used in the field of design. The initial systematic search strategy resulted in a large number of articles (see Table 3 in the section Results).

To investigate what design elements are used to communicate the design process visually, all articles found were examined in relation to inclusion and exclusion criteria. The inclusion criteria of this study are articles that have visualized the design process in a model. The criteria's for the articles reviewed; in this study the examined design methodology models are published in the sample of journals 1) titled as figure or model by the researcher; 2) presented anywhere in the published article 3) presented as a visualization of the design methodology or design method or design process. Exclusion criteria is articles that did not visualize the design methodology process in a model (see Table 1).

Table 1. Presentation of the scoping review of literature and sample layout.

Keywords	**Design + methodology**
Sample of Journals	Design and Culture Design Issues Design Studies The Design Journal Visual Communication Visual Communication Quarterly International Journal of Art and design Education
Period of review	2007–2017
Number of articles found by using key-words	173
Sample	70 articles visualizing the design process
Exclusion	103 articles *not* visualizing the design process

The study followed by a visual content analysis and a concept map in order to provide a detailed pattern and categorize the design models found in design research. Concept mapping demonstrates how relationships are visualized between different concepts (Lanzing, 1996). In this study we provide a free form concept mapping including overlapping circles and non-hierarchical connections to organize data and suggest relationships giving way to a more qualitative understanding (Wheeldon and Faubert, 2009).

The coding categories (see Table 2) are inspired by the model of design requirements in the Vitruvius triangle by Vande Moere and Purchase (2011), presented in the previous chapter. Although, we have reinterpreted this model and in the content analysis we have focused on the aspect of *Attractiveness* (the visual aesthetic aspects) in order to investigate how the design processes are visualized. In consequence, the two other aspects *Soundness* and *Utility* are excluded variables in the coding scheme as the former two often are included as evaluation criteria for scientific research (Vande Moere and Purchase, 2011).

Table 2. Box-model showing the coding categories in the content analysis.

Forms (the most prominent shape in the model)	Triangles, Squares, Circles, Other* (*Other: text, arrows, dotted lines or a mixture)
Process (how the process is visualized)	Flows, Linearity, 2 x 2 - matrix, Other* (*Other: a mixture)
Technique (handwritten or made by computer)	Sketch, Graphic, Other* (*Other: photography or a mixture of above techniques)

Thus, based on the discussion on the Attractiveness requirement by Vande Moere and Purchase (2011), the categories that underlie the visual content analysis are developed. In order to categorize the models found, we thereby focused the content analysis on the three categories of Attractiveness including: 1. forms (geometrical forms of triangles, squares or circles), 2. process (Flows, Linearity, 2 x 2-matrix) and 3. technique (sketch or graphic), see Figure 1 below.

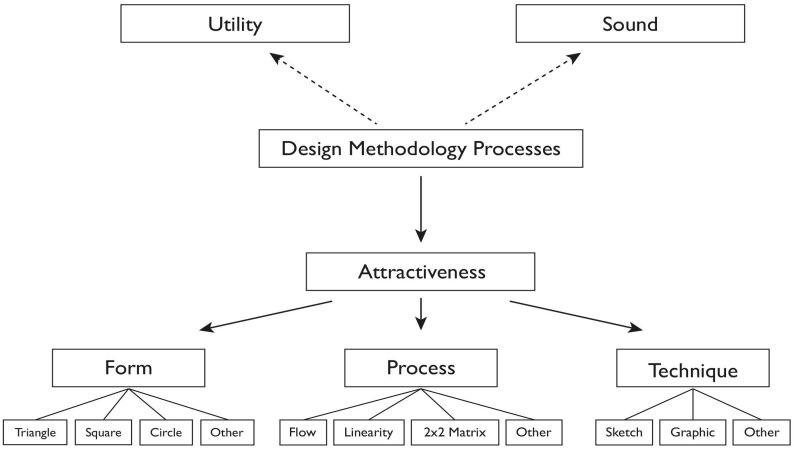

Figure 1. Tree-map showing inclusion criteria (boxes with arrows and lines) and exclusion criteria (boxes with dotted arrows).

In the first category, variables of triangles, squares, circles or other was included and the most prominent shape used to visualize the design methodology model was examined. In the second category, the content analysis focused on how the process itself was visualized as a flow or linear process or as a 2 x 2-matrix, even here the variable of other was included. The third category examined the technique used in the visualization of the design methodology model, and here the variables investigated whether it was a sketch or a graphic illustration, or other techniques used.

4. Results and Discussion of Results

Linked to design activism, the results indicate a need for more sophisticated evaluation methods when visualizing design processes, to ensure that the results are accessible and understandable. Models illustrating design processes are often implicit, which creates difficulties regarding the validity and effectiveness of the models. None of the examined

visualizations are similar. Hence, every researcher communicates their own model. The initial systematic search in scientific journals of design resulted in 173 articles (see Table 3 below). The analysis resulted in a concept map. Design processes are often visualized as linear processes with square shapes. Circles are common when illustrating design processes that are flowing. The results also show that there is no established standard for visualizing design processes.

Table 3. Articles published in journals of design research between 2007–2017. N-value: 173.

Journal Year	Design studies	International Journal of Art and design Education	The Design Journal	Design Issues	Visual Communication	Visual Communication Quarterly	Design and Culture	Total
2007	3	2	1	3				9
2008	7		1	7	2			17
2009	6		3	4			1	14
2010	5	1	2	3				11
2011	5		3	6			1	15
2012	3		2	3			2	10
2013	3		3	1			1	8
2014	9		3				1	13
2015	8		1	1			1	11
2016	5	2	4	3			2	16
2017	5		44					49
Sum	59	5	67	31	2	0	9	173

By doing a visual content analysis we found that 70 out of the total 173 articles have visualizations of design methodology processes. In comparison, 103 articles seemed to focus on design methodology since these articles matched the keywords, but they turned out not to have any visualization of the processes. By that means, these articles are excluded, and we

call these nonvocalized design methodology processes. One example of an excluded article is Dong and Vanns (2009), who presents the design methodology with an inclusive design and user-centered approach without visualizing the process. An example of an article that is visualizing the process and thereby is included in the result, is a study by Bredies, Chow and Joost (2010) where they present a design process model evolutionary phases mapped across design and use. The results indicate that a substantial body of work has grown around design methodology in design research during the last decade. For example, in 2017 there are 49 articles found compared to 2007 when it was 9 articles. This could be seen as a sign of an increased interest in design methodology and design thinking. Interesting though, is that there are no matches found by using the keywords "Design + methodology" in the Journal of Visual Communication Quarterly, and only two articles found in the journal of Visual Communication. This might be an expression of that design methodology is not commonly occurring in the field of visual communication, so far.

4.1 Visualised design elements

In the following section we discuss what design elements are used to visualize the design process by using a concept map. The results are categorized into three fields and the categories discussed are related to the code manual in the content analysis in order to map the attractiveness of the models found by their visual Form, the visualized structure of the Process and Technique used (see Table 4).

Table 4. The quantitative results from the content analysis. N-value: 110.

Forms	Triangles = 2 pieces Squares = 38 pieces Circles = 23 pieces Other = 47 pieces
Process	Flows = 32 pieces Linearity = 36 pieces 2 x 2 - matrix = 8 pieces Other = 34 pieces
Technique	Sketch = 15 pieces Graphic = 80 pieces Other = 15 pieces

Forms

The most prominent forms in the models are squares (38 models) and one example is Methodology for context-sensitive system design by mapping internal contexts into visualization mechanisms by Jung (2010) where the researcher visualizes roles of context in a time sequence. Also, circles are commonly used (23 models) and an example is Students' responses

to inclusive design by Herriott and Jensen (2013). The study visualizes design activities and finds patterns that are behind a process that is perceived chaotic. There are hardly no triangles in the visualized models (2 models). Triangle-based models are found in The Interaction Design Research Triangle of Design Practice, Design Studies, and Design Exploration by Fällman (2008) and A Design Approach by Artifacts and Projection presented by Chow and Jonas (2010). Also, the result show that there are many models consisting of a mixture of squares and/or circles, arrows and text boxes, these models are coded as Other. One example is in the study the roles that artefacts play: technical, social and aesthetic functions by Crilly (2010) where classifications of functions are defined in a table and then into a function matrix showing how different functions are combined. Another example is the study Cognitive Activity-based Design Methodology for Novice Visual Communication Designers by Kim and Lee (2016) where a model includes text blocks visualizing a linear and chronological process with the purpose to give help to more effective cognitive activities during the design process.

Process

In a study by Bousbaci (2008) there is an overview model on how the models have evolved over time from linear to circular and at last reflective. The results show that it is most common for the researcher to visualize the process as a line with a start and an end, either from left to right or top to bottom. This type of design methodology processes is categorized as *Linear*, and here the result shows that 36 models are visualized as a linear process. Here, we see a parallel to the statement by Crilly, Good, Matravers and Clarkson (2008), that design methodology is highly influenced by the linear model of Shannon and Weaver from 1949. One example is a model published in the study *Sketching sounds – Kinds of listening and their functions in designing* by Nykanen, Wingstedt, Sundhage and Mohlin (2015), where the results shows that sound design is a listening process and the authors argue that there is a need for new tools and methods when sketching sound. Another example is the study *Are Inclusive Designers Designing Inclusively? An Analysis of 66 Design Cases* by Herriott (2013), which compares an authoritative model with the aim to reach a special type of design goal with the practitioners working towards that goal.

Another common way of visualizing the design process, is through flows (32 models). One example is a model published in *What makes software design effective?* by Tang, Aleti, Burge and van Vliet, (2010) where the researchers have explored decision making in the design process and how designers can design more effectively. Another example is *The design of implicit interactions: making interactive systems less obnoxious* by Ju and Leifer (2008) where a model shows the structure of design problems through signs from different layers, not in a linear order. One last example of visualizing the process in a model with flow is *Designing for the unexpected: the role of creative group work for emerging interaction design paradigms* by Pirhonen and Murphy (2008) where the method draws on structural semiotics to emphasize the design when visualizing the design process.

Only eight models consist of 2 x 2-matrix, one example is a study by Pierre Johnson, Jen, Thorup and Brooks (2017,) where models are developed as dialogical tools in the shape of design discussion posters used when discussing design solutions in the design process. Also, the results show that there are many models that are difficult to interpret as there is no clear or explicit form or process, these models are coded as *Other*. One example is a model with five steps in the article *Assessing methods for effect-driven design: Evaluation of a social design method* by Tromp and Hekkert (2016) where the researchers study the effectiveness of the effect-driven design method Social Implication Design (SID) presenting improvements.

Technique

The results show that the technique used to make visualizations are mostly made by computer using a graphic technique (80 models). Here, a model by Vezzani and Gonzaga (2017) statutes as an example of this phenomena as they try to define an educational model for the good of society. Also, there are models based on sketches, and in these 15 models a hand-drawn technique is used. This is for example illustrated in a model in the shape of a 3D conceptual map by Bidault-Waddington (2017), including strategies toward urban development with the aim to notice design thinking and the role of critical designers in organizations. Another example is *Connecting Values: Teaching Sustainability to Communication Designers* by Benson and Napier (2015) where the researchers work with visualizing individual values and mapping the activities into the design process connecting to sustainable frameworks.

15 models are categorized as *Other* and these models contain either both graphic and sketching techniques or/and photographs. An example is a model using photographs and a 2 x 2 matrix deduced from the 4 Stagioni method in the study *Active, Local, Connected: Strategic and Methodological Insights in Three Cases* by Morelli (2011), arguing for a need for new methods related to sustainability. Another example is a model with six criteria containing both sketches and photographs used in a model in aesthetic design methodology (McCardle, Storer, Torrens, Whitehead, Mailley and Farrell, 2011).

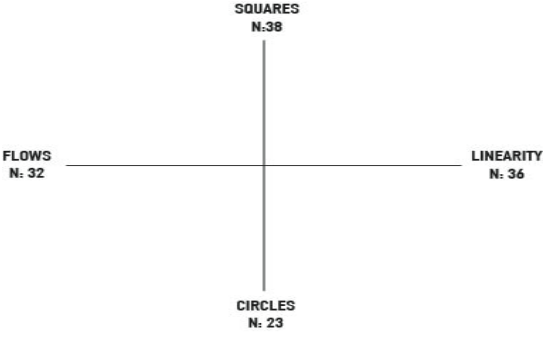

Figure 2. The picture above shows the results of the concept map.

4.2 Concept map

The results of the concept map include examples of models containing squares and circles visualizing the design process with flow and linearity, in nonhierarchical connections (Figure 2 above). This was further developed into a free-form concept map (see Figure 3 below).

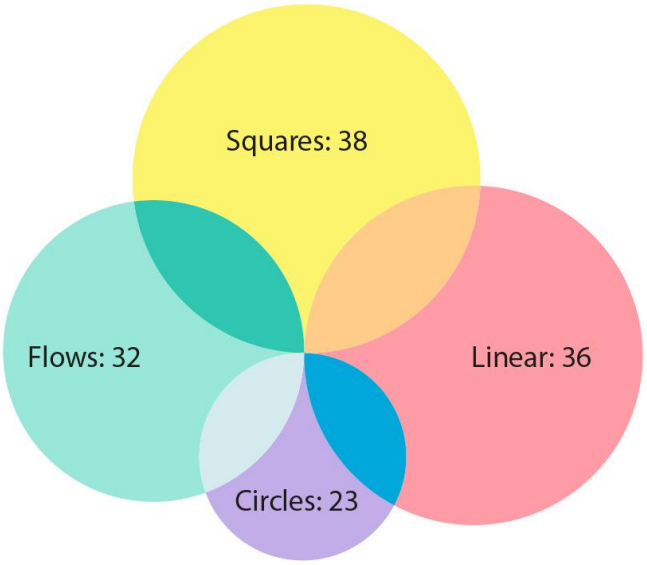

Figure 3. Free-form concept map with overlapping categories summarizing models containing circles and squares in flow and linearity, in nonhierarchical connections.

The free-form concept map shows that design processes often are visualized as linear with square shapes. Also, there is no standard model among the published models. This indicate that there are different views among researchers on how to visualize design methodology processes in a model. Notably, squares are a commonly used to visualize the design process linearly. At the same time, circles are a common when illustrating the design process as a flow.

It is also interesting to reflect upon the phenomena of the great amount of nonvocalized design processes found in research. Out of 173 articles, 103 *did not* visualize the design process, and this could indicate that there is a visual territory to further develop in design methodology research. In accordance with Shneiderman (2014), we agree that visualizations are cognitive processes with the aim to gain insights and looking upon the result from this point of view, many of the models in the category of Attractiveness can be developed using more

images, and less text. This result goes along with Puwa and Sharma (2012) pointing out that images are easier to address than words and by visualizing design methodology processes even more people can absorb and understand complex research. Although, Drucker (2011) argues that that there is a problem associated with validity and how reliable visualizations are, and this issue is present in the results.

6. Conclusions

This paper investigates how design processes are visualized in research, with the overall aim to highlight dominant structures from a design activist perspective. Linked to this perspective, there is a need for more sophisticated user-centered methodology when visualizing the design process in order to gain insights from the models presented. There are several types of visualizations of design processes, but several of them can be perceived as being too complex. There is a potential for disrupting existing power structures by questioning how results are visualized. Models should be explicit for increased understandability, accessibility and validity.

This study shows patterns of linearity processes when visualizing design methodologies, and this can be an indication of that the heritage of the transmission view presented in the Shannon and Weaver model from 1949, even now is present. This confirms that the linear model still is the norm when presenting design methodology processes visually. Also, the linear process is closely related to the squared format and this shows that it is attractive to visualize design process in a cubistic form and on a clear line, either from left to right or from top to bottom.

The design requirement of Attractiveness in the visualization is closely linked to the individual expression of the researcher, and a conclusion is that none of the visualized models are entirely similar. Instead, this study shows that many researchers communicate their own model. In this context we would like to emphasize the potential fragility of the process and that this pluralism of models could generate a lack of stringency and a weakness of opacity. In order to improve design processes in research we suggest that the concepts of validity and reliability should be taken into account when visualizing design processes. A reflection related to this is that many of the examined models could be seen as not being explicit, i. e. implicit models require a deeper reading to be understood.

Finally, this study underscores the potential of having a design activist perspective when looking upon these visualizations; this perspective can broaden our understanding and raise awareness about existing structures in design processes.

7. Further research

Exploring visualizations of design processes arises several questions related to design activism. It would be interesting to further study for example, how design research can become even more innovative in developing models that are understood cognitively and communicative? This aligns with the conclusion that the visualizations of design processes often are too complex. Therefore, knowledge of universal design principles and attractiveness needs to be developed, and how to evaluate the functionality and quality from a user-centered approach. We are also looking forward of future studies to come focusing on Utility and Soundness in The Vitruvius triangle.

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Acknowledgements: We are grateful to design researcher Per-Olof Hedvall for very helpful commenting in the writing process.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Fashion-Tech Revolution: Future Frontiers from Products to Processes

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Abstract | The fashion industry is a highly pluralistic and diversified context in which material and intangible products, cultural capital and human resources merge together. As the outcome of a complex integration process among different methodologies and areas, fashion contributes to a new reading of the cultural changes which shape our present. By drawing on various codes fashion is capable of generating a narrative which bestows meaning on the relationship between references, materials, technologies, products and processes. Given the need to rise to modernity's challenges and to be innovative, the forms of cross-fertilisation in the contemporary world are becoming ever more daring, while the number of disciplines involved is steadily growing, and the skills required are becoming increasingly specialised.
Nowadays, the fashion system is linked to technological progress. Fashion-Tech sector is originated in the interplay among fashion design and digital technologies and is a special disciplinary niche, as it is marked by elements which are unprecedented in history in terms of revolutionary impact. This process of hybridisation has opened up new possibilities in terms of innovation, and it has generated products and services with enhanced performances, whereas technological advancements have been given the chance to enter consumers' lives and bring them innovation. From design to retail, from product to communication, fashion and technology are interconnected and the shift from craft to industrial production, from an analogue dimension to a digital one involves not only all stages of the production process, improving them and making them quicker and more efficient, but also the design practice, changing its meaning and purpose.
The paper aims to trace and define the revolution taking place within the fashion world, those avant-garde movements which are experimentally operating on the boundaries of different disciplines, describing realities that are sometimes in contrast with the traditional practice. In particular the research investigates how these dimensions, resulting from the intersection between fashion and technological progress, are impacting on human beings, on their relationships with the garments, with their bodies, with the environment and with other people. The paper will analyse the changes induced by the fourth industrial revolution in the field of fashion and the impacts on processes, products and languages.

Moreover, it will analyse the technologies currently employed in the fashion landscape, along with their possible applications in future scenarios, referring to the most relevant case studies in the field. Cases will be introduced combined into clusters, according to the subject areas involved, that represents Fashion-Tech innovation tracks:

- Artificial second skin: body equipment with embedded sensors able to monitor human body parameters that are critical for healthcare;
- Hyper-body: products are becoming increasingly connected with the body, becoming part of it;
- Fashion-Tech takes care: sustainability – intended as efficiency, recyclability, transparency, mission orientation and ethical upgrades – can cover the entire fashion supply chain;
- Physical avatars: digital beauty in real layers.

These are not intended as market trends, but rather trajectories, at a different stage of development, orienting the design practice within the Fashion-Tech field. They result from observation, analysis and interpretation of emerging issues in the Fashion-Tech context, conducted by desk research.

The paper concludes with a reflection on the role of design in guiding technological innovation, highlighting how fashion design, within the Fashion-Tech paradigm, can accomplish, or at least offer, the possibility of bringing the results of the most daring scientific progress closer to a human and tolerable dimension.

KEYWORDS | FASHION-TECH, HYBRIDISATION, DISRUPTION

1. Introduction

> "The avant-garde is the symptom of a new situation ... The arts of our century are characterized by the tendency to move towards borderline areas where each art touches the boundaries of the other, often invading its territory." (Spatola, 1969)

The worlds of design and fashion are inextricably linked to the temporal variable. Indeed, the historical context integrally and intimately defines objects: not only does it determine their reason for existing in relation to needs and functionality, but it influences the stylistic, material and technical choices.

The complexity of the fashion sector, its intrinsic and communicative value, and its relationship with time can be well exemplified through the linguistic paradigm.

Clothes, like words, cannot exclude the comparison with time. In linguistics, the sign—the word—is formed by the arbitrary union of a signifier and a meaning (Ferdinand de Saussure, 1979). The signifier, or expression (Hjelmslev, 1991), can be a sound—in the oral sign—, or a handwriting—in the written sign—. The meaning instead is the content, which the sound or handwriting wants to convey, and the concept embodying the mental notion of an object. Meaning makes it possible to understand or express the sense, value or content of a sign. In communication, the sign has a dual function: one of a referential type, that is to tell something about the world; the other one is an aesthetic one—to communicate something self-related.

Like words, objects can also be traced back to this model. They have a tangible dimension which can be experienced through senses. They have also an intangible dimension of content, a referential meaning which refers to reality. Lastly there is an aesthetic meaning that refers to imagination, more or less similar or dissimilar to the representation of reality. The link that binds meaning and signifier is not natural and necessary, but arbitrary, as a cultural product that exists in a certain historical and geographical moment.

It is precisely in this arbitrariness, in this mutual bond between the parties of which the space-time component is a fundamental variable, where the concept of 'contemporary' resides.

In the world of design, we can define 'contemporary' not only as what has been designed and produced in the present time, but also as what is aware of being contemporary, therefore able to fully express the *Zeitgeist*, the spirit of the time (Blumer, 1969; Vinken, 2005): the collective taste, the general moral, ideal and cultural climate that characterises a particular historical period. Therefore, only some of the objects produced and made in the current context can be considered in all respects contemporary: the fact of being able to trace their genesis back to the present time is therefore a necessary but not sufficient requirement to be defined as such.

Clothes, like other categories of artefacts, are balancing a dualism of difficult reconciliation: on the one hand the cyclical re-proposition of tradition, its enhancement and the maintenance of ties with the past, on the other the push towards innovation, the search for a language compatible with the complexity of the present and the ongoing digital revolution. The paper is

particularly interested in analysing those Avant-guard (Szabolcsi, 1971) realities breaking the cyclical re-proposition of tradition, instead taking new directions to explore other territories and generate innovation, proposing not only a new aesthetic, but also a new vision of the world. But where do they head?

2. Hybridisation and Innovation

> "Who are we, who is each one of us, if not a combination of experiences, information, books we have read, things imagined? Each life is an encyclopaedia, a library, an inventory of objects, a series of styles, and everything can be constantly shuffled and reordered in every way conceivable." (Italo Calvino, 1988)

In his Six Memos for the New Millennium, Italo Calvino (1988) listed multiplicity among the six values that were to underlie the new millennium's literature. He envisaged the novel of the future as a large network in which different kinds of knowledge and diverse codes could generate a new and multifaceted vision of reality. The multiplicity value anticipates aspects which were subsequently to characterise both the internet and the structure of unsolvable complexity inherent in the contemporary world, a 'system of systems' based on integrated links and the coexistence of diverse elements which inform everything (Gadda, 2007).

Indeed, the world nowadays is becoming increasingly complex and interconnected; thus, the challenges of the modern times require the cooperation of various actors who avail themselves of different types of knowledge and skills, thereby integrating them and making them complementary. Our present is propelled forward by rapid changes which have affected every area of knowledge. In the meantime, the vast availability of information has blurred our perception of points of reference once embedded in our history, such as the analytical, linguistic and cultural ones.

In a context such as the present one, a dialogical approach shifts an individual and partial perspective to a choral, inclusive one, and may therefore enable the creation of shared and integrated solutions based on multilateral participation.

The boundaries between various branches of knowledge are not closed, but rather allow for constant infringements, and in fact present themselves as areas open to contamination and mediation (Lozupone, 2015). Indeed, modern disciplines are best seen as a complex interaction (Pizzocaro in Bertola & Manzini, 2004) among a plurality of systems (Von Bertalanffy, 1971): the various empirical sciences may therefore be reduced to conceptual models, each of which relies on interdependent elements that intersect one another.

The reasons behind such hybridisation, or cross-fertilisation, among different branches of knowledge with little in common are numerous. The first of these is the possibility of

generating innovative solutions, as knowledge transfer is indispensable to give rise to new ideas.

This blend among diverse fields has led to noticeable innovations across a number of them. Therefore, in a contemporary perspective, the ability to innovate appears to be largely dependent on various forms of cooperation among numerous areas of knowledge.

Fashion as a discipline has always been characterised by the intertwining of complex trajectories based on thematic references, borrowed methodologies and the appropriation of various unrelated fields of expertise, with the clear aim of generating innovation.

In the course of history, fashion and technological advances have often influenced one another. This process of hybridisation has opened new possibilities for fashion in terms of innovation, and has generated products and services with enhanced performances, whereas technological inventions have been given the chance to enter consumers' lives and bring innovation to them.

The fashion system is entirely affected by technological progress nowadays. Consequently, the Fashion-Tech sector, which originated in the interplay between fashion design and digital technologies, is a special disciplinary niche in the contemporary world, as it is marked by elements which are unprecedented in history in terms of revolutionary impact. Indeed, digital technologies have wholly pervaded the fashion system in its processes and products, have altered the DNA of traditional paradigms, and have changed the role of the actors involved (Testa, 2019). The interplay of various sectors is attracting a growing number of actors and businesses both from the fashion and the technology sector.

The introduction of digital technologies and ICT has marked a revolution in the fashion system (Testa, 2020). This modern revolution has led to more flexibility in the classic design paradigms, especially those concerning processes, codes and materials, and has mellowed former dichotomies into a seamless spectrum. Natural elements and man-made materials, analogue and digital technologies, standardisation and customisation, the artisan's and the engineer's approach, the outward appearance and the essence, the shape and the function, have all ended up coexisting in this context, and have merged with one another.

Today the fashion industry is a highly complex pluralistic and diversified organism in which material and immaterial products, cultural capital and human resources merge together. As the outcome of a complex integration process among different methodologies and areas, fashion contributes to a new reading of the cultural changes which shape our present, and by drawing on various codes it is capable of generating a narrative which bestows meaning on the relationship between references, materials, technologies, products and processes. Given the need to rise to modernity's challenges and to be innovative, the forms of cross-fertilisation in the contemporary world are becoming ever more daring, while the number of sectors involved is steadily growing, and the skills required are becoming increasingly specialised. Fashion's boundaries are open to the boldest forms of research and experimentation. They are the result of the interplay and mutual integration of highly diversified and specialised fields, which

range from medicine to aeronautics, from engineering to city planning, and from biology to cosmetics. It is these mergers which supply the lifeblood of creativity and innovation. Contemporary fashion designers are forced to operate on more levels in increasingly complex contexts, and to harmonise diverse elements which are in contrast if not in outright diametrical opposition. They therefore show a shared inclination to a high degree of flexibility which conjugates the cross-fertilisation of different kinds of knowledge and know-how and experience a similar need to experiment materially and to reach a developed vision of the technology they apply. Such modus operandi strives to seek and define original scenarios and presupposes a special ability in audaciously stretching the designers' initiatives beyond the comfort zone, thereby challenging and breaking the limitations derived from traditional paradigms such as matter, codes, and processes (Cappellieri, Tenuta, Testa 2018).

3. Future Scenarios for Fashion-Tech

3.1 Methodology

The following part of the paper will address the peaks of innovation and will describe future scenarios for Fashion embracing the digital shift through the identification of future possible directions in regard to new Fashion-Tech products, consumption habits, markets conducted with the scope of evaluating and identifying opportunities and requirements for development of main topics within the areas of Fashion-Tech.

These scenarios may be referred as 'Design Orienting Scenarios' (Jegou and Manzini, 2000) as they allow the exploration and description of promising innovations involving a set of relevant actors. The scenarios are then visualized through a Cartesian coordinate plane, producing a 'Design Plan'—design directions for the development and refinement of innovative body equipment in the field of Fashion-Tech—.

Starting from the idea that a trend is a direction of movement or change in an observed value (Thomsett, 2015), information is the common denominator among all the emerging future directions that are described in the following sections. These are not intended as market trends, but trajectories, at a different stage of development, orienting the design practice within the Fashion-Tech field. They result from observation, analysis and interpretation of emerging issues in the Fashion-Tech context.

This process proposed by Jegou and Manzini (2000) was particularly useful as it helped us approaching in a systematic, coherent and organised way a complex situation with a large quantity of variables. The followed process started with a desk research, with an overview of the state of the art in Fashion-Tech through literature search and review, case studies analysis and interviews.

We then identified main macro trends within the field of interest. A macro-trend can be defined as a change in the context of the current system that may have a potential effect on its

development (Manzini et al. 2009). For the field of Fashion-Tech we found as a relevant and discriminating element the degree of interactivity of a product (autonomous interaction/controlled interaction) and its scope in relationship with the body (functional/expressive).

It was created a Cartesian coordinate plane according to the polarities:

- the scope on the abscissa axis: on one side functional body equipment and on the other one expressive body equipment;
- the degree of interactivity on the ordinate, based on autonomous interaction and controlled interaction.

Lastly, we used the Cartesian coordinate plane to map the case studies and we built different alternative scenarios exploring potential reconfigurations of the current fashion system. The scenario building methodology we followed made use of a polarity-based approach, represented within a Cartesian coordinate plane. Polarities show possible variations along one dimension of a piece of body equipment, between opposite directions.

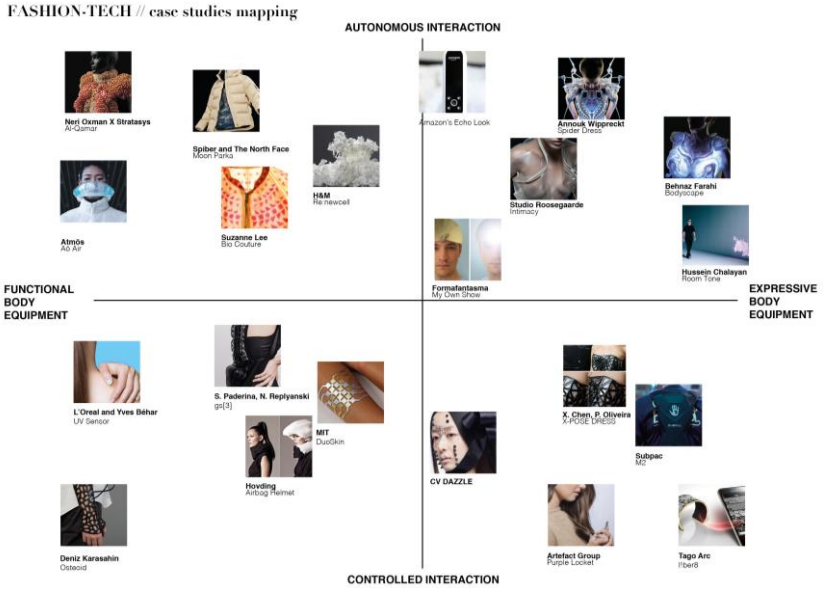

Figure 1. Fashion-Tech Design Plan, case studies mapping. Source: Authors.

3.2 The Four Macro Areas

Four macro areas emerged from the Design Plan methodology that may represent a direction of future development and potential applications of the products for the Fashion-Tech.

The four scenarios are:

1. Artificial Second Skin: body equipment with embedded sensors is able to monitor human body parameters that are critical for healthcare
2. Hyper-Body: products are becoming increasingly connected with the body, becoming part of it
3. Fashion-Tech Takes Care: sustainability – intended as efficiency, recyclability, transparency and ethical upgrades – can cover the entire fashion supply chain
4. Physical Avatars: digital beauty in real layers

For each Fashion-Tech scenario, most of the products, technologies, fabrics or techniques come from worlds apparently far from that of fashion and are only the result of the meeting of different disciplines and fields. Medicine, architecture, gaming, robotics and automotive are just some of the areas where most of the innovations we are seeing are being implemented.

The examples contained in the following paragraphs are presented in an order that is not intended to highlight the state of diffusion, marketing, or development process of the product, but to picture and highlight general common trends, the existence of some avant-garde sectors, generated by contamination and integration with areas other than fashion. It is in fact a transversal research towards the approach to innovation in the field of fashion.

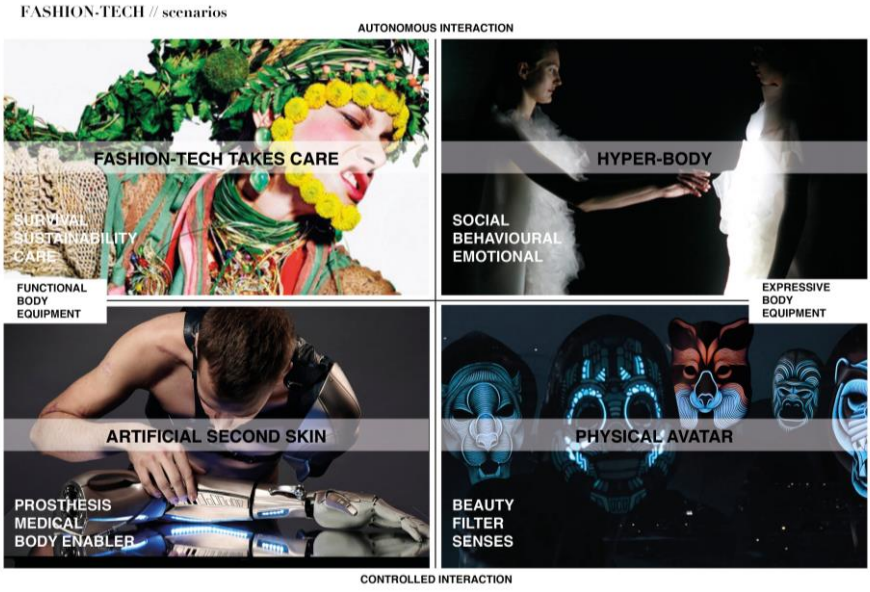

Figure 2. Fashion-Tech Design Plan, scenarios. Source: Authors.

3.2.1 Artificial Second Skin

The first scenario concerns body equipment behaving like a second skin, from one side monitoring or intervening on body parameters and on the other side acting as body prostheses to control external environments or smart devices.

It features products whose interaction activation is controlled: they can be activated either by the environment or by the users, enabling them of enhancing their performances, opening the possibilities of spreading new behaviours. For this reason, this category of body equipment is mainly purely functional.

While health and wellbeing products had previously been focused on providing information on the users' vital signals for a quantified self to improve lifestyle and control it, wearables and smart textiles with embedded sensors can monitor physiological, neurological and body kinematic parameters, critical for healthcare (Cho, 2010). Body signs, such as heart rate, respiration and motion patterns, can provide data to detect behavioural changes and health risks, diagnosing issues at early stages (McCann & Bryson, 2009; Cho, 2010). Fashion and product designers, and textile, electronics and material engineers are the main professionals involved in this first macro area. It is a mature and marketable scenario, that involves robotic, automotive, military and medicine fields.

Within the medical field, GS[3], designed by Snezhana Paderina and Nikita Replyanski, is a graduated spine support system providing dynamic back support. It is addressed to patients suffering from medical conditions, which cause joint hypermobility and chronic musculoskeletal issues requiring daily spinal support. Using data assessed by an integrated neural network, the lightweight cable mechanism of the graduated spine support system can easily and precisely be adjusted to the wearer's rigidity and support level. Within the same field, VTT Technical Research Centre is interested in creating wearable sensors and technologies to understand human movements and behaviours, while CCT Group is developing protection sensors and actuators, artificial muscles and second skin interfaces.

Moving to the field of safety, the main target group for protective wearables is mostly sick or elder people, who are statistically not highly familiar to digital technology. This instead may be helpful to predict possible future accidents or health problems. According to a study published in Smart Clothing Technology and Applications, people in general are keener in welcoming in their daily body equipment smart items that would satisfy physiological and safety issues (Cho, 2010), which are placed at the base of the Maslow's pyramid of human needs.

Thus, the need for protective garments is further proven. Protection is not only connected with monitoring the body but also with safety. Hövding 3 is an airbag for cyclists that is worn around the neck such as a collar. In the event of an accident, the airbag inflates and covers head and neck as a protective hood. Sensors inside the collar read the cyclist's movement pattern 200 times per second. In the event of an accident, the airbag inflates in 0.1 second.

The UV sensor by L'Oréal and Yves Béharto fits into body equipment designed with safety purposes, as it protects the wearer against melanoma. It is a small UV Sense device which works without the need for a battery: its dimensions are so small that it is possible to be worn on a nail. The device tracks sun exposure, as a way of lowering the risk of skin cancer.

Finally, the last case study deals with a piece of body equipment directly applied on the skin. Designed by MIT Media Lab, DuoSkin is a fabrication process that enables users to create customized functional devices which can be attached directly on their skin, as metallic jewellery-like temporary tattoos. Using gold metal leaf, a material that is cheap, skin-friendly, and robust for everyday wear, DuoSkin is designed to allow three types of on-skin interactions: sensing touch input, displaying output, and wireless communication. DuoSkin devices enable users to control their mobile devices, display information, and store information directly on the skin.

3.2.2 Hyper-Body

Hyper-body concerns body equipment designed with a high aesthetic and expressive value and not fully controlled by the user's will.

In the relationship between technology and fashion, the body plays a crucial role. While on one side technologies are becoming autonomous, contactless, wireless, on the other side products with embedded technology are becoming increasingly connected with the body and the skin, in some cases becoming part of them.

Starting from medicine, engineering and military fields, artists, fashion and textiles designers together with electronic engineers explore how to develop new body languages, through wearables and smart textiles.

Some projects are working on designing wearable items with behavioural attitudes, able to respond with a certain degree of autonomy to body or environmental stimuli. Some products are able to react thanks to the properties of the smart materials as My Own Show by Formafantasma. This head piece moves from the idea of preserving the privacy of the wearer and works against facial recognition. Hacked flashlights mounted on a golden radiating wire construction will flash as a reaction to other cameras, resulting in overexpose of the face of the wearer. The headpiece questions the thin borderline between the private and the public, and the way we daily 'sculpt' our own image on network communities.

Some other more radical projects investigate instead the capability of a garment to assume the behaviour of animals.

The Spider Dress 2.0 by Dutch designer Anouk Wipprecht, for example, well shows the power and beauty of technology when integrated into body equipment. The 3D printed item features animatronic mechanical limbs with sensors, that protect the wearer's personal space.

Conceived to respond to external factors through proximity and respiration sensors, the piece extends or retracts its limbs once the sensors are stimulated.

Another project that explores the relationship between people is Intimacy by Studio Roosegarde. These high-tech garments are made of smart e-foils able to track and respond to the wearers' life signals, such as heartbeat. The e-foils become more or less transparent based on the wearer's interactions with people, creating a sensual play of disclosure.

Within the context of project exploring the behaviour of the human body, Bodyscape focuses in particular on highlighting and enhancing the wearer's movement through light. As the wearer moves, the garment lights up thanks to embedded LEDs. The lights are controlled by a gyroscope that tracks the shoulder movements of the body. Bodyscape is not only a technologically advanced fashion item produced using 3D printing technology, but it also raises fashion to the poetic dance of light and human movement: it amplifies the performative qualities of the body in motion and creates an enchanting, illuminated choreography of the movements.

In this context of Fashion-Tech performances it is simply not possible to overlook the work of Hussein Chalayan, one of Fashion-Tech's visionary forerunners, who began experimenting with the application of wearable technology to haute-couture right from the establishment of his brand in 1994. He has amazed the public of his fashion shows with clothing that changed shape by means of microchips, dresses with countless embedded LED lights which reproduced the same effect as pixels on a screen, and tables that turned into gowns. For his SS 2017 collection he cooperated with Intel on a line of technological clothing that was showcased at Paris Fashion Week. As models moved along the catwalk, images relating to their stress levels were being projected on the wall behind them, something that was made possible by the biofeedback which the accessories they were wearing kept sending. Glasses powered by the Intel Curie module gathered biometric data from three different sensors. Combined they were able to infer stress in real-time. That data was then communicated to a belt via a Bluetooth and then translated into the visualizations displayed on the wall as the models moved down the runway.

It goes from products to services able to store data and working through artificial intelligence.

Echo Look is the device launched in 2017 by Amazon that acts as a virtual stylist giving fashion advices. It is a smart camera that reacts when the user awakens its smart soul, invoking Alexa the Echo products virtual assistant. Once the outfit is worn, Alexa is asked to take some photos in different positions and from all angles. Having collected the data, Alexa compares the outfit with other ones already stored in its database, giving a preference based on algorithms. Thanks to these smart devices Amazon can collect an infinite amount of data and information about its users extremely quickly. These data are useful to better profile consumers' tastes with ever greater precision, to propose items that we might purchase on its platform.

3.2.3 Fashion-Tech Takes Care

Sustainability goes across design, production and retail covering the entire supply chain and it is intended as efficiency, recyclability, transparency, mission orientation and ethical upgrades. Involving mainly smart textiles and digital manufacturing, the level of maturity of this trend is very high as well as its marketability. Usually the presence of technology is behind the scenes and it is managed by material and textile engineers, biologists, computer scientists and fashion and product designers.

Due to the fashion industry´s high impact on the environment, investing in technological solutions to decrease its negative effects is crucial (Forbes, 2016). While digital technologies, such as 'see-now buy now' concept or digital solutions offered by companies such as Berge and Teko Solutions can decrease waste by producing only what is in demand, involving microbiology and biotechnology into fashion to produce biodegradable garments can close the cycle of production, disposal and re-use (Seymour, 2010). Thus, some realities, such as BioCouture and Bolt Threads, are advancing sustainability working with sustainable fibres and production techniques. While BioCouture´s aim is to grow garments from bacterial cellulose (Seymour, 2010), Bolt Threads is brewing spider silk protein to then spin it into yarn (Forbes, 2016). According to Danielle Wilde, Associate Professor at the University of Southern Denmark, designers should learn from biology in order to shift their design process to more sustainable practices. On the other hand, a sustainability related issue requiring attention relates to different theoretical life spans of textiles and the electronics utilized in wearables (McCann & Bryson, 2009), which can be challenging for a workable integration of the two (Seymour, 2008).

Moon Parka, developed by Spiber together with The North Face, made from artificial spider silk, is designed to endure the harsh conditions and intense cold of the South Pole. Spiber staged a five-step innovation cycle in order to produce ever better qualities of artificial spider silk. It starts with molecular design: designing amino acid sequences, on the basis of bioinformatic analyses, that deliver better tensile strength, elasticity and heat tolerance. The second step is gene synthesis: synthesising genes that produce the desired amino acid sequences. Then, microbial fermentation. The synthesized genetic DNA is introduced into microorganisms. Test spinning can begin as soon as 10 days after gene synthesis is complete, once fermentation and refining conditions have been fine-tuned. The fourth step is spinning. The fibroin proteins produced through microbial fermentation are refined and formed into fibres. Spiber established a scalable spinning process that paves the way for mass production of artificial spider silk. Finally: prototyping. Spiber produces textiles and composites from their new materials; they assess their productivity and functionality. They feed back this data into the next generation of molecular design, after which a new cycle begins. The result of all this hard work is enormous: compared to when they started in 2008, they have dramatically increased productivity and decreased costs, bringing us to a place where large scale adoption of protein materials is finally becoming a reality.

Sustainability is becoming a trend, and this is demonstrated by the interested to the topic by the fast fashion giants. H&M group have partnered with Swedish company re:newcell, whose unique technology recycles used cotton, viscose and other cellulosic fibres into a new, more sustainable dissolving pulp. The pulp can be turned into new textile fibres and be fed into the textile production cycle. The partnership is another step towards H&Ms goal to use 100% recycled or other sustainably sourced material by 2030. Also, the birth of the first global retailer in fashion launching Gold level Cradle to Cradle (C2C) CertifiedTM T-Shirts. C&A produces in consideration of the environment, in a way that does not create excess waste, uses only safe chemicals and dyes, produced in a socially responsible way and is designed for its next life.

Sustainability also includes all those products that foresee an 'apocalyptic' vision of the world, in the event that there is no action in time with sustainable solutions.

Some products for example are designed to assist us in the act of breathing, such as Aō Air Atmōs. Consumer concerns regarding air quality are increasing on a global level due to the high levels of pollutants found in urban areas, which is seeing new products like the Aō Air Atmōs wearable air purifier be developed. The purifier works by being worn over the face and creating a light seal over the face to let the user enjoy purified air throughout the day when commuting or exercising. The unit doesn't focus on creating a tight seal around the face in order to not cause discomfort and allow the skin to breathe instead of feeling hot or constricted.

Other projects instead explore alternative territories, such as life in space or on other planets. For the future - the fourth revolution - Neri Oxman predicts the arrival of what she calls the Biological Age, in which microorganisms, living matter, and wearable micro-biomes will be designed that nourish the skin or photosynthetic buildings will be built that convert carbon into biofuel.

3.2.4. Physical Avatars: Digital Beauty in Real Layers

In the last scenario, the user-controlled product becomes a purely ornamental interface to create new digital-experiential levels within the physical world.

The body can be counterfeited as with CV Dazzle. CV Dazzle explores how fashion can be used as camouflage from face-detection technology, the first step in automated face recognition. The name is derived from a type of World War I naval camouflage called Dazzle, which used cubist-inspired designs to break apart the visual continuity of a battleship and conceal its orientation and size. Likewise, CV Dazzle uses avant-garde hairstyling and makeup designs to break apart the continuity of a face. Since facial-recognition algorithms rely on the identification and spatial relationship of key facial features, like symmetry and tonal contours, one can block detection by creating an ‘anti-face’.

In other cases, the body can be revealed according to the type and intensity of interactions.

X.pose for example deals with digital data production. Since we have already ceded control of our digital data emissions, X.pose broadcasts the wearer's data for anyone and everyone to see.

Users can directly control the aesthetics of their items, customizing them and adapting them to their taste. TagoArc is a bracelet featuring a full E Ink display that can change according to the user will. Thanks to a smartphone app it is possible to change the displayed pattern on the item an infinite number of times.

Another layer that can be created is that of memory taking a digital form. Design studio Artefact Group created a conceptual smart locket that wirelessly interacts with social networks to display a digital memento of friends or family. Intended as a benchmark for how fashion and technology can complement each other, Artefact's Purple is a proof-of-concept locket that wirelessly receives images and messages from the wearer's social networks, offering a 21st century update to the traditional keepsake. The locket is able to connect to social networks, but rather than swamping the wearer with every possible update, the user first selects the people they'd like to receive notifications from. An accompanying app enables further options like creating personalised keepsakes with filters and effects, or adding and removing people from the update list.

The added layer can also be haptic to amplify the musical experience. Subpacby M2X is a tactile transducer to be worn on the back that conveys to wearers a physical impression of sounds just as if they were in a real club.

4. Conclusions

> "As we move deeper into the twenty-first century, it becomes ever clearer that the ultimate, most intimate territory for design is not electronics, or interiors, or furniture, or the web. It is us—our own living, breathing, biological selves." (Rick Poynor, 2013)

For a long time, digital innovation applied to body equipment has been mostly carried out by the technology industry.

Engineers and scientists have moved their research mainly in function of an improvement in terms of quantifiable performance, data and mathematical results, with the aim of pushing humanity constantly beyond its limits.

Contemporary society is markedly based on performance, on overcoming borders, breaking records, in the incessant pursuit of the myth of the super-human. The fantasy that nourishes the common imagination is that new technologies applied to the body and clothing have the aim of becoming functional prostheses capable of improving human performance and therefore, as a direct consequence, his quality of life. But is this really the case?

In this regard, the reflections of Sobchack are interesting. Through her essays, she deals to varying degrees with the theme of the 'techno-body', a personal and stringent question following the surgical amputation of one of her legs as a treatment against cancer. In her 1995 essay on computer theory, Sobchack criticizes the "delirious liberating rhetoric of technophiles" and does so from the position of someone who is "technologically enabled in the most intimate way", but who is not and does not feel, however, a cyborg. In particular, she addresses Baudrillard (1991): "(...) Unlike Baudrillard, I have not forgotten the limitations and finitude and naked capacities of my flesh – nor, more important, do I desire to disavow or escape them" (Sobchack, 2004, p.172). While not a 'technophobe', Sobchack argues that a critical emphasis on the 'lived body' is crucial to providing an ethical basis for issues relating to the intersection of technology and the body (Sobchack, 2004, p.172). This is why performance for those who live with the need to use bodily prostheses is no longer a priority, but the priority becomes the possibility of 'normality'. And this is precisely the crucial point. The theme of innovation and performance, whether or not enabled by digital technologies, is approached from a different point of view from engineers and scientists to designers. Progress has long been a monopoly of science and this has led to its being associated over time with values linked to performance and functionality.

Today, an increasing number of designers are working in the field of biological research, creating speculative and critical design projects, in an attempt to encourage the public to actively participate in the discussion of scientific advances and ethical issues surrounding them.

The growing interest in these hybridizations is evidenced by the inclusion of degree programs in design that intersect with scientific disciplines, from Design Interactions at the Royal College of Art in London, to Contextual Design at the Design Academy in Eindhoven, to the Master courses dedicated to Fashion-Tech at Politecnico di Milano.

In this territory, design and fashion have the task, or at least the possibility, to bring the results of the most daring scientific progress closer to a human and tolerable dimension.

What is urgently needed is to initiate a substantive discourse on the role and contribution of designers when collaborating with scientists and engineers.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

From the product to the object. The speculative design practice as instance

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_DCs Abstract | Switching from the function-object to the speculative-object transforms the meaning of the object, in so far as it is no longer a passive element of the discourse, but the triggering actor of an embodied reflexive process. In this perspective, the object transforms itself, from a functioning commodity to an open minded "thing" full of meaning. (Bodei, 2009). Understanding it as a device of thought, the speculative-object, becomes the narrating subject for a cultural reflection on humankind and it definitively changes its ontological status. (Harman, 2018). It imposes itself as a cognitive trigger of emancipation compared to a predeterminated thought, toward a deconstructive logic that does not give absolute solutions. In this context, the designer transforms himself from the one who solves problems (problem solver) to the one who identifies problems (problem-finder), through an investigative approach oriented towards evolving scenarios. Speculative objects therefore connect subject and thought and the more they exhort a disruptive vision, the more they demonstrate their intrinsic capacity to produce change.

KEYWORDS: RESEARCH THROUGH DESIGN, SPECULATIVE DESIGN,

PROBLEM-FINDING, CRITICAL MAKING, MATERIAL CULTURE.

_DCs 1. At the roots of *Speculative Design.*

In a post-industrial scenario as the current one, where the production system is increasingly converted into new configurations, the concepts of function and meaning of the product need to be reanalyzed. The transition from the *functional product* to the *speculative object* - understood as the ability that design has to consolidate a critical vision of the world into an object - is now being strengthened at a global level, not only through the emerging designers that implement it, but also the research conducted in the more institutional places of education.

In the essay *What is criticism?* Renato De Fusco analyses different meanings of "criticism", from an etymological, philosophical and historical point of view. In many definitions found, criticism indicates the ability to examine, through a sort of judgment, the results of particular notions, doctrines or works, in order to understand their contents and evaluate them appropriately. "Criticism's definitions are followed by those of "criteria", which are to be considered as the constructive elements of criticism, sharing the same root, *kpivo* (distinction). (De Fusco, 2002). The criterion is the parameter that guides the choice of a specific critical interpretation. However, over time it evolves continuously, in relation to the changing cultural and social sensitivity and subjective taste.

But the critical approach also indicates a particular analytical attitude that aims to build an elaboration of a certain thing or event. Traditionally, this term has been closely related to disciplines such as art, history, philosophy and only in the last few decades this term has been strictly related to the culture of the project, to the point of identifying a theoretical and applicative specific field.

Referring to the intellectual aspect of the project, Thomas Maldonado argues that his vocation par excellence has been "to disagree, to think differently", and that his expression somehow is a form of heterodoxy. "Heterodox are to be understood as all those who, in one way or another, act in opposition to dogmas, doctrinal bodies, models of behaviour, symbolic orders, and even existing power structures […] Rebels, oppressors, antagonists, transgressors, and in some cases openly revolutionary. The tradition of the heterodox is certainly the tradition of intellectuals." (Maldonado, 1995).

Through the description of intellectual figure by Maldonado and De Fusco's definition of “criticism”, it is clear that a speculative design approach leads to a breakthrough in the creation of new meanings and relations between object and user. This premise helps us to understand the typology of approach that led to the birth of Radical Design between the late 60s and 70s in the cities of Milan, Florence, Turin and Naples. By collecting the main experiences of those years - counter-design, conceptual architecture, poor technology, eclecticism - Radical Design starts to spread thanks to the theoretical and practical work of Archizoom, Superstudio, UFO, Global Tools, leaded by architects and designers as Ettore Sottsass, Gianni Pettena, Andrea Branzi, Ugo La Pietra, Riccardo Dalisi.

The term “radical”, coined in 1966 by the historian Germano Celant, indicated a position of change with respect to the social, political and industrial system in force. Among the themes supported by the movement, there was a return to a process of "making design" closer to mankind, in opposition to the current industrial de-humanisation and rigid functionalism with a rationalist imprint.

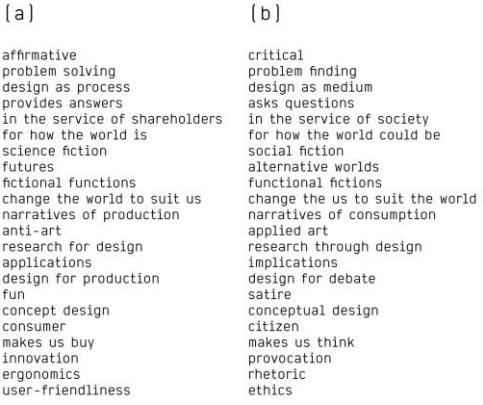
By promoting social interaction, spontaneous creativity, free individual expression, far from stereotypes and pre-established systems, Sottsass argued that "all the terms, relationships, controls, classical organizations had crumbled, had been overthrown, to give way to the new images which turn on and off here and there, caused by vital explosions where there are, by sexual activity, by heroic ambition, by frenetic activity, by repentance, by selfishness, by terror, by insolence, in a sort of chaotic, confused, overwhelming and overflowing landscape. (....) What does my furniture have to do with all this? It is trivial and does not matter. But the idea would be to invent new unlimited possibilities, new forms, new symbols: to seize the things that are dying to see if it is possible to inject more energy, more life, more dynamics into people's lives." (Sottsass, 1965). Perceiving utopia as an initial stimulus on which to build the desired reality, and so tracing alternative ways of living and dwelling, the user participated in a wider social project that included an awareness towards the consumer’s society. In this perspective, the hypothesis of a perfect industrial world, made of many perfect and functional products, homologated for everyone, was dropped.

Following the economic boom of the 1980s and the widespread interpretation of design as a mass product, the theoretical legacy of Radical Design found new life in 1999 in the Anthony Dunne's book *Hertzian Tales*, further developed in *Design Noir* (2001). In opposition to an affirmative design that can give absolute answers, Dunne & Raby's Critical Design consisted more in "an attitude than anything else, a position rather than a method […] Naming it *Critical Design* is simply a useful way of making this activity more visible and subject to discussion and debate." (Dunne and Raby, 2001).

If comparing the two movements, despite the different historical moments, there are several common aspects: the corrosive attitude, the intellectual inclination, the will to deconstruct an existing system, the speculative and questioning approach. Another analogy derives from the fact that both had fertile ground for development from two different periods of crisis: on one hand the energy crisis of 1970s, on the other the early economic recession of 2000s. The spread of divergent thinking in these two precise historical moments is not accidental, but testifies the evident need to react, through the elaboration of an alternative cultural proposal, capable of unhinging an obsolete system.

In 2013, drawing up a series of parameters of the "speculative" project, Dunne and Raby publish the A/B manifesto. (Figure 1). The decalogue parallels a design as it is traditionally recognized, consistently with the market logic of a contingent functionality, to a design as it could be, influenced by the needs of society, beyond the market’s logic. Therefore, A "Design for production" corresponds to B "Design for debate", A "Applications" corresponds to B

"Implications", A "Consumer" corresponds to B "Citizen", in a dialectic of total transformation that involves the entire design process.
In *Speculation Everything*, published in 2013 by MIT Media Lab in Cambridge, Raby and Dunne state "how this is an intentionally eclectic and idiosyncratic journey through an emerging cultural landscape of ideas, ideals, and approaches. […] to explore the idea of "speculative everything" and design as a catalyst for social dreaming." (Dunne and Raby, 2013). The field of research is, therefore, strongly connected to the design of what is possible, not yet imagined. It is about to temporally place the research in a projected dimension, adopting the design project as a functional element to a destabilization of acquired certainties. In this sense, speculative elaboration is configured as a "political" choice that in turn creates new ways of expression and unexpected fields of action. Its aim is to pose a question mark on the world, encouraging new types of behaviour. It moves consciences. It becomes a concrete stimulus in reality, taking possession of every means available.



(a)	(b)
affirmative	critical
problem solving	problem finding
design as process	design as medium
provides answers	asks questions
in the service of shareholders	in the service of society
for how the world is	for how the world could be
science fiction	social fiction
futures	alternative worlds
fictional functions	functional fictions
change the world to suit us	change the us to suit the world
narratives of production	narratives of consumption
anti-art	applied art
research for design	research through design
applications	implications
design for production	design for debate
fun	satire
concept design	conceptual design
consumer	citizen
makes us buy	makes us think
innovation	provocation
ergonomics	rhetoric
user-friendliness	ethics

_DCs Figure 1. A/B Manifesto. In Dunne, A., Raby, F. (2013). *Speculation Everything.* CA: MIT Media Lab.

_DCs 2. *Problem-Finding* approaches.

In a civilization invaded by the dimension of goods, the design of an object plays a crucial role. Relating to the *object-industry* connection, what has been happening in this last decade is that, without waiting for a specific company commission, the designer has started to move independently in order to intervene directly on the social, political and cultural demands of society. It is quite a radical change in the way of designing and producing, which leads to the

creation of objects that do not perform specific and closed functions in themselves, but, provided of “a different spirituality” (Branzi, 2006), take on new appearances and purposes.
For the designer, it is practically a matter of working on the object for its cultural value and intrinsic capability to sensitize the thought, destabilizing it. In this scenario, a new "designer-thinker" figure emerges - someone who accepts the challenges of the contemporary world, putting together complex inventive processes.
Referring to the theory of Speculative Design, among the most relevant characteristics of an object, there is the fact that there is no tangible and predeterminated industry for it. These objects do not have a circumscribed market, but are linked to a visionary dimension, a work in progress creation. Indeed, by not turning to a traditional market - through the staging of a sort of anti-industry - the divergent thinking and the critical reflections that derives from it, are devoid of any immediate economic purpose.
By implementing this operative modality, the designer acts with a strongly intellectual approach, transforming himself from the one who builds perfect models (*problem-solver*), to the one who instead identifies problems (*problem-finder*) in a constant investigative logic towards non-definitive solutions. It is evident that the *problem-finding* activity, in contrast with the traditional concept of design as an outcome of problem solving, opens the discipline to a different theoretical approach. In this case, the value of the project is determined by its ability to actively relate to mankind, imposing itself as a device for a cognitive process, oriented to a deconstructive logic, far away from reassuring solutions.
Closely connected to contemporary art practices, speculative objects acquire, in man's life, aims that the functionalist spirit of the last century had always looked upon with distrust. Far away from basic functions, their use is overturned compared to a past conception for which the consumption of an object took place through an exchange of physical type. Beyond a rationalist logic, the speculative object embraces a complex sensibility and leads to a disorientation on the part of consumers, stimulating broad and deep reflections. With the construction of objects so conceived - through operations of an aesthetic, material and sensory nature -, the difference between intellectual and physical consumption vanishes, highlighting a whole series of emotional and conceptual components that exist in the man-object relationship.
In this vision, the dialectic between project-industry-object transits through different modes of investigation that free design from the sole "industrial" denomination, towards other more inclusive interpretations, since the crisis of industrial products - in relation to its "ontological" change and areas of research - opens new perspectives to a more independent design. It's an openness witnessed by the frequent use of new production methods such as, for example, the numbered series, the unique piece, the adoption of hybrid materials and techniques, the spectacularisation of the process, performance, the use of digital devices. Even visual design, indeed, takes on a central role and becomes a "common space to facilitate processes of understanding, approach and management of the fragilities of our time. […] It becomes a cultural device to dismantle prejudices by acting as an intermediary for the construction of

cultures of civilization and life scenarios that are sustainable, solidary and fair. […] The designer, in this sense, has an enormous responsibility, because in his being a measurer of what exists, he records and keeps track, reads and interprets, conveying an idea of the future […] and affecting reality". (Piscitelli, 2019).
By highlighting unexplored fragilities and desired possibilities, the speculative approach makes the object a strategic vector for new dialogic processes. The aim, at the end, is to open questions and to understand what role design could play in the immediate future, acting first of all in the perspective of change.

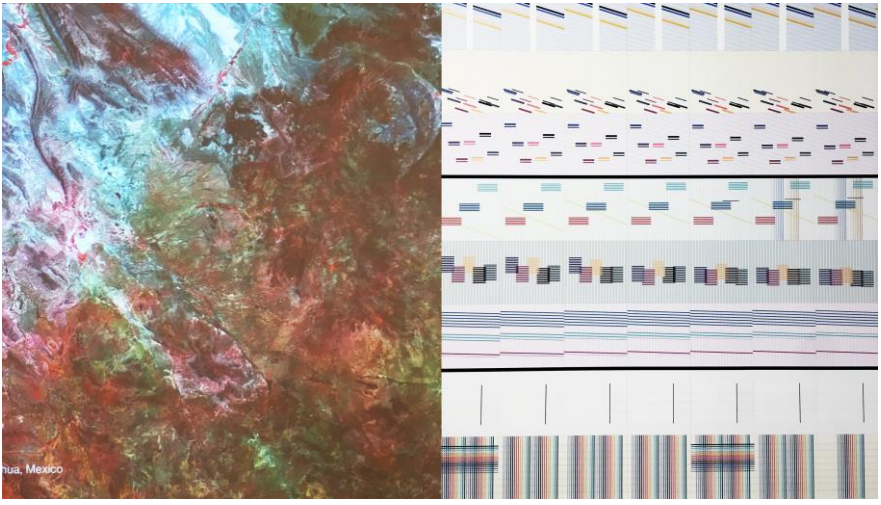
_DCs 3. The transversal instances of contemporaneity.

The industrial supply chain has now become fragmented and it's not been considered anymore as a monological reference for the development of design. In an challenging and not yet decided reality, in this sense, the speculative object can address a myriad of possibilities, constantly renewing itself through the contribution of diversified knowledges. According to the asynchronic evolutions of contemporaneity (Agamben, 2008), in a highly experimental investigation territory, design hybridizes with heterogeneous knowledge such as, for example, electronic and materials engineering, biotechnology, natural, social and economic sciences, philosophy and human-studies in general. The transdisciplinarity of the project is therefore a fact from which to understand the future horizon, the interweaving of fields, their specific interdependence and therefore the nature of design itself.
In the acceptance of this multiple encroachment vision between the fields of knowledge, the seed of a deeper nature of design - intended as an intermediate and binding agent - is hidden. (Langella, Ranzo, 2013). This transdisciplinary perspective responds, indeed, to the complex relationship that binds nature, man and the things that surround him, in an anti-hierarchical and anti-speciesist vision (Haraway, 2016), conform to the growing complexities of the world. As the anthropologist Eleonora Fiorani states, "boundary fields do not limit themselves to opening or cutting out new fields, contaminating concepts, categories, methodologies, procedures, models, experiments, knowledge taken from separate differentiated disciplinary fields, but they elaborate and develop them from within their own methodologies, articulating them into models, experiments, devices, with effects of translating meaning and opening up new perspectives of methodologies, which are decontextualized and contextualized differently because they then have repercussions in the same disciplines of origin". (Fiorani, 2012).
Feeding from more branches of knowledge, belonging both to scientific and humanistic culture, the speculative approach reinterprets reality, implementing "migrations" of thought beyond the traditional disciplinary dichotomies, for an interconnected dialogue between object and man.

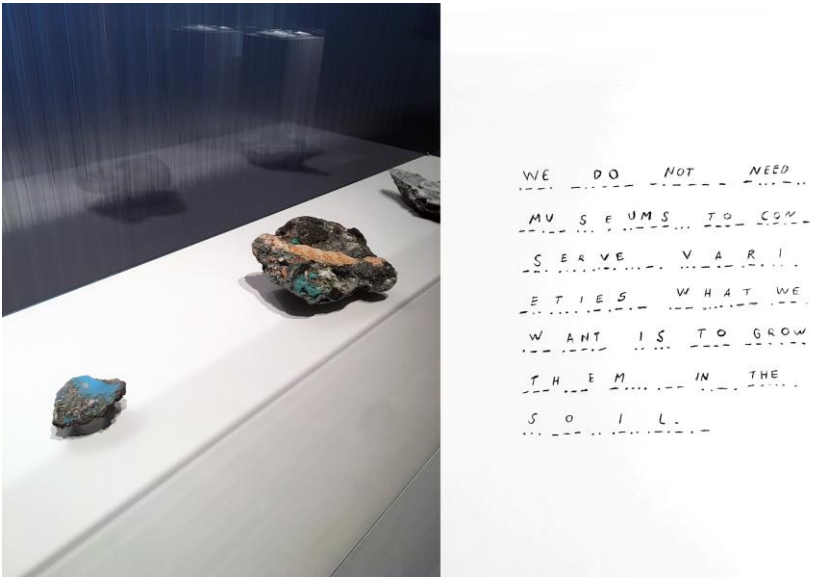
From the spaces of science and art, between architecture and politics, fashion and new technologies, combining the digital and the organic, design culture has slowly built its own identity, autonomous compared to other disciplines. In this sense, the relationships between designers, engineers, scientists and researchers must be read in an inevitable perspective of collaboration. According to a speculative approach, dealing with real issues - such as environmental sustainability, political debate, social emergencies, the relationship with new technologies - designers make objects in the broadest sense of cultural devices. Among the most urgent topics, the design project also addresses a series of complex themes such as geopolitical phenomena, gender equality, technological body, robotics, synthetic sciences.

To understand this language and the new action fields, among the most emblematic examples, we can refer us to the exhibition Broken Nature, curated by Paola Antonelli and inaugurated at the Milan Triennale in 2019. Here, the objects exhibited were designed to the survival of man on earth, the preservation of living species, the care of the territory and biodiversity, the coexistence of digital technologies and organic materials. The exhibition was practically devoid of design products intended as industrial, in conformity with a mass market. Installations, videos, study maps, material experiments and technological devices create a science fiction landscape where it is impossible not to ask questions about the current role of the designer, in the acceptance of how the discipline is radically changing, once again. (Fig.2, Fig.3).

In many cases, these objects are the result of self-produced collaborations and co-funded research within a trans-disciplinary empirical-experimental practice. The storytelling of the process is as important as the final result: the works are always accompanied by critical texts, photographs of work in progress, interpretative scenarios, which reveal their complexity and demonstrate their singularity. A singularity that is inextricably linked to the vision of the individual designer or the work team. Through the staging of these objects, the positivist vision according to which the designer is a problem-solver vanishes definitely, affirming himself instead as the one who identifies fragilities, questioning them, without absolute solutions. In this perspective, speculative objects have the ability, through both their physical and narrative existence, to act within reality by raising awareness aimed at new behaviours and human-world interactions.



_DCs Figure 2. XXII International Exhibition Broken Nature 2019 – The Room of Change (on commission) Giorgia Lupi, Gabriele Rossi, Nicola Guidoboni, Giovanni Magni, Lorenzo Marchionni, Andrea Titton, and Alessandro Zotta of Accurat. 2019. Photographs of two work details, by the Author.



_DCs Figure 3. XXII International Exhibition Broken Nature 2019 – View of two different exhibited works. Photographs by the Author.

_DCs 4. The object as a device of thought.

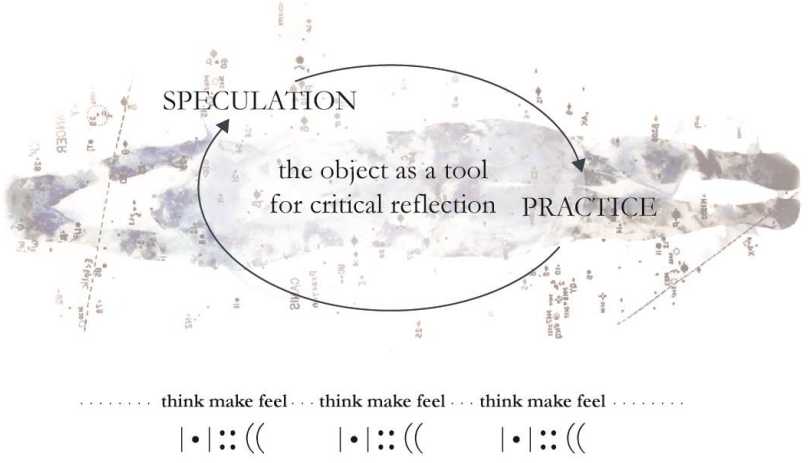
The never-ending crisis of today's society has made us aware of the limits of industry and economic development and it has brought to light countless reflections on a design related to a mankind integrated with the macrocosm. (Caffo, 2017). In this context, the task of design is to produce objects capable of being instruments for a concrete and aware exploration of the real. Acting against an industrial overproduction without logic or meaning, the objects resulting from a speculative approach express a point of view of reality. Therefore, they are not passive observed objects but objects that observe: both because they condense within them the world expressed by the designer, and because, considering themselves as subjects (Harman, 2018), they reaffirm the ability to communicate, to give meaning, to shape the world.

A speculative "research through design" that investigates the object as a thinking device poses itself halfway between an intellectual elaboration and a technical exploration of the artefact, understood as a dual possibility of design investigation of the object. In the transition from the functional-object to the speculative-object, the relationship with the material could play a fundamental role. With the integration of thought into matter, it is possible to introduce a different way of making design that acts in the interstitial space that exists between the conceptual elaboration and the material experimentation of an object.

In the laboratory space, far from a design fiction logic, a material approach of a critical object can use concepts and visions simultaneously with instruments, techniques and machinery. Similar to the alchemist, the designer transforms materials and workshop experience into knowledge, since the ability to transform materials also transforms thought. This modality is the more necessary the more research will focus on issues related to manufacturing production and physical construction aspects of the object. An innovation of these logics can only take place from the inside and through a reconfiguration of spaces, tools and materials used for the practical realization of the objects. Within this dynamic, the place in which manufacture is carried out evolves from a space outside of thought, to a space within which speculative elaboration takes place, in a total symbiosis between thought, material and object. In order to do this, innovative materials, advanced manufacturing techniques, self-built instruments, are combined with reflexive processes and experimental methods for the production of the artifact. This type of research, hybridizing digital and analogical, if left to the exclusive digital instrument, it would be impossible to implement. "The tactile, the relational and the incomplete are part of the physical experience that is lived in the manual act of drawing. Drawing symbolizes a wider range of experience […] as well as the act of playing an instrument, the infinite exploration of the mysterious qualities of a certain chord. The difficult and the incomplete should be positive events in our intellectual activity; they should stimulate us, just as simulation and facilitated digital manipulation of already complete objects cannot do. (Sennett, 2008).

With the adoption of these trans-disciplinary modes, it is possible to see an evolution of design practice capable of distorting the constructive systems of objects from the depths. Reinforcing the methodology of “design through design" with a speculative investigation that includes a conceptual-practical double track, it is possible to highlight the connections between the critical-intellectual aspects and those of an experimental nature. Reclaiming the meanings of matter, substance, process, the laboratory activity is therefore intended as an expansion of speculative activity, for a reduction of design barriers between thinking and doing. In this operative space, matter can be understood as a "hyper-contemporary" instrument of the project. The workshop space, on the other hand, takes on the meaning of a place of knowledge through senses, with a continuous feedback from and to new theories and methods. In this perspective, the critical approach holds together both strictly scientific and humanistic elements, through an unconventional aesthetics and new ways of interaction with the objects. The essay wants to affirm the conclusive thesis that it is precisely through a simultaneous critical/physical approach to the production process, that a deep innovation of the object, in its speculative and technological innovation, can be achieved.

By investigating structural logic from the inside, reconstructing processes, materials and possible interactions, it is evident how speculative-material research can be configured as one of the most evocative areas, for its ability to open horizons and explore new possibilities of being for the objects. Every time an object expresses a new technological challenge, with its presence it offers the viewers a reflection on what and how it is possible to exist in the world. In the context of a theoretical-critical culture of the contemporary object, it is necessary to reflect on the relationship between the metaphorical capacity of the object to evoke something else and its material or technical connotation. Object, subject and thought are connected to the extent that there is an exchange of energies and a mutual influence. In this sense, the implementation of these workshop processes takes on the meaning of a precise choice by the designer of whether or not to explore a certain sensation, for a not merely functionalist purpose, but one that is above all cognitive. Technology and materials are not only used for an aesthetic or functional optimization of the object, but they themselves are an instrument of knowledge, capable of establishing a new mental relationship with the human beings.



_*DCs Figure 4. Speculation / Practice, Author's Study Graph, 2020.* Uninterrupted making processes, where the functional object is replaced by the speculative object, understood as a tool for critical reflection, outcome of a never-ending evolution.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

From trustful empowerment to overwhelming guilt: pedagogy in current activism practices.

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Abstract | This paper seeks to unpack the pedagogical value of environmental activism as a practice within the context of a medium-sized Danish city. The approach of an empirical field study, conducted as through immersive observation and combining knowledge from activism theory, communication design and ethnography, led the research to deepen a behavioral understanding of design practice through sensory ethnography, workshop and interview. The findings showed the role of trust as a base for growing a powerful community. A design experiment was carried out to recontextualize, reflect and test the previously observed elements out. Understanding this behavioral logic could create knowledge for empowering communication assets. Acting as observer, objective interviewer, activist-facilitator, the author highlights activism as a multifaceted empowering platform that tends to create social meaning among citizens and develop knowledge for all, but which could eventually, on the other hand, stimulate guilt and rout if the message formulation misses its audience.

KEYWORDS | ACTIVISM, ETHNOGRAPHY, COMMUNICATION DESIGN, PEDAGOGY

1. Introduction

Protest is an ancient practice, predominantly concerned with the correction of injustice (Beder, 1991). Protest actions such as demonstrations, blockades, protest marches and meetings are the traditional method for groups of people to communicate to the wider public. It is used as:

> "a method for involving people in a meaningful experience in challenging unjust laws or actions; a way of demonstrating to others the depth of commitment felt by a group about an issue; a means to obtain publicity and apply pressure on politicians" (Martin, 1984; Beder, 1991).

Activists are daring citizens willing to raise their voices and get involved in public life. This paper investigates insights for the pedagogical quality of the mediation of activists in the community. Visual communication is built around the purpose of conveying messages and, in this case, communication works as an exchange between activist as designer and the audience to create response-ability and engage a conversation (Martin, 1984; Bush, 2003).

This paper is about observations of a four-month-old pacifist volunteer group, Food:Re:Formers, (also referred to as “FRF”) in a medium-sized Danish city. Organized as an informal egalitarian grouping, the volunteer base is composed of local students and young activists. With very limited financial resources, they rely mainly on the active participation of their supporters (Pickard, 2019). Focussing on the local area, the group aims for the reduction of food waste and the engagement of local stakeholders, centering their work around the value of sharing. They engage with citizens as well as policy makers through workshops, events and discussions in order to raise awareness around the issue and what is required to address it. The empirical focus of this dissertation is shaped around the ways in which the Food:Re:Formers share knowledge and shape their stakeholders’ relationship. The study concerns the quality of the activists’ workshop and its effect on citizens’ involvement. The question was whether and how the teaching experience facilitated by the activists from Food:Re:Formers caused a change in the audience’s behavior.

2. Methodology

Through action research (Checkland et al., 1998), the effect of an activist informative experience on an “inactive” audience was studied using the following methodology : participatory observation (Allen, 2017), sensory ethnography (Pink, 2019), visual data collection such as photo ethnography, drawing; audio recording, surveys, formal and biographical interviews (Levinson, 1978) with volunteers and stakeholders. This dissertation analyses how the sender and receiver of a message interact and learn from each other, within a realist environmentalist context (Hasler et al., 2019). Through this blend of data collection the author tried to comprehend the way the Food:Re:Formers use pedagogy and inclusion to achieve understanding and spark action amongst their audience (Sauvé, 2017).

Firstly, a literature review into activist practice and environmental pedagogy was conducted. Observational research in the field was then used to create knowledge through immersion into the FRF's organization. This took the form of a group discussion and was documented through notes and photography. Conducted in parallel, an ethnographic interview of the two co-founders was operated, alongside with sensory ethnography methodologies. The first interaction with the group lead to participatory observation, putting an end to our contextualizing phase and beginning an empathic understanding of our area of concern which would, in an action research perspective, develop our framework of ideas. In order to gain further access to the teaching intentions as well as experiencing direct contact with the audience (Kolding citizens), we completed our participatory observation of the event with a research planning survey. The gathered insights helped finalize a research participant map coupled with a user-groups definition to understand the variety of stakeholders involved in or revolving around FRF.

The preceding observations lead to a grounded conception, by way of the generation of design principles and of an experience simulation coupled with field activity. These worked in combination as a design experiment and helped to explore the role of facilitation within an educational sustainable food picking concept. By this means behavior patterns were observed and insights gained. The ladder intervention was purposely held outside the Food:Re:Formers' context in order to implement the knowledge of action previously collected into the real world, while addressing a similar audience (Sanders et al., 2012). In essence, and to understand how FRFs work, the workshop modelled on their approach was carried out by the researcher, at a school, for lunch time, involving a similar audience and topic.

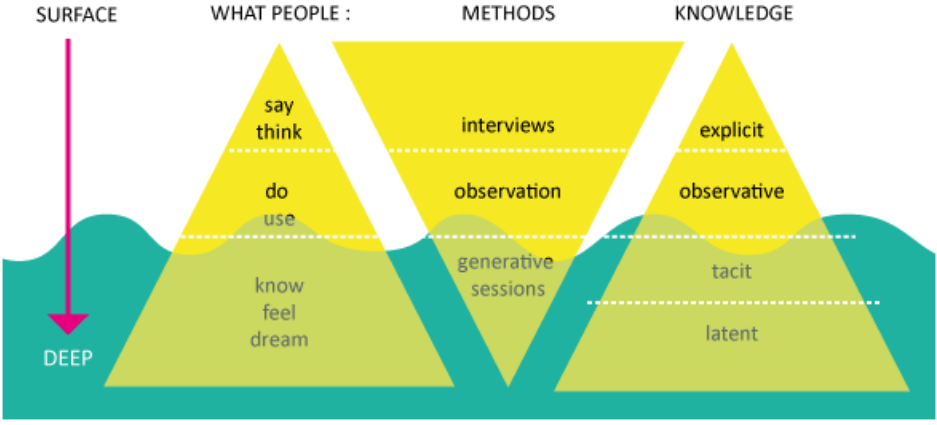

Figure 1. Sanders et al., 2012.

3. In action: recipe for knowledge sharing

Three main situations were observed during a two-week time frame: (1) the volunteer meeting, (2) the Dumpster Dinner and (3) the Smørrebrød workshop. The first two instances were organized by the FRF. The aim in the first session was to get an understanding of their inner organization and their point of action; and for the second session, the aim was to observe their interaction with stakeholders. The third session was a design experiment created in order to put into action the collected knowledge and comprehend its components outside the context of the activist group. So: first the author observed the FRF activities, developed a model of them and then set about testing this model by simulating the FRF approach.

3.1 Preparation

This section explains the FRF's organization (internal organization and relation to the community) and action plan for the event to come (the Dumpster Dinner).

The first part of preparation is the volunteer meeting: a closed working day where the agenda is decided. It helps ensure everyone has the same information. Based upon observations and corroboration through an ethnographic interview, there appears to be no leader in the group; the organization seems horizontal (Pickard, 2019). Every participant is invited to pick a role which suits them best in terms of time and skills. The meetings take place in the new headquarters offered by the municipality (Hasler et al, 2019). Equipped with a brand-new shared kitchen, the area resembles a living-room: a large "family" table, around which participants take part, is set out with a large amount of food.

The food is provided by a local anonymous collaborator shop as surplus food (items which cannot be sold due to superficial damage of the packaging or contents). The items were collected by the volunteers as the main resources for the upcoming Dumpster Dinner. The process of sorting (items past the sell-by date), cleaning and preparing the food is a chance for the volunteers to get to know each other and to share tips and recipes, increasing the collective knowledge of the group, and testing out the recipes which will be served during the next event.



Figure 2. Food:Re:Formers in their headquarter kitchen.

3.2 Cook!

This section explains the FRF's facilitation role during the event (the Dumpster Dinner), as well as the setup for it.

The FRF´s competence sits in raising awareness and creating events to inform about the issue of food waste. By these means, they aim to activate their local community. The main "external" monthly action, the Dumpster Dinner is a three-hour event where fifty people are served with a meal made from surplus food. The event is inclusive, free, open to everyone and created in collaboration with Tobber's, a well-known local restaurant. The dinner is thoroughly planned and cooked in a team-effort. In the dining room, the guests snack on appetizers, socialize and learn. A lecture about the new local recycling system is given, followed by a "conversation starter" activity where strangers from the same table are invited to share knowledge from their (un)sustainable daily practices. After this hour of extra-activity, the buffet is presented. To find out what kind of citizens this event attracts, research planning surveys were handed out. This data collection was meant for the participants to express their "before" and "after" impressions and thoughts of the event. 52 questionnaires were distributed and 35 collected.



Figure 3. Volunteers cooking for the Dumpster Dinner.



Figure 4. Participants of the Dumpster Dinner evening.

3.3 The Smørrebrød workshop

A design experiment was held as a method to determine the relationship between factors affecting the FRF process and its output. This section explains the design experiment inspired from observing FRF actions. The facilitation role was intentionally removed and replaced by textual content, presenting the ecological footprint of the showcased ingredients. Here, the author wanted to test the importance of the facilitation wrapped up within the experience.

Inspired by Shameplane.com's approach to showing data upfront (Müller, 2018), this workshop was an attempt to move the audience through informative content. Inspired from previously collected insights from the FRF modus operandi (Kimbell, 2012) such as: inviting participants, building a trust ground, using food as a conversation starter, providing the participant with freedom of choice and information about their consumption. It was organized without input from FRF. The workshop took place at a higher-education school. It was aimed at local Kolding citizens and internationals (six participants, aged from 21 to 54). They were invited, during their lunch break, to create their smørrebrød (typical Danish lunch composed of a slice of bread and a selection of ingredients on top) in two stages.

First came the smørrebrød creation, then, an individual written questionnaire. The participants received the following materials: plates, cutleries, their regular canteen environment, a variety of the most regular components of smørrebrød (rye bread, tomatoes, salmon, cucumber, pâté, cheese, boiled eggs, hummus, mayonnaise). Key component of the workshop, data sheets bearing further information about the environmental cost of each of the dietary pieces. Designed to be as visual and fast-to-read as possible, the ladders were placed next to their related piece of food. During the second phase, participants were provided with a questionnaire so they could reflect on their actions. They were asked to respond, without interaction with other participants. The researcher played a very light facilitation role, directing participants from phase 1 to phase 2.



Figure 5. Participant of the workshop making smørrebrød.



Figure 6. Participant answering the Smørrebrød Workshop's survey.

4. Taste as result

Though recent, the organization of the FRF is settled. With a core of about 30 activists from various backgrounds, the group has started onboarding local stakeholders and created a bridge with their audience, raising awareness through creative and engaging platforms. Their will to teach and share is assumed, the co-founders mentioning their wish to make a change from the bottom by influencing behaviors through criticality. Though efficient, their gathering concept, collecting citizens from various levels of eco-engagement, remained, as from the results of the research planning survey, fairly superficial. Succeeding in raising awareness, there seem to remain a weakness in action taking from the audience side. As an attempt to explore the facilitation role, the Smørrebrød workshop was designed to encourage action taking and criticality by inviting the audience to act by themselves and follow their judgement. Our model might not be accurate as the length, type of food & context differs. But this brief experience helps us comprehend by collecting insights. It was observed in participants' behaviors and reflected in their answer to the reflective questionnaire, that some of them were distracted or uncertain, when their decision process seemed to be disrupted by the presence of data sheets; while others navigated peacefully in the buffet, picking ingredients "eyes closed". The majority of participants expressed guilt as a result of their food choice in relation to their sense of sustainability.

5. Discussion of the research

Often comprised of a blend of political participation, civic engagement, and compromises (Diaz Romero, 2013), activist movements are a peer-to-peer platform of interaction as well as a bottom-up voice which attempt to be heard among numerous other groups both local and global. They are actors campaigning for environmental protection, seeking to confront and disrupt governments and corporate power. These environmentalists -classified as greens, from the light negotiators, to the dark provocateurs- exist in multiple shapes (Beder, 1991; Hasler et al., 2019), and act both against and with the states as seekers of a working relationship with policy makers (Hasler et al., 2019). Nevertheless, even activists of the lightest green complexion are, by their actions, confrontational in some way and for a person or group to choose such a strategy generally demonstrates a lack of faith in society's decision-making structures or a lack of access to formal communication channels with decision-makers. Protest action is the resort of the weak. It is the action of those outside of the power structure and, as such, protestors are only weakly able to influence the way governments will respond to the pressures placed on them (Beder, 1991).

From the field study, three targeted stakeholder groups have been identified: volunteers (active citizens), (inactive) citizens, policymakers. For volunteers, who already possess a level of sustainable education, FRF wants to be a platform for sharing and developing their sustainable involvement, as well as networking. Assuming citizens lack sufficient knowledge about the environment, the aims of FRF are to inform them, get them into action, to

provoke and to inspire new habits. The aforementioned stakeholders are very likely to spread the word and onboard their community, reaching policymakers as a consequence of the demand to come. The third stakeholder group, also directly targeted by FRF, includes the municipality, stores and local businesses. These empowered actors are the only ones able to make a global-scale difference and are of a key interest in the action.

“Ground trust” is basic for encouraging coordinated action with each one of their stakeholders. None of the FRF ingredients of action is chosen without consideration. First, the FRF only uses invitations and never forces interactions. Second, the activist always talks eye-to-eye, in a day-to-day manner, which emphasizes equality, inclusion and transparency in the conversation. Third, the chosen medium, food, is an inexhaustible topic of discussion, incredibly creative and non-confrontational. It is a social mediator, a daily routine, a shared and relatable community value (McCoy, 2003); donated by familiar supermarkets and selected with care by expert activists. Finally, the context, Tobber’s restaurant, is a safe and known place for Kolding residents. The chef is known for his quality food, and the environment is cozy. The event has gained a good reputation and has been recommended by relatives or the local news. The participants of the dinner are not perfect strangers, but familiar faces who can be met around town. To put it in a nutshell, the very local context of Kolding community as well as the FRF methodical modus operandi plays a strong role in trust building and invites knowledge sharing. Trust is a soil for growth.

Picking from the previously cited ingredients, we have attempted to mimic the activists’ action but reduced the role of the potentially essential part: the facilitator. Regretting a lacking bridge between the food prep and its eating phase during the Dumpster Dinner event, we have decided to take it as a pretext to empower the participants of the Smørrebrød Workshop. This was under the assumption that consumers would be happy to get more knowledge about the provisions they are used to buying for themselves and will take more considered decisions, which would make them reflect on their usual pick. Unexpectedly, and probably because of the purposely removed facilitation action, when presented with such an amount of information, some participants experienced confusion and felt overwhelmed. All of them were affected by the information but responded in different ways. One group would ignore the information notes, while the second one would consider them but would feel guilty about their selection. There is an interesting bridge we can create here, resulting from this last observation: guilt seems to be the result of the overwhelming feeling created by the weight of the content. On the contrary, during FRF activities, it seemed like the volunteers’ facilitation eases the burden of serious of the topic, making it more digestible for the audience. There is here a clear, mappable pattern of guilt contrasting with empowerment and trust drawing at the horizon as our research led us into deeper feeling observation (Sanders et al., 2012).

6. Conclusion

This empirical study was to explore the sharing mechanics of pedagogy, the bridge between this activist group to their direct environment. Observations show their use of a variety of methods: the volunteer welcome day, the Dumpster Dinner. Further insights were gained through artefacts and experiments: interviews, surveys, documenting on site, workshop. The gathered knowledge seeks to map out an understanding of the pedagogical approach of activism.
It was my objective to participate as much as feasible in the FRF actions and call up my communication skills and knowledge in the sender-receiver exchange process, in order to understand the needs. My role as a researcher was multifaceted, interchanging from spectator to participant.

Design is about the recognition of the human element in communicating. FRF's methods are intuitively dealing with this through the facilitation. The message is in part the medium (MacLuhan, 1964). The researcher intended through the workshop to explore this facilitation role by removing and replacing it with informational sheets. Providing to the participant the same informational content, the inanimate bit was designed graphically to improve its accessibility (time and content). Attempting to compensate the role of facilitator, the designer acted here as a visual translator and information designer. Whether or not the role facilitator could be reshaped into raw facts delivered through a graphically optimized medium was explored. The ladder experiment resulted in an unexpected answer from the audience, a raise of conscious provoking a feeling of guilt so far unperceived and unexpressed during the two first sessions.

FRF is a key platform, bridging citizens as well as the rest of their stakeholders towards the reality of facts. Leader of their community, they want to spark action amongst citizens as well as local representatives of power (stores, municipality, local businesses, etc.). Most of the time senders of messages, the FRF is also an open space for sharing, from citizens to stake-holders, and the other way round; but most important, FRF is opened-ears as well and flexible enough to support and learn from their community. This learning-from-each-other dynamic is helping the community grow towards sustainability and inclusivity.

Observed at every stage of the activists' action when presented with facts to process, we can identify two responses from stakeholders: empowerment, often resulting from a pattern of trust-building followed by an invitation to acting and/or share an experience; on the other hand, confusion looms when a pattern of overwhelming information coupled with a shaming tone of the message. At the extreme we have noticed in that case of decision making, confusion leads to the feeling of guilt for the participants.

Activism bears many interests from a communication design perspective, I have focused my interest on the educative quality of the activist's message, in all the various forms it could take (content, meaning, medium). The safe space of interaction they created as well as this strong ground of trust make them distinguished game-changers amongst their community.

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Acknowledgements: Warm thanks to Food:Re:Former's for their open arms, Patricia Csobánczi for accompanying this research, Louis Rose for the mental support. Grateful to Ulla Ræbild and Richard Herriott for their wisdom.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Guilty Materiality: why we play down material relations.

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Abstract | In a recent conference keynote, a key researcher on influencing product lifetimes through product design presented her current hierarchy of strategies for the implementation of a circular economy. Not surprisingly at the top of this list are refuse (do not buy) and reduce (consume less), closely followed by reuse, repair and refurbish. Moving to a circular economy involves paying attention to, and prolonging the lifecycle of the material artefacts we use. While material relations are at the centre of the consumption habits we now need to modify, there are many reasons why engaging with materiality may be avoided. As designers we don't tend to look systematically at the different reasons why attention is not paid to a large part of material relations. Therefore this paper aims to present and discuss, in a more systematic way, the different factors that generate what could be termed 'guilty materiality'.

KEYWORDS | MATERIALITY, PERSON-PRODUCT RELATIONSHIPS, SUSTAINABLE CONSUMPTION, KEEPING HABITS, ENTANGLEMENT

1. Introduction

In a recent conference keynote, the co-author of a seminal article (van Nes & Cramer, 2005) on influencing product lifetimes through product design spelled out her hierarchy of strategies for the implementation of a circular economy (Cramer, 2019). Not surprisingly at the top of this list of ten points are refuse (do not buy) and reduce (consume less), closely followed by reuse, repair and refurbish. Moving to a circular economy involves paying attention to, and prolonging the lifecycle of the material artefacts we use. While material relations are at the centre of the consumption habits we now need to modify, there are many reasons why engaging with materiality may be avoided. As designers we don't tend to look systematically at why, as a society, we avoid paying attention to a large part of material relations. Therefore this paper aims to present and discuss, in a more systematic way, the different factors that generate what could be termed 'guilty materiality'.

Identifying the different themes that negatively influence the way we consider material objects is a somewhat subjective issue. For this reason, the selection of possible themes presented here cannot be considered exhaustive. The aim is therefore to explore a certain number of themes which could potentially modify our relations with material artefacts.

Insights from addressing this subject with master's level design students and from wider research into longer product relations support this discussion. Out of eight different studies into longer product relations carried out between 2012 and 2019, three in particular (see Table 1, below) highlight ambiguous aspects of material product relations and reasons why we may tend to overlook or avoid these relations. This research involves two different cohorts and research protocols: design students on one hand in an inventory based study, and two different groups of (non-designer) adults aged between 40 and 71 in an inventory-based study and a cultural probe based study (Gaver, Dunne & Pacenti, 1995, Mattelmaki, 2006).

Table 1. Overview of 3 studies into longer product relations

study name	content	participants	main instructions given	output
1. DAILY STUFF THAT MATTERS	Mini-(memory) inventory	**35** *18 - 25yrs*	think about and note down ten everyday objects that matter to you and that you plan to keep/keep using	sketched list with notes and comments
2. WHAT I SEE AT HOME	Virtual + in-situ recorded oral inventory	3 45 - 55yrs	a) describe all the objects you see when you visualise your kitchen, b) other objects visible in kitchen not mentioned in a)	audio recording transcribed, researcher notes + photographs
3. probe of everyday things	Probes, starting with all I touch in a day inventory	8 40 - 71yrs	note everything you touch, at home, from morning 'til night. Don't note big furniture and fixed objects, nor single use items (eg: paper hanky, food)	Self-report notes in different formats, story-telling, photographs

2. Some problems with material object relations

> "By their number, their redundance, their superficiality, the lavishness of their forms, by playing with fashion, by everything about them that goes beyond their pure and simple function, objects do nothing but simulate the essence of sociability - STATUS…That is what generates this madness, this frenzied world of trinkets, of gadgets, of FETICHES which try to mark eternity with value, and in the absence of salvation by grace attempt salvation through things." (Baudrillard, 1970, p77 - 78)

Beyond the sphere of design, in everyday life, a certain number of themes can distort the way we look at material objects, and by extension distort our relations with them. The quote above from French sociologist, philosopher and cultural theorist Jean Baudrillard was written fifty years ago, but remains appropriate today and does not encourage us to have positive vision of our relations with objects. Starting this overview with a quote from the 1970s is also a useful reminder that negative attitudes towards material things and thing-relations are not a new phenomenon. In the design sphere attention is generally focused on the objects and products being created and their desirability, but there is perhaps not much attention paid to what makes us avoid products, objects and object relations. For this reason, it may be useful to try to identify themes which may negatively influence material object relations and perhaps contribute to making us avoid looking at things and the reality of our material relations.

2.1 Overflowing

A useful start-point is a theme that could be named "too much". Faced with the scale of the current environmental crisis, a natural reaction is illustrated by the words of Claudia Dona (1988, p152): "we live in a world overflowing with our own productions, a world in which objects besiege us, suffocate us…"

According to an article in the L.A. Times in 2014, the average American family possesses 300,000 things in their home. A detailed and widely cited study by a team of researchers at the UCLA, between 2001 and 2004, on 32 middle class Californian families noted even in the smallest house studied (90m^2 with two bedrooms and a living room) 2,260 objects visible. As an illustration of the profusion of things in every part of the homes, the study mentioned that each of the families on average had 55 things stuck to the surface of their refrigerators.

In the last twenty years there has clearly been a growing awareness of the number of objects in our homes. There has also been considerable communication around the subject, for example Graham Hill's (2011) TED talk entitled "Less Stuff More Happiness", or James Wallman's (2016) talk on "Stuffocation". Daniel Miller (2008) comments that "we live today in a world of ever more stuff - what seems a deluge of goods and shopping".

Even if these commentaries are a reflection of reality, looking at objects in terms of an undetermined mass or an incessant uncontrollable flood may also be a way of not

addressing directly our relations with these things. In a more recent work by Miller, the author notes that

> "Stuff is ubiquitous and problematic. But whatever our environmental fears or concerns over materialism, we will not be helped by either a theory of stuff, or an attitude to stuff, that simply tries to oppose ourselves to it…" (Miller, 2010, p5)

In study 2., in the form of virtual then in-situ inventory of what could be seen in their kitchens, the three participants (working mothers aged between 45 and 55) each overlooked a large majority of the things in their kitchens during the virtual recollected scan of their home space. Notably in each case the things overlooked and not mentioned were pots of kitchen utensils and cutlery, stacks of chopping boards and water jugs and bottles. This "stuff" simply didn't register in a vision of their kitchen at a distance, so while being problematic, some stuff is managed by being not seen.

2.2 Transitory

The stuff concerned by the 'deluge of goods' is perhaps mainly what Stuart Walker (2017) calls the "unremitting production and marketing of short-lived, unrepairable and often relatively trivial products…that arouse feelings of dissatisfaction and stimulate consumption and waste." There is a tendency to separate certain objects carrying meaning from the mass of trivial, cheap objects destined to become waste. The "Significant Objects" project of Rob Walker and Joshua Glenn illustrates this idea. , The authors bought a variety of trinkets without value, and then gave them value by asking writers to create stories about them, before re-selling them with the stories attached. The authors wanted to test whether adding "meaning" could artificially transform the value of an otherwise worthless artefact.

Chapman (2005) writes that 90% of material resources extracted today will become waste in less than three months. This suggests that there is a large percentage of "stuff" that never reaches the status of 'object' and transits directly and invisibly to the status of waste. This theme sees objects as something transitory; goods that don't reach the status of relation and go directly from acquisition to rubbish. Fromm (1976) describes the vicious circle of "consumer-buying" as; "Acquisition → transitory having and using → throwing away (or if possible, profitable exchange for a better model) →new acquisition." The goods are considered, from the start, as transitory, perhaps like the plastic toys described by Roland Barthes twenty years before Fromm: "chemical, in substance and colour, the material itself introduces a gut feeling/sensation (*cénesthésique*) of use, not of pleasure. These toys die by the way very quickly and, once dead, have no posthumous life for the child."

Chapman (2008) comments that many people detest our "throwaway society in which lack of quality is taken for granted". Walker (2004) writes that "all physical artefacts will sooner or later decay and be discarded, but their meaning and value can remain relevant" by associating utility, poetry and symbol. A more recent example of selecting objects by

meaning could be the “spark joy” test suggested by Marie Kondo, in the highly popular Netflix series (Chamberlin & Callmer, 2019).

Opposing meaningful and meaningless stuff might seem an unsatisfactory strategy considering the sheer quantity of things encountered. As Barthes suggests, a majority of things are probably unconsciously registered as transitory, and only in terms of their immediate use.

The ambivalent status of everyday use things can be illustrated by part of the verbatim in study 2. In the virtual scan, one participant thinks out loud “and then on the right-hand side there’s various things that we use quite often, so, kettle and pestle and mortar and tea and coffee jars”

When asked if any of these things matter, the participant, rather reluctantly says “The um, we’ve got a Bodum kettle, which is also probably the least annoying kettle I’ve ever had (laughing), so that’s quite good” The kettle, despite being “least annoying ever” didn’t really count as something that mattered, and needless to say, was replaced less than 3 months later.

2.3 Materially inept

Many of the objects in the “stuff” category don’t have a problem of material quality and adding meaning is not always a pertinent response. The comments in the previous section perhaps illustrate another theme that could be named “material ineptitude”. The example of the toothbrush is a good illustration of an object which is very durable but that we are meant to change every three months. It is in fact an object with too much material quality, for which we are only today starting to look for more environmentally relevant solutions. On this subject, it can be useful to add a comment of Barthes (1957, p172) on plastic as material, “…sublimed as movement, almost inexistent as a substance…entirely swallowed up in its use”. The use of certain materials (perhaps certain plastics) reinforces the invisibility and transitory nature of things and thus represents an inept material choice.

The case of toothbrushes concerns generally a combination of two or three plastic materials (polypropylene or polyethylene, nylon and sometimes silicon) but a clearly a product like the smart-phone contains nearly all the elements of the periodic table (Chapman, 2008). The question of material choices is highly complex, and may generate confusion, rejection or avoidance behaviour.

2.4 Toxic (materials and behavior)

Beyond simply inept or unadapted materials, actual toxicity is another theme that could generate negative object relations. If smart-phones represent one of the most visible examples of toxic materials, toxic forms of product and even behaviour that we could qualify as toxic, an example dating from the beginning of industrial design is also quite relevant. The

place of William Morris in the history of design tends to be in relation to using design and by extension well-designed products to improve lives, with for the person behind the production and the consumer. But even in the Victorian era, his wallpapers were suspected of making both workers and buyers ill. It is even more ironic that the colour responsible for poisoning was the colour green. Even after having stopped the use of arsenic in the pigments, in the 1870s following public pressure, Morris himself didn't believe in the toxicity of his products, writing to his dye manufacturer in 1885 "As to the arsenic scare, a greater folly is hardly possible to imagine: the doctors were being bitten by witch fever" (Kirby, 2003). The fact that pigments containing arsenic were already criticised for clothing in the 1860s (Hawksley, 2016) show the paradoxes and slow reactions around toxic products.

While toxicity might be a valid reason for negative opinions towards products, the cases of Victorian wallpaper and of today's smart-phone suggest that the influence is probably more ambiguous and more complex.

Individual research and presentation exercises with a group of final year product & service design masters students on the question of negative connotations of product relations drew attention to problems around plastic water bottles. Discussions within the class very quickly generated considerable interest and a certain anxiety, as none of the students (in 2019) were familiar with plastic leaching, and advice not to re-use old or damaged bottles.

Two insights from study 2. illustrate more ambiguous positions. One participant commented on a set of old plates "we've washed them so much, all the varnish is coming off. And I don't know if it's dangerous or not, because earthenware's got metal in it, but anyway, I'm attached to those plates, but I say we should stop using them because of that…" Another participant jokes about a vintage style toaster that doesn't have an on/off switch so is potentially quite dangerous "but at the same time it's very slim, it's small, it doesn't take up much space, so I can't bring myself to get rid of it".

The student reaction, as well as the two insights highlight that perhaps rather than toxicity, the key issue is perhaps lack of material knowledge.

2.5 Anti-social

The themes mentioned above may influence the way we think about (or don't think about) material objects. It is useful to also keep in mind themes not yet evoked that could be qualified as reasons for considering that relations with objects are in themselves a problem. Claudia Dona (1988, p152) writes that objects "very often distance us from one another both physically and mentally…they make us forget how to feel, to touch, to think". Miller (2010, p5) confirms that a common view is that "stuff somehow drains away our humanity" and that (Miller, 2008) our relations to things come at the expense of our relationships to people. Miller (2008) aims to prove the opposite view that at least in some cases "the closer our relationships are with objects, the closer our relationships are with people", but insights from all three studies suggest that people are often not comfortable admitting object

relations. A typical response in Study 2. commenting a favourite orange coloured mug: “it’s nice and big… I just like that one, it must be my autistic side”.

While directly admitting attachment to everyday objects appeared to initially be unnatural for many participants in the studies, identifying a social meaning was a very frequent and perhaps more acceptable first reason given for an object attachment.

2.6 Morally reprehensible

The arguments put forward by Erich Fromm in his book To Have or To Be (Fromm, 1978) illustrate why object relations may be seen as morally unacceptable. Citing Buddhism, as well as the Old and New Testaments, Fromm describes two fundamentally different modes of existence that are reflected in our daily lives. The “being” mode “means aliveness and authentic relatedness to the world. In the “having” mode the relation to the world is “one of possessing and owning” and Fromm (p65) signals that in this mode of existence,

> “All that matters is my acquisition of property and my unlimited right to keep what I have acquired. The having mode excludes others; it does not require and further effort on my part to keep my property or make productive use of it.”

Beyond the notion of relations to objects at the expense of relations to other humans, Fromm also details what is wrong with these relations: we should not be bound, tied, chained to what we own and what we have…things “are not in themselves “bad”, they become bad; that is when we hold onto them, when they become chains that interfere with our freedom and block our self-realisation.”

2.7 Entrapping

Fromm’s arguments evoke the difference between the static and enclosing nature of “having” and the movement, productivity and activity of “being”. Accumulation is seen as leading to being imprisoned and becoming a servant to our possessions. François Châtelet (1992) comments “those we call primitive peoples have a very good understanding of the problem that accumulation creates. The fact that it can enslave us and that it is not a crime to consume our stocks.”

In relation to themes of entanglement and dependence between humans and objects, Ian Hodder gives an explanation of the notion of “Hau” first described by Marcel Mauss:

> “Enchainment is created because of the “hau” of things—that is their need to be moved on, to be mobile. Gifts are treated as responsibilities that are to be quickly got rid of—it is wrong, impossible, for something to be stationary.” (2014, p22)

Another form of entrapment by objects is suggested by Bruno Latour (2000). In networks where humans are linked with objects, it is possible to question whether the control or mastery is in the hands of the humans or the (technical) objects, and this questions the distribution of power to act between different actors (human and non-human) within a

network. In many situations clearly things make us do things, and Latour gives these things the name "*faitiches*" - linking the verb "*faire*" (to do), and fetiche, highlighting how things in mediation can be seen as problematic.

A related point was raised by the group of master's students, who suggested adding the theme of objects-that-spy-on-us, and objects that collect information on us, which is clearly an issue of growing relevance.

In economic terms, the acquisition of goods (and the acquisition of income) generates a certain number of treadmill effects which in effect tie people down and thus limit freedom and movement. Binswanger (2006) notes four different kinds of these treadmills: a positional treadmill, a hedonic treadmill, a multi-option treadmill and a time-saving treadmill.

2.8 Materialistic

The positional treadmill proposed by Binswanger is related to the acquisition of goods as a means to acquire and keep social status. This theme can be linked to the idea of conspicuous consumption, described by Thorstein Veblen (1899). Ostentatious consumption of luxury goods was identified by Veblen as a means for gentlemen of leisure to gain respectability.

> "The superior gratification derived from the use and contemplation of costly and supposedly beautiful products is, commonly, in great measure a gratification of our sense of costliness masquerading under the name of beauty."

This form of consumption corresponds to the idea of terminal materialism, the fact of desiring objects for themselves (Belk, 2001). A more general definition of materialism given by Belk (2001) is the belief that possessions bring happiness. Belk also notes that in most studies more materialistic people are less satisfied with their lives than less materialistic people. The clearly negative image of materialism contributes to the fact that it can be difficult to admit many material object attachments.

Valerie Guillard (2009/2013), researcher in marketing and management science, identified a tendency that she differentiates from, but links to, materialism. Named the "tendency to keep everything" (*TTG/ tendance à tout garder*), this behaviour is defined as follows:

> "The chronic tendency to keep everything is a personal determinant which manifests itself with certain consumers in a stable and recurring fashion. It concerns useable objects, for which the consumers no longer have any use and are not worth selling."

Guillard suggests that our current consumption society is torn between excessive accumulation and rejecting waste. An interesting aspect of Guillard's research is the very negative description of this tendency. The author suggests effects may be dysfunction for the consumers and their social environment as well as restrictions to mobility. The notion of keeping things is seen as obviously problematic and strange, and the author expresses surprise at certain "TTG" consumers using objects right up to the end of their useful life. On

this point it might be useful to gauge whether ecological questions have modified opinions on this type of behaviour.

In the probe based study (3), completed in 2018, the notion of "keeping" things generated surprising results. Participants were asked to make a list of everything touched in one day, then refer back to the list and mark the things they planned to keep and continue to use. On average participants only marked 21, 8% of things touched during the day as being for keeping. Participants were also asked to note things for replacement in the near future. Very few things were marked in this category, which seemed to suggest, in the context of the study, that daily objects are not consciously for keeping or replacing, or rather that the lifespan of the objects is not something that is thought about. It can be useful to note that what is seen as critical in the Marie Kondo method of decluttering (Chamberlin & Callmer, 2019) is helping people to focus on what they love and want to keep, shifting people's attention away from feelings of guilt and loss.

2.9 Compulsive

In certain cases keeping objects reaches dangerous or pathological levels. Compulsive accumulation or "hoarding" is defined as; "the habitual practice of accumulating obsolete objects privately and the inability to dispose without clear conscious motivation or control" (Cherrier & Ponnor, 2006). The authors signal that the term hoarding initially referred to the behaviour of rats, collecting and transporting an immense variety of things. This extreme version of keeping things is likely to be familiar to many people. Two to five percent of the American population may have this pathology according to Frost and Steketee (2010), and two-thirds of people interviewed for their study of the phenomenon personally knew of a significant case of hoarding. Frost and Steketee illustrate how some examples of hoarders, like the Collyer brothers in New York become forms of urban legends, and are used as a threat by generations of parents to get their children to tidy their rooms.

On a more familiar scale, an essay on clutter (Baker, 1995) raises some useful points around everyday accumulation. Once it is named clutter, material is identified as a problem, as matter out of place. It is the impulse to collect then hating this trait in ourselves. Clutter is also "unstable and volatile" and the revenge of objects on design. Baker calls clutter

> "Disordered things that impede movement or reduce effectiveness …That part of our "self" that escapes "our" control, "proper" control, and is all the more galling for being represented by dumb objects, disobedient objects."

These points made in relation to clutter are an effective conclusion. Our stuff and clutter is a reflexion of our behaviour, and is also in many ways out of control, and our relations with material objects are also unstable and complex.

3. Conclusion/Implications

The aim of this presentation of themes that may generate forms of "guilty materiality" is to show the diversity of the question. The breadth of the subject means that this presentation cannot be considered exhaustive, and the scope of this article does not allow for detailed development. The table below (Table 2.) gives an overview of the themes mentioned. While the ethnographic studies cited here can confirm the possible influence of some themes on object relations, these findings are as yet only indications.

Table 2. Themes that may negatively influence relations with things

1	**too much**	things overflowing, flooding, becoming unmanageable
2	**stuff**	unidentified material, unseen
3	**waste**	things without value
4	**short lived**	seen as transitory
5	**inept materials**	unadapted to life-cycles
6	**material confusion**	and lack of material knowledge
7	**toxic materials**	and lack of information and reaction
8	**toxic behaviour**	and behaviour dictated by things
9	**anti-social**	object relations detract from human relations
10	**morally wrong**	we should aim for "being" rather than "having"
11	**entrapping**	objects can entangle or trap us
12	**restrict movement**	treadmill effects, restricting personal mobility
13	**materialism**	desiring things for themselves
14	**spying**	objects can spy on us, and collect information
15	**hoarding**	pathological behaviour
16	**clutter**	matter out of control,reflecting our lack of control

Further research on the above themes would be useful to better understand negative biases linked to material relations. Stigmatising and ignoring material relations is probably not useful in environmental terms, and may contribute to inappropriate behaviour. Understanding these biases can help to rethink and inform design for more responsible material relations.

This study aims to introduce a question that deserves further exploration, and also identify a number of possible directions for that research. The negative connotations linked to material relations constitute an important study area for the influence they may have on appropriate sustainable material-related behaviour in the near future.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

MANIFESTO! Now: Game Design for Revolutionary Thinking

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Abstract | This paper presents recent work designing and testing a card game for manifesto writing, including a new edition that focuses on the "Future(s) of Europe" as well as a digital edition. The game began in 2019 with a "Tech Edition" and has since been tested in classrooms and grassroots organisations across Europe. Beyond the basic rules, each trial has brought about significant modifications: in terms of content, timing, number and type of cards permitted, and other aspects of gameplay. In our game the manifesto is conceived of as a *revolutionary* genre - a tool for activists in challenging and complex times. By developing a new set of "provocations" for our European edition, on themes like climate action, countering extremism, the need for unity, action against racism, and finding empowering uses of digitalization, our aim is to help rebuild the commons and encourage consensus on the most difficult issues we face.

KEYWORDS | MANIFESTOS, GAME DESIGN, ACTIVISM, CREATIVE SUBVERSION

1. Come, comrades

This paper presents recent work designing and testing a card game for manifesto writing, including a new forthcoming edition that focuses on the "Future(s) of Europe" and a digital edition. The game, which began with a "Tech Edition" created for a conference on human-computer interaction (Hanna, 2019), has since been tested in university classrooms and grassroots organizations in locations across Europe. Beyond the basic rules (described in Section 3.1), each trial has brought about significant modifications: in terms of content, timing, number and type of cards permitted, forms of collaboration, and other aspects of gameplay.



Figure 1. MANIFESTO! the game. ©Words in Freedom Project.

At its most basic, a manifesto may be defined as a public declaration issued by a group or individual with the purpose of declaring principles and aims. In our game the manifesto is conceived of more specifically as a *revolutionary* genre - a "tool for change" (Hanna, 2019) that by "defining and enacting the identities of radical groups, individuals, and parties ... has galvanized revolutionary movements" for centuries (Lyon, 1999, p.1). In the digital age manifestos have been present since the beginning, for example in declarations made by hackers, cyberfeminists, and techno-utopians. Manifestos are arguably timelier now than ever; while they hold great potential for constructive change, they also reflect the dangers of extremism

and a fragmented populace. The return of a form that was so ubiquitous in periods of crisis is symptomatic of our present upheaval. On balance, however, the manifesto will be presented as a unique and indispensable tool for activists in challenging and complex times. Drawing on our experience collaborating with the Collective Intelligence Unit of the UK innovation organization Nesta to create a "manifesto toolkit" (Section 3.2), we will argue that helping people to articulate their views and crowdsource common principles on key topics is a worthwhile activity.

2. Games for political change

Games by their very nature present a certain ideological worldview, and the rules of the game normalize that worldview. A chess player can only win by defeating the enemy through violence, and by implicitly accepting a system of hierarchy and class centered on the monarchy. Popular children's games such as The Game of Life and Monopoly reinforce culturally specific, often conservative values, for example that the winner is the person who accumulates the most capital by whatever means necessary. Golf enshrines class privilege through the relationship of caddy and player, and through the levying of costly membership fees for use of privately owned land. Under the pretense of innocent fun, games, like all designed objects, tend to reproduce the social relations and ideology of the society in which they were created.

How then do we create games that give players new frameworks in which to think, challenge entrenched ideas, and support meaningful social critique? The French Marxist theorist Guy Debord's Le Jue de la Guerre, in which opponents wrestle with "contesting interpretations of the topology of physical space under spectacular capitalism", offers one interesting example. It not only contains a critique of Western capitalist society but also offers itself as a training tool for the means of changing it (Barbrook, 2015). Under the auspices of "gamification" there have been many attempts to directly leverage games to modify behaviour. In 2007, a game called World Without Oil placed 1,700 players in a fictional oil-scarce world. In the three years that followed, it was reported that most players kept up the fuel saving habits they had learned in gameplay (McGonigal, 2010). Evoke, a game deployed by the World Bank in over-exploited economies, asks players to solve major natural catastrophes and epidemics, largely using profit and market-driven solutions (Waddington, 2013). Games like The Day We Left seek to raise awareness: at the height of the Syrian war, this game placed players within a Syrian family trying to escape the war zone. Its aim was to act as a counter-narrative to stories promoted by privately owned media corporations that Syrian refugees in the West were part of an undercover invasion by Islamic State (Wong, 2016).

Like games, manifestos seek to structure reality. However, while games generally create a reality separate from and in parallel to our own, manifestos attempt to (re)structure *actual* reality through revolutionary speech acts (Puchner, 2006, p.23). Most games leave the "real"

world unaffected, at most changing a player's perspective on the world, whereas a manifesto ideally lays out a path towards or provokes a rupture leading to actual change. By bringing the two together, what we have done in the various editions of our game is to create a system, either open or closed, in which the larger system can be questioned and reimagined (and even, in the closed system, safely smashed). The outcome of the game is a manifesto. Players are permitted to act as revolutionaries, but they are also encouraged to create lines of reasoning and critique that can extend outwards, beyond the limits of the game, to address and unsettle real world systems and institutions.

3. MANIFESTO!

3.1 Tech Edition

MANIFESTO! is a card game for individual or group manifesto writing. While it stands alone as an analogue game, it also serves as a design probe for the Words in Freedom project. The first iteration (the "Tech Edition") was developed in 2019 and first deployed at the annual CHI conference the same year (Hanna, 2019). We wanted to use the game to engage players around issues affecting all of us within technology-related disciplines (and the wider world we live in), in order to: 1) take the temperature of colleagues in the field on adopting a more activist stance, 2) test our notion of manifesto writing as a key activity in pushing technology in a more progressive direction, and 3) test our game for subsequent iterations, and as a design probe for inspiring new collaborative authoring tools, both analogue and digital.

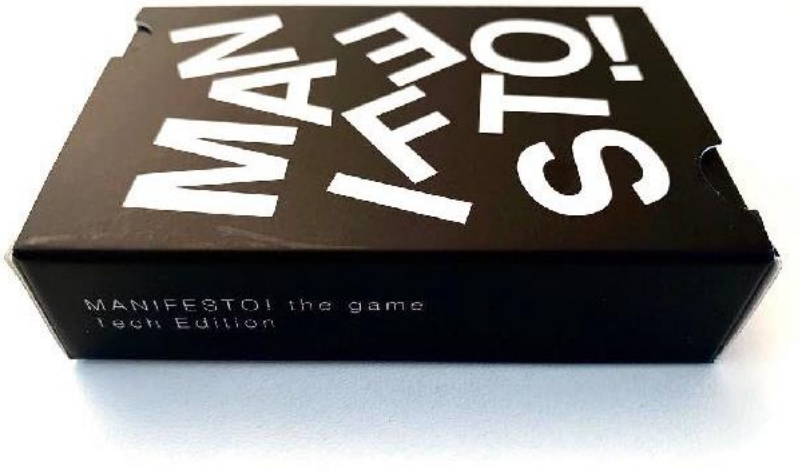

Figure 2. MANIFESTO! Tech Edition. ©Words in Freedom Project.

The rules are as follows: it is a game for individuals or groups of 2-6 players. In each round, player(s) are dealt one random card from each of four categories: Provocation, Orientation, Opening, and Tone. One card substitution is allowed per round. The categories each define a different parameter or constraint of the overall objective. Provocation suggests a broad topic or theme (e.g. “Better for whom?”); Orientation designates the type of manifesto players will create (e.g. “Declaration”); Opening offers the initial phrase (e.g. “We declare”); and Tone is the rhetorical register to be used in addressing the subject or audience (e.g. “Hopeful”). Players use these four constraints as a prompt to write or draw their manifesto individually or collectively. Each round can be timed (we suggest 10-15 minutes per round) or open-ended. When a round is complete players vote for the “winner” - the most persuasive manifesto - and are encouraged to disseminate the text either publicly or privately as a means of continuing the discussion. Having players take turns performing their manifestos in an exaggerated dramatic style is also recommended.



Figure 3. MANIFESTO! Facilitator.

MANIFESTO! was inspired in part by The Thing From The Future (TTFTF), Stuart Candy and Jeff Watson’s design fiction game, which was made to be “hacked and customised” (Candy, 2015). Like TTFTF, MANIFESTO! is distributed under a Creative Commons (BY-NC-SA) licence. Beyond the simple prompt-based game structure, there are significant differences between

MANIFESTO! and TTFTF. While TTFTF encourages players to create an everyday object (e.g. a postcard) that tells a story about a possible future, MANIFESTO! seeks to focus players on thinking about real possibilities for change in the present. In this first edition, MANIFESTO! featured roughly half as many cards (53 instead of 108), a modified game sheet with combined text/image authoring space and room to place actual cards, and colour-coding on card backs to indicate the four categories, which were also different: Orientation, Opening, Provocation and Tone in place of TTFTF's Arc, Terrain, Object and Mood.

In designing MANIFESTO! we sought to allow for productive dissonance between the four cards of a given hand, inspired by the anarchic and chance-driven processes of 20th century avant-garde movements such as Dada, Surrealism, and Fluxus. After all, the avant-garde manifestos of the last century serve as positive models of disruption through noisy provocation, creating new realities on the fly, as R. B. Kitaj does in his *First Diasporist Manifesto* (1989):

> "Diasporist painting, which I just made up, is enacted under peculiar historical and personal freedoms, stresses, dislocations, rupture and momentum" (qtd. in Caws, 2001, p. xxix).

Or as Tristan Tzara declares in his effervescent Dada Manifesto of 1918: "Dada: abolition of prophets: Dada: abolition of the future: Dada; absolute and unquestionable faith in every god that is the immediate product of spontaneity: Dada; elegant and unprejudiced leap from a harmony to the other sphere; trajectory of a word tossed like a screeching phonograph record" (Danchev, 2011, p. 144). Manifestos embody impatience with the old ways, and a push to imagine and realise new ones as quickly as possible: here, now, today.

We encouraged players to subvert the rules of the game if they wished, and in testing many players took advantage of this opportunity to co-create the game with us. These "creative subversions" fell mainly into two types: taking back control, and trying to make the game more democratic. There were several instances where players seized control of various aspects of gameplay to make the game more interesting or better suited to their needs. For example, some players wanted to choose cards that reflected issues they care about, rather than having them dealt at random. In terms of making the game more democratic, one group chose to give every member a chance to lead rather than nominating a single leader. Another group chose not to have a leader at all, while a third group decided to split into two smaller factions because they could not agree on a single set of principles.

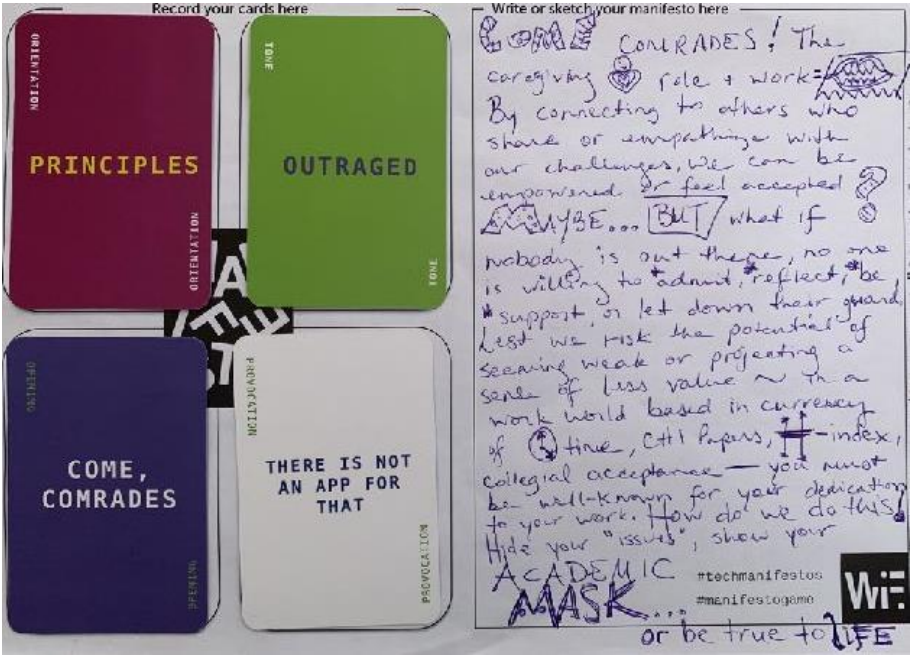

Figure 4. Example manifesto.

3.2 Nesta Collective Intelligence Edition

In late 2019 we repurposed MANIFESTO! to help stakeholders produce a mission statement or list of guiding principles for collective intelligence, in collaboration with a leading UK innovation institute. Working closely with Nesta, we developed a manifesto writing toolkit - a new edition of MANIFESTO! with accompanying rules and materials - to help researchers and practitioners articulate ideas for change, define a set of shared values, and create a sense of community around the idea of collective intelligence.

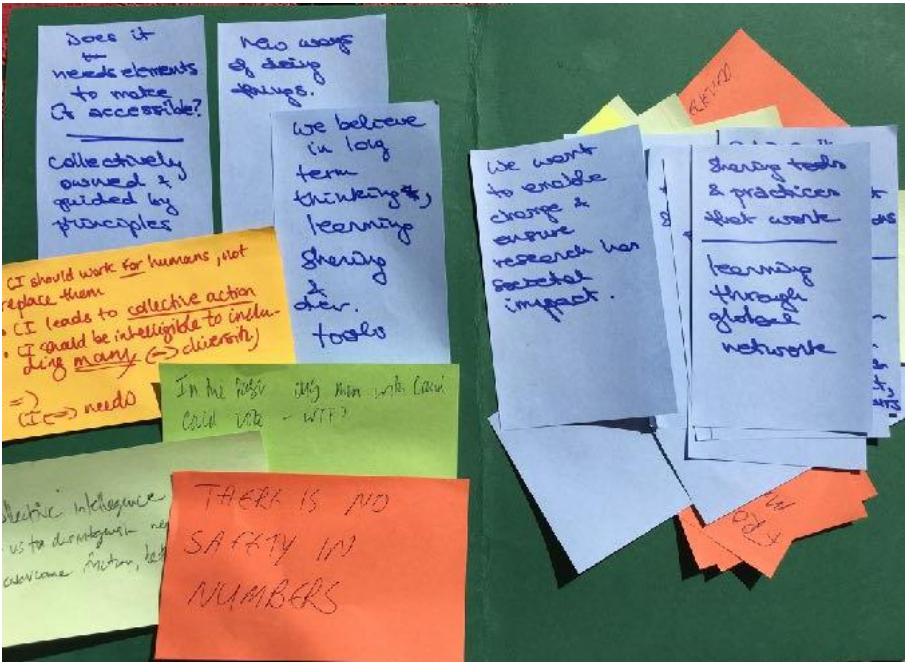

Figure 5. Nesta collective intelligence manifesto brainstorm.

Over the course of two workshops, we introduced the game, played one hand of cards, facilitated discussions around the topic, and gathered the resulting manifestos with five points each from the seven groups that participated. We then extended the discussion to a wider online community interested in collective intelligence using the polling platform Sli.do, allowing anyone interested in the topic to vote on the most important or compelling principles. This crowdsourcing process helped us winnow the original 35 principles (total) down to the top ten. After a week of voting, the following list emerged of the most popular principles (in order):

1. Ask yourself, how can you prevent bias from being replicated? Collective intelligence needs collective diversity.
2. Collective intelligence should serve an equitable distribution of power.
3. Let's use collective intelligence to build empowerment, ownership, and agency.
4. Seek the intelligence of the many; in all its diversity and forms.
5. Imagine if everyone could use, access, and benefit from collective intelligence.
6. Enable change and ensure research has societal impact.

7. Give the unheard a voice, and give that voice power.
8. We believe in sharing tools and thinking.
9. Re-imagine and build new tools - based on the experiences of the many, not the few.
10. AI currently works in the interest of capital - let's use collective intelligence to drive social change. (Grobbink, 2019)



Figure 6. Nesta Collective Intelligence Edition cards and game board.

The rules of gameplay for this edition were significantly different from the original version. The main reason was the shift in purpose or desired outcome: in this case we wanted players to come together and write a manifesto on a common, predetermined theme (i.e. collective intelligence) rather than focusing on a particular, randomly chosen issue (e.g. gender, surveillance, access, machine learning, etc.) on the subject of technology and ethics. In this new edition there were only three categories rather than four - Orientation was unnecessary because everyone was writing the same type of manifesto, i.e. a list of principles. Players were handed one Tone card, and three each of the Opening and Provocation cards, which they used for inspiration rather than as strict constraints. They were permitted to draw additional Provocation cards if they needed more ideas. The game was also slightly longer than

usual, being timed at 20 minutes. The materials - cards, gamesheet, and board - were all re-designed to suit the theme and context, as were the phrases on the cards themselves. We learned from this edition that MANIFESTO! can be successfully tailored to address a specific topic and fulfill a practical goal, and that multiple group manifestos on the same theme can be combined and voted on to produce a single crowdsourced "master" list of principles.

3.3 Future(s) of Europe Edition



Figure 7. MANIFESTO! Future(s) of Europe Edition cards.

The latest physical edition of MANIFESTO! will focus on the possible futures of Europe, where our group is based, to encourage discussion, engagement and envisioning at a time when faith in politics is at an all-time low and hope in the future is collapsing under the weight of the pandemic, the spread of conspiracy theories and false news, grim predictions of environmental and economic collapse, and dystopian visions of society in the vein of *Black Mirror*. By crowdsourcing a new set of "provocations" for our Future(s) of Europe edition, on themes like sustainability, climate action, countering extremism, the need for unity, action against racism, and finding positive, empowering uses of digitalization, our aim is to help re-build the commons in Europe and encourage consensus on some of the most difficult issues we face. We want people to see that their words and ideas matter, that they have something of value to contribute to crucial debates, and that everyone living in Europe - north,

south, east or west, center or periphery, rural or urban - has an important role to play in deciding our collective fate. Fortunately, we are not alone in this pursuit: we have drawn inspiration from a number of recent projects and publications seeking to build new commons and enrich our visions of possible futures (e.g. Bowles, 2018; Candy & Potter, 2019; Latour, 2020; Smith & Ashby, 2020; Staszowski & Tassinari, 2021; as well as the SpeculativeEdu project).

We have begun to assemble a list of new provocations, including some nods to dissenting or discordant voices, with the aim of crowdsourcing dozens more using Twitter and other social media platforms. These initial provocations for our Future(s) of Europe edition include:

Denial is not a policy
Our house is on fire
Stronger together
Stronger apart?
Europe is not a choice, it is a necessity
Sharing not the burden, but the responsibility
Every country needs a Minister of the Future
Economic growth through inclusive growth
Inequality is by design
GDP is not the only measure of well-being
We need a revolution of values
We are not prisoners of fate
Progress or stability?
The new commons

Once again, we will redesign MANIFESTO! to suit the new circumstances and context. For example, the card design will use the official EU colors of Pantone Reflex Blue and Pantone Yellow as well as a stars motif. Gameplay will be based on random prompts as in the Tech Edition in order to generate discussion on a wide range of topics. It will also be important to reach new audiences - not only students and urban professionals, but also (for example) school children with an interest in imaginative games and drawing, newly arrived immigrants with a stake in Europe's future, workers fed up with politics as usual, or older people playing cards and trading gossip in the local park. Manifestos are for everyone!

3.4 Digital version and online platform

We are also expanding the Words in Freedom online platform to host a digital version of MANIFESTO! the game (currently accessible on GitHub), along with the existing Manifesto Machine and Moving Type Machine digital authoring tools (Ashby, 2018; Matos; 2019). The digital version (see Figure 8) mirrors the analogue card came, with the addition of a "SPIN" button for randomly dealing card hands. The online platform will make it possible to crowdsource and share new Provocation cards and game editions to accommodate multiple domains and themes, while ultimately enabling the infinite expansion of prompts, agile experimentation with new variations, the ability to link to existing examples of online digital manifestos, and smoother integration of social media sharing. Some of the potential new

crowdsourced game editions we envisage include: communities, design, higher education, and science.

The online platform will also serve in publishing and showcasing manifestos generated using our analogue and digital tools, with additional functions for facilitating ongoing discussion in the form of comment threads. This is an important new feature that is in response to feedback received from MANIFESTO! participants, who want to know that their manifestos will be visible to a larger public. It also picks up on Latour's invocation for a more dynamic approach to manifesto writing that prompts individuals towards modes of discussion, debate and reflection (Latour, 2010).



Figure 8. MANIFESTO! the game web app.

4. In the future

We are currently testing the cards, along with our existing suite of online tools, in secondary school and university classrooms in Europe. Additional improvements to the next analogue iteration of MANIFESTO! will include: providing two options per Provocation card (doubling the choice of themes); and introducing variations to gameplay instructions, including embodied dramatic techniques, such as the tableau vivant.

Continuing on the Future(s) of Europe theme, our long-term vision involves the design of an interactive multimodal public installation that invites participants to give their voice to a constructive, collaborative and iterative form of manifesto writing on imagining a range of possible and preferable futures of Europe. Installations will be in a select number of European cities and towns (e.g. in public squares, museums, etc.). Some potential modalities we have been considering broadly include: a large visual display, synthetic speech, kinaesthetic interaction, and use of analogue artefacts.

The main idea is to engage Europeans (broadly defined) and anyone living in Europe in talking openly about values, beliefs, anxieties and concerns in a creative and positive space, away from private chat groups and outside of filter bubbles. What does it mean to be European? What does it mean to live in Europe in the 2020s? We want to support the growth of a new commons in Europe and encourage consensus-building on some of the tough issues we face, while at the same time allowing for the healthy divergence of views and productive friction within a respectful and stimulating public setting. The manifesto provides the soapbox and the megaphone — the chance to reflect on our value systems, where they clash and where they overlap — the chance to offend but also to unite.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Ph.D. Admission System Based Comparative Study in Design Discipline under Chinese Context

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Abstract | With the appearance and development of graduate school at Johns Hopkins University in the end of the 20th century, the emerging doctoral program and cultivation paradigm was established. At the same time, the doctoral training system pays more attention to the training process and gradually incorporates general knowledge. Also, the general trend of doctoral education is to shift from the 'European model' to the 'American model'. On the other hand, the design doctorate emerged in North America in the 1950s, after which the Chinese design doctorate establishment in 1982. This study comparatively analyzes the existing 19 design doctoral admission systems in China and puts 29 criteria indicators into 3 categories with the help of literature study, field study, and expert interview. Finally, based on the 'application-assessment' system, the researcher proposes several enrollment suggestions for institutes and applicants to refer to, which helps to figure out what are these two stakeholder groups' hope based on the current situation.

KEYWORDS | DOCTORAL EDUCATION, ADMISSION SYSTEM, COMPARATIVE STUDY, DESIGN EDUCATIONAL INSTITUTION, CHINESE CONTEXT

1. Introduction

There have been approximately 30 years since prof. LU Yong-Yi gained her doctorate in the industrial design field in October 1990, which witnessed the very first doctorate awarded to the field of design discipline in mainland China, and it also marked the very first Ph.D. in design cultivated by Chinese independently. Although at that time industrial design was still operated as one of the research directions of architecture in Tongji University, it provided preliminary educational and research materials to people who work in the related fields. After 25 years of Dr. LU's graduation, Tongji University set up Ph.D. Degree in Design in 2015.

During almost 40 years' iteration, it seems that higher education in design discipline has accumulated from specialty to doctor degree. However, the design discipline in China is still in the initial phase. For example, the title of the discipline and degree change every five to nine years at bachelor or master level to cater to academic and political needs, which in turn affects the robustness of design discipline. To some degree, the turbulence reflects the uncertainty of goal and mission in design as a discipline compared to other fields. Moreover, the legitimacy of the existence of discipline generally depends on its knowledge, research construction, and some other factors, which directly refers to its researchers' contribution. Professionals and practitioners, therefore, begin to wonder what kind of educational system may cultivate competent design researchers who will be in charge of knowledge generation and discipline construction. In addition, the admission system is the most direct and efficient access to influence the audience group, which is also the inevitable way to select doctoral candidates (Wang, 2018). For instance, China's 'application- assessment' system was established in 2013 to supplements the examination-oriented education system. However, due to various reasons, application- assessment had not attracted sufficient attention in the field.

2. Methodology

Methods used in this study include literature research, field study, comparative study, expert, and doctoral student interview. Combined with experts' review, students' feedback, research outputs, and practical proposals, this study will give corresponding conceptual doctoral admission suggestions and hope decision-makers to adjust the existing system in design. To be exact, these suggestions cannot directly be made available to the practical situation, but they may help to correct the guidance.

3. Literature Review

2.1 Research on the Admission System Based on Universal Experience

Chen (2019) summarized the existing problems in the 'application- assessment' system for doctors in China from the 5 aspects of application qualifications, tutor power, selection standardization, selection scientificity, and selection effectiveness, and suggested that from the history and experience of ancient Chinese civilization and foreign higher educational practice and modern talent assessment theory draw on ideas. Finally, it is recommended that employers select professional researchers that meet the standards based on the principles of fairness, science, and effectiveness. These three principles also correspond to the first, middle, and third procedure of the doctoral recruitment stage.

Gong and Yang (2018) have discovered the problems from the general experience of the doctoral admission systems in China, such as low quality of doctoral students, insufficient investment in doctoral education, single selection mode, inadequate admissions motivation mechanism, and incomplete quality assurance system. Secondly, the author proposes to improve the existing doctoral admission system from the aspects of admission mode and evaluation system.

Zhao et al. (2018) and others compared the similarities and differences between Chinese and American doctoral admission systems from application conditions, application materials, and selection process, and pointed out the harsh registration conditions, informal expert recommendation letters, the absence of standardized examinations, and the limited admission autonomy of supervisor are issues that affect the admission system for doctoral students. Based on the status quo, the author proposes that the doctoral colleges improve the mid-term assessment mechanism to extend the quality supervision cycle of doctoral students, discover the transferability of doctoral students, and empower supervisors' autonomy.

2.2 Research on College Admission System Based on Empirical Cases

After briefly introducing the background of the 'application-assessment' admission system, Wei Li and Yu-Qian Yang took Harbin Institute of Technology as an example, focusing on the application qualification, application materials, foreign language requirements, and subject assessment in details (Li & Yang, 2017). The author then compared the enrolment data from 2012 to 2015 to illustrate the effectiveness of the Harbin Institute of Technology's implementation of the 'application-assessment' system. Finally, the applicant's comprehensive evaluation form was designed based on the four optimization measures of standardizing the application materials, improving the review and evaluation system, refining the mentor evaluation index, and trialing the review and scoring mechanism to make the reform opinions concrete. Yao et al. (2019) first introduced the college's Ph.D. admission and interview from the perspective of the international education reform of the

School of Pharmaceutical Science and Technology of Tianjin University. They emphasized that the candidate's academic foundation, academic literacy, academic potential, and personality qualities should be explored in a short interview process. Subsequently, the author introduced the general principles of doctoral admissions in the United States and the United Kingdom, abstracted the US doctoral admission tests into an index system consisting of 8 items and 6 abilities, and listed 19 common questions in 4 major categories, covering applicant background, future planning, school selection, etc. Finally, the author suggests that the interview of doctoral admissions in China should adopt a standardized question system and pay more attention to discovering the potential qualities of applicants.

Based on the current situation of insufficient high-quality students, uneven distribution of students, shortage of admissions programs, and excessive administrative power interference, Wang (2018) horizontally compared the 'application-assessment' of doctoral admissions in China with the ordinary admissions system. Then the author illustrated the possibility of operating the two admissions system under different conditions by regarding Nanjing Normal University as an example, such as applying for 'application-assessment' in the science and engineering colleges with a small number of applicants to achieve accurate selection, and enrolling in a liberal arts college with a large number of applicants in the form of ordinary recruitment to raise effectiveness. The author advocates that the two forms of examinations run in parallel to ensure the diversity and accuracy of selection.

2.3 Literature review summary

In the process of literature research, the researcher found that the existing academic studies on the doctoral admissions system are mostly based on researchers' own sensory experience, and there is no evidence for empirical research. On the other hand, the study of the admission system is essentially a type of research based on practice. The lack of empirical research data will cause the dilemma of abstract research conclusions, reduced reliability, and weak reference directivity. Therefore, this study will analyze the existing doctoral admission systems based on 19 cases of design educational institution who have the authority to award a doctorate in China, then discover the common regularity when they make decisions on admission. Finally, the author proposes resilient suggestions on doctoral admission strategy which adapt to design discipline's educational philosophy, subject attribute, and development trends.

4. Discussion

This study selected 19 design doctoral admission systems as research objects from 19 design educational institutions. There are 4 of them located in Beijing, Beijing Institute of Fashion Technology(BIFT) (Beijing Institute of Fashion Technology, 2019), Beijing Institute of Technology(BIT) (Beijing Institute of Technology, 2019), Central Academy of Fine Arts(CAFA) (China Academy of Fine Arts, 2020), Tsinghua University(THU) (Tsinghua University, 2019); 4

located in Jiangsu province, Jiangnan University(JNU) (Jiangnan University, 2019), Nanjing Normal University(NNU) (Nanjing Normal University, 2019), Nanjing University of the Arts(NUA) (Nanjing Institute of the Arts, 2019), Soochow University(SU) (Soochow University, 2019); 2 located in Shaanxi, Xi'an Academy of Fine Arts(XAFA) (Xi'an Academy of Fine Arts, 2019), Shaanxi University of Science & Technology(SUST) (Shaanxi University of Science and Technology, 2019); 4 located in Shanghai, Donghua University(DHU), Tongji University(TJU) (Tongji University, 2019), Shanghai University(SHU) (Shanghai Academy of Fine Arts, 2019), Shanghai Jiao Tong University(SJTU); 2 located in Zhejiang province, Zhejiang University(ZJU) (Zhejiang University, 2019), China Academy of Art(CAA) (China Academy of Art, 2019);1 located in Hubei province, Wuhan University of Technology(WHUT) (Wuhan University of Technology, 2019); 1 located in Hunan province, Hunan University(HNU) (Hunan University, 2019); 1 located in Jiangxi province, Jingdezhen Ceramic Institute(JCI) (Jingdezhen Ceramic University, 2019).

By studying admission documents of 19 institutes, the researcher classified 29 index items into three categories, administrative examination, research quality, and professional appraisal. The three categories can be seen correspond to successive three periods of each candidate. The administrative examination involves applicants' master thesis, transcripts, recommendation letters, and others, which proves the previous achievements. Secondly, most of the research quality requires applicants to provide research outputs, design works, or awards in the last few years; these would reflect their current quality. Lastly, the essence of a professional appraisal is to discover applicants' academic potential, for example, which requires them to write papers on related topics in three hours combined with interview and defense. The following three tables will present the concrete performance of each institute on 29 items.

4.1 Administrative examination

Besides academic activities, administrative management is one of the key elements in the educational system. Investigating administrative requirements will not only help to learn applicants' previous competence, but realize the governor's vision toward doctoral education. Table 1 describes the required administrative documents. The researcher will interpret typical items according to the following statistics.

Table 1. Statistics of administrative examination requirements.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
BIFT		●						●	●		●		●		
BIT		●			●	●	●	●	●	●	●	●	●		
CAFA		●							●	●	●		●		
THU					●				●	●					
JNU		●		●	●		●	●	●	●			●		●
NNU		●			●	●	●	●	●	●			●		
NUA		●						●	●		●		●		

SU		●			●		●	●	●	●	●		●		
XAFA	●	●				●	●	●	●	●			●		●
SUST	●	●					●	●	●	●		●	●		
DHU	●	●			●		●		●	●	●		●		
TJU		●			●	●	●	●	●		●		●		
SHU	●	●			●		●	●	●	●	●		●		
SJTU		●			●	●		●	●	●	●		●		
ZJU			●		●	●		●	●	●	●		●		
CAA		●					●	●	●	●	●		●		●
WHUT	●	●			●	●	●	●	●	●	●		●	●	●
HNU					●		●	●	●	●	●		●	●	
JCI		●							●				●		

*Legend: 1. student status verification report. 2. registration form. 3. curriculum vitae. 4. Ideological and Political Situation Questionnaire. 5. proof of foreign language proficiency. 6. undergraduate transcript. 7. bachelor's degree certificate. 8. graduate transcript. 9. master's degree certificate. 10. ID card. 11. master's degree thesis. 12. Master's Degree Thesis Review Book. 13. recommendation letter. 14. letter of acceptance from the tutor. 15. health check.

Curriculum vitae reflects a person's general competence and logical organizational capability. Among 19 institutes, only Zhejiang University requires this curriculum vitae.

There are 12 of 19 institutes requires proof of foreign language proficiency, and all of them are comprehensive university. In addition, the rest 7 institutes include 6 art colleges, which indicates the various educational goals. From bachelor level to doctoral level, Chinese comprehensive universities focus more on all-round quality, which parallelly cultivates as many abilities to make well-balanced citizens. When graduated, these people are supposed to engage in extensive careers. On the other hand, art colleges are more practical and equip students with special talents, such as fine arts or dance. Traditionally they spend more time strengthening these talents to be qualified, while this narrows down their career after graduation. Thus, that is why English as a communication tool seems less indispensable to art college students.

Compared to undergraduates, the graduate transcript and master's degree earn more attention. Firstly, masters' courses are based on research skills cultivation, which is similar to doctoral study requirements. Secondly, the performance of the master level reflects applicants' research quality to some degree.

The master thesis presents a general academic quality. According to Table 1, 13 institutes examine the master thesis, including 7 comprehensive universities. However, art colleges pay less attention to this part, for they pursue special talents.

Tsinghua University is the only institute that does not require a recommendation letter. On the other hand, the other 18 institutes require two recommendation letters. Besides, diversified graduation assessment indicates a transformative tendency in Tsinghua.

The tutors' group consists of a group of supervisors, which is a new model to do the tutorial. Compared to one on one supervision, tutor group provides suggestions from diverse

perspectives, which not only releases supervisors' burden but offers more opportunities to do defense for students. Also, acquiring confirmation advance with supervisors will improve the efficiency of enrollment and leave space for applicants to do subsequent plans once failed. Table 1 shows that only Wuhan University of Technology and Hunan University request the confirmation of acceptance from the supervisor in advance.

Based on statistics, the most valued document is the master's degree certificate, which is requested by all institutes. Then are the registration form and recommendation letters. The most unvalued document is curriculum vitae and the Ideological and Political Situation Questionnaire, each of which is only required by one institute. Secondly, Wuhan University of Technology requests most documents, and Tsinghua University and Jingdezhen Ceramic Institute request the least documents, 12 and 3 respectively. Thirdly, Jingdezhen Ceramic Institute is the only institute that has not to employ the 'application-assessment' model in the admission system, of which details will be discussed in the following texts. Lastly, third-party evaluation tells applicants' quality from the side, such as recommendation letter. For lacking censorship, third party evaluation can be subjective and need to balance justice and authenticity.

4.2 Research quality

Unlike compulsory administrative examination, most of the research quality requirements are optional. However, this part is also the key to widen the gap among applicants. Then, points and ranking will be evidence to selected people for the next round.

Table 2. Statistics of research quality requirements.

	16	17	18	19	20	21	22	23	24	25
BIFT	●	●	●	●	●	●	●		●	●
BIT	●	●	●	●	●					●
CAFA	●	●	●	●	●	●		●		●
THU	●	●	●	●	●	●				
JNU	●	●	●	●			●		●	
NNU	●	●	●	●	●					
NUA		●	●		●		●			
SU	●	●	●	●	●				●	●
XAFA	●	●	●	●	●	●	●			●
SUST	●	●	●	●	●	●	●			
DHU	●	●	●	●	●	●	●		●	●
TJU	●	●	●	●	●	●	●	●	●	●
SHU	●	●	●	●	●	●	●		●	●
SJTU	●	●	●	●	●	●	●			●
ZJU	●	●	●	●	●	●				●
CAA	●	●	●	●	●	●				●
WHUT	●	●	●	●	●	●	●			●
HNU	●	●	●	●	●	●	●			●
JCI										

*Legend: 16. honor and award. 17. paper. 18. project. 19. monograph. 20. patent. 21. recent work. 22. Portfolio. 23. proof of participation. 24. self-evaluation. 25. research plan.

Almost all the institutes request awards, papers, projects, monographs, and patents. These 5 items reflect applicants' achievements and are easy to be quantized. For example, the account of the published paper or award certificate can be scored. However, portfolio, self-evaluation, and research plan suggest applicants studying experience, which is harder to examine immediately but will expose logical construction and thinking process. For academic research, the thinking paradigm is more essential than other qualities.

Self-evaluation is similar to a personal statement, which requests applicants elaborate growth experience, interests, academic background, vision, etc. On another side, self-evaluation reflects one's communicative competence and self-promotion ability, both of which belong to transferability. Also, as an increasing number of doctors choose not to do research work, their employment appears diversified.

Jingdezhen Ceramic Institute follows a traditional examination system, which uses written examination to test applicants' quality. Thus, no research quality material is requested.

4.3 Professional appraisal

Table 3 explains the details of how institutes organize further examinations.

Table 3. Statistics of professional appraisal requirements.

	Preliminary test		Second test	
	26	27	28	29
BIFT	●	●		●
BIT	●	●		●
CAFA	●	●		●
THU	●		●	●
JNU	●	●		●
NNU	●	●		●
NUA	●	●		●
SU			●	●
XAFA	●	●		●
SUST	●	●		●
DHU	●		●	
TJU			●	●
SHU		●		●
SJTU				●
ZJU			●	●
CAA	●	●	●	●
WHUT	●	●	●	●
HNU	●	●	●	●
JCI	●	●		●

*Legend: 26. foreign language. 27. professional test. 28. professional retest. 29. comprehensive interview.

As is shown in Table 3, most institutes combine the foreign language examination and the professional tests, which is to ensure applicants' quality during the examination paradigm transition period. Generally, Soochow University, Tongji University, and Zhejiang University have neither foreign language tests nor professional tests, but these institutes request proof of foreign language proficiency and research quality evidence before the preliminary test. Besides, the Central Academy of Fine Arts, Tsinghua University, and China Academy of Art offer diverse foreign language examinations to applicants, including English, French, German, and Japanese.

It can be seen from the comparison that all of the institutes have either professional test or retest. This reflects professional quality is as valued as a professional interview. Professional quality is examined by design theory, design creation, or writing, which the details will be discussed below.

According to the admission system, all institutes ask for professional examination except Tsinghua University. Besides, only Nanjing University of the Arts, Shaanxi University of Science & Technology, Zhejiang University, China Academy of Art, and Jingdezhen Ceramic Institute explicitly give reference book lists. Then, Central Academy of Fine Arts, Tsinghua University, Nanjing University of the Arts, Soochow University, Xi'an Academy of Fine Arts, and Jingdezhen Ceramic Institute ask for writing tests under limited time. Next, Beijing Institute of Technology, Central Academy of Fine Arts, Xi'an Academy of Fine Arts, Jiangnan University, Shanghai University, and Jingdezhen Ceramic Institute ask for professional creation. Among them, the Central Academy of Fine Arts, Xi'an Academy of Fine Arts, and Jingdezhen Ceramic Institute request all of the three examination models.

As for the interview, it is requested by all institutes, and most of them explore applicants' professional foundation, research, and creative potential, communicative, and interdisciplinary capacity. Sufficient time is compulsory if juries are willing to discover applicants' potentiality. However, only Soochow University points out the interview should not be less than 30 minutes; Tsinghua University and Shanghai University request around 30 minutes of an interview; Jiangnan University, Shanghai University, Zhejiang University, and the Wuhan University of Technology provide 8-15 minutes presentation with applicants.

According to the conditions mentioned above, the researcher considers more kinds of foreign language examination should be given, or with which combined professional test, because the essence of foreign languages are communicative tools and should not be a limitation to the future researchers. Then, the professional test ought to reflect the educational vision of each institute, which is to promote institutes to cultivate their educational idea and avoid homogenization. Next, interview and discussion guarantee applicants' quality, so time is mandatory. Lastly, the official cultivation plans help applicants to realize the educational experience of the learning period, and this inquires administrative efficiency and inclusion. On the other hand, the hidden information implies confusing educational ideas, which leads to resource waste.

5. Conclusion

5.1 Research summary

The 'Application-assessment' admission system aims to break the limitation of traditional examination, which comprehensively examines applicants' quality. On the other hand, transferability earns increasing attention along with educational paradigm transition from European mode to American mode, so institutes should also consider applicants' undergraduate knowledge structure (Melles, 2009). In addition, institutes should give priority to the efficiency with due consideration to fairness. Confirming with supervisors before selection may increase efficiency, but this also narrows choices and even aggravating injustice.

With increasing consideration of the transferability of doctoral students and multiple doctorates, design discipline ought to make customized admission systems bases on the educational vision of each institute (Hamilton & Carson, 2015). For instance, Beijing Institute of Technology, Jiangnan University, and Hunan University provide a successive master-doctor program to design doctoral applicants, starting from the department of science and engineering. This cultivation mode pays attention to explore the further depth of the field, and institutes mentioned above take advantage of their goodness on science and engineering to introduce this program to the design field.

Doctoral education is different from compulsory education, which should put quality before quantity (Durling, 2002). However, the condition is that most institutes make enrollment plan based on administrative governance rather than practical educational capacity. For example, Wuhan University of Technology publishes a point system and selects candidates based on point ranking at the interview round. On the other hand, Nanjing Normal University releases resilient space to discuss special cases in order not to leave out potential talents in the first round, which set an example for others.

Human beings are ends, and do not use them as means. Information symmetry shows respect for individuals, especially in the education field. To adequately value students' rights, a cultivation plan should be published on official platforms and open to everyone, which also engages the public to supervise and advise the education career.

5.2 Reflection

Based on existing published 19 admission systems, this paper organizes a comprehensive criteria index to analyze and provide the design education field with reference and data. The researcher suggests four aspects should be taken into consideration during doctoral enrolment.

1. Physical health is the basis of scholarship. According to statistics, only 4 institutes request health checks during selection, so health risks exist in doctoral students and even institutes.

2. Moral quality guarantees researchers contribute their outputs to human well-being. For instance, juries may examine applicants' experience in community work, volunteering, etc.; they can also examine this with the help of the third party appraise.

3. Professional foundation provides practical experience and materials to researchers in the future, in which portfolio, patent, or exhibition certificate will be ideal evidence. Cross-disciplinary applicants should also prove related capabilities.

4. Academic quality reflects not only in methodology but also in academic sensitivity, which helps a lot for junior researchers. At the same time, institutes should make customized selection criteria to clarify the educational vision.

Last but not least, this study is the start point of design doctoral educational system research, which will be followed by curriculum comparative research, transferability research, and other related academic issues in the future.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Politics by design

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Abstract | Digital transformation and biotechnologies offer powerful means, through which autonomy and automatism could lead to new governance models. As institutions failed to timely grasp their profound implications, a concerning disconnection grows between political and social life. As design moves towards social and political gaps, it now participates in social transformation by challenging current habitus. Whether in a contesting or reforming attitude, design agency generates pressure in and out everyday life, impacting the way politics is thought and practiced. Guided by a correlational approach, the contribution aims to frame a field of research in which design acts politically as a "vector of the present" to cope with instability. Embracing the unfinished character of societal artifacts, design fuels contradictions as vital functions of the democratic discourse, pushing for new conceptions about politics and democracy themselves.

KEYWORDS | DESIGN ACTIVISM, AGONISTIC POLITICS, SOCIAL INNOVATION, SOCIAL ARTIFACTS, EXPERIMENTATION

1. (Re)directions for the XXI century

We live in a time of exceptional turmoil and, at the same time, of dramatic disorientation. This is the time of posteriority of great events that shaped history, returning a vague, undefined present and foretelling an uncertain future as well: it is "a natural habitat of legitimate hopes and expectations, [that] becomes home for nightmares" and widespread nostalgia, ending up framing an exclusive dimension of reality, the "retrotopia" (Bauman, 2017). It appears to be the perfect time to act.

An informatics and technological revolution has been unceasingly shaping the world over the past twenty years: although its achievements comforted the world with an optimistic message, it now gives rise to a sense of shared fear and concern. Acting as a force of change, such a revolution is going to shake the historically consolidated status quo significantly. However, it would not be the first time: as Fulvio Irace (2014) says, "every progress in science coincides with the proposition of new technologies, which certainly produce tools for use, but also, and above all, new lifestyles and new worldviews".

Technological progress goes on at an unparalleled pace now, making it even harder to keep up (Kurzweil, 2004). The fertile combination of the technological and biological front is going to shape tomorrow in a new, radical way[1]: a powerful interweaving that will blur the already thin boundaries between the digital and organic/physical worlds (Schwab, 2017). Such a scenario unfolds the opportunity of designing products and services by borrowing adaptive and evolutionary behavioral patterns directly from biology. The resulting outputs would benefit from an "organic intelligence" (Gerasimov et al., 2019), wherein algorithms will evolve their processing and predictive models through adaptive and combinatorial patterns, proper to organic beings. Such hybrid technologies offer powerful means to support alternative development models, where autonomy and automatism could lead to new governance models: their first implications foretell an unprecedented cultural and economic impact, such that "acting" in the XXI century will mean operating within cybernetic biomes, machine-to-machine systems, where digital transformation requires careful and thoughtful intervention by political actors *in primis*, historically charged to guide their transition and consolidation.

However, even if governments and institutions have traditionally provided tools and models to secure the complex balance among the biosphere-technosphere-sociosphere, on the other hand, it is important to remember that design itself has always acted as a catalyst for innovation aimed to bend technology towards preferable futures. Moving from "making stuff" to "making something" (Sanders & Stappers, 2013) for people and their lives, design offers the sensitivity to research and take action in a moment of a historical transition, marked by deep global issues.

The paper aims to trace how design enters the political dialogue, as a source of constant

[1] As shown by recent MIT Labs activities focusing on the intersection among generative design, computational design, synthetic biology, digital fabrication and materials science (Oxman, 2010; Hays et al., 2015).

destabilization, generating solutions that consent, compete or even dissent with the established order, offering new chances of dialogue among the society-market-institutions system, wherein digital transformation suggests and promotes the (re)shaping of worldviews and the formulations of new governance paradigms for men and things. Today design enters the whole societal context, engaging with "politics" and the "political", a distinction theorized by Mouffe (2005), which triggered a significant debate in political philosophy over the last decades: designers are participating in the debate too, whose practices, discourses and intents happen to raise "questions about their agency and potentiality to challenge our *habitus*, generate alternatives and create positive societal change" (Fuad-Luke, 2015).

2. A technological challenge to politics

The context framed so far in terms of technological advance will produce profound implications on the political dimension, as long as digital technology offers new enhanced tools to deal with complexity, generating new perspectives about dwelling in the future world.

The forces of change acting today feature asymmetrical evolutional rhythms, so that the deep connection between technology and politics is not easily detected. Nevertheless, there is a growing need for political theory to investigate and address the radical effects of emerging technologies (Susskind, 2018), now more than ever. Institutions today react to technological innovations with either slow, outdated measures, or short-term solutions, constantly overlapping and contradicting the older ones. Contemporary conceptual, methodological, and instrumental apparatus result unsuitable to properly frame and understand the current technological actor (Accoto, 2019).

This troubling scenario can be read on a deeper level, where the present is the field where the clash between future and past paradigms unfolds: technology is laying a posteriority character on democracy (Bartlett, 2018), wherein politics misses to embrace the digital within its domains, because of an outdated perception of the "technological" as other from "the political". However, as Susskind (2018) writes, the digital is inherently political. Digital technologies naturally fragment and spread power to all the nodes of its deeply networked structure (Naím, 2013), affecting significantly communication and information systems: the digital transforms the political because it targets political life at its foundations, altering the way politics is made and how and where political action takes place.

Current political systems missed a timely grasp of the incoming digital disruption, triggering a growing disconnection between political life and social life: on one hand, the technological front progressed undisturbed, on the other, society proved to be extremely receptive, facilitating the absorption and diffusion of technological innovation. Runciman's (2018) "technological takeover" is challenging indeed, since he recognizes a strong participation of digital technologies in the failure of current political systems, democracy included. However, while the very idea of failure is anchored in outdated conceptions, it is undeniable that technology is hardly pushing for a mutation of political thought and action. The term

“politics'' suffers from outdated conceptions too, especially when they stem from institutional discourses.
The meaning of “politics” is not a question that resolves in a single take, but a site of ongoing contestation, where any shared assumptions tend to be relatively local and temporary. Embracing its dynamic nature is crucial, because it encourages the stance to discover new theoretical and practical spaces for alternative discourses and functional conflicts. This resonates with the various interpretations that literature offers, among which Mouffe’s (2005) work about democracy as agonistic pluralism stood out, tracing a discourse about democracy as a form of collective life that involves unresolvable differences and conflict. Rancière’s (2015) work also enters the conflictual theme, agreeing with the agonistic struggle among adversaries, where the instability of the resulting order is vital for conflictual political relations to reemerge. Mouffe (1993) calls this potential “the political” and Rancière (1999) uses the term “politics” or “democracy”, but both understand the political friction, disagreement, and disruption as the essence of democratic politics: as a result, whenever the agonistic attitude is missing or consensus overcomes political difference, democracy is lost.
Conflict and dissensus display in an environment where political action is a collective activity expressed in the public realm. Technology is enhancing such expression, thanks to the empowering and auto-organizing effects offered by social platforms and community-oriented services, in which the involvement of institutions to answer social problems does not coincide with a primary need. Acting politically as well as acting through designing in these times means thus moving in a space of possibilities, where freedom and creativity is experienced in a way that can never happen in private, thus embracing the political sphere by giving it new dimensions.

3. Design as catalyst: from value to power

Ubiquitous design relies on digital technologies as accessible means through which people’s capability of *voice* is amplified and extended to a wider range of individuals and communities. Such empowerment gives the chance to self-organize and deal with societal - and political - problems acting within everyday life. This cultural shift has been possible thanks to a broader diffusion of design culture and attitude in the past decade, besides its evolution and subsequent politicization.
In fact, design culture has experienced a continuous transformation as historical phenomena of change gradually disclosed new domains for its theories and practices (Jones, 2014). Assuming a designing approach - *“*using human power to conceive, plan, and realize products that serve human beings in individual or collective goals*”* (Buchanan, 2001) - means promoting better living conditions in a counter-intuitive perspective over reality. Moving from material to human systems (Buchanan, 2001) and from affirmative to critical practices, design culture deeply engaged in social systems, resulting in new operational fields like experience design, organizational design, and service design. These approaches aim to tackle

complex problems by gathering various stakeholders - end users, citizens, employees, partners - in charge of "experts of their experiences" (Sleeswijk Visser, 2005 in Sanders & Stappers, 2008), in order to conceive better outputs to improve lifestyles.
Thus design becomes ubiquitous, as the many-to-many approach involves an extensive range of social players, from professionals to citizens, who happen to apply design thinking, processes and approaches finding themselves managing the designed output directly (Fuad-Luke, 2013; Manzini, 2015).
This leads to the growing fields where design is deployed for social transformation: new social demands match with governmental "inaction", where grass-rooted movements and initiatives aim at filling the resulting social gaps. This trend gains particular relevance in those developing countries, where human rights are not fully recognized[2]. Such design practices, however, intensify even where democracy is a historicized condition.
The structural crisis of the neoliberal paradigm calls for new expressions for social, economic and environmental sustainability: such critical scenarios offer design culture the favorable terrain to renew itself and to address its efforts in the production of artifacts within social movements, experiencing a shift in its aims and methodologies. According to Julier (2013), crisis in the neoliberal paradigm coincides with a spark of activist impulses in designers, so that they embed their practices "into everyday life through intervention with real people in real places" (Julier, 2013), lending their "power of resistance from being precisely a designedly way of intervening into people's lives" (Markussen, 2013).
The efforts underlying co-design and social innovation practices are a whole new way in which design channels positive results in the attempt to "design for democracy[3]". These are recent challenging practices, relevant in triggering new approaches to power through design. By expressing stronger activism, design culture appears to be charged with growing awareness and responsibility, thanks to its strong contribution in the fundamental processes of reality production: given the ubiquitous presence of designed outputs and systems, including the possibilities that digital technologies offer, design activists are challenging the "distribution of the sensible" (Rancière, 2015) to bring light on new perceptions and actions, opening up the public sphere to active participation.
Moving from design culture to design activism, designers participate and amplify an "agonistic revolution", as they enter into various modes of action starting from the free choice of which power structures to work with, for or against: their pluralist and agonist

[2] Design Studio For Social Intervention and Design that Matters provides few examples of a strong design action to support social justice within disadvantaged communities and developing countries. Retrieved February 6, 2020, from https://www.ds4si.org, https://www.designthatmatters.org

[3] In their "Open Letter to Design Community: Stand Up for Democracy, Ezio Manzini and Victor Margolin state the need for designers to conceive, develop and connect new possibilities to support democracy and all that it should embody. Retrieved February 6, 2020, from http://www.democracy-design.org/statements/

agenda is the product of a non-alignment, pushing for a participatory concept of democracy (Fuad-Luke, 2015). Acting as a social compass, design activism ensures an extended participation, encouraging responsibility while disrupting and diversifying the existing habitus. Fuad-Luke (2015) traces the levels of the teleological force in design activism propositions, setting them within agreement, agonist or even antagonist attitudes[4]. (Re)orienting systems and local realities is thus possible thanks to design's stimulation of common will and responsibility, channeled in a path toward *radical* change of institutional and cultural practices and languages.

3.1 Reframing design practices: a political view

Since innovation lies also in the perspective chosen to observe problems within the hosting system, it is worth recalling Fuad-Luke's (2015) framing of social design as the "weaker" form of design activism, due to its roots in the current neoliberal representative democracy. Here, he argues, designers are constricted in a consensual agenda, pursuing public good to re-shape the system from within. Perhaps this is also the reason why there is a widespread tendency to depoliticize most of the social design practices - especially from the outside -, where it is often shrunk to a humanitarian inclination: "the ability of this type of 'do-gooder', socially oriented design to address questions of social justice and inequality is very limited (Chin et al., 2016)". Although these authors refer to some specific humanitarian designs[5], this perspective has helped to cast a shadow over the actual connections between politics and social design.

Basically, design is designing something for someone. Starting from everyday life, design has always been conveying values and messages aimed at (re)defining reality: design can be persuasive as designing a chair is a matter of defining what "sitting" would be like (Redström, 2017). Thus, design is a participating actor in the production of worlds and, as such, "operates in the space between poietics and politics" (Redström, 2017).

Today social design expresses its poietic ability to support democracy, which now lives in a sclerotic condition. However, despite the "weaker agonistic character" traced by Fuad-Luke

[4] Fuad-Luke (2015) lists some case studies working as "spatial agency" and offering counter-narratives, counter-dialogues and counter-actions in public spaces. As for the agreement section the pedestrian bridge designed by Zones Urbaines Sensibles is an example of participatory crowdfunded urban-making. Agonistic approaches are traced in Collectif Etc works, whose built interventions, street furniture or even conferences serve as propositional artifacts, raising questions about public issues. Antagonism is found in *Recetas Urbanas* by Santiago Cirugeda, a project offering downloadable models to trigger political negotiations with exercises of urban allegiances.

[5] Several NGO's are working with designers in this sense. MigrationLab is now running projects in six european cities. The goal is co-creating opportunities with and for migrants, refugees and locals to meet, interact, inspire each other and collaborate through the transformation of urban spaces. Retrieved February 6, 2020, from http://www.migrationlab.org

(2015), social design plays a strategic role for democracy as-is since they share the same structural language: *incremental* change. This is the case of Helsinki City (Berglund, 2013) where several design interventions were later absorbed, adopted and adapted by the city municipalities themselves[6]. Such social progression is supported by a *prototyping-suggesting* attitude of social designers, a stance which seems to facilitate the permission of design intervention into urban and civic environments by those municipalities who are open enough to let the experimentation take place.

Gazing into the future, looking for "preferable" scenarios (Fry, 2010), design implements practices that generate positive alternatives to the current status quo. Social design as a political action stands for this purpose, occurring as a form of activism which "rather than being resistant, is mostly generative" (Thorpe, 2011). Far from an opposing and protesting approach, such design interventions feature a reformist action of the present, or, rather, of all those approaches and perspectives that have contributed to generate the unsustainability of today's world. In fact, social designers enact reflections through the direct involvement of institutions or by addressing their structural issues to return better opportunities of dialogue. Improvement pushes institutions forward, so that urban and civic environments, as well as public services, will look for more creative processes to innovate themselves.

Carl DiSalvo's contribution (2010) on adversarial design offers arguments for further discussion on such design approaches, establishing a meaningful connection among digital technology, society, and institutions. Following Mouffe's discourse (2005), DiSalvo traces a field for design action intercepting both "politics" and "the political": the former stands for the means by which cohesion within a state, organization or social order is achieved; the latter refers to a condition of social life, whose experience and expression no longer occur according to the old models of protest and debate. The distinction between politics and the political in design practice leads to different kinds of design outputs, depending on their combination and final goals:

- design for politics[7], focusing on improving structural transparency and functioning;

[6] Helsinki's DIY-urbanism, urban tactical experimentations and prototyping show as practices where design engages with official urban policy, fueling an "urban vibe", where citizen-led initiatives inspired by degrowth economics met administration - sometimes cautious - support. Such results were meaningful to activists as their actions were rewarded with an empowering institutional acknowledgement.

[7] Horizon 2020 Framework Programme of the European Union founded several laboratories aiming to design open government strategies to improve the governance culture. Here is provided an example of toolkits designed to ease this kind of innovation. Retrieved February 6, 2020 from https://oecd-opsi.org/guide/open-government/design-an-open-government-strategy-or-initiative/

- political design in the agonistic approach[8], aiming to reveal and confront power relations;
- design for policy[9], where public administration is led with a service innovation approach.

DiSalvo's (2012) analysis helps provide design criticism about the relationship between political expression, computation and the processes/products of design.
Such experiences can be traced in a "reformist attitude" of the political system as-is, where design works within the current paradigm. Despite the "weaker" impact on the system - not a disruptive one -, these kinds of interventions gain a character of "feasibility", which designers use as a means to trigger an internal innovation. Here consensus produces a meeting point between realities that suffers from distance: political and social life.
In this way social design exploits certain conditions of neoliberalism - where it stemmed -, to recycle and reprogram them: it is worth noting that this concept aligns with Julier's (2013) concept of design activism, so that applying design to politics to improve its structural issues is still a contestation, as it intercepts a problem needing a solution that conventional approaches to political issues have not offered yet.
Thus design activism occur in different theoretical and practical spaces, seemingly fueled by two complementary tensions: the activist-disruptive and the social-incremental one. Together they discover new meanings for democracy.

4. Politics by design

Design as a significant driver in building future realities seems to embody a new kind of political force, defining a promising field in which it would be possible to implement "the transformation of the entrenched cultures of unsustainability towards pluriverse practices" (Escobar, 2018). By creating "worlds within the world, mutually transforming each other" (Fry et. al, 2015), design discovers itself capable of generating not only new entities and interactions within political life, but also new political entities and interactions.
The paper relies on the complementary interplay between the agonist revolution and the reformist attitude of design acting politically as a promising path leading to the expansion of the conception of politics, compared to the current one.

[8] The sweden city of Malmö instituted a dedicated laboratory for participative initiatives to perform social innovation. Activities are carried out through a design practice-based approach which entails long-term engagements with different social actors, leading to significant impacts on city's settings. Retrieved February 6, 2020 from http://medea.mah.se/malmo-living-labs/

[9] Italian studio Oblo Design, part of government's digital team, provides a quick example of design for policy performed with the direct engagement of citizens. Together they designed a platform aiming to ease the access to public services, with all actors receiving reiterative feedbacks. Retrieved February 6, 2020 from https://io.italia.it

Thus, design agency generates pressure in and out everyday life, impacting unavoidably the way politics is thought and practiced. Fuad-Luke's (2015) concept of design activists crucial positioning as "non-aligned social brokers'' along with the social designers "working from within" suggests a well outlined space for contradictions, stemming from the very nature of design problems and, therefore, of design as a whole. According to Cross (1982), design problems are always ill-defined due to time and/or resource constraints. The wicked feature results in the impossibility of an exhaustive analysis supporting the correctness of the preferred solution, but the designer is still asked to produce a precise solution within a given schedule. Designers, then, cope with complexity by imposing themselves limits to contain the problem and manage it better. Such a process calls for high responsibility, which designers know to hold as practitioners of a poietic activity that always works with internal and external instability: as Julier (2013) notes, designed outputs are unfinished, multifaceted - as they exist either as sketches, prototypes, updates - subject to reiterating reshaping and repositioning. Furthermore, since designers work in complex networks of actors that constantly influence themselves mutually, designed outputs are subject to external constant transformations too, occurring at all levels from meaning to value.

This is why designers are used to thinking critically about the problem at hand, mainly questioning which designing process to adopt from the very first step (Hegeman, 2018). The lack of generally viable models and methods is the key to the *designedly* ways of *design.* Every problem encountered and the way it is positioned from time to time within a specific contingency results in the design of the designing process itself: in these terms design culture seems ready to offer a meaningful contribution to the *plungingly* ways of *politics*. Coping with contradiction helps assuming uncertainty as a foundational feature of reality, something to embrace as it appears in its chaotic beauty, where collective thinking and actions offer a fertile ground for new lifestyles and worldviews. Such shift is taking place as some institutions are recently showing a growing interest in design approaches too, even with weak signals - whether they be the adoption of designing tools to better inform decision-making processes or the diffusion of experimentation through civic participatory workshops -, in order to speed up their regulating actions: guided by design's proactive attitude, they are questioning their own schemes to keep up with contemporary global issues in an anticipatory approach, which should be far from a linear and coherent projection of the present into the future.

If politics calls for coordination, cooperation, control, and management skills within this framework, then facing the high complexity of the coming future - in which time exerts increasing pressure – will mean activating a more elastic transdisciplinary dialogue, made up of as many voices as communities hold. Complexity shows to be the main driver of unfinished products, as long as solutions are actually prototypes meeting the contingent need of a delivery in an everchanging reality. Therefore, politics would develop a deeper sensibility about uncertainty and, most of all, the unfinished feature of societal artifacts, whose experimentation would leave marks and traces to build up f(r)ictions (Mallol, 2011; Fuad-Luke, 2016) as vital sparks of collective life.

Such a combined approach outlines the field of research of "politics by design", which

proposes to investigate the *designedly ways of making political plans*, which embrace parallel and contradictory answers to socio-political issues as a result of a contingent attitude to manage complexity. Design culture is therefore believed to be capable of disclosing experimental areas in which political, digital, and social life can interact and reiterate themselves at deeper levels, where challenges could be faced by many to many. New spaces for free, public and creative expressions would rise, where design as a "vector of the present" would encourage a growing awareness in shorter and longer-term horizons, exerting multiple divergent forces while speaking the language of change in both incremental and disruptive declinations.

5. Conclusions

Correlations examined so far show the need for a more extensive dialogue, whose gravitational point is crossing the plain transposition of instruments and models from one knowledge domain to another, from theory to practice. As discussed before, the hyper-complexity of current systems is not problematic in itself, although it needs a new perspective to be tackled properly. According to the old approach, machine-to-machine interactions would be outlined through a technocratic view. Even so, interactions are inherently human-related: hence a human perspective is needed to unravel the knots, because meaningful interactions take place every time objects and human beings connect. Aristotle wrote that social life is realized thanks to the innate sociality of man, in which he exercises the *logos* as a means of confrontation.
It is in language that *inter-esse* unfolds, the in-between space where interests clash for their acknowledgement first, rather than unfolding in group conflicts about opposite positions. As long as words and actions infuse each other, they produce Mallol's (2011) "commonplace", the ubiquitous social material assemblies which everyday life is made of. These artifacts work together in the definition of - many - possible and divergent worlds, where disagreement stands for a stance, an approach of inquiry and practice: setting the stage for dissensus means reframing the configuration of problems both from a theoretical and operational perspective from time to time, while heterogeneous contributions amplify unpredictability. Thus, the capability of voice empowered by design enhances the interplay between revolution - the disruption of habitus - and reformation - the slow yet more feasible advancement. Such tensions dialogue in an agonistic way, never excluding each other, so that choices and decisions for further regulations will entail an ever-growing responsibility, which needs to be reframed too - along with other political conceptions - since the technologic actor is rapidly gaining less marginal roles within new governance assets. Design seems to be in an ideal position to make a significant contribution, by developing counter-narratives which reframe everyday problems as possibilities that address contingent realities. The specific way in which designers can develop their own thinking and practice gives them the ability to intervene on the sensible layer of reality, where ethics and aesthetics intertwine in such a phygital world, leading to new worldviews and *modus*

vivendi. Here, as Redström (2017) notes, design practices explore and influence some future directions, discarding the others despite their viability. Therefore, the act of choosing which alternative would be the preferable one is full of social, economic, political responsibility. Design is a defining practice and, as such, a philosophical operation, but also and above all, a political one. The responsibility of designers as makers of worlds is significant, urging a reflection about their own ontological potential and how it is perceived from other disciplines, in order to develop a deeper awareness of their moves and their roles in the society of the future.

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Acknowledgements: this this work is the result of Authors' common reflection on the basis of the first stages of a Doctoral research project, which MCC is conducting at University of Florence (Italy).

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Projecting Change: Redefining Preservation in the Era of Sea Level Rise

Liliane Wong

Abstract | Historic preservation and climate change act upon our built environment from opposing directions. Preservation sustains a past state of being in the future while climate change renders a past state of being unsustainable in the future. As one attempts to delay change the other causes potentially irreversible change. In a future of rising seas, they will converge in a clash of values. This paper examines the collision of the preservation of coastal heritage and sea level rise through academic investigations of reuse for coastal heritage. Focusing on the question of how heritage coastal communities can be readied for needed but drastic measures, visualization is explored as a means of preparing these communities for inevitable future change.

KEYWORDS | BUILT HERITAGE, SEA LEVEL RISE, CLIMATE CHANGE ACTION, VISUALIZATION, ADAPTATION, COMMUNITY ENGAGEMENT

1. Introduction

The preservation and conservation of buildings and the science of climate change are both modern. The roots of preservation are found in Europe; the Society of Antiquaries of London (SAL) was established in 1751, the Commission des Monuments Historiques in 1831, and the Society for the Protection of Ancient Buildings in 1877. In the United States of America, historic preservation was only formalized with the National Historic Preservation Act of 1966. The roots of climate change science are found in the early 19th century with the defining of "ice age" and the 1896 observations and calculations of carbon emissions by Swedish scientist, Svante Arrhenius. Through the late 20th c., historic preservation focused on "maintaining the artifact in the same physical condition as when it was received by the curatorial agency" (Fitch, 1990). This premise would be challenged in the millennium by climate change and its impact. Preservation aims to sustain a past state of being in the future while climate change renders a past state of being unsustainable in the future. As one attempts to delay change and the other causes potentially irreversible change, these modern phenomena will converge, resulting in a clash of values. Its resolution will require a revolution as long standing beliefs are challenged by an unknown future. Academic investigations are notable for their freedom from pragmatic constraints and, as such, they are often the harbingers of revolutionary ideas. This paper categorizes and analyzes current options for the preservation of structures from the impact of climate change and offers future possibilities through a project explored within the educational environment.

2. Of Climate Change and Heritage

Climate change is the defining issue of our time. Extreme weather, changes in precipitation, heat waves, sea level rise, all pose a threat to our built heritage. Of these different climate threats, sea level rise is significant for built heritage due to the founding of many cities near the coasts. Estimated at 6.8 billion in 2010, the global population is predicted to increase to 10 billion by 2030 and 44% of this population live within 200 km of the coastline (*Human Settlements on the Coast*, 2019). From Shanghai to Tokyo, Rotterdam to New York, it is estimated that 570 cities will be affected (Muggah, 2019). The built heritage of such cities with long and rich histories will be threatened by flooding and rising waters. Venice, with its innumerable historic treasures, is an example of a city that has long battled rising waters. According to researchers from the University of Padua, "[b]y 2200, the IPCC [Intergovernmental Panel on Climate Change] projections indicate that global sea levels could be between around 2 and 5 meters [6.5 and 16.4 feet] higher, which would leave the city permanently submerged if no action is taken to protect it…." (Aristos, 2019).

Coastal cities are now considering various options for protecting against sea level rise. These range from aggressive infrastructural and engineering projects for building sea walls, dams,

and surge barriers to land mitigation strategies and resilience building. These strategies require adaptation and, therefore, change.

2.1 Built Heritage and the Regulatory Process

Built heritage such as Venice is protected by regulations - international, national, regional - that 'manage change.'[i] The protection of such architectural heritage was primarily a national endeavor until the First World War when the resultant devastation crossed international borders. The Athens Charter of 1931 was the first step within an international arena toward the protection of heritage. The two World Wars resulted in the creation of the United Nations and subsequently the establishment of UNESCO. The ground breaking 1964 Second Congress of Architects and Specialists of Historic Buildings in Venice resulted in the establishment of the Venice Charter and the establishment of the International Council on Monuments and Sites (ICOMOS). UNESCO and ICOMOS are global non-governmental organizations that promote the conservation and protection of monuments. Through these organizations, varying charters for the management of heritage are proposed and adopted in an international forum. They span subjects from intangible heritage to ethical treatments.

The development of regulations for combatting the effects of climate change and, in particular, sea level rise, on world heritage is in a nascent stage. UNESCO's World Heritage Committee on climate action and heritage issued recommendations and policies for assessments and managing short term actions. For cultural heritage sites, this equates to mitigation, monitoring, defining responses, research and communication (*Climate Change and World Heritage*, 2007). In 2019, ICOMOS released its comprehensive vision for mobilizing the cultural heritage community around climate change. In 'Heritage and Climate Change Outline Report,' climate change action is summarized as including data gathering/heritage monitoring, mitigating greenhouse gases, strengthening resilience and adaptive capacity to climate-induced impacts as well as preparing for losses and damage (ICOMOS Climate Change and Cultural Heritage Working Group, 2019). In addressing the management of heritage from climate change, the report cites 'loss' and its implications as critical components for combatting sea level rise. These include the consideration of strategies for memorializing, the expanded use of removal and relocation, the recording of sites prior to loss (ICOMOS Climate Change and Cultural Heritage Working Group, 2019). These recommendations exemplify the goal to "maintain" the artifact in the same physical condition as when it was received and, if not possible, to accept its loss. Is 'loss' inevitable due to an adherence to a definition of preservation formulated in an era with different priorities? Does the speed of the pending devastation wreaked by climate change require a reconsideration of that definition? Is there an alternative to loss? What of the possibilities of combatting rising seas using principles of adaptive reuse, principles premised on change? A future of living with and in water will require a reuse of structures beyond our established modes of thinking. The acceptance of such alternatives to losing built heritage will test the

premise of preservation. A comparison of two coastal communities facing the dire threats of sea level rise offers us the range of possibilities for such action.

3. Of Sea Level Rise and Heritage

3.1 A Tale of Two Venices

The city of Venice, Italy, and its lagoon are listed on UNESCO's World Heritage Site. The protection of Venice is governed by many different regulations: The Code of the Cultural and Landscape Heritage, the 1973 Special Law for Venice, public authorities such as Magistrato alle Acque (the Venice Water Authority), a Management Plan with input of both regional and municipal bodies. These regulations share the objective to protect and maintain Venice as an artistic achievement, as an influence on the development of art and architecture, as an archaeological site, as an outstanding example of a semi-lacustral habitat (*Venice and its Lagoon*, 2019). The many governing bodies collaborate to manage change so as to maintain Venice, as much as possible, the historic city founded in the 5th century and first inscribed on the UNESCO World Heritage List in 1987. While Venice has always been under threat from *acqua alta* and flooding, it was hit in November 2019 "by the highest tide in more than 50 years" (*UNESCO closely follows tides and flooding in Venice World Heritage site*, 2019). The UNESCO World Heritage Centre, together with pertinent advisory boards, has agreed with Italian authorities to conduct an advisory investigation of these issues in 2020. In the meantime, citizens of Venice traverse their city on elevated catwalks hovering over the 4 feet 3 inches (1.30m) of flood water that has invaded the ground levels and foundations of Venice's built heritage.



Figure 1. Venice, Italy, at its highest tide of 6 ft (1.96m) in 1966 (left) and at 4'-3" (1.3m) in November 2019.



Figure 2. Venice, Louisiana, USA, rebuilt with houses raised on stilts (left) and on buoyant foundations in the water (right).

Venice, Louisiana, USA, is a community of 200+ persons sited on the banks of the Mississippi River. Its industry includes commercial and sport fishing. Located some seventy miles south of New Orleans, Louisiana, USA, it was devastated by Hurricane Katrina in 2005. Since then, the small fishing community has rebuilt for a resilient future through employing unconventional and even extreme strategies. To withstand rising waters, houses, apartment blocks and small businesses have been raised on piers up to 15 feet (4.6m) above ground. Alternatively, single family homes are built directly in the water, supported by buoyant foundations. This rebuilt community is drastically different than its pre-Katrina existence. Visually, more than half of the town hovers on wood structures or piers high above the beach while streets have been replaced with boardwalks and jetties. Not of historic or cultural significance and unfettered by preservation standards, Venice, Louisiana is a demonstration of the strategies that may be necessary for coastal communities to thrive in future rising seas.

The two Venices provide a striking contrast of climate change action in coastal communities. Representing the opposing ends of sea level rise interventions, they reflect the range of possibilities between retreat, defense and adaptation. The comparison prompts an examination of the relationship between heritage protection and climate change action. In the face of rapidly rising seas and the urgent need to act, how does one negotiate the complexities of heritage protection and its particular conflict with change? What might coastal built heritage such as Venice, Italy, look like utilizing the extreme measures taken to allow Venice, USA, a future with water?

3.2 Sea level rise adaptation

Strategies for combatting sea level rise on heritage property can be categorized as either defensive or adaptive. Defensive strategies include large scale infrastructural interventions

such as Venice, Italy's, implementation of mobile barriers (Modulo Sperimentale Elettromeccanico, Experimental Electromechanical Module) to defend the city from the *acqua alta*, begun in 2003 and pending completion in 2022. It also includes systemic interventions such as those for diverting stormwater or the creation of blue streets that control the influx of water. These are remote interventions that do not touch the built heritage itself but, rather, protect it from afar. Adaptive strategies include the small interventions to the property itself. These include protective retrofit actions – storm and water proofing, flood vents, sump pumps, etc. - that divert water from or incorporate water into the buildings. Both types of interventions "maintain the artifact" in the same relative physical condition thus fulfilling the premise of preservation/conservation.

These interventions suffice for the current state of water levels but with alarming predictions for the near future, additional measures are required now. The case of Venice, Louisiana, demonstrates what these measures might look like. But such additional measures will test the premise of preservation and its very definition. The elevation of structures, high above the water line, is one such example. This type of intervention is derived from flood insurance policies requiring that a structure, rebuilt post-flood, be built at a base elevation above the flood line. While this appears reasonable, it is for the most part unregulated. Those with means can exceed the base elevation to satisfy their comfort level. On the outskirts of New Orleans where Hurricane Katrina devastated many homes, some houses are rebuilt and elevated more than 14 feet (4.3m) above ground – coining the term "lollypopping," where structures are raised on stilt-like supports of varying heights. Local governmental agencies are in process of developing flood guidelines for such interventions. Currently, however, the landscape of the outskirts of New Orleans has changed dramatically with homes that are both elevated and not. This type of intervention, permissible for Venice, Louisiana, would not be permissible for heritage such as Venice, Italy, or any other protected landmark abiding by the current definition of preservation. To prevent the loss of built heritage in a future of rising seas, a different and less restrictive definition will be required. If so, what is necessary to establish a new one? How does one propose and pass regulations for the extreme and drastic measures that are required to make impactful change in the face of urgent circumstances?



Figure 3. A house on the outskirts of New Orleans, LA.

4. Case Study: *Projecting Change*

4.1 Newport, RI, USA

These were the questions facing the city of Newport, RI, one of America's oldest historic cities. Founded on the edge of the Narragansett Bay, the city is a treasure trove of built heritage, all protected by historic preservation guidelines. Newport, RI, USA, a city that holds some of America's greatest historic treasures from 18th century homes of the American Revolution to 19th century mansions of America's Gilded Age, is exemplary of other historic American cities on the Atlantic coast. The destination of the 17th century settlers who left England in search of religious freedom, the Atlantic Coast is dotted from north to south with waterfront cities - Plymouth, MA, to Newport, RI, Annapolis, MD, Charleston, SC, and St. Augustine, FL - that represent the earliest endeavors of the citizens of the newfound nation. These cities are preserved through strict standards and regulations aimed at maintaining them as cultural evidence of that period in history.

986 of Newport's historic structures and 53% of the acreage of Newport's homes are located in the flood plain (Union Studio & Conservation Associates, 2016). The project site, Easton's Point (or the Point Neighborhood), is one of the oldest neighborhoods of Newport. Founded in the 17th century, it is part of the Newport Historic District Zoning, created in 1964 and designated a National Historic Landmark District in 1968. The neighborhood is characterized by 18th century houses, many of which are built directly on grade. These historic homes experience flooding from precipitation, storm surge, and extreme high tides. High-model projections of the National Oceanic and Atmospheric Administration (NOAA) predict 1 foot (30 cm) of sea level rise by 2035, and 3 feet (91 cm) by 2065 and almost 7 feet (213 cm) by 2100. The built heritage of the historic Point Neighborhood, which already floods with each severe storm, will be under water without a careful plan for its future.

In 2017, the City of Newport provided for the protection of these and other assets through a recently approved Hazard Mitigation Plan. The Hazard Mitigation Committee's recommendations for flooding included: retrofitting flood risk structures, evaluating zoning to allow for flood retrofitting, constructing a sea wall. It also addressed floodplain management through inclusion in a recognized Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP). As part of the program, new home owners requiring federally insured mortgages, as well as current owners submitting flood claims, must comply with the FEMA requirement of elevating one's house above FEMA's design flood elevation.

All houses in the Point Neighborhood are sited below FEMA's design flood elevation of 13 feet above NAVD88 (Union Studio & Conservation Associates, 2016). Compliance with the FEMA requirement in the Point would destroy the historic fabric of this community of two-story homes on grade. Yet, without specific preservation flood guidelines in place, this was already taking place as new owners and current owners of flood related retrofits complied. In addition, some concerned owners with means have also selected to elevate their homes. Together, these houses are raised some distance from 3 to 7 feet (91 – 213 cm) above the FEMA flood elevation. This "lollypopping" of various heights is visible now on many of the Point Neighborhood's streets where the characteristic on-grade structures are slowly disappearing. These interventions are not in keeping with the principles of a National Historic Landmark District. But to keep the built heritage of the Point above water would require more than the raising of structures a few feet. Herein lies the clash of preservation's aim and that of responding to the effects of climate change.



Figure 4. The changing face of Bridge Street in the Point Neighborhood with the phenomenon known as 'lollypopping.'

4.2 Projecting Change

This was the context when, in 2017, graduate students in the Rhode Island School of Design's 1-yr post-professional Master of Art program in Adaptive Reuse undertook an investigation of the impact of sea level rise on the coastal heritage Point Neighborhood of Newport, RI. Sponsored by the van Beuren Charitable Foundation (vBCF) and the Newport

Restoration Foundation (NRF), the aim of the semester-long project, *Projecting Change*[ii], was to engage the 1000+ members of this historic coastal community threatened by sea level rise in discussions of their future. The objectives of the design studio were two-fold: first, to use design to redefine preservation in the face of significant future sea level rise and, second, to convey these implications to a community that had yet to discuss their future.

4.2a Projecting Change: Design

In meeting the first objective, 16 students worked in small teams to produce designs addressing the future of the Point Neighborhood, assuming NOAA projections for 2100. These designs ranged in approach as strategies for combatting sea level rise. Four projects were developed, representing the approaches of *retreat, defend or adapt*: *Memory Trace, Grey Green Blue, Living with Water* and *UpStruct*. The project *Memory Trace* accepts that the Point Neighborhood could not be maintained in its present location in rising seas. It chose to retreat as a strategy. Assuming future inundation, the project relocates the houses of the neighborhood to higher ground but leaves a memorial in situ consisting of the cast facades of the houses themselves. This proposal of reuse through translocation maintains James Marston Fitch's definition for preserving the physical buildings albeit through relocation to higher ground.



Figure 5. Casts of the houses are left as a memorial park in the project Memory Trace.

In contrast, *Grey Green Blue* employs an expansive strategy of both defense and adaptation in order to maintain the Point neighborhood in its historic moment and in situ. A proposed breakwater on the nearby shoreline defends the community while a system of blue streets and retention ponds are integrated into the neighborhood for accommodating water over time. In this project, the built heritage is envisioned as part of a blue system in which the individual houses will serve not only as domicile but as part of a vast adaptive intervention.



Figure 6. Water is brought into the neighborhood over time in the project Grey Green Blue.

Living with Water employs more experimental means to maintain the neighborhood exactly as it was. Assuming the NOAA projections for future sea levels, the project proposes to replace all existing building and infrastructural foundations with buoyant ones. Tethered together, the houses would rise and fall with the water as it rises over time. While the built heritage would be reused as adapted water vessels, they will remain in place together as originally built in the 17th century.

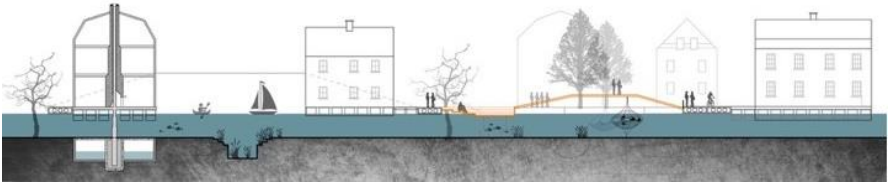

Figure 7. All the houses are placed on buoyant foundations in Living with Water. As the seas rise, the houses rise together with it.

Upstruct instead proposes to update the definition of preservation in the face of sea level rise. It posits that if the historic community as we know it today is premised on the relationship of the buildings to each other in a horizontal ground plane, why not redefine

this relationship through a configuration defined by water? It offers a new vertical grid that maintains the relationships of the historic houses to each other but in a different axis, the z. In a vertical future, houses would have redefined but similar relationships to one another through streets that rise up into the air, with neighbors above or below rather than to the side and back. *Upstruct* proposes the reuse of a heritage neighborhood as a skyscraper in the sea. While fanciful for the present, it offers a glimpse of future possibilities.



Figure 8. Historic communities are reinterpreted as vertical historic neighborhoods in the project Upstruct.

4.2b Projecting Change: Community Engagement

The demographics of the neighborhood were critical to achieving the second grant objective of engaging the community in a discussion on sea level rise. A neighborhood of approximately 550 households, the Point is sited on a long narrow strip of coast. Three primary streets parallel the waterfront and are intersected by 11 short streets. The heart of the neighborhood is situated on the southern side, bounded by Bridge and Elm Streets. This area is populated with households of various ages, the most prevalent being those in their 20s, 50s and 70s. (Statistical Atlas, https://statisticalatlas.com/neighborhood/Rhode-Island/Newport/The-Point/Overview)

At the start of the project, the students interviewed members of the households in the 5 most populated blocks. The neighbors' understanding of and reaction to the threat presented by sea level rise corroborated the 2018 Pew Research Center survey which found that only 59% of Americans view climate change as a major threat (Fagan & Huang, 2019). Even those who were in this slim majority believed that sea level rise would not happen in their life time and would not affect them personally. Most of all, they did not believe their own actions would make a difference.

To engage this somewhat disenchanted group, the students explored the potential of visualization to help spark the discussion. Their objective was to enable the neighbors to experience impactful interventions for coexisting with high water levels. Utilizing both virtual and augmented reality, the four projects were presented in a one-day neighborhood event called *Projecting Change*. Three activities were offered at 64 Bridge Street, the property of co-sponsor Newport Restoration Foundation. The first comprised a series of exterior augmented markers, located in the backyard of the house and along the adjacent side streets. Google cardboard lens were distributed together with a download of the software Entiti. This enabled users to point their phones at any of the markers and, depending on which, they were able to see one of the four design schemes in 'sensurround.' Simultaneously, two virtual reality stations with Occulus headsets were available inside the house. Those selecting this option were also able to access one of the four designs and, in addition, place themselves in various locations within the schemes. The participants of both activities experienced the streets of their historic neighborhoods turning blue, retention ponds spreading into their gardens, and their houses flying into an *Upstruct* high-rise configuration.

The third activity was in the form of an I-pad game, with the neighborhood as its gameboard. With the assumption that a storm and related flooding were imminent, players had 10 minutes to make decisions regarding their house and neighborhood. Selecting to save one's own home would advance one to the next level. However, in subsequent levels, the player realized that collaboration with one's neighbors was necessary for ultimate survival.



Figure 9. Using augmented and virtual reality, the members of the community experienced sea level rise interventions on their phones.



Figure 10. A section cut through Upstruct's vertical neighborhood.

Visualization allowed the members of the community - from middle schoolers to octogenarians - to finally experience what sea level rise might look like in their immediate surroundings. They were also able to understand what 'retreat, defend and adapt' might resemble as future scenarios. With this understanding, conversations about the future took place between neighbors as never before. Through visualization, *Projecting Change* connected the members of the community and introduced an unprecedented definition of preservation for a future yet to arrive.



Figure 11. On May 26, 2017, the Point Neighborhood community of all ages looked into their future using the visualization techniques of augmented and virtual reality.

5. Conclusion

Academic explorations in tandem with visualization were critical to the acceptance of sea level rise and the action required to preserve the Point's coastal heritage. Often constrained by the empirical, the common person may find it near impossible to embrace new ideas that threaten to upend the certainty of their known environment. The leeway granted to students at the Rhode Island School of Design, known for thinking 'out of the box,' resulted in new vistas unfettered by real world constraints. Similarly, visualization offered the ability to place one in unknown situations, otherwise untried. *Projecting Change's* unique combination of academia and visualization provided a bridge for discourse that would not have taken place. Presented through visualization, the projects served as a catalyst for dialogue amongst the members of the Point Neighborhood that spawned an interest in the opposing demands of historic preservation and climate change action, both locally and

globally. Community members requested that the visualization materials be displayed as a permanent exhibition of the local church, with the hope that ideas on climate change would become part of daily life, post-event. Newport law makers were interested in the use of the game for community discussions on sea level rise. Outside of Newport, the project was accepted and presented at 8 conferences in the US and Europe from 2017 -2019. This interest culminated in a 2019 *New York Times* article, *'We Cannot Save Everything': A Historic Neighborhood Confronts Rising Seas* (Dean, 2019). In 2020, this project was published in Chinese as part of an Adaptive Reuse issue of the Chinese journal, *The Architect*. This interest became impactful when, two and a half years after *Projecting Change*, "The City of Newport became one of the first communities in the country to adopt standards designed to help protect some of its most historic neighborhoods from the threat posed by rising sea levels" (Daily News Staff, 2020). Newport's historic preservation planner announced a new set of guidelines for elevating properties that considers contextual, architectural and material considerations – a direct response to the issue of "lollypopping." Furthermore, a permitting process will be implemented to allow for discussions that consider both historic preservation and climate change issues, in hopes that ultimate decisions will protect the historic neighborhood from vulnerability on both fronts. More importantly, the introduction of these guidelines acknowledged the urgent need for change in the preservation of Newport's coastal heritage. Within the current methodical but slow moving discussion on heritage and sea level rise, this local development of town governance was ground breaking.

The adaptive reuse of the built heritage of the Point Neighborhood – as memorial, as systemic intervention, as water vessel and as skyscraper in the sea – demonstrates the need to embrace change in the face of drastic conditions. In her 15th annual New Year's speech, German Chancellor Angela Merkel said of climate change action, "We need, now more than ever, the courage to think in new ways, the strength to leave well-trodden paths, the readiness to venture into new territory and the resolve to act more quickly…." (Schuetze, 2019). The willingness to consider new ways and the mustering of the strength to leave well-trodden paths are challenging, especially when these new ways and paths are entirely foreign to what we know and understand. This is all the more pertinent when considering change for scenarios in the future, a future we can understand but not see. Humans require proof to consider revolutionary change in thought and action. Today we have incremental proof of climate change but the ability to extrapolate to what it portends for our future demands a certain faith. Thinking in completely different and revolutionary ways about the management and reuse of our built heritage will be a test of our understanding. Visualization, however, can help one to 'see' beyond what one can understand. On a January morning in 2007, daffodils bloomed in Washington D.C., USA, months earlier than they should have. The physical presence in the depths of winter of these golden harbingers of spring was a physical proof of the effects of climate change that caused *New York Times* writer, Thomas Friedman, to pen his now famous editorial on climate change, "A Warning from the Garden." As we look to gather consensus on climate change and to plan for its impact on our historic built environment, visualization will be necessary to allow everyone to see into their future so as to take action now.

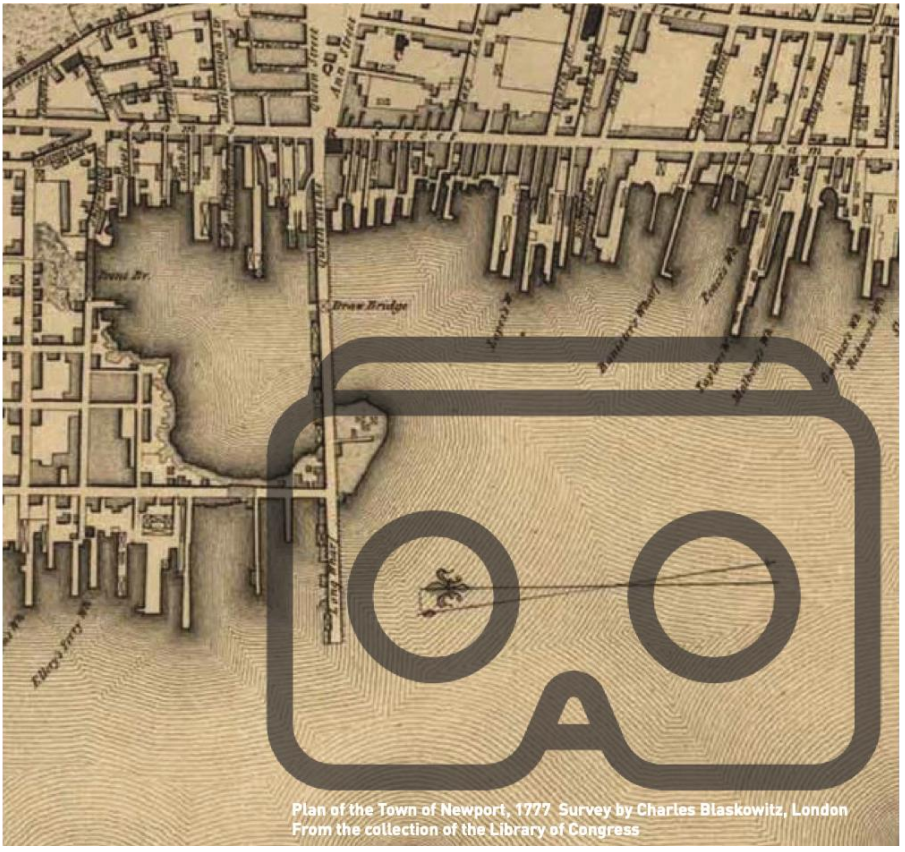

Figure 12. Projecting Change is a RISD graduate studio co-taught by Markus Berger, Michael Grugl and Liliane Wong. The students: Neethi Abraham, Angelica Carvajales, Udeeta Jain, Mengran Jiang, Vinoti Kabara, Krishna Lingutla, Sneha Mathreja, Hana Mehta, Gloria Ramirez, Eshank Rishi, Eder Romero, Yinhua Tan, Rohit Vantaram Rao, Ananya Vij, Plub Warnitchai, Mengyue Zhou

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Figure 3. Courtesy of Liliane Wong

Figure 4. Courtesy of Liliane Wong

Figure 5. “Memory Trace,” courtesy of authors: Udeet Jain, Eshank Rishi, Plub Warnitchai

Figure 6. “Green Grey Blue,” courtesy of authors: Angelica Carvajales, Eder Romero, Sneha Mathreja

Figure 7. “Living with Water,” courtesy of authors: Hana Mehta, Vinoti Kabara, Rohit Vantaram Rao

Figure 8. “Upstruct,” courtesy of authors: Ananya Vij, Krishna Lingutla, Mengyue Zhou, Yinghua Tan

Figure 9. Courtesy of Newport Restoration Foundation

Figure 10. “Upstruct,” courtesy of authors: Ananya Vij, Krishna Lingutla, Mengyue Zhou, Yinghua Tan

Figure 11. Courtesy of Newport Restoration Foundation

Figure 12. Courtesy of Liliane Wong

About the Author:
Liliane Wong received her BA in Mathematics from Vassar College and her MArch from the Harvard University Graduate School of Design. She is Professor and Chair of the Department of Interior Architecture at the Rhode Island School of Design that focuses on architectural interventions to existing structures. Her interest and teaching in this subject led her to co-found the *Int|AR Journal* on Design Interventions & Adaptive Reuse that promotes creative and academic explorations of sustainable environments through exemplary works of reuse. She is the author *of Adaptive Reuse_Extending the Lives of Buildings, co-author of Libraries – A Design Manual* . She was recognized by Design Intelligence for 2018-2019 and 2019-2020 as one of the top 25 most admired design educators in the US.A long-time volunteer at soup kitchens, her teaching emphasizes the importance of public engagement in architecture and design. Other teaching and research areas include design as social activism, preservation and sea level rise, the mathematics of curved space, affordable modular housing and technical textiles. A registered architect in Massachusetts, USA, she has practiced through her own firm, Mahon Wong Associates, as well as with the Boston firms of Perry Dean Rogers and FHCM. Key projects include the American Embassy in Jordan, Montclair Public Library, Hartford Public Library, and the design of the Kore Library Furnishings Line.

[i] The management of change is an idea that is prevalent in discussions and writings on historic preservation. Graham Fairclough in his essay, “Cultural Landscape, Sustainability, and Living with Change?” in *Managing Change: Sustainable Approaches to the Conservation of the Built Environment*, The Getty Conservation Institute, Los Angeles, 2001, summarizes these ideas in this quote: “The cultural landscape is central to the debate about managing change. It is entirely the product of change and of the changing interplay of human and natural processes; …… Change, both past and ongoing, is one of its principal attributes, fundamental to its present character. There is no question of arresting change. Change needs to be managed, however.”

[ii] Projecting Change is a RISD graduate studio co-taught by Markus Berger, Michael Grugl and Liliane Wong. The students: Neethi Abraham, Angelica Carvajales, Udeeta Jain, Mengran Jiang, Vinoti Kabara, Krishna Lingutla, Sneha Mathreja, Hana Mehta, Gloria Ramirez, Eshank Rishi, Eder Romero, Yinhua Tan, Rohit Vantaram Rao, Ananya Vij, Plub Warnitchai, Mengyue Zhou

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Realising Discourse: A Strategic Design Solution to the Problem of Addiction.

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Abstract | This paper reflects upon new possibilities for strategy design. Information architecture (IA) is reconsidered as a tool for meaning-making with relevant links to discursive design methods. Together, these design forms provide an extension of synthetic reach into complexity and synthetic integrity to addressing deep socio-cultural change. A review of a design project conducted to address the challenges of addiction forms the basis of the discussion. Ontological complexity is revealed to be a defining feature of the problem of addiction and is considered in reference to the recent emphasis in design into considering human experiences. IA and discursive design are then discussed in reference to design artefacts created in ideating a strategy design solution. The paper concludes by offering an outline of a method and model for consideration as a pre-pattern derived from said project. Whether towards transformation or the sustainability of social ontologies, the solutions presented stand to assist design in theoretical, educational and practical terms.

KEYWORDS | STRATEGY DESIGN, DISCURSIVE DESIGN, INFORMATION ARCHITECTURE, ONTOLOGY, ADDICTION

1. Introduction

Designing solutions to wicked problems is no simple matter. This paper adds to the already complexity fraught domain, the manner in which socio-cultural ontological constructs can be central to their wickedness.

This discussion reflects on the socio-cultural aspects of synthetically determining a strategy design solution for U-ACT[1], an addiction treatment facility and provider of addiction recovery services in Johannesburg, South Africa by the author. The design project was undertaken employing a research through design[2] (RTD) methodology for an MA dissertation in Design (Hobbs, 2021) from the University of Johannesburg.

In the Thesis[3], a new form of information architecture (IA)[4], Conceptual IA (CIA), is posited and explored for *the design of a strategy* enacted through the Design Thinking (DT) process-method. The use of both strategy design and CIA take their cue from DTs theoretical response and relevance to the complexity associated with wicked problems in design (Buchanan, 1992).

IA is usually associated with activities supporting end-user sense-making in digital design. The thesis argues on constructivist grounds that sense-making and meaning-making are mutually inclusive concepts which tacitly constitute an internal meaning of design objects so intended for the world. In the conception of a CIA, which is enacted in a problem-led, non-assumptive manner following the DT process-method, all designed objects are argued to contain within them such semantic structures which constitute 'contrived ontology' (Hobbs & Fenn, 2019):

> "In essence, sensemaking and meaning-making in IA are the processes of decoding and encoding in DT where, from a humanities and cultural studies perspective, contrived ontology is understood as a subjective, constructed reality embedded in designed artefacts and systems." (Hobbs & Fenn, 2019, p. 764)

[1] Three entities exist to provide these services, referred to collectively as U-ACT herein: The Foundation Clinic (the treatment centre), The Recovery Wellness Programme (an outpatient and public-facing, peer-to-peer recovery programme) and the Ubuntu Addiction Community Trust offering accredited, experiential recovery coach training and certification.
[2] Specifically, Zimmerman, et. al.'s methodology (2007) designated as 'Research Through Design' by the authors, however not in reference to Christopher Frayling's (1993/4) conceptual category by the same name.
[3] To be referred to herein as 'the Thesis' (Hobbs, Applying Information Architecture In Design Thinking: Ideating Solutions To The Wicked-Problem Of Addiction, 2021).
[4] In digital design, IA (Rosenfeld, Morville, & Arango, 2015) is best described as a derivative application of, and from, Library and Information Science (Resmini & Rosati, 2012) frequently enacted within User Experience Design. Pervasive IA (Resmini & Rosati, 2011) positions IA for cross-channel, systemic design at similar levels of abstraction to Service Design.

The first section in this paper brings together related theory and perspectives from across the spaces of DT, strategy and service design and addictionology. The second section reports on the design project conducted, highlighting those aspects of the design relevant to this conversation. Lastly, drawing on insights which emerged from a reflection upon the extensibility of the design process and its artefacts (Zimmerman, Forlizzi, & Evenson, 2007), an outline of a method and model for use in and of strategy design will be presented.

As such, this particular method and model stands as a potential pre-pattern for consideration, rather than knowledge per se in any scientific sense. Hopefully its contribution will be found to be of sufficient value to warrant further study and validation, use, and experimentation with, in practice and ultimately inclusion in design education curricula.

2. The Problem of Ontology

Indeterminacy in Design, introduced by wicked problems as conceived by Richard Buchanan (1992), challenges traditional product-led approaches to problem solving in design. Since any particular artefactual outcome should not be assumed under these circumstances, a shift occurs in the object of design: from concrete product-making to abstract solution-creating (Buchanan, 1992) commonly understood in DT as Ideation or design-led innovation.

Service design, closely related to strategy design and human-centred design (HCD), resolves the 'design object-level' or product-level void by 'rising up a level' and orchestrating systems-level interactions in such a way as to manifest new experiences at the product-level 'below' (Polaine, Lovlie, & Reason, 2013). In a Service Dominant Logic framing (Lusch & Vargo, 2006), the ambition lies in co-creating value in-use with users for the purposes of the improvement of a systems wellbeing. Consequentially, the wellbeing of the system's system takes centre stage due to the constructive, networked nature of value co-creation (Vargo, Maglio, & Akaka, 2008). In many cases, the strategic act of problem-solving manifests as the use of design tools, often enacted with stakeholders in the immediate problem system, which facilitate and stimulate design's thinking at the system level (Stickdorn & Schneider, 2010). For example, the use of customer journey maps (Curedale, 2018).

Systems-level framings and their related design research methods, models, techniques and information are argued in the Thesis to be supported by CIA in accessing a further level of abstraction, a conceptual-level, 'above' the systems-level. In this wholly abstracted and conceptual domain, the dominant socio-cultural, political and economic logics of a subject-matter may be deconstructed in context. Based on theories of social practice and construction, such as Bourdieu's Habitus (1977), this meta-discursive space (Tharp & Tharp, 2019) in design may be described as a critical, conceptual immersion into the problem-ecology (Hobbs & Fenn, 2015) of the problem at hand. For example, if a bank asks for design assistance in improving their home loan / mortgage product, the brief may be taken at face value (product- / object-level). Alternatively, the designer may question home loans and

property ownership as the only, or best, potential solutions available for living (systems-level). And the designer may question further still, what the bank's place is, or could be, in the relationship between a home, shelter, society and available resources (conceptual-level).

It was at the conceptual-level of the abstraction of problems, that the strategic effort in resolving the wickedness of addiction, emerged. The reasons for this are best explained through the ontological nature of addiction as a problem in the world.

2.1 Approaching Addiction

One explanation for the wickedness of addiction can be extrapolated from the work of Guy Du Plessis who, writing from the perspectives of Integral Theory and clinical psychology, roots the challenge of addiction in its ontological complexity (Du Plessis, 2014). In short, his argument and approach (Du Plessis, 2017) lies in an analysis of addiction summarised as follows:

> "...the phenomenon of addiction is a third-order ontology, which can only be coenacted (brought-forth-in-the-world) when juxtaposed with associated methodological variety and epistemological depth (Esbjörn-Hargens, 2010). The notion of epistemological distance highlights that some facts of addiction speak louder than others and some elements of addiction are only enacted within certain worldviews. Methodological variety refers to the fact that:
>
> "The more epistemological distance and ontological complexity increase, the more methodological variety will increase. Thus, the more multiple an object becomes (the What), the more methods and disciplines you will need to study and make sense of it (the How), and the more perspectives there will be on what is or is not the nature of that object (the Who). (Esbjörn-Hargens, 2010, p. 162)"" (Du Plessis, 2017, p. 60)

A parallel may be drawn here to how the multiple perspectives of varying stakeholders are understood in DT (Kolko, 2012). If fact, he is only actually describing one aspect of the domain, being the positivist-oriented spaces of addiction's multiple object, such as the varying perspectives across and within areas like neuroscience, psychology and social science. His description does not include other related systems and their actors in the broader ecosystem such as healthcare systems, family and community systems, education systems, workplace, supply systems, a criminal justice system and the police officer knocking on your car window.

Post researching the domain (Hobbs, 2021) it is clear that no universally accepted etiology of addiction yet exists. Research has emerged over the last decade or so providing neurobiological accounts of how one comes to be dependent on psychoactive substances due to changes which take place in the brain's functioning (U.S. Department of Health and Human Services, 2016) but this research is unable to definitively explain why people become dependent in the first place. Furthermore, neither of the two prior points provide sufficient knowledge to determine what should be done to recover from substance dependence, other

than the rather uncreative yet largely ubiquitous suggestion of abstaining from such substances.

Du Plessis' likening of the ontological problem of addiction-in-the-world, as a wicked problem, to the ontological problem for an addict being-in-the-world, stem from his view that the problem, for both, is being-in-the-world. In other words, the condition is a fact of life in being a part of the human condition. His view is not dissimilar from how one might interpret Buchanan (1992) or Normal (2010) regarding wicked problems and complexity (though not in existential terms): that wickedness and complexity are natural states of (social) reality, beyond direct epistemological reach, which we frame in an attempt to understand and design within. Cross's (2006) conception of design's intellectual culture as being distinct from that of the sciences and humanities relates to this point.

In Heidegger's *existential* phenomenology, Dasein[5] refers to the experience of being human, or the experience of experiencing your being. As such, experiencing your existence gives rise to a self-awareness of your human condition. However, 'to be' through this act of experiencing, is not a (static) state of merely being alive but is rather a process of continually 'becoming' in relation to one's dynamic, embodied experience: the human 'being' alive in the world. In contemporary design discussions within HCD, interaction design and experience design (Hassenzahl, 2010) (Rogers, Sharp, & Preece, 2012) (Wilson, 2010) (McCarthy & Wright, 2004) – even in IA (Hinton, 2014) - we see a popular interest in phenomenology and the theories from fields such as embodied cognition and environmental psychology, amongst others.

In addiction terms, Du Plessis takes our existential human condition as his starting point for addressing recovery in addiction. As he wryly observes:

> "To talk at a molecular [neurobiological] level about addiction is like saying that an amoeba, which only primarily exists in a primitive level of ontological complexity, has abandonment issues originating from poor object relations" (Du Plessis, 2017, p. 97).

Du Plessis' view also draws on Max-Neef's theory of Human Scale Development (1989), where any fundamental human need, "… not adequately satisfied generates a pathology" (Du Plessis, 2017, p. 109). Du Plessis continues to explain that unmet fundamental needs manifest the experience of psychic or psychological pain, for which psychoactive substances are well suited in terms of pain relief (*ibid*). When coupled and left unaddressed, the use of psychoactive substances becomes a second, or third, problem to emerge as dependence develops as a neurobiological disorder (U.S. Department of Health and Human Services, 2016). As such, he describes addiction as "a misguided attempt at self-repair" (2017, p. 109).

[5] This interpretation of Heidegger's use of the term is not specific. These are common and largely accepted interpretations, outside of philosophical circles. Thomas Wendt's (2015) "Design for Dasein" is recommended as an entry point for considering Heidegger's concepts in Design.

3. A Design Response to Addiction

Strategy design is interpreted literally herein, meaning ideating a strategy through the DT process-method where the output, a strategy, acts as the object of design, the 'what', which will inform further making, such as in prototyping. In the Thesis, the design of the strategy lies in the synthetic resolution (Dorst & Cross, 2001) of the problem using CIA in a manner which followed Rumelt's (2012) 'kernel' of any good strategy. The kernel comprises a *diagnosis* of the problem, a *guiding policy* for the solution and *coherent actions* for the execution of the guiding policy (Rumelt, 2012, pp. 77-94).

Together, these various approaches merged to form a working theoretical model (Fig. 1) within which a strategy (design) was synthetically determined in complexity.

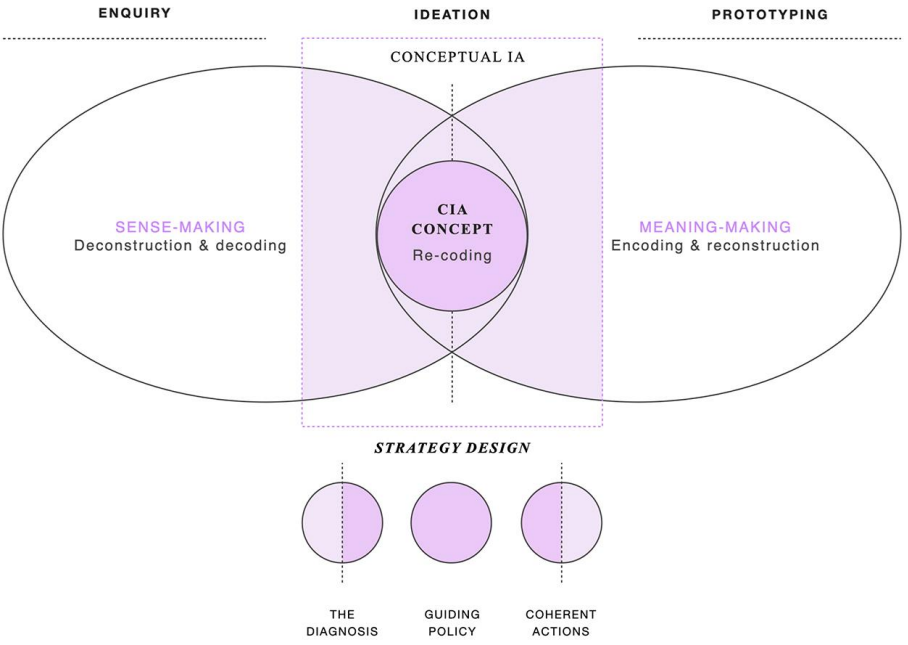

Figure 1. Illustration of the conceptual framework and working theoretical model employed in the Thesis[6] (Hobbs, 2021).

[6] A simplified categorization of the DT process-method is presented here. In the project execution nuances to be found across various descriptions of the process (Harris & Ambrose, 2009) (Stanford D.School, 2018) (Hasso Plattner Institute, n.d.) were applied.

Figure 2 presents activities performed across the DT process-method enactment (Hobbs, 2021). The model depicted builds upon IDEOs description of the HCD process (2009)[7] amended to represent the increased breadth and depth of engaging with the wicked problem. The three rows in the figure represent the levels of abstraction previously discussed: the product-, systems-, and conceptual-levels. Activities relating to the CIA and strategy design are depicted at the conceptual-level of abstraction during Ideation (within the pink rectangle).

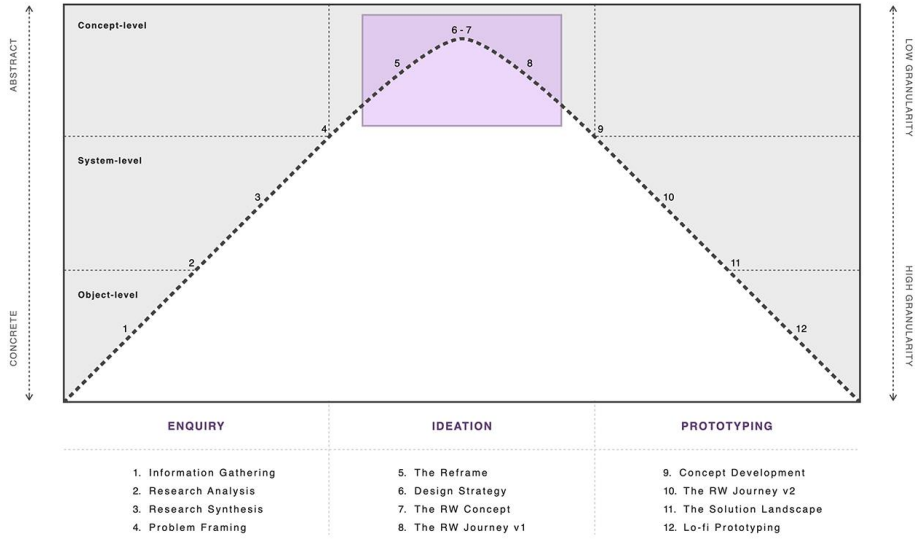

Figure 2. Design activities mapped to a conceptual model of the DT process-method enacted in the Thesis (Hobbs, 2021).

Lastly, figure 3 presents a detailed view of the various aspects of the strategy design as enacted in reference to Rumelt's (2012) kernel. (a) represents the reframing (*i.*) of the problem, being the *diagnosis*; (b) represents the strategic solution (*ii.*) at top and the CIA concept (*iii.*) below being informed by the reframe and constituting the *guiding policy*; and (c) identifies a journey map (*iv.*) created in response to the strategic solution and CIA

[7] The original version - to be found in the 'Intro PDF' (IDEO, 2009, p. 11) - consists of two rows. The lower row contains activities oriented within a 'concrete' modality and the row above includes activities oriented towards an 'abstract' modality. The movement is from the concrete (researching), into the abstract (Ideating) and back down into the concrete (prototyping).

concept, which contained the *coherent actions* within. These three aspects are discussed respectively in the sections to follow.

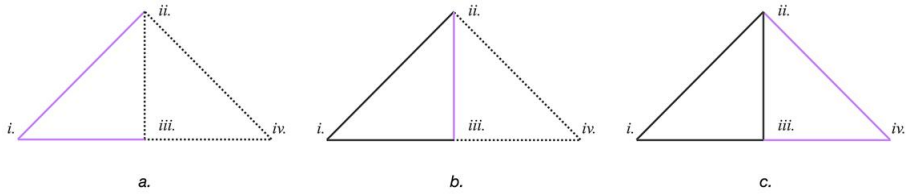

Figure 3. The strategy design and Conceptual IA illustrated through their creation in Ideation in the Thesis (Hobbs, 2021).

3.1 Shifting the conversation

In the design project conducted the problem of addiction was reframed from one centred on addiction and substances, to one centred on a consideration and prioritisation of the human condition across the lifecycle of addiction. By far, the near pervasive belief persists that the solution to addiction lies in abstinence from psychoactive substances either as a preventative or rehabilitative course of action (Hobbs, 2021). In the abstinence model, recovery from addiction is understood as a binary state of either being 'clean and sober' or 'using' (Solheim, 2015). Figure 4, presents a distillation of the author's interpretation of information gathered for the purposes of summarising a model[8] (Solheim, 2015) (Solberg, 1983) (U.S. Department of Health and Human Services, 2016) (White, 1996) (Collins, 2018) (DiClemente, 1998) (West, 2005).

[8] To the author's knowledge no such graphical or so modelled interpretation of the abstinence approach exists.

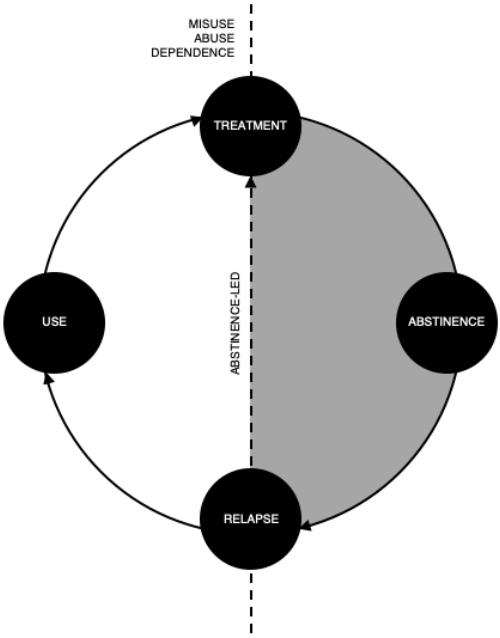

Figure 4. Use and abstinence in addiction conceived as a lifecycle model (Hobbs, 2021).

The reframe and descriptions which follow represent a subjective interpretation of the problem space premised upon research conducted and validated by U-ACT.

It needs to be noted that many South Africans, despite its constitution being one of the most progressively liberal in the world, remain in many ways and across many domains, a conservative[9] people living in the aftermath of a colonial, Calvinist Apartheid era (Collins, 2018) and indeed prior to Afrikaner rule.

In South Africa, the dominant negative socio-cultural logics with regards to psychoactive active substances (beyond alcohol, cigarettes and perhaps marijuana) imagine addiction to be a result of defects of character (lack of self-control, willpower or taking responsibility) or immorality (Collins, 2018). The moral recrimination applies largely due to most of these substances being illicit, and by implication the user too is 'bad' or 'wrong' or 'deserving of what they get'. This is in no small part a global inheritance of the USA's 'War on Drugs' (The Global Commission on Drug Policy , 2017).

[9] Today, SA has some of the longest jail sentences in the world for crimes relating to illicit drug-related crime.

A further dominant logic lies in the classification of addiction as a mental health disorder (Solheim, 2015). The issue thus moves into (mental) health or public health spaces (U.S. Department of Health and Human Services, 2016). Sadly, even here, the view emerges of the addict as a social abnormality and another to be pitied and / or treated differently. An example would be the non-disclosure of a substance disorder in general social terms or when applying for a job.

However, a 'resource model' of addiction[10], a term being coined herein, would suggest that addiction is better understood as the problem of problems, where a lack of internal and / or external resources available to an individual suffering from psychological pain - as a pre-existing condition - provides an arguably rational and reasonable inclination towards the (mis) use of psychoactive substances to ease the pain (Collins, 2018). This follows the views presented earlier by Du Plessis[11]. Left unaddressed, a dependency on psychoactive substances can result, leaving the individual with two problems rather than just the original, one.

In this reframing the addict possesses innate and intact dignity, where the implicit moral intent in the reframe, positions addiction alongside other critical theory discourses with their concerns for justice, equality and fairness. This view is most loudly advocated in the Recovery Movement and its practice known as Recovery Management. Solheim observes:

> " The goal of recovery [has become] repositioned as "improvement in key areas of life that were impaired by chronic SUD [substance use dependence], emphasizing the need for coordinated and comprehensive services" ... The literature has moved far beyond the ideas of cessation of substance use: we have entered the developmental realm of recovery management, embracing recovery as a process, not a state, a process that is experienced as a better quality of life." (Solheim, 2015, p. 13)

Du Plessis further notes that "QOL [quality of life] is applied as a fundamental concept across health care research… especially in mental health care and disability studies… QOL is increasingly recognized as a valuable indicator of the impact of treatment, need for health

[10] In the Recovery Management domain, the concept of *recovery capital* centres on a recovering addict being assisted in building up the resources required for long term, sustained recovery (Solheim, 2015).

[11] In citing Max-Neef, Du Plessis very cleverly contextualises addiction by connecting the individual to the larger socio-political system within which the addict suffers: "Each economic, social and political system adopts different methods for the satisfaction of the same fundamental human needs. In every system, they are satisfied (or not satisfied) through the generation (or non-generation) of different types of satisfiers…We may go as far as to say that one of the aspects that define a culture is its choice of satisfiers. Whether a person belongs to a consumerist or to an ascetic society, his/her fundamental human needs are the same. What changes is his/her choice of the quantity and quality of satisfiers." Max-Neef (in Du Plessis, 2017, pp.107-108).

care, evaluation of interventions, and for cost-benefit analyses." (Du Plessis, 2017, pp. 115-116).

It is in the context of these enormous shifts in thinking about addiction that the well-being of an addict (in recovery or not) needs to lie at the heart of any design intervention.

3.2 Message-Content and Message-Form

In a most unexpected turn, it would appear that an overlap exists between IA and Discursive Design which could have far reaching, and positive, implications both for Design and IA.

In Tharp & Tharp's (2019) "Discursive Design: Critical, Speculative, and Alternative Things" they describe **message-content** which refers to the content of the subject matter under discussion within a discourse, and **message-form** as the mode of discourse or form for sharing the content. It is in their considered and combined form that an additional level of meaning is conveyed which allows for complex handlings of content, form and context (Tharp & Tharp, 2019).

In its simplest form, IA is typically used to create the content structures of websites. This involves the identification and grouping of information into categories, all of which are labeled, and then modelled in an iterative top-down and bottom-up process to develop a structure, an IA, which people navigate through using a (graphical user) interface. This act has recently been reframed (Hobbs & Fenn, 2019) as the creating of a *structural logic* which through taking a form, referred to as a *semantic formation*, (trans)forms when realised (made *and* used) within design objects.

Although discursive design (DD) and IA have very different purposes and contexts of use, they use almost exactly the same constructs: message-content being structural logic; and message-form being semantic formation. For now, these constructs will only be highlighted for their likeness in relevance to the strategy design conducted. Later, the conversation will resurface again for other reasons.

The strategy design solution consisted of defining an aim for the design, a concept for the design and the approach to be taken to its execution. Sadly, there is only space within this paper to discuss the design concept and even then, at-a-glance.

The CIA concept, which emerged from the reframe, while also functioning in relation to the aim and approach, consisted of two parts: a set of 'experience drivers' (Fig. 5) determined through synthesis of the research; and a novel lifecycle or 'relationship model' (Fenn & Hobbs, 2017)(Fig 6) for a wellbeing centred recovery. The former operates as message-content / structural logic and the latter, as message-form / semantic formation.

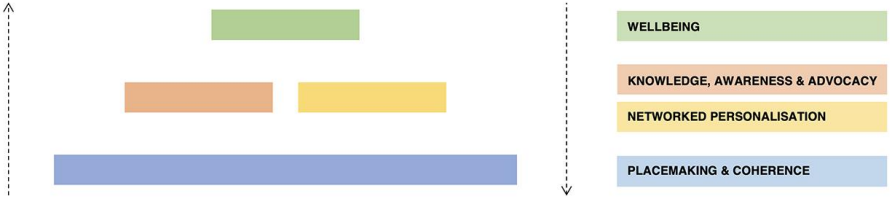

Figure 5. The experience drivers model as the message-content / structural logic (Hobbs, 2021).

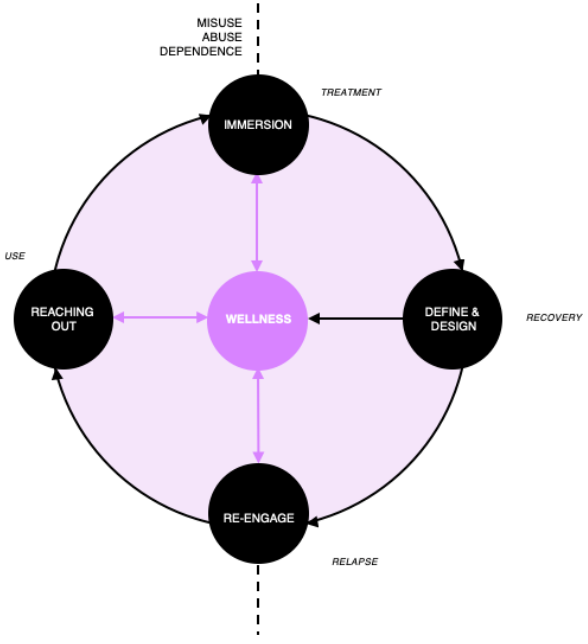

Figure 6. A wellness centred relationship model as the message-form / semantic formation (Hobbs, 2021).

Together, these two artifacts provide the structural semantic architecture as, and for, a new 'contrived ontology' for the solution intended for the world.

3.3 The Contrived Ontology

The experience drivers and relationship models provide something like a *kernel* for the IA of the entire solution to be built upon, thus providing a contrived ontology. The CIA concept's first instantiation took the form of a more familiar design artifact, a Recovery Wellness Journey (Fig 7). This journey is in essence a pervasive, cross-channel information architecture (Resmini & Rosati, 2011) functioning at a systems-level. In turn, and sustaining the thread from CIA concept, specific services and products (Fig 8) were able to be ideated and prototyped at an object- / product-level for stakeholders engaged across the ecosystem.

In figures 7 and 8, the relationship model is rendered in a linear form as the top line of five, black journey stages, reading from left: Immersion, Define & design, Wellness and re-engaging. The content depicted below, organised per stage, is colour coded in reference to the experience drivers model. In this way the coming together of the structural logic and semantic formation to form a *whole* is made visible.

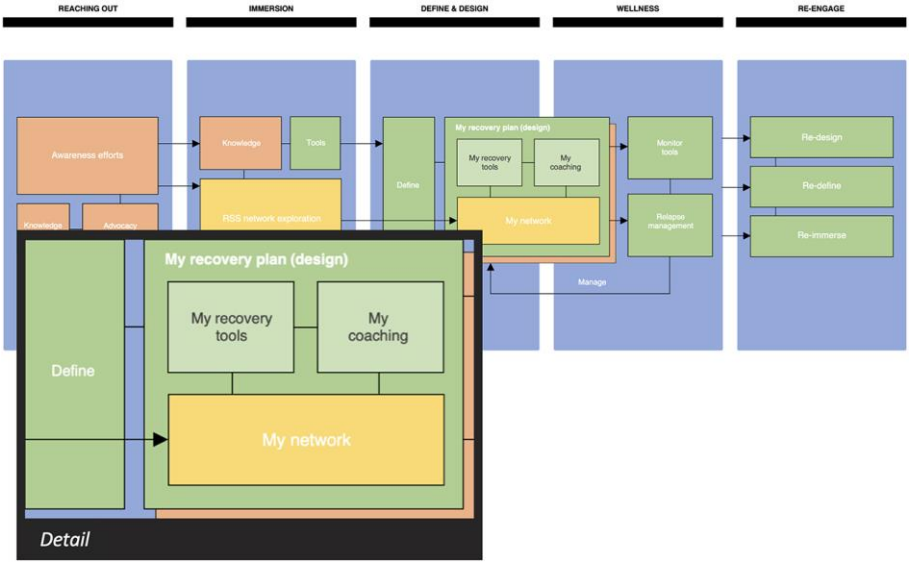

Figure 7. The version 1, lo-fidelity prototype of the Recovery Wellness Journey (Hobbs, 2021).



Figure 8. Mapping of cross-channel ideas generated into journey stages (top) and colour coded by experience driver (below) (Hobbs, 2021).

Figure 9 presents an example of one of the in-channel (website) user journeys created for the Immersion stage, transitioning towards the Define & Design phase in the same channel.

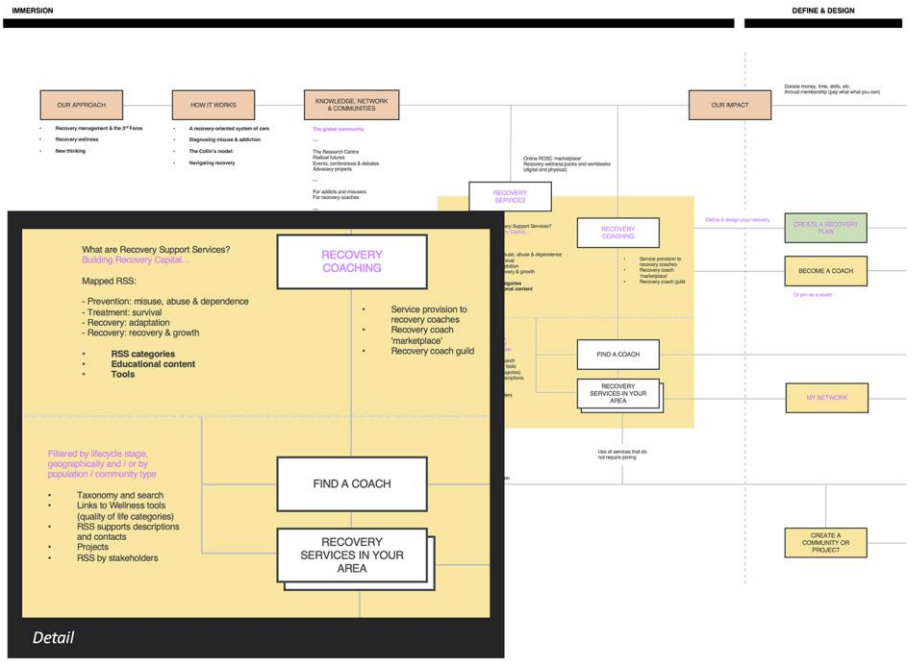

Figure 9. The 'Immersion' stage in the relationship model for the website user journey from the Thesis (Hobbs, 2021).

Visible across figures 5 to 9 should be the move from upper abstract levels of description downwards towards increasingly granular and concrete descriptions of the concept in design. Visible too should be the manner in which each successive level of ideation and description takes its logic, and **meaning,** from the prior level. Thus, *the form* of the CIA concept is both preserved and discovered through the DT process-method to ultimately manifest a contrived ontology as a meaning tacit within the user's experience of the solution[12].

[12] A distinction is made in the Thesis between a minimal conception of contrived ontology, being a meaning intended for the world, and a maximal conception, where the meaning transcends contrived intent to become an authentic ontology co-produced with users. The extent to which the maximal contrived ontology coheres with the minimal may be taken to be a measure of the quality of a design.

4. System Wide Synthetic Integrity

Synthetic integrity is a praxeological concept also referred to by its authors as a 'golden thread' (Fenn & Hobbs, 2017). Their original conception was of a horizontal, linear thread which, through the use of design journeys, made shifts in the meaning of information visible and traceable through design processes (Hobbs & Fenn, 2013). This is important in DT where, due to reframing, information used throughout the design process, such as research data or, even decision making, transforms in meaning due to deconstruction and decoding in Enquiry, recoding in Ideation and encoding and reconstruction in prototyping (Hobbs, 2021).

The Thesis expands upon the original notion where a second thread was observed operating 'vertically' forming, by way of analogy, an X- and a Y-axis. The X-axis represents the aforementioned golden thread. The Y-axis manifested through the CIA concept being employment across the three levels of abstraction from Ideation through to the end of Prototyping. Together the axes provide a scaffolding which pervades the design process.

It is in this way that the complexity of the wicked problem is harnessed through the use of IA and CIA in two ways: first, affording a *realising* of meaning, through sense-making in Enquiry at the point of reframing, through deconstruction and decoding; and second, *realising* the CIA concept as meaning-making in Prototyping through encoding and reconstruction.

It is worth restating that IA comes be discursive, though not necessarily critically so, when it shifts from applied science to Design (Hobbs, 2021). In this shift, how one considers and treats information derived from research and employed throughout the design process needs to be understood in the terms of Design's mediation of social reality (Hobbs & Fenn, 2019). Without this, it becomes extremely difficult for Design to take responsibility and be accountable not just for what it makes but also how it makes what it makes (Hobbs & Fenn, 2019).

The strategy design, sitting at the pinnacle of the process thus becomes a hinge for managing not only project, programme and even cultural design-related affairs, it provides for the management of the meaning in the system created and the networked meaning of this system in relation to others in its ecosystem. In this context, meaning could possibly be understood as *value* in the language of SDL (Vargo, Maglio, & Akaka, 2008) however, more consideration of these implications is required in general.

4.1 A Pre-Pattern?

The basis of a method and a model for praxis, a pre-pattern in RTD (Zimmerman, Forlizzi, & Evenson, 2007), has been developed in the Thesis which builds upon Buchanan's (1992) concept of *placements*. In this method we may observe an ontological reframing of what addiction could come to mean in the world. This shift in meaning is captured in the CIA concept, the Recovery Wellness Concept, which acts as a 'pivot' for exploring solutions. The mechanic for exploring and defining combinations of placements across space and time, in

the Thesis, was a journey map, which in turn inherited its structural logic and semantic formation from the CIA.

As the dual enactment of IA, and CIA, occurs across both X- and Y-axes a scaffolding, or semantic structure, comes to pervade the DT process-method providing system-wide synthetic integrity (Fig 10).

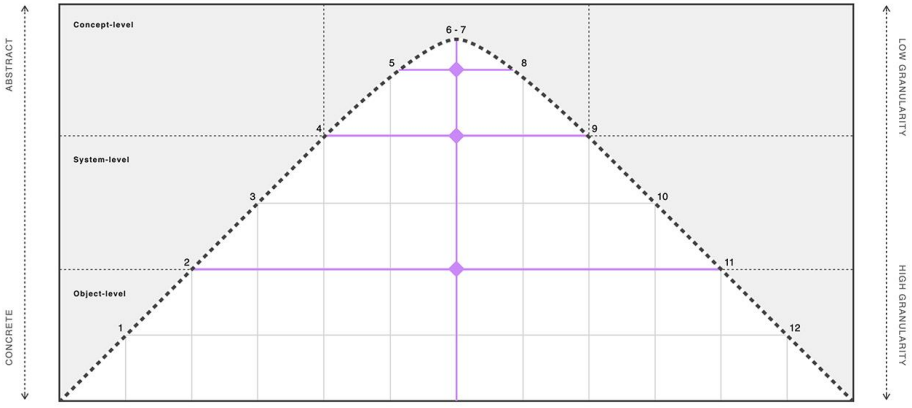

Figure 10. Diagrammatic representation of the synthetic, structural integrity created by a conceptual information architecture (Author).

What synthetic integrity then brought forth was a *concept* for a generalised architectonic for **systems of meaning** and **meaningful systems** as two parts of a gestalt whole (Hobbs, 2021). The system of meaning took the form of a *system of wellbeing* - from the relationship model as the semantic formation; and the meaningful system took the form of a *system to be well in* – from the experience drivers as the structural logic (Fig 11).

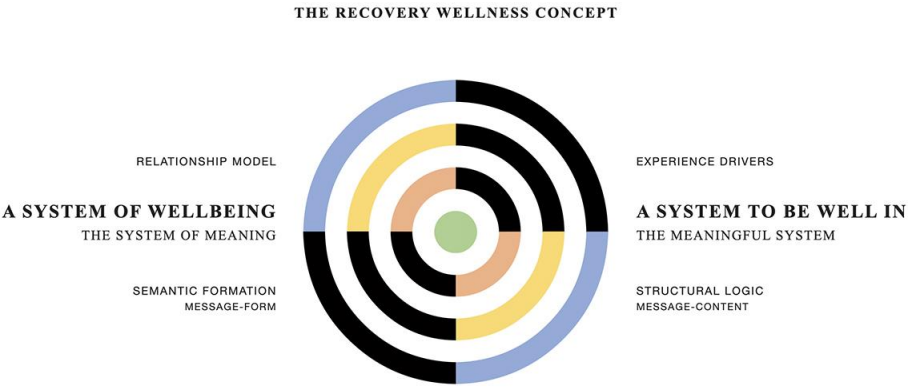

Figure 11. Communication device created for sharing the CIA concept in the Thesis (Hobbs, 2021)

In concluding this exposition of the project, a last observation is to be made. In terms of a coherent and consistent framework of meaning, the integral, structural nature of the system to emerge from the strategy design is one in which all instances of the system appear in the system itself, but in turn, the entire system can be observed in any particular instance. This last point provides the technical explanation of how the system's tectonics some to support the meaning for its architectonic.

Conclusion

This paper has provided an account of strategy design created through the DT process for the purposes of solutioning for the highly complex topic of addiction. Strategy design in this case, is demonstrated as a meaning-making process capable of emerging through synthetic resolution in Ideation. Through the use of conceptual information architecture (CIA) such meanings are capable of manifesting in the world as contrived ontologies within robust, transformative systems. In the identification of the shared semantic mechanics of discursive design (DD) and information architecture (IA) important and exciting opportunities become available to design, and the world.

Both DD and IA make meaning by *being* in social reality, however DD would emphasise a transformative social agenda and IA would likely default to a sustainability agenda (which should not necessarily be interpreted as a conservative socio-political stance). Where contemporary IA practice perhaps differs from DD is in its principal application in the design of increasingly pervasive digital spaces (Resmini & Rosati, 2011) which have shifted from our being related to, to our becoming dependent upon (Floridi, 2016).

These digital spaces are interactive and functional and thus, what were discursive 'readers' become discursive 'users' of semantic systems. In a sense, the nature of digital environments renders the message-form, in the first instance, as something to *be in* rather than to observe at a distance. The pre-pattern presented within allows discourse to become realisable as the environments within which we will soon be living.

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Acknowledgements: Thanks are due to the Faculty of Art, Design and Architecture at the University of Johannesburg and Marc Edwards (my supervisor) for their assistance related to the MA. Perhaps it goes without saying, but a huge debt of gratitude is owed to Terence Fenn, my research partner and friend for over a decade now. Lastly, a special thank you to my parents, Janine and Mike Hobbs, for putting up with me (and putting me up) during this time of the COVID pandemic.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Reframing development: A proposal on the role of design research in Latin America based on situated views of the world

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Abstract | Design has gone, through the past decades, from looking for solutions to everyday problems to the production of actions on a systemic level. That path has led design into getting involved with the process of policymaking. But as many researchers have reported, a constant failure in the implementation of policies for innovation and development on so-called 'third-world' countries, might imply a necessity to investigate its possible reasons and implications. Design practices related to policy making have proposed possible frameworks to evaluate those failures and seek for solutions, however, these procedures might be based on the wrong assumption, that these failures are barriers to overcome, rather than embedded values to be encouraged in the design process of possible new systems and ideas of the preferred future. This paper considers some critical notions of embedded values on Latin-America communities and the implications for a growing role of design in devising actions that can lead us to a preferred future state of the system.

KEYWORDS | POLICY DESIGN, SYSTEMIC DESIGN, EMBEDDED VALUES, LATIN-AMERICAN DEVELOPMENT

1. Introduction

In the past 60 years, design theory has developed significant arguments about the nature and role of design as a discipline as a way of thinking (Polanyi, 1964; Alexander, 1967; Simon, 1969; Bucahanan, 1992; Banathy, 1996; Cross, Christiaans & Dorst, 1996; Sevaldson, 2017). Some of these arguments have been widely accepted and some are still discussed among academic communities, but from them we could establish certain principles and trends that can show us current exploratory practices and their possible impact in the future role of designers in the world. One of the most significant ones and the one on which this article is supported the idea of design thinking and design process as possible tools for the design of economic and political policies (Ingram, & Schneider, 1993; Soss, 1999; Skelcher, Mathur, & Smith, 2005, Hendriks, 2009, Kimbell, 2015).

This practice is located inside the conjunction between the capacity of design to look and research into possible preferred future states of the system (Simon, 1969; Banathy, 1996) with the purpose of producing tangible artefacts as catalyst for the required transformation, and the notion that design is by nature systemic (Sevaldson, 2017), and it is constantly looking for connections outside the initial scope and for solutions to larger or wicked problems (Rittel & Webber, 1973).

But most of the approaches presented in the research literature about the process of design for policymaking, assume the existence of a system in place, and focus on the systemic search for failures with the intention of producing formal solutions that fit into the system and improve its functioning, either by overcoming barriers (Woolthuis, Lankhuizen, & Gilsing, 2005) or by a participatory model that informs the process (Barbero & Bicocca, 2017). This methodology present significant problems when the view of the system moves from theoretical and structural to a real, complex and dynamic view, and factors like the culture and values are recognized, not as barriers to the adoption of a policy, but as leading principles of the real system. Leading to the question of how to make sense of those systemic failures as index of underlying principles of the community not capture by the design process.

This paper seeks to interrogate the idea of design for policy making, with the specific case of Latin-American models of development (Escobar, 1991), when concepts like situated knowledge (Haraway, 1988) and systemic values (Friedman et.al., 2013) are incorporated inside the design process; and what are the possible implications for the area of study.

2. Theoretical context

2.1 Designing for policy making

Design devises tangible means of transformation of the world (Simon, 1969) on a systemic level (Sevaldson, 2017), therefore its recent role on acknowledging different stakeholders

and the use participatory approaches to recognize possible spaces of transformation on governmental policies and produce viable possible alternatives to address those issues. Initially based on the application of 'design thinking' techniques (Buchanan, 1992) to include the targeted communities on the discussion and to search for creative solutions to complex issues on the governmental level, design for policy making has quickly turned to a systemic approach. This idea of a systemic and yet actionable approach that design brings, has created new opportunities for designers to get involved on the process of policymaking on a higher level (Bason, 2014).

But those design actions focused on the improvement of society have shown over the years to present significant problems on the search for the development of the so called 'third-world' (Escobar, 2012). Projects of social innovation and social awareness, have fell into oblivion when communities are unable to support or maintain those design solutions built for the covers of magazines. And large scale policies for development slowly bleed out their resources on the intent for acceptance and implementation. One possible reason is that there are several intrinsic factors in the systemic level of policy making, like the situated knowledge of the community, their cultural values and their views of the world, that are usually not incorporated by policy makers under the assumption that their role is to make their policies viable.

This notion of viability is a very dangerous statement, since it assumes the existence of one view of the world and one image of the future, and policies as the correct mechanisms to lead us there. In this model, the failure of policies is conceived as the result of a series of systemic barriers that must be identified and resolved to make the policy implementation possible (Woolthuis, Lankhuizen, & Gilsing, 2005). We could argue that a significant problem of many design processes is that they focus their attention on the production of artifacts (either images, objects, plans, service blueprints, etc.), but that the real objective of this artifacts, that is the actual transformation of the future system, is sometimes overlooked. Ideas like predictability or anticipation, that are coming from economical sciences and engineering, support this idea of the production of objects that intent to fill a predicted gap of the future and that their success is measured based on acceptance rather than on the unintentional consequences that they produce or the values that they support. This view eliminates one the most important principles of design: that it is about the actionable transformation of reality.

However, the application in the process of design of socio-political and cultural theories as systemic factors, might present a more critical way to devise policies that agree with the reality of the system and the stakeholders involved, or at least to a more critical understanding of the system and the real reasons for failure.

2.2 The importance of situated knowledge

One of the different struggles for policymakers to introduce new policies that support a specific model or view of the world, is the one that is presented when communities are

forced to accept policies that go against their current practices. This conflict between the traditional practices and the requirement to accept new ways of doing, is usually seen by policymakers as a deficit or inability of individuals to adapt or develop (Smith, 2000), even though those disregarded traditional practices, might sometimes have a better understanding of the ecosystem. This type of knowledge that is produced by cumulative experience of a tangible relationship with the world, or situated knowledge (Haraway, 1988), is not just built on a more systemic process, but is also intrinsically connected with cultures, traditions and ways of being in the world.

Besides the fact that communities who are subject to models foreign to their reality must deal with the erosion of their traditions, they also should tolerate the disdain of the situated knowledge that they have built through generations by the institutionalized structures of knowledge, and accept new methods that rely on notions sometimes built on a lab separated from reality, or based on theoretical ideas that have not been fully developed.

Escobar (2007) points out this phenomenon on his critique to the ideas of development,

> "…the forms of exclusion that went along with the development project, particularly the exclusion of the knowledges, voices and concerns of those whom, paradoxically, development was supposed to serve: the poor of Asia, Africa and Latin America" (p. 20).

This disregard of their traditions, this silencing of their voices, is not just a barrier to overcome or a matter of inclusion, it is a sign of a larger problem on a systemic level, and it raises the question of whether the role of design is to find a way to ease the transition, or to reframe policies and the notion of development in a systemic level.

This issue is not just a matter of cultural acknowledgement, it is important to recognize, that even though situated knowledge does not follow the paradigm of scientific knowledge, it is constantly producing hypothesis that are tested for even longer periods than the ones used on science process, and they are deployed under real conditions. It is also important to add, that a possible advantage of situated knowledge for problem solving, is that it seeks for actions on real instances, it does not rely in the ability to validate or explain, but on the pragmatic search for a solution. Finally, situated knowledge does not simplify or discretize reality like the scientific process, it works in a systemic way, connected to all possible variables and consequences (Haraway, 1988). Therefore, in the case of design practices, integrating this kind of knowledge to the construction of ideas for the future of these communities is not just adequate but necessary.

We can see several examples of this denial of situated knowledge by the political systems of hegemonic knowledge, and they extend far beyond 'underdeveloped' countries. Praxon (2012) argues that there is a political decision behind the imposition of these models and that their effect might put in danger a specific knowledge that has not been collected or recognized by other means; Marcellino et.al. (2001) also explains how the introduction of

modern technologies on the production of cheese has been eradicating ancient techniques and knowledge,

> "As traditional cheese making techniques are threatened or have been abandoned, the collection, characterization, and preservation of native strains of cheese-ripening microorganisms are critical..." (p. 4758).

This idea of a standardized knowledge eradicates the possibilities for conversation, and assumes a given truth about the world, ignoring that many of the problems that we face today were already resolved hundreds of years ago by the communities that inhabit those spaces.

That is the case of the flooding areas of the Zenú river in Colombia, where the larger hydraulic system of ponds, canals and floodgates of the Americas was set on place even before the arrival of the Spaniard Conquistadors, managing the caudal of the river to provide irrigation and organic material to the soils, bringing sustainable wellness to the local communities. This model that guaranteed prosperity for the whole community was based on the principle of governance as a service and management instead of ownership in terms of the use of lands.

However, the introduction of political decisions intended to provide benefit to individuals, and policies that disregarded that situated knowledge, transformed the overflown of the river into a constant focal point of humanitarian crisis, where, on yearly bases, families lose their crops and assets. As lands are no longer communal, communities are forced to deal with their own problems as individuals, and large scale actions are only reserved to a governmental level.

But cases like these are even more complex when indigenous communities that are still actively using that knowledge, and we can count that on hundreds of communities in Latin-America, are forced to face science, medicine or modernity. We see their lack of acceptance of these ideals as lack of development or understanding, ignoring that their knowledge of reality might be better connected to the natural system.

These statements are supported by different authors, some of them, like Escobar (1992), criticizes the notion of 'development' as a constructed ideal for the future that has been imposed by the mechanisms of power that are in place, to maintain control over the 'less-developed', ignoring their voices and their ability to produce their own idea of future. We live in a society that has taken for granted a single idea of what the future is, and the role of technology, science and politics in the construction of that future, ignoring that there are other communities sharing the space and dealing with the consequences of our ideas; communities with other views of the preferred future, that are based on cultural values different than those of the modern western world that have determined the path we have followed.

2.3 Embedded cultural values and their systemic repercussions

The discussion about embedded values in design have been getting more attention and discussion on research literature (Pereira, Buchdid, & Baranauskas, 2012; Friedman, et.al. 2006) and other design related disciplines on the fields of architecture and engineering have included the use of values on the definition of current projects, from infrastructure to big data and AI, human values have gained attention as significant variables on the construction of large scale system or environments. Values are strong forces pulling into specific directions, especially those with cultural origins, since they represent a shared view of our roles inside society; these intrinsically bounded cultural values of local communities, define a big part of their traditions and actions, since those have been historically oriented to the fulfillment of symbolic needs.

However, as stated by Escobar (2007), there is no way to assume that policies intent to fulfill the real needs and requirements of societies, especially since most of these (needs) are produced by a dialectical relationship with the ideals of the ideology on place. It is necessary to recognize that the role of design on communities where foreign values have been already introduced might go farther than applying participatory processes to recognize their needs, since those might be skewed from reality. As for those communities that have not been obligated to adopt external models or ideologies, these values could be leading into a different direction.

It is then important to understand that for many traditional Latin-American communities, the wellbeing of a community is more valued than individual interests, and the ecosystem is valued beyond the discrete idea of 'resources'. Those communities historically have looked for balance and flourishing rather than growth or development as a definition of future, for them notions like individual growth or private property are not only foreign but dangerous. In that sense, Riley (2000), points out about how non-Western indigenous communities still carry a deeply embedded notion of property as a value intended for the wellbeing of the community that clashes with the ideal of individual property of western copyright laws; adding to that, Redford & Stearman (1993) also argue on the dangers of imposing western notions like 'property' on the issues of land on indigenous communities, since the sustainability of many of the tropical forest areas of the Amazonia have been supported by a complex system of collaborative and communal management of those lands, and oriented to guarantee its persistence for present and future generations.

Isemberg (1992), also discusses how the delicate ecosystem of North-American communities was disrupted by the imposition of European policies, and how the practices of sustainability of Native American communities change from a system of multisource communal support to a nomadic economy of hunters, forcing them to abandon their traditional lands. He also points out the devastating consequences of the introduction of the notion of capital as a desirable value and a constant goal that is opposed to the wellbeing of communities. These factors present a significant learning for design in general and design for policymaking in particular, since it reveals the constant existence of embedded values on everything created

by humans, from everyday objects to large-scale policies, and the significance and implications of those values on human behavior and on the balance and survival of the system.

3. World-views and images of the future

Both the values and the situated knowledge represent the past and present of communities, the trends, patterns and lenses used to produce an image of both the present and the future system. They have been a significant part of what have produced specific 'world-views' or 'Cosmo-visions' on local communities. Therefore, any image of the future used on a design process (Banathy, 1996) that fails to incorporate those views will produce a natural resistance on the implementation process.

These views of the world might be significantly different to ours; particularly in Pre-Hispanic America, these visions were based on a sustainable and systemic view of the world, where nature was not defined as a set of human resources, but as a living organism, and the role of humans to maintain its balance. Escobar (2007) comments

> "…alternative political ecology, based on notions of sustainability, autonomy, diversity and alternative economies that do not conform to the mainstream discourse of development" (p. 21)

referring to the vision proposed by local black communities in Colombia on their process of trying to define their idea of future, and proving a systemic dislocation between large scale politics and the real intention of communities.

And yet, many policymakers still try to implement policies that are foreign to the reality of these communities, disregarding the lessons of the past. The implantation of policies based on unaligned world-views may produce unintended (or not) negative effects; as Isemberg (1992) points out, the imposition of modern 19th Century worldview of the evolutionary struggle of the species facing the cruelty of nature and the need for individual survival as the 'fittest' might have come with devastating consequences, like the nearly eradication of both American buffaloes and Native-American communities.

All these principles are embedded in communities and born through their relationship with the real world, but in the process of policy making are not commonly acknowledge as possible factors to seek the transformation of the current policies or even the reframing of notions like development or the underlying economic and political models that supports them. Woolthuis, Lankhuizen, & Gilsing (2005) explain this dislocation between policies, situated values and knowledge as a "Soft Institutional Failure" and argue that policy designers must overcome those to be able to implement the desired policy, disregarding the possible importance of these principles in the constructions of policies. Others, like Skelcher, Mathur & Smith (2005) argue for a participatory process for policy design, that allow communities to part on the definition of their future, but even in the participatory approach

the role of communities is reduced to the production of ideas for policy making, leaving outside the discussion if there is a real common view of the future, and if those policies are just patches sawed on a defective system.

If design is indeed a holistic process of understanding and transformation of reality based on a specific view of the world, and that both the understanding and the possible implications of design actions are supposed to be happening on a systemic level (Sevaldson, 2017), we should not be looking only into the production of artifacts to support the implementation of one single view of the future, or to ease transitions into what some stakeholders assume as the right direction. We should be able to reframe those notions of the future, to include the reality of the communities that we are working for, considering possible game-changing actions intended as catalyzers to the large-scale transformation of the current system, and if Escobar's (2012) argument of "Design has doubtlessly been a central political technology of modernity" (p. 5), we should also have a significant role to lead us pass that notion of modernity into a more inclusive view of the world.

We can see emerging cases of participatory future building in Latin America, like the one presented by de la Rosa, et.al. (2021) about the creation of the CIIC (Communitarian Center for Research and Innovation), where communities lead grass-root processes that seek to produce images of their future that can help them modify the policies that affect them. These actions do not seek to map problems or needs, but rather recognize their values, and their ideas of what a better future looks like for the community, and then plan for strategic actions that can lead into them.

On these practices design becomes an enabler of their process, it does not ask for problems or presents solutions, but recognizes the design process as its main contribution, and the constant reminder that the goal of the process is the future of the community, and the participation of every voice. In this process design is not the savior or the initiator, it does not take the credit or publish creative innovations on the cover of a magazine. It rather maintains a silent role of support and focus.

On the mentioned case of the CIIC, the design team organized a series of community-based workshops that used methods like value-mapping, cultural probes, self-ethnography, prototyping and collaborative analysis to create images of a future where community values where acknowledged and incorporated for the wellbeing of the community.

Although these processes emerge on very specific circumstances of socially concerned community values and a history of participation. The role of designers seems ideal for policy-making, facilitating discussions about the future on a systemic way, interconnecting intentions and agencies to produced strategic plans to incorporate voices and actions into the construction of that future.

4. Discussion

The problem for neglected communities could go as deep as the primordial principles of the capitalistic system and may explain the permanent seek of Latin-American communities of alternative systems, and their foreplay with communist ideals, that at the end become also imported views of the world. Escobar (2007) point out that

> "with their focus on discourse, the post-development proponents overlooked poverty and capitalism, which are the real problems of development" (p. 21).

This might determine the need to go even farther in the definition of future, and the idea of development, to seek from the perspective of policy design an approach that recognizes the real nature of communities as a foundation to produce new models, and as Escobar points out, enter the era of post-development, when communities become more involved in their construction of their future.

From the perspective of design, as a process that constantly seeks for the transformation of reality to achieve a preferred state, the question is, how do we define the notion of 'preferred'? Is it based on the view of the systems of power in place or is it really considering the preferred views of the members of the communities that those policies serve? And how deep into the system should design process look? Should it be just a tool to serve to patch the gaps of a failed system or a catalyzer of transformation of current models and institutions?

Design have historically play the role of facilitator, greasing the wheels of the power system, either as the building arm of the economic powers or the path maker that with the ideal of social innovation helps to maintain the inequity of the system. Giridharadas (2018) on this issue, quotes the 1891 essay by Oscar Wilde, referring to the actions of design thinking as a tool to alleviate poverty, rather than a radical force of change, as the good slaver who by actions of kindness covers the horror of slavery. Isn't it time then that Design assumes the role of truly aiming for a preferred future that we can all share, and not one that has been systemically designed to maintain poverty an inequity as a mechanism of control.

If Escobar (2012) is right is, the constant failure of the systems is related to the implementation of extraneous politics and models that are unaligned with the values of the communities they seek to represent, and do not recognize the nature of these communities. With the assumption that the role of design as a discipline is investigating the future to produce new artifacts, and that those artifacts are determined based on the structure of the system, working with a failed system as an initial parameter, will mostly produce inadequate results. Therefore, every intention to produce innovation and development in Latin-America might be by nature flawed and might require for design researchers as their priority to investigate the notions of development and future to produce new models that include the reality of the socio-cultural ecosystem of Latin-American communities.

This paper calls for design research communities in Latin-America to prioritize the design for policy making as their main initial preoccupation and to seek for ways to reframe the idea of development towards an inclusive, sustainable and responsible model of the future world from a systemic perspective.

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Acknowledgements: This paper recognizes the work of social organizations and popular and situated knowledge researchers that have been fundamental to conceive these ideas. The CIIC and the amazing team that works there. Sebastian, Valentina, Carlos, Dora. They are authors as well of these paper

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Speculative Design for the Public Sector. Design Fiction as a Tool for Better Understanding Public Services.

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Abstract | This paper investigates how speculative design and particularly design fiction can be an effective educational approach to public sector design. The innovation and digitization of public services has been an important driver for the introduction of design thinking and service design methodologies in the public administration in recent years. Design for the public sector on the other hand affects the way the citizen-institution relationship is conducted and therefore requires an ethical and possibly critical approach. Likewise, the global challenges that await public policy choices are increasingly confronted with analyses and foresights of the future. Design fiction is a way through which, starting from the designer's educational path, design, politics, foresight and civic participation can be combined within a conscious and ethical narrative framework.

KEYWORDS | DESIGN FICTION, SPECULATIVE DESIGN, SERVICE DESIGN, DESIGN FOR SOCIAL INNOVATION, DESIGN FOR PUBLIC

> Without a utopian element, another world is not possible and would remain the expression of a pious ethereal wish without concrete consequences.
>
> *Gui Bonsiepe* (2010, p. 41)

The purpose of this paper is to investigate how speculative design can represent a useful didactic methodology for providing designers with the skills necessary to take on the challenges of digital public service design. In recent years, innovation and digitalization in public administration have been an important stimulus for introducing the methodologies of design - and service design in particular - into the field, especially in cases where design's capacity to promote inclusion and civic participation proves to be a useful resource. The result of this process is an increasingly intense and inevitable synergy between designers and the public sector.

1.Design for the public sector

This is reflected in the fact that international experiences concerning the design of digital public services have recently been on the increase. The effectiveness of digital public services, in fact, represents one of the policies monitored by the European Commission through the Digital Economy and Society Index (European Commission, 2019). One of the most significant ongoing experiences, in terms of originality and scope, is certainly the seminal work conducted by the British government through the activity of the Government Design Service (GDS), which began in 2011. Having employed to date over nine hundred designers (Downe, 2019b), the GDS is the proof in the field of how the sector of design for public administration represents a promising field of development for the near future. Jason Shupbach, Design Director at the National Endowment for the Arts during the Obama administration, left no room for doubt when he stated that "to me, that's where the real energy is on good governmental graphic design" (cit. in Budds, 2017). Professional opportunities, of course, are not the only question of interest here. Indeed far more significant are the civic and democratic ramifications that designing the relationship between citizen and institutions implies, and which makes public sector design so crucial. It is certainly not difficult at the present time to recognize that "democracy is a design problem" (Chisnell, 2016), particularly given the challenges implicit in the widespread and generalized distrust of politics. Training designers who are skilled in crafting services in the public interest thus constitutes a precious necessity which university-level education must ensure.

It is important, nevertheless, to dispel a series of quite common misunderstandings that view the design of public services as limited to the simple graphic rendering of an interface,

or as a problem of an exclusively technological nature. Public service design represents a classic example of one of those wicked problems that Richard Buchanan, using Horst Rittel's definition, so usefully described, identifying the design thinking approach as the only one capable of handling these specific sets of problems (Buchanan, 1992/2019). They present unique challenges to traditional solutions because they are symptomatic of numerous conflicts; they are problems that risk being aggravated rather than resolved by solutions that are isolated from the broader context. Naturally, public organizations are not enthusiastic when faced with these questions: "After all, wicked problems are (social) issues that no one entirely understands and that cannot be effectively addressed by any one person" (Schaminée, 2019, p. 31). Only through a holistic approach to design can we hope to structure effective paths for public service design that attribute the necessary importance to the "human factor." Participatory approaches and co-design, the involvement of the various stakeholders, and the creation of multidisciplinary coalitions are the necessary conditions for an effective approach to digital public service design, as the experience accumulated in recent years demonstrates.

But which characteristics should a service have in order to be considered effective? The answer provided by Lou Downe, ex-Design Director at the GDS, in his recent book *Good Services. How to design services that work* goes straight to the point: a well-designed service must be a *good* service for the user, a *good* service for the organization that provides it, and a *good* service for society in general (Downe, 2019a, p. 36).

Preparing to design a new generation of citizen-centered digital public services, therefore, means first creating the necessary skills in the designers of the year to come. Skills which cannot be limited to mere aesthetic and technological solutions, but must include the ability to guide and direct those processes that underlie the management of the services themselves. Without innovation in administrative processes, any action risks leading to the development of disappointing and ineffective services (Downe, 2016), yet public organizations are not always structured to grapple with the techniques and methods of design thinking. Where possible, it is necessary to build the necessary bridges between designers and public sector innovators to develop a shared method and language for the achievement of their common goals.

But dealing with the frequently contorted and bureaucratic reality and procedures of public administration can often prove frustrating, nullifying the enthusiasm of even the best intentions. Limited aptitude for technological innovation, antiquated procedures, overlapping competencies between various offices, and disagreements over how to manage change constitute some of the main hurdles in the interaction between designers and the public sector. At times, such obstacles can even provoke cases of "friendly fire," with the consequent slowing down - if not out-and-out stalling - of the innovation process (Schaminée, 2019, pp. 40-62; Tassi, 2019, p. 83). All of this clearly represents a significant impediment for designers' work in this particular field. As Mike Monteiro summed up, "for the most part, no one wants to be doing these things. They're not exciting. They're tolls for

existence" (Downe, 2019a, p. 8). Managing to understand this reality, establishing constructive dialogue, and getting the most out of the excellent resources that are present in the public sector constitute a necessary step in public service design. Thus emerges a responsibility on the part of the educational system, along with public institutions, to identify less common and potentially more intriguing ways of interesting students in the design of public services, fully conscious of the fact that only an active presence of designers can guarantee the development of *good* services. Ben Terrett, another former GDS Design Director, doesn't mince words when he argues that

> "every designer should work in the public sector. Being a civil servant and using your talents to help the people in your country is an honour. In an industry so often obsessed with novelty and persuasion, government is a chance to do real design work. If the government started a fast stream programme for design grads it would start to change the industry and make services better at the same time" (cit. in Pasqual, 2017, p. 199).

And it is here that higher education must intervene: in the creation of a shared workspace for design and the public sector. As Kees Dorst put it, "there's a lack of instruments and tools where organizations and design intersect. Moreover, there's not even a profession for that area" (cit. in Schaminée, 2019, p. 14).



Figure 1. The final exhibition at the 2016 Iuav Design Workshop (University IUAV Venezia) on the design of future public services.

Developing specific courses on government service design means preparing tools to make this field more attractive and stimulating, going down less traditional paths. This phase appears increasingly urgent because public service design provides a renewed opportunity with which, as Victor Papanek phrased it (1973, p. 19), "design can and must become a way in which young people can participate in changing society."

2.Design fiction and public sector

One of the most promising approaches in this perspective is represented by speculative design, and particularly by "design fiction," a method still little used in public sector design with the controversial exception of defence departments and the armed forces (Otero Verzier, 2018). Design fiction brings together the creation of objects not yet existing in reality with the construction of a fictional narrative context whose purpose is to stimulate "debate" and reflection on the part of the general public (Tharp & Tharp, 2019).

A story's ability to mold the public perception of government policies has been investigated on many occasions. We know, for example, how the mainstream media, particularly film and literature, have had a direct influence in orienting U.S. government policies regarding the reorganization of psychiatric institutions after the publication of Ken Kesey's novel *One Flew Over the Cuckoo's Nest* (1962), or in supporting the huge federal investments in space exploration through Hollywood's massive production of science fiction films (McCurdy, 1995). Cinema also has a long history of representing the machine of government, the bureaucracy and its functionaries, highlighting its merits or, more often, its downsides (Holley & Lutte, 2017). Similarly, the science fiction genre has repeatedly transposed onto the silver screen visions of public administration of the future – from the obsessive, obtuse bureaucratic system of *Orwell 1984* (1984) and *Brazil* (1985) to the lobby-like pressure groups in the Galactic Senate in *Star Wars: Episode I - The Phantom Menace* (1999), from the alien census in *District 9* (2009) to the ludicrous public health system of *Altered Carbon* (2018), in an alternation between utopian and dystopian visions (Lee, 2017; Sauvé, 1998). Speculative design brings a narrative, critical dimension –sometimes provocative and politically antagonistic – into the work of the designer.

The term "design fiction" indicates the method of creating alternative future scenarios through the design of particular objects or, to use the famous words of writer Bruce Sterling, "Design Fiction is the deliberate use of diegetic prototypes to suspend disbelief about

change"[1] (Sterling, 2013). In this approach the centre of interest is no longer design in itself, but rather the user and those changes, opportunities, and critical conditions that design can contribute to create. As highlighted by Dunne and Raby (2013), two of the most representative explorers of this approach, when it comes to speculative design,

> "rather than thinking about architecture, products and the environment, we start with laws, ethics, political systems, social beliefs, values, fears, and hopes, and how these can be translated into material expressions" (p. 70).

It is difficult not to see in this orientation the essence of that "design hope" discussed by Tomas Maldonado (1970, p. 60): "Politically speaking, the revolutionary sense of dissent is really only attainable through design. Dissent that rejects design hope is nothing but a subtle form of consent."

Design fiction has not often been used for the public sector precisely because it is so strongly connoted by this provocative vein, sometimes subordinated to the narrative, other times explicitly evoked to exploit its potential tension within participatory processes (Boer & Donovan, 2012). Of course this tension also constitutes a risk, and may sometimes even be the cause of rejection in those public milieus less inclined to innovation, or strongly opposed to changing their consolidated processes. The fact that speculative design is characterized, as we mentioned, by an explicit political outcome is certainly useful in stimulating discussion, but can become problematic when the bodies that use it have to present themselves as impartial, as is the case in the public sector.

Yet anticipating and imagining the future represents a meaningful way of evaluating the implications of the choices made in our present. With the global challenges humanity faces today – the climate crisis, social inequalities, migratory phenomena – we can ill afford to disregard a perspective so suitable for probing long-term consequences. Design, too, must therefore ensure that it does not lose sight of the consequences of its work for the next "seven generations," as the Great Law of Peace of the Iroquois required. And this is even more applicable when that work pertains to the public policy sector.

3.Policies and future

A growing number of organizations and international research centres have identified speculative design as a useful procedure in defining governance policies. In 2012 UNESCO

1 "'Deliberate use' means that design fiction is something that people do with a purpose. 'Diegetic' is from film and theatre studies. A movie has a story, but it also has all the commentary, scene-setting, props, sets and gizmos to support that story. Design fiction doesn't tell stories -- instead, it designs prototypes that imply a changed world. 'Suspending disbelief' means that design fiction has an ethics" (Sterling, 2013).

began constituting a Global Futures Literacy Network,[2] with 11 countries currently involved, that aims to develop operational tools for applying speculative design to government, business and community initiatives (Miller, 2018). The Organization for Economic Co-operation and Development (OECD) has utilized anticipatory scenarios to identify risks and critical issues for possible innovative paths in Brazilian public administration (OECD, 2019, pp. 105-118). The EU Policy Lab recently initiated "The Future of Government 2030+," a project whose approach to defining political responses combines forecasting, design and citizen involvement; the purpose is to answer the question of how citizens will model governments, policies and democracy from 2030 on (Vesnic-Alujevic et al. 2019). Forecast scenarios are the basis of the Danish Design Center's Future Welfare platform, whose purpose is to imagine that country's future healthcare system (Bason & Striegler, 2019), while Lancaster University's "Imagination" lab has conducted a series of design fiction-based workshops with senior citizens from various assisted living facilities to investigate how politics might innovatively confront the general aging of the population (Darby et al., 2015). Also in the United Kingdom, the Policy Lab, the Cabinet Office's consultative body for the introduction of new political tools and techniques, has frequently underlined the creative power of speculative design (Drew, 2015), while Nesta, an innovation foundation, underlines how important it is for governments to consider the future implications of their political choices with a forward projection of at least 15 years (Kolehmainen, 2016).

In all these cases, the "shock therapy" of provocation, at times implicit in the design fiction approach, becomes a stimulus for the institutions themselves, while the narrative aspect turns out to be particularly interesting in the context of a co-design of services, paying particular attention to citizens' hopes and fears regarding their own future and that of society. After all, citizen involvement is an essential step if we want to locate speculative design for the public sector within an ethical and, necessarily, empathic framework. Ethics and empathy are two important characteristics of speculative design that allow for the development a critical discourse, rather than limiting ourselves to a mere exercise in science-fiction narrative or techno-enthusiastic marketing (Jensen & Vistisen, 2017).

[2] https://en.unesco.org/themes/futures-literacy

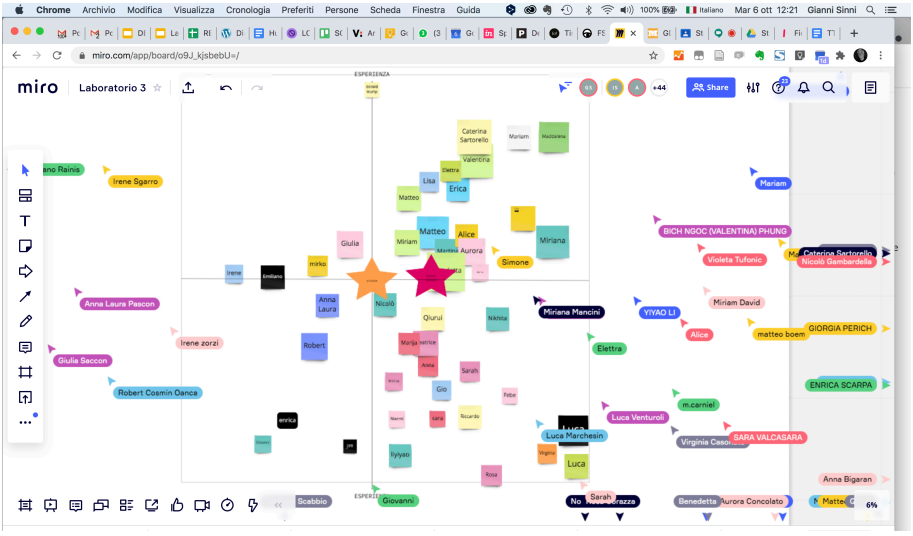

Figure 2. The Polak Game on Miro platform during the Communication Design Lab at Iuav University of Venice, 2020.

4.Tools

Within the practice of design fiction – from the anticipation of scenarios to the creation of diegetic prototypes – it is necessary, from an educational standpoint, to develop tools that are applicable to public design and give the necessary emphasis to the ethical dimension. A first important goal, therefore, is to try to infuse design students with an awareness of the implications that each project brings with it and the complexity of the ecosystem involved.

In this direction we can identify several examples of tools applicable to speculative design projects for the public sector, tested in workshops and university classes[3] [Fig. 1], that are characterized by a collective brainstorming process. One place to start is by assessing participants' expectations about the future through a version of the Polak Game where everyone is asked to indicate their own position with respect to the semiotic square of the experience of change (things are getting better/worse) and influence on change (I can do

[3] The experiences reported here were developed in the Hybrid media design Labs at the master degree course in Design at the University of the Republic of San Marino in the years 2017-2019; in the 2016 Iuav Design Workshop and in the Communication Design Lab at the Iuav University of Venice in the year 2020.

little/can do a lot) [Fig. 2] (Hayward & Candy, 2020).



Figure 3. A "What if" brainstorming workshop at the international symposium "Updating Values", University of the Republic of San Marino, January 2020.

With the "What if" question, starting from a specific argument – the narrative premise introduced by the phrase – a discussion group can construct a matrix of the scenario's implications such as the Futures Wheel: a visual representation in which participants hypothesize the future repercussions in various fields – social, economic, philosophical, religious, healthcare, juridical, ethical, environmental, and so forth (Glenn, 2009). For example, if the initial topic of the discussion is "What would happen if all cars became driverless?" we could mention as one of the social consequences the "drastic reduction of fatal accidents," while from the healthcare perspective we would note a "drastic fall in the availability of organs for transplants."

An even deeper immersion into the complexity of future projections is represented by the transformation of the above "What if …" narrative premise into an "If … Then … Else" conditional instruction, in which the many possible implications are developed on the basis of the first statement, before serving themselves as a point of departure for subsequent branches, a representation of the classic "butterfly effect." Applied to a chronological grid based on the "Futures Cone"[4] of Joseph Voros (2001) [Fig. 3], this representation of the

alternatives will outline the map of scenarios and turning points for possible futures, beginning from the choices of today: “IF all of our sensitive privacy data were grouped into a single database, THEN this would have to be managed by the government, ELSE it would be possible to request a public service of virtual reconstruction of our identity after death”.

Also worthy of mention as an introductory tool for public sector design fiction, lastly, is the immersive approach to storytelling and brainstorming represented by games of “reverse archaeology,” as in the case of the renowned “The Thing from Future.” Created by Stuart Candy at the Situation Lab, the game requires participants to create a story starting from a series of premises defined by playing cards – chronological placement, trend, context of reference, type of object, mood – with nearly endless possible combinations, culminating in the creation of an object-find from the future, the factual evidence of the story (Candy, 2015).

5.Conclusions

The general governmental trend toward offering digital public services makes the contribution of design thinking and service design increasingly crucial to designers’ approach to a given project. It also underlines the need to train an adequate number of designers capable of grappling with the peculiarities of working for the public sector. The creation of efficient services, of *good* services, has a significant impact on citizens’ civic participation, how they exercise their rights and are reminded of their duties, and thus plays a major role in delineating the perception and the boundaries of the relationship between citizens and institution. The crisis that has affected this particular relationship in recent decades and the emergence of new, increasingly complex and global challenge underline the need for innovative approaches in the definition of new public policies. For this reason the most sensitive international institutions have introduced specific research labs for the study of the future implications of today’s policies. Speculative design, and design fiction in particular, provides a stimulating method which, from a designer’s formative years, is capable of combining design, public policy, projections and civic participation within a conscious, ethical narrative framework.

[4] In Voros’s formula the future 4 P’s are represented as a cone of light projected forward in time, in which we can identify, starting in the centre, the probable future, the plausible future and the possible future, among which we try to orient ourselves toward a *preferable* future (Voros, 2001).

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Speculative Design in Education: Mapping the Landscape.

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Abstract | This paper presents findings from a recent European-wide study on the use of Speculative Design approaches within education. The study included a survey of design educators and interviews with Speculative Design practitioners. This data has contributed to a mapping of the current educational landscape in Europe and will inform the development of an open set of resources for educators interested in Speculative Design and related approaches. Themes that emerged from the study are discussed in detail in the paper including; views on defining a curriculum along with metrics for assessment, the development of open guidelines and frameworks, attitudes towards generating change and implementing action, and understanding the distinguishing characteristics of Speculative Design within an educational context.

KEYWORDS | SPECULATIVE DESIGN, CRITICAL DESIGN, EDUCATION, INTERDISCIPLINARITY

1. Introduction: the survey and interviews

1.1 Speculative and related design approaches

Speculative, Critical and Fictional Design methods question the conventional practices of design, including interrogations around who has the rights and privileges to carry out the activity of designing. This alternative way of working foregrounds the freedom to use creativity to extrapolate from signals observed here and now, in order to ask questions about how the future - or indeed the present - could be, rather than merely how it should be (see e.g. Auger, 2013; Dunne & Raby, 2013; Sterling, 2009). This family of design methods, based around the blending of aesthetics and critique, has attracted much attention in recent years from both enthusiasts and sceptics, and many words have been written about the nuances of different styles and approaches (e.g. Bardzell & Bardzell, 2013; Malpass, 2017; Tharp & Tharp, 2019; Tonkinwise, 2015; Blythe & Encinas, 2018). In this paper we use the term Speculative Design in an inclusive manner, acknowledging that there is a broad range of related approaches, each with their own emphasis, and that these continue to evolve. This paper, however, focuses specifically on how Speculative Design - and related disciplines - is currently used as an educational approach, both within directly design-related disciplines as well as in other educational domains at undergraduate, postgraduate and professional levels. While conventional design practice often focuses on making technology easy to use, functional and desirable, in Speculative Design, an educational curriculum can propose a practice that engages further with social context. It uses design as a means of examining both the potential positive and negative implications of introducing something into everyday life; imagining possible, as well as preferable situations.

The inherently discursive and reflective nature of the Speculative Design approach makes it particularly useful for teaching both practice and theory. If applied effectively within an educational setting, the processes of creating speculative objects and narratives can encourage interrogation of prevailing assumptions and invite exploration of other, alternative states of being and doing. These activities can lead to a deeper understanding of, for example, the contextual, political and cultural factors that influence the activity of design, and in turn, consideration of the potential implications and effects caused by bringing new products and services into the world (Dourish & Bell, 2014).

Educational contexts are varied, with different motivations and expectations and therefore they require different pedagogical approaches. Speculative Design has tended to sit within art and design school curricula, especially within western European universities and within the art school tradition, but this is changing. As an approach, it has become relevant where there is a focus on imagining products and services that incorporate technology, and it is now increasingly finding a place within subjects such as computer science, engineering, and social sciences. It is currently being reinvigorated and reinvented in other geographical areas, such as south-eastern Europe, and in varied types of independent research and educational institutions.

1.2 The SpeculativeEdu Project

The SpeculativeEdu project began in 2018, at a point where Speculative and Critical Design practices were maturing and becoming widely discussed. The project offered a timely opportunity to take stock of how the domain had developed so far and to consider where it is heading as an educational approach into the future. The SpeculativeEdu project is situated within a European context, with partners across five European countries, but as authors and project partners, we are mindful of the expanding reach of Speculative and Critical Design. The project's stated aims are to "strengthen Speculative Design education by collecting and exchanging existing knowledge and experience whilst developing new methods. Its scope is to collect, exchange, reflect upon, develop, and advance educational practice in the area of Speculative Design and its self-critical approach" (SpeculativeEdu, 2018). At a time when many designers are becoming interested in alternative design approaches, disillusioned with the conventional, dominant narratives of innovation (Morozov 2013), problem-solving (Encinas et al. 2018) and technological growth, speculative, reflective and expressive approaches are offering fresh possibilities to practitioners and educators.

It is against this backdrop that the Speculative Design interviews and education survey were conceived; in order to examine and share knowledge and practices, and to collectively work towards developing educational techniques, especially those focused on the critical relations between technology and human society.

1.3 The Interviews

A primary activity during the SpeculativeEdu project has been the interviewing of key figures from across the Speculative Design landscape. These figures were chosen to provide a broad a range of perspectives – established practitioners in the field, recent graduates from Speculative Design programs and critics/curators who have provided valuable interrogations of the approach. For consistency, similar questions were used across the interviews, although in many cases the questions were customized for the interviewee – based on specific projects, articles or personal experiences.

1.4 The Survey

The Speculative Design in European university education programs survey was available online and open for responses from early 2019 until early 2020, available to anyone who wished to contribute. It was disseminated through the project's networks and social media and was aimed at educators involved in the development or delivery of a program that included an element of Speculative Design or a related topic. The survey gathered examples of current teaching practices and methods from a range of design-related disciplines, as well as asking for viewpoints about the direction that the field should take in the future. The survey in particular aimed to understand the breadth and variety of current speculative educational practice across different disciplines, including modes of delivery, examples of

teaching resources and assessment strategies. The survey also asked questions about the motivations and rationales informing the development of courses, and about plans and ambitions for the future.

2. Analysis: Interviews

2.1 Interview Questions

Speculative Design is a relatively new approach and as such its borders are quite blurred, its purpose can seem vague and its systems of evaluation immature. The interviews provided an opportunity to focus on these key issues:

1. **Purpose:** This can be relatively straightforward when considering the role of mainstream design (e.g. variants of form, function, desirability, market appeal). However, Speculative Design promises a diverse range of possibility; design for debate (Dunne, 2008), to improve government processes and policymaking (Kolehmainen, 2016), to critique current design practice (Auger, 2013) and re-think the technological future (Mitrović, 2015). Such claims have, on occasion, left the approach open to critique, for example, “Where is the debate?” “Who is it between?” “What is the impact?” One of the key questions asked of the interviewees was “what is the strength of Speculative Design?” The aim being to present a more coherent definition within the lifetime of the project.
2. **Metrics:** The design community is very fluent in evaluating the various qualities of traditional designed artefacts. Countless books have been written on this subject and relate to the straightforward notions of purpose listed above, and well-known lists guide students and practitioners towards (so-called) good design (Rams, 1976). Speculative Design suffers from the fact that its purpose is still unclear – without purpose, evaluation is impossible. After examining the question of purpose, we then asked interviewees to suggest an exemplary Speculative Design project and to describe why it stands out.
3. **Value:** The first two questions potentially paint a bleak picture for Speculative Design, so what is its true potential? We asked, how could Speculative Design become more politically active or more purposeful in its aim to challenge mainstream design?

3.2 Interview Themes

In comparing the interviews, we have identified a number of themes that encompass the responses from the interview participants:

- **The state of design:** a discussion of ideas on what Speculative Design has accomplished by placing it in relation to a particular understanding of the status of design as an established practice within the wider contexts of business, culture and politics. This might be due to the influence of Dunne and Raby´s (2013) well known "A/B List" a manifesto that positioned critical design against normative or non-critical design.
- **Existential angst:** a recurrent topic of discussion within the interviews was related to the agency and responsibilities of practicing Speculative Design. Who gets to future? What kind of privileges do speculative and critical designers enjoy? Or what does it mean to design a future for a context in which the designer does not participate?
- **Divergent references:** the materials that interviewees suggested varied greatly in terms of disciplinary background. There were references to texts belonging to politics, economics, history, literature, design and many others. The answer to the question; "what kind of knowledge should the education of a speculative designer include?" resists reduction in terms of defining a canon of suggested literature.
- **The "speculative" in Speculative Design and the "critical" in Critical Design:** most interviews involved a stage of setting the common ground between interviewer and interviewee through finding a consensus for the meaning of speculative and critical. Defining what speculative and critical mean seemed to be a necessary step in establishing the ground for further discussion on particular examples of Speculative and Critical Design.
- **The future as context:** while not specifically implied in many of the questions asked during the interviews, many participants chose to locate their arguments in a more or less distant future. This seems to be a characteristic of Speculative Design but not a necessary one because alternative presents or counterfactual stories abound in the history of Speculative Design. This is interesting because many of our respondents expressed the intentions of their designs in terms of having an impact in the here and now.

3. Education Survey Analysis

3.1 Survey Questions

The survey was constructed in separate parts and this paper describes two of these parts; the first asked for descriptive information about educational programs, and the second asked for further information about approaches and opinions. Each part was analyzed separately in order to keep the answer data anonymous. Throughout the survey, questions

included a mixture of multiple choice and open-ended questions where respondents could write as much or as little as they wished. The open questions were analyzed using a simplified thematic analysis approach. To do this, the authors each read the anonymized responses individually and then shared their own interpretations of the important emergent themes. These interpretations were then compared in order to arrive at the list of overarching themes.

3.1 Respondents

The Speculative Design survey was aimed primarily at European university education programs but participation was open to everyone, including educators working outside of universities, for example delivering short courses or workshops. By early 2020, the survey had collected 36 usable responses, of these there were a mix of courses described at undergraduate and postgraduate levels, with rather more at undergraduate and some at both levels. All the courses mentioned were based in Europe, spanning 12 countries. Over half of the courses mentioned were first presented from 2018 onwards, demonstrating rapid growth in recent years. The majority of the respondents reported that their courses were situated in design disciplines, mainly in Interaction Design, Product Design and Graphic Design, including Communication Design and Information Design, along with several situated in Art disciplines. Other design fields mentioned included Interior Design and Fashion Design. Of the remaining disciplines mentioned, a few were situated in Computer Science related disciplines, and some were situated in humanities, management and interdisciplinary disciplines, such as Futures Studies.

3.2 Current Approaches and Future Directions

The following sections describe some of the main findings from the online survey relating to current educational approaches, opinions and future directions. One of the first questions asked about the names used to describe the approach. Of the three options provided; Speculative Design, Design Fiction and Critical Design, there was an almost even distribution across the choices. Other terms were offered, most of which included the word “design”, and “future” also appeared frequently. Other words included “research” and “debate”, and some of the descriptions included words that could be described as provocative, such as “adversarial” and “inconvenient”.

3.3 Rationale and Motivation

When asked about the motivations for developing the course and why Speculative Design was used, two main themes emerged, firstly the importance of multidisciplinary and interdisciplinarity in preparing students for the future, and secondly the development of a mix of both practical and critical skills. This emphasis on interdisciplinarity was seen as important in order to equip students to work and contribute to society in an as yet unknown

future. The ability to work within various industries and with a range of stakeholders was often mentioned as a priority, as these respondents put it:

> "… as the world changes increasingly rapidly, we are educating future designers and other creative practitioners for jobs and contexts that don't yet exist. They instead need to be equipped to identify and exploit new opportunities by working across disciplines and considering multiple intervention points - from hard systems transitions, such as mobility or energy, to soft systems transitions, such as culture, identity or narratives."

> "The production of near future scenarios allows to uncover new opportunities and to produce professional profiles who are able to help organizations and institutions to deal with the transformation of society, of the environment, of cities and people's daily lives."

In terms of skills development, these can be grouped into two categories - practical and critical - which were both discussed by respondents and were seen as working in tandem in many cases. The development of practical skills included many of the pragmatic aspects that are familiar within design teaching, such as project-based skills and competencies, communication through design, the development of usable designs, research skills, lateral thinking skills, and the creative presentation of research insights. Speculative Design was also seen as a promising approach for developing criticality and systemic thinking, in particular for building the competencies and knowledge needed to address the world as it could be in the future, rather than the current status quo. Strategic, long-term thinking was seen as necessary for dealing with complexity, controversy, uncertainty, and societal, technological and cultural change. The ability to interrogate and debate, to understand relevant theoretical framings, and to reflect critically on the application of design methodologies were discussed. This comment illustrates these points:

> "…the … course proposes to read the challenges of a changing society through the controversies that animate it. The course trains students to decipher the latter via three complementary disciplines (theory of imaginaries, digital mapping of controversies and design fiction). They offer an original and unprecedented toolbox, whose instruments make it possible to locate the controversy in a field, to unfold its facets in the present while considering future blind spots and layers of representations inherited from the past, sedimented in the actors' discourses."

Approaches to support this type of critical skill development included challenging current approaches by promoting values. Students are often encouraged to question ideas such as; design as need-seeking and problem-solving, and design for comfort and convenience, as expressed by this respondent:

> "The course … investigates the potential of "Inconvenient Design" as an interrogative design approach, as well as critical design tactic and practice. It addresses the trend in the design discipline to design products, interactions and services (and thus, futures) with one aim: convenience. … Using tactics and mechanisms of Design

> Fiction and Speculative Design, we explore the design of discursive objects to express criticism and initiate discussion."

A theme of values was frequently evident in the survey responses, with a strong emphasis on social and environmental justice, and participatory citizenship. Across the survey there was evidence of a desire to go beyond the more accepted, rather passive Speculative Design aims such as; questioning stereotypical views of the future, critically reflecting on the roles of technology in society, and considering implications and consequences, and instead to take a more proactive role in shaping the future through activism. For example:

> "design futures could be framed as ways to develop and deploy prompts, artefacts and narratives to critically interrogate tomorrow's societal debates today; as such, it is intentional from the outset in its questioning of the dominant paradigm in the pursuit of preferable futures and therefore social and environmental justice."

> "This is a powerful opportunity for communities as well as for organizations and institutions, who can benefit from speculative designers in creating new strategies and to get communities engaged and involved in participatory, collaborative transformations."

3.4 Teaching and Assessment

Addressing the delivery of teaching and assessment approaches, a mix of theoretical and practical elements were evident. In the multiple-choice section of the survey, the most frequently used approaches mentioned were; practical creative work, group projects, and workshops, demonstrating the emphasis on collaboration and pragmatic skills development. Theoretical essays were used to some extent, while written examinations were rarely used. Other approaches mentioned that were not directly asked about in the survey included several types of research such as social, artistic and observational research, and cultural probes. Debates were also mentioned, especially involving external actors and stakeholders.

In answer to the question on the main teaching resources used, a very wide range of materials was mentioned, echoing the findings of the interview analysis discussed in Section 2. In addition to art and design texts, and writings on Speculative Design, Critical Design and Design Fiction, there was mention of texts and examples from such diverse subjects as storytelling, comics, science-fiction, film and television, architecture, urban design, foresight and futures, social science, and many others.

There was an open section in the survey for suggesting appropriate assessment metrics for evaluating student work within a Speculative Design approach. A total of over 40 individual metrics were proposed, some of which included more than one metric bound up within them. Here these are summarized into two categories, Process and Practice:

Process Assessment Metrics:

- Depth of research

- Criticality in research documentation and analysis
- Criticality of future trajectories
- Creative engagement with alternatives
- Experimentation and risk taking
- Communication to, and engagement with, intended audience and publics
- Self-reflection and self-assessment; critical discourse around the project
- Creating potential for stakeholders to adapt in changing situations
- Enabling and stimulating debate and critical reflection
- Team working, participation
- Understanding of context

Practice Assessment Metrics:

- Response to the brief, and ability to serve the needs of stakeholders
- Novelty, originality, innovativeness, imagination and challenging paradigms
- Plausibility and internal consistency; social, political, technological, environmental, etc.
- Action generation, potential to stimulate impacts and consequences
- Analysis of possible impact and consequences of the designed output
- Breadth and depth of worldbuilding and storytelling
- Quality and comprehensiveness of the proposal, presentation, exhibition or demonstration
- Evidence of rationale for design or technology artefacts, prototypes or representations
- Collection of, and engagement with, feedback from audiences

3.5 Defining a curriculum

The survey asked a question about how important it is, within the context of a design curriculum, for Speculative Design to be either fully defined; or whether there should be an open approach relating to sets of methods, tools and techniques. The majority of respondents favored an open or mostly open approach, but there was a substantial number of respondents who were unsure or favoring a defined approach. In the open comments, both sides were represented, citing, for example, the utility of explanations of specific

methods, but also the benefit in the diversity of approaches due to the “bottom up” and relative youth of the field. In fact, not all of the respondents answered this question which suggests that there is no consistently strong feeling over this issue, or perhaps that this is as yet an unresolved question for some educators. One respondent did indeed make the comment that they need to reflect further on this topic.

Some respondents mentioned working towards creating open source collections of their own design materials and resources. For future development, guidelines, frameworks and quality criteria addressing teaching approaches would be welcomed by some respondents, but openness and breadth of types of teaching materials were also mentioned. Briefly, some of the types of learning sources mentioned as potentially useful included; seminal films and videos, expressions of past future visions, theatre and improvisation, data tools and information visualizations.

3.6 Future Directions: Towards Action

Within the responses there was generally an optimistic view expressed of the development of the field as playing a transformative role in wider society, or at least training the practitioners of the future to use skills of transformation, underpinned by a methodological approach. However, there were reflections on some critical aspects of speculative practice such as lack of action, lack of political commitment, a need for decolonization and emancipation from the current economic and socio-political system. This theme of moving towards implementing active change, for example in policy making and citizenship, in addition to the development of design skills, emerged strongly in the survey. The desire to transition toward top-level influence was clear in some of the responses, for example in urban planning and government organizations, with a stronger influence on the "real world" and impact on more mainstream practice and educational approaches. There was an awareness expressed around the limitations of showing work only in “white cube” gallery spaces, and a desire to create broader impact in society and in professions. Comments often mentioned a need to include Speculative Design methods in more curriculum subject areas such as policy making, psychology, social and anthropological studies, economics, business and management.

Finally, here is a comment from one respondent who mentioned working with younger students, demonstrating the wide potential for the approach:

> “I really hope it will continue as a vibrant, diverse, pluralistic community of practice and that it won't become too much of recipe. I'd love to see these approaches more embedded outside design education as from our experience in working with over 200 STEM oriented teenagers we've seen how hugely transformative they can be in providing them with handrails upon which to imagine, explore and question how the world should and could work.”

4. Conclusion

As we, the authors, look over the results of the interviews and survey, representing a substantial collection of voices in the field, it is clear to us that Speculative Design and its related approaches remain an important and evolving domain, exhibiting a desire to reflect upon its own future. This is a domain that is no longer in its infancy or led by one or two institutions; as our study demonstrates, it is a broad and diverse field and as it enters its mature phase, educators and practitioners need to come together to create a shared vocabulary, collection of best practices, methods of evaluation, and more. At the same time, as the world has changed dramatically in the past two decades, so has the role of design – as the interviews and survey demonstrate, Speculative Design today has moved beyond its early function of provoking internal debates, to a more outward looking role of facilitating urgent discussions about the central role design plays in shaping our collective futures and society as a whole. One of the most striking themes that emerged from both the interviews and surveys was the clearly articulated desire to implement transformation and to create impact on the world through action. This desire was supported by discussion around the importance of defining underpinning values, including such ideas as responsibility and justice.

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Acknowledgements: SpeculativeEdu (Speculative Design – Educational Resource Toolkit) 2018-2020 has been funded by the Erasmus+ Programme of the European Union.

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Targeting Design Intervention across Levels of Complexity

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Abstract | As service design continues to expand its reach and blur the lines between disciplines to address value co-creation and deeper contextual based challenges, it becomes increasingly crucial to work within an ecosystemic perspective. For the sake of simplicity, designers build frames of reference and construct metaphors to better understand and target possible intervention and the roles, activities and consequences of that intervention. In reality, when addressing increasingly complex issues, design action may cross the boundaries constructed by these models making it more difficult to understand. Using a more fluid metaphorical model to target design intervention across levels of complexity enables designers to consider the ecosystemic nature of an intervention, the level of control they have over the end outcome and the potential consequences it may bring.

KEYWORDS | ECOSYSTEM, LEVELS, VALUE, CO-CREATION, CONTROL

1. Introduction

As a heterogeneous and emergent discipline, Service design has over the last two decades evolved to blur the lines between disciplines. By borrowing and adapting concepts from management, participatory design, marketing and anything else that works to face the current challenges in design practice, it has expanded its reach and objective. (Kimbell & Blomberg, 2017) This expansion has followed a logical shift from a goods-oriented perspective towards a service-dominant one, (Vargo & Lusch, 2004; 2008) and consequently, toward new conceptualizations of design objectives. (Kimbell & Blomberg, 2011; 2017; Meroni & Sangiorgi, 2011; Wetter-Edman et al., 2014) These new conceptualizations form the basis for arguing the relevancy of service design as a means of designing not only meaningful service encounters but also value co-creating systems and socio-material configurations (Kimbell & Blomberg, 2011; 2017).

With the shift toward designing *for* services - instead of the design *of* services - designers are increasingly introduced to the complexities of services on both the 'front' and 'back-stage' of service delivery. These complexities reach past the interaction between product and user and into value networks and service systems where value is co-created for both users and service providers, within the context of a complex constellation of actors, institutions, stakeholders and technologies. (Normann & Ramirez, 1993) As the recognition of contextual effect on services grows, so also does the need for new ways of thinking and adapted tools to design for service ecosystems that additionally consider and even emphasize value created in-context (Nelson & Stolterman, 2012; Vargo & Lusch 2004).

1.2 From Linear to Ecosystemic

While some value propositions are conveniently constrained to linear service encounters and walled off from other channels of delivery, others "straddle digital and physical spaces; instantiated by individual actors moving freely and at will between locations, devices and contexts." (Lindenfalk and Resmini, 2016). Lindenfalk and Resmini (2016) go as far as to claim it is a "myth that the service designer can design a perfectly bounded artefact and simply drop it in place within a dynamic environment." Although they admit there are benefits to focusing on the experience of a single touchpoint, if complexity is unnaturally constrained to a linear path it can result in jarring over simplification.

To address this complexity designers can shift their perspective from linear to ecosystemic to focus on more than one perspective within the context of an ecosystem. Where a linear perspective considers the entire end-to-end experience, an 'ecosystemic' perspective also considers the many vantage points that make that experience work. To implement this shift, designers have to start considering both the different possible perspectives of actors and the possible value not just created in-use but created in-context, at each level of the ecosystem (Vink et al., 2017; Lindenfalk and Resmini, 2016). This infers the designer may also have to give up some control over each interaction in favor of the value that can be created in the

context of the greater ecosystem. This perspective refocuses the goal from a complete instance of value creation designed and controlled exclusively by the designer, to potentially creating the favorable conditions for interactions and relationships to co-create value - Kimbel (2011) describes such a shift from service design to design for services.

To guide further discussion on designing for ecosystemic value creation we will use the analogy and framework of an organism, which under different magnification can be viewed at an atomic, molecular and organism level with varying degrees of relational complexity. In its most complex and complete form, this analogy refers to an ecosystemic organism with emergent and adaptive qualities. As each level is no more important to the survival of the organism than the other, it produces value within its own sphere and as a part of a whole.

After outlining each level we will then discuss how being able to target a design intervention across these levels can help designers consider and target areas of intervention within complexity using a more fluid organizational model and visualization. This model outlines each level's characteristics, but only loosely constrains them to allow interventions to be framed and considered across multiple levels. The intention is not to propose new methodology or tools for working with ecosystems but possible ways of seeing and thinking about the objectives and goals of service design. Such a discussion can help form a clearer conceptualization of a context informed design process, and offers insights into the different roles and opportunities for designers within that process. This model also potentially frames the design intervention not just as design action but also as design consequence which can help designers better consider potential impact and the consequences of their participation in the intervention.

2. Atomic Level

2.1 The Encounter

According to Kimbell and Blomberg (2017), interactions at this level are conceptualized as 'The service encounter' which they propose is one object of service design and focuses, "on the experiences people have as they engage in interactions with touchpoints provided by others." This objective implies that the goal at the atomic level is that of new service development (NSD) and is outcome focused (Homlid et al., 2017).

Considered within the perspective of designing for service ecosystems, however, the goal expands to designing interactions as a means of reconfiguring the relationship between humans and the service to evaluate and create strong value propositions that clearly fulfil what Christensen et al. (2016) call the 'jobs to be done.' Although micro in comparison to the organism, interactions at the atomic level are crucial to the survival of the system as they form the basic arguments for desirability— the reasons why customers hire products and services to achieve their desired outcome (Christensen et al., 2005).

Focusing on relationships, channels and value propositions as part of the experience at this level connects it to the greater ecosystem and emphasizes the need for more co-design based practices to consider multiple perspectives when designing the digital and material artifacts that guide the service encounter (Vink et al., 2017). These value propositions also form the basic assumptions of interaction at the molecular level to consider even more complex relationships and value co-creation strategies.

2.2 Atomic Consequence

Uber, the American born ride-sharing service claims that, “In the United States alone, more than 45 rides on Uber happen every second” (West, 2019). From the Atomic level perspective Uber is a digital application that allows anyone to easily find and pay for a ride. As a relatively simple service, at least in concept, most experiences include one mobile interface and two dominant touchpoints, the application and the vehicle. As a relieving service the Uber app has many features designers have consciously included that allow riders to fulfil the Job-to-be-done and more are added each year to further personalize the experience. Many of these design choices are benign and solely focused on creating a good experience. Others are not so innocent and even an omission or lack of consideration can have serious ecosystemic implications.

In December 2019, Uber released its first Safety Report that reported “3,045 sexual assaults during its rides in the United States in 2018, with nine people murdered and 58 killed in crashes” (Conger, 2019; West, 2019). To combat these safety issues, starting in 2018 Uber has released many safety features including, pin identification, audio recording and even emergency response integration (Marshall, 2019; Dicky, 2018; Singh, 2020). Whether the possible consequences of a service like this were considered before seven years after its launch may be a mystery but we can clearly see how design decisions at this level, to include safety features or not, can not only influence the success of the experience but have very serious consequences for participants, the company and society as a whole.

3. Molecular Level

3.1 Value Co-creating System

At the molecular level of the organism the focus turns from the service encounter to the value co-creating system. Here, the materials and objectives fundamentally change from the orchestration of touchpoints to form positive service journeys (Blomkvist et al., 2018), to dynamic reorganization of resources to form arrangements between actors to achieve mutually beneficial outcomes and value creating relationships. (Kimbell and Blomberg, 2017; Vargo and Lusch, 2004) Typical tools used at this level include service ecosystem maps and value constellations to focus on the negotiations between actors, their desired outcomes and how they account for those outcomes (Kimbell and Blomberg, 2017; Patricio et al., 2011;

Normann and Ramirez, 1993). Although this level can involve professional designers working with methods and tools, a service eco-systemic perspective recognizes that design activities are not single actions in the process and that value co-creation is ongoing and collective in nature; each actor participating in the relationships they have entered into to realize preferred change (Vink et al., 2017; Manzini, 2016).

3.2 Beyond the Experience

To create value in context it is not enough to design a good experience. Designers must, as Normann and Ramírez (1993) put it, "redefine the roles, relationships and organizational practices," of the business itself. Almost two decades later Normann and Ramírez's example (1993) of IKEA in the furniture industry, still stands as a successful implementation of just such a redefinition of in-context value co-creation. In this example, IKEA ultimately shifted the responsibility of the assembly of their product from the business to the shopper. To do this they not only designed the assembly experience but the entire ecosystem around it. Judging by IKEA's current success as #39 on Forbes top valued brands for 2019 valued at $15.8 Billion with revenues of $45.8 Billion (Forbes, 2019), IKEA continues to re-evaluate their value co-creating systems to keep them at the top of the industry.

3.3 Business modeling

While ecosystem maps and value constellations emphasize a focus on reconfiguring actor relationships and resource exchange, developing and investigating business models is another way of understanding and experimenting with creating value in-context (Osterwalder and Pigneur, 2010). This includes both the context of the business itself and as an entity within a market environment. Mapping the market forces, macro-economic forces, industry forces and key trends surrounding a business model and its parts can offer an environmental and eco-systemic view of issues and opportunities crucial to reconfiguring or maintaining the right value proposition, relationships and competitive edge. (Osterwalder and Pigneur, 2010, 2014; Porter, 1979)

This indicates that the value proposition, albeit crucial, is not the only element of a business model that describes how an organization creates and exchanges value (Osterwalder and Pigneur, 2010) and various forms of business modeling techniques and experience building tools can be used to organize these elements to create new services. New service development (NSD), however, is not the only purpose of service design at the molecular level. Holmlid, Wetter-Edman and Edvardsson (2017) argue that only viewing service design within an NSD process limits its scope and potential by treating services like goods— to be developed through the same type of process. In an ecosystemic perspective, however, the scope of service design expands to potentially include active participation in the development and reconfiguration of actors and resources, and implies a change in practice to arrange for implementation (Holmlid et al., 2017). This could be considered what Martin

calls ‘the design of business’ (Martin, 2009) and of which more traditionally falls in the camp of strategy, management and operations.

4. Organism Level

4.1 Emergent Value

While reconfiguring service encounters and value co-creating systems at the atomic and molecular levels takes into consideration the ecosystem, the value created at the level of an organism can be very different due to its emergent and adaptive qualities. The object of service design at this level also expands further to focus on the socio-material configurations that impact assemblages of people, entities and institutions; both formal and informal. (Kimbell and Blomberg, 2017; Vink et al., 2017). It is worth noticing that while such configurations are not exclusive of this level, unlike other levels, the focus here is on the broader ecosystem.

According to Nelson and Stolterman (2012), within an ecosystem, elements are interdependent and value is created both between relationships and as an aggregation of value co-creating systems. This value emergence co-occurs with the intentional actions and behaviors of actors as they pursue their desired futures and cannot be completely controlled through the design process (Vink et al., 2017; Jones, 2014; Manzini, 2016). This implies that the goal at the organism level is similar to what happens at the molecular level and is not to create a final product but to create the favorable conditions for the right relationships to happen (Kimbell, 2011; Vink et al., 2017). The main difference between these two levels, however, lies in how much control is relinquished to focus on allowing for value to emerge out of the context of the ecosystem and the potential for self-maintenance and reproduction of the ecosystem (Sangiorgi et al., 2017).

4.2 Blurring Boundaries

In the example of IKEA, Norman and Ramírez (1993) describe how the company redefines relationships internally and with its suppliers to form an efficient and successful machine. Although IKEA goes about doing this with consideration for the ecosystem, redefining relationships in this way relies on an amount of control as each entity in the system carefully negotiates desired outcomes. This control indicates that value created here, although created both in-use and in-context, does not directly facilitate uncontrolled emergence like an organism, and could be viewed as molecular in nature. On the other hand one example of emergent value does illustrate how these levels may not have as clear cut boundaries as often modelled.

IKEAHackers.net has since 2006 gathered IKEA furniture customizations into a blog to be viewed free by anyone. In 2014, however, IKEA threatened to take legal action claiming

IKEAHackers.net was infringing on intellectual property. After a vast public outcry, IKEA back-peddled and apologized about the situation claiming that they are actually excited about how this site and customization movement fuels desire for their products (Hanesgarde, 2014; Winston, 2014). In this case, value emerged from the arrangements of both formal and informal actors outside of the original design and context. Reportedly, some IKEA staff have even used IKEAHackers.net for inspiration in the design of new products (Winston, 201), and IKEA has since then continued to open their doors to new ideas of customization (Chaudhuri, 2017). While the initial move to threaten legal action may have been short-sighted, the continued decisions to embrace and use this movement exemplifies an understanding of ecosystemic thinking and emergent value co-creation within a market.

4.3 Designing 'Space'

At both the atomic and molecular levels, interactions in value co-creating relationships are typically dyadic. Even if one entity has relationships with many others each relationship is negotiated separately as one to one agreements with different aggregations of resources and value exchanged. At the organism level, however, these relationships can become entangled forming 'many to many' interactions, relationships and networks. With so many variables and negotiations happening between multiple entangled actors it becomes difficult to control a final outcome. In some cases the complexities become so dense that no single entity can understand the system. As such, the goal and object of service design can shift from designing the experience or relationships in the system to designing the service providers role in the service ecosystem and the 'space' or institutional arrangements needed to facilitate the emergence of relationships and co-created value (Sangiorgi et al., 2017; Jones, 2014).

The creation of 'space' to facilitate the emergence of value can refer to the design of platforms (both digital and social) that provide the necessary tools and conditions for "communities of contributors [to] build on…to create new services that expand the ecosystem." (Sangiorgi et al., 2017). Although platforms can be broadly defined they all are characterized as 'pull based' and "[allow] each of us to find and access people and resources when we need them, while attracting to us the people and resources that are relevant and valuable, even if we were not even aware before that they existed." (Hagel, 2016, Hagel et al., 2010). The opposite being 'push based' which is characterized by product 'pushed' out into the market and requires anticipating customer demand to align the right amount of resources or inventory to meet that predicted demand (Hagel et al., 2010).

Platforms are also defined by Hagel (2010) as,

> "a governance structure, including a set of protocols that determines who can participate, what roles they might play, how they might interact, and how disputes get resolved."

Based on recent tech trends, it is easy to think of platforms as only digital. Although trends in technology have allowed digital platforms to become the almost default option for bringing parties together, platforms can also be created in physical and social space, and may be more or less defined by set protocols (Björgvinsson et al., 2010). Examples of such a 'space' include maker's spaces or communal gardens that provide a physical platform for value creation, and tools and elements to engage people in an interaction without prescribing the details of the interaction or the possible outcome. These spaces must also constrain the interaction with set protocols or rules to keep participants safe and to protect against liability.

4.4 Institutional Creation and Disruption

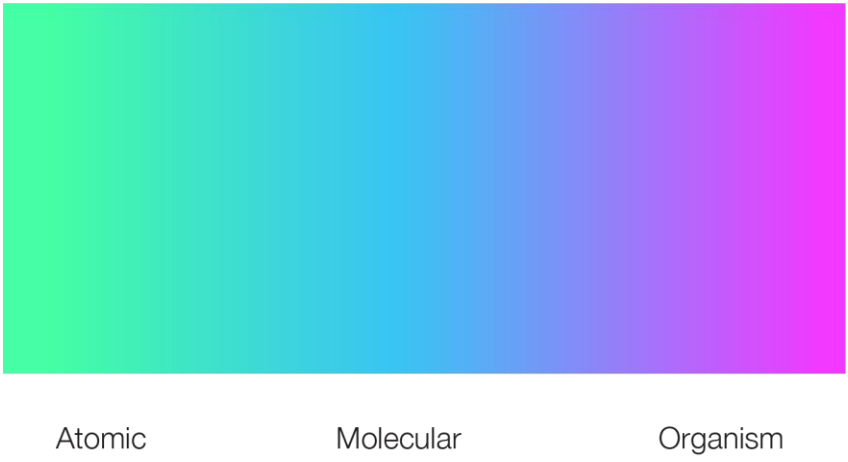
In some cases the object of service design at the organism level focuses less on roles and 'spaces' and more "as a means of reshaping the institutions that guide value co-creation in service ecosystems." (Vink et al., 2017). In this consideration, the word 'institution' relates to the 'rules, roles, norms and values,' that support an entity as they pursue a desired future (Vink et al. 2017). Institutions can be built, maintained or disrupted to facilitate preferred futures (Björgvinsson et al., 2010). Similar to how things present opportunities to realize new behavior, prototyping preferred futures and alternative institutional arrangements with participating actors can expose them to new ways of working and allow them to "iteratively develop and establish new [institutions] to support their preferred future" (Vink et al., 2017). In inconceivably complex ecosystems like healthcare, transportation or climate change, where the end outcome is difficult to control, reshaping or disrupting institutions to guide actors to pursue one desired future over another, can have a powerful effect on the emergence of patterns, properties and value, albeit with ethical concerns and considerations of unforeseen consequences and representation (Sangiorgi et al., 2017; Jones, 2014; Irwin, 2015). Partly due to its complexity, this level is still being understood and defined.

5. Targeting the Intervention

5.1 A More Fluid Model

So how does an understanding of these levels help designers target a design intervention and for what purpose? As we consider all of the levels as part of an ecosystem and present at varying degrees within a design intervention, the boundaries between each level start to dissolve (See Figure 1). To visualise this we propose using a gradient model. Rather than placing over simplistic and limiting boundaries between each of the levels, a gradient facilitates a fluid way of thinking across each level. (See Figure 1.) For example, Atomic level action within an intervention may grow in scope to start looking more like Molecular action as it navigates partnerships and value potential, or as discussed in the beginning of this paper, have far reaching effects at the Organism level.

It does not matter, necessarily, if a design action is strictly targeted to one level as long it is considered along the gradient. Although heuristics may be derived at each level, this more fluid way of seeing complexity better facilitates discussions of scope and designer roles as well as the consideration of actions and effects— rather than constraining them to limiting silos where exceptions abound and disagreements of nomenclature grow. Even while writing this paper some examples seemed to be able to be seen from more than one level. Business modelling, for instance can be used in a molecular setting to understand and coordinate the



elements within a company, but it can also be used to manipulate or provoke changes within a market context. Both may lead to creating value for the business but with different levels of controlled and uncontrolled emergence.

Figure 1. With no strict boundaries, a gradient show how each level flows into the other.

This model also provides a way for designers to start seeing 'control' as a key element of their participation in a design intervention, their role and the ultimate effect. Within an intervention the control a designer has over the end outcome shifts to inversely correspond to its complexity. (See Figure 2) This shift plotted along a curve illustrates that at the Atomic level a designer will have more control over the end outcome as they have more power to constrain the agency of the end user. At the Organism level, a designer will have less control over the end outcome and a user or participating actor will have less constraints placed on their agency. Used as a scoping tool designers can target how much control they actually have over the outcome of the intervention and plan the corresponding action. When used to define and align roles, designers can see where their specific skills fit into the intervention while still considering the ecosystemic effects of their decisions. From the previously discussed example of Uber (West, 2019), we can see that an absence of this consideration

can be far reaching and more dangerous than might be expected when only considered at one level alone.

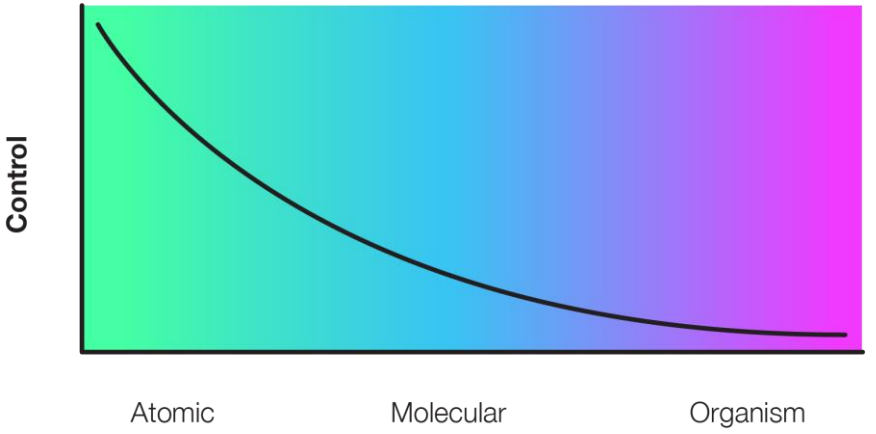


Figure 2. Control: The amount of control a designer has over the end outcome inversely corresponds to the level of complexity.

6. Conclusion

This perspective and model, although functional, can have an even deeper purpose of guiding designers to critically consider their decisions and actions as constraining, directing or enabling individual choice with corresponding levels of consequence. While some choices may be individual, facilitating the conditions to enable many individual choices can create a more ecosystemic consequence and ultimately an uncontrolled emergence of value.

As service design continues to expand its reach to address increasingly complex and contextual based challenges, it becomes crucial to consider the potential for this emergent value, whether positive or negative. Understanding opportunities, roles and effects at each level and within an ecosystem offers insights into the expanding roles designers play in the development of services within ecosystems and how to adapt processes and methods to fit the contextual inquiry (Author 2, 2016; Vink et al., 2017). As this expands the potential for strategic impact on business and society, does it also expand the responsibility to explore and consider the designer's place as they contribute to that impact?

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The Agency of Discursive Design Exists in the Industrial

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Abstract | Can there be a closer collaboration between academic design and the industrial world? This paper outlines common territory between Discursive Design and industrial market forces and proposes a partnership for a more sustainable future. In contrast to the commercial product, I advocate for the *Twenty-First Century Activist Discursive Object*. This object acts as a catalyst for change, rejecting the antiquated model of the designer aspiring to create a perfect aesthetic in favor of a collaborative, team-based multidisciplinary practice where comprehensive solutions are offered to the global commons. This paper envisions a future where intellectual criticality is capable of positively influencing practices that exacerbate societal and environmental ills, thus proposing a more sustainable future. As ideas generated in Discursive Design grow and become integrated into commercial culture, their positive effects will become palpable, and the status quo will transition into a friendlier, more sustainable reality.

KEYWORDS | DISCURSIVE DESIGN, DESIGN ACTIVISM, RESPONSIBLE DESIGN, INDUSTRIAL DESIGN, ETHICAL DESIGN.

1. Introduction

In a world where consumerism, environmental degradation, and inequity are ubiquitous, this article analyses the role of design in creating positive change within society. Specifically, I address the difficulty of introducing effective systemic change within the existing consumer-driven culture using design. I also showcase how Discursive Design can serve as a tool to normalize the integration of ethical principles into commercial practices.

I begin by presenting the need for industry to embrace a new mind set and highlight how Discursive Design can play a potent role in influencing the methodologies of the business world. Then, I define Discursive Design and its activist dimension within communities and illustrate its close link to a sustainable capitalism that has been proposed by ever increasing segments of industry in recent years. Following the study of these seemingly dissimilar fields, I argue that the most effective kind of agency for Discursive Design exists when conceptual designers are able to work in close partnership with industry and the public. Finally, I study the positive contributions of an industrial discursive product and illustrate the importance of further fruitful collaborations to demonstrate my argument.

This collaboration between the discursive and business fields is central to the establishment of more sustainable economies and the idea of global citizenship. The ultimate goal of the paper is to demonstrate that Discursive Design is able to go well beyond the parameters of theory and infiltrate industrial production and consumer culture. Helped by industry, Discursive Design has the power to remodel long-established realities and to reinforce values of social fairness and sustainability. And while a successful discursive object is one that engages with the user, thus bringing about its activist dimension and transformative power, I am proposing that discursive objects that are imbedded in the digital culture of the twenty-first century have greater power to achieve this end. These are what I call *Twenty-First Century Activist Discursive Objects.*

2. The Collaboration of the Business and Discursive Design Worlds as a Solution to Unsustainability

2.1 Failure to Address Issues of Sustainability

Throughout the twentieth century, product designers served industry by creating an endless stream of appealing objects. The job of product designers was to create beautiful objects and to increase a consumer's desire to buy (Andrews, 2009). The capitalist industry became associated with self-serving actions and pursuit of profit. As a result, ecological and social systems that we depend on throughout the world have been negatively affected and find themselves in decline. Our supply of materials and energy is suffering, and the disparity in wealth is increasing as are a multitude of educational and health problems (Thorpe, 2003).

Since the publication of the *Brundtland Report, For Our Common Future* by the World Commission on Environment and Development in 1987, a multitude of theories have been posited to explain the "principles of sustainable development." Summing up the underpinnings of these theories are three core principles: environmental stewardship, social equity and justice, and economic stability (Walker, 2006, p. 36). Designers have discussed the benefits of potentially integrating these values into production, but have failed to open up new spaces for practice beyond the conventional market model where design is seen as an engine to create goods for the market (Margolin, 2003).

2.2 The Need to Introduce a Change in Mentality

Given the urgency to address structural unsustainable practices and the process of what Tony Fry has called "defuturing" (2011), it is important for designers to create strong collaborations that result in more favourable conditions for the planet (Fry, 2011). Ethics within design practice need to be reformulated, and producers need to be held accountable for their impact on communities and the environment.

Today, designers and industrial producers will need to bear responsibility for the impact of their practices and collaborate to create a more meaningful material culture (McCoy, 1995). Designing for sustainability and working to increase a global sense of citizenship are matters that touch on both design and industry. To address contemporary issues, such as the globalization of industrial capitalism, environmental degradation, and social disparity, both designers and producers need to question the structure of the current material culture. New design solutions will need to be critical of a consumer culture that focuses on results that are fashionable at the expense of more ethical considerations (Walker, 2006). The challenge for a sustainable economy hinges on finding new ways to capture values of sustainability and citizenship within a commercial system that can nevertheless remain profitable (Thorpe, 2007).

Behaving ethically and showing a strong sense of global citizenship in the field of product design is a mentality that the designer, industry, and the consumer need to adopt. To succeed in this endeavour, all stakeholders must be accountable for the consequences of the resulting industrial production. The transition from the current practice model, which relies on mass production of consumer goods, toward a more meaningful material culture, requires new kinds of design solutions that address both environmental and social conditions (Hart, 2010). This transition to a new reality requires both grass-roots behavioural changes and a strong sharing of ideas among players (Manzini & Jegou, 2003).

A tight collaboration between the community of discursive designers and industry is in fact mutually beneficial. The market is not inherently bad and is able to offer many benefits to the discursive world, especially as it relates to commercialization and reaching a wider audience (Tharp & Tharp, 2018). Discursive Design is a tool that can be used by corporations to create innovative approaches and bring about societal good in ways that would be financially beneficial in the long term.

2.3 The Potency of Discursive Design

Discursive Design is a branch of design that focuses on research and the formulation of positive change. In opposition to commercial design, its priority is to criticize non-sustainable behaviours and propose design in the context of possible futures that lead to better social conditions. It enriches societies with new knowledge and aims to introduce some level of sociocultural change (Tharp & Tharp, 2018, p. 7). Discursive Design is often dismissed because of its highly poetic or unrealistic qualities. Still, given its high concern with issues of sustainability, matters of citizenship, as well as its courageous stand against destructive behaviours, it has a mentality that can positively influence industrial approaches.

Collaboration between Discursive Design and industry is therefore possible. The Discursive Design world, though young as a field, has matured into a domain with well-defined parameters and approaches (Tharp & Tharp, 2018). At the same time, the industrial world is ready to embrace innovative ideas, and commercial players are eager to embody technological advancement, introduce disruptive ways of working, and change industry's dynamics (Lefkofsky, 2007; Harmut, 2009).

3. Discursive Design

3.1 The Function of Discursive Design

This paper considers Discursive Design, a design approach focused on articulating criticism of the status quo, to be an essential pillar of our quest for a better future (Dunne & Raby, 2013). The function of Discursive Design is in the debate, and this function is what is critical. In their book, Discursive Design: Critical, Speculative, and Alternative Things, Bruce and Stephanie Tharp (2018) define Discursive Design as

> "…the creation of utilitarian artifacts whose primary purpose is communicative…. They encourage reflection and also often aim to subsequent debate and response" (p. 51).

Discursive Design acts in the tradition of many art and design movements, which are rooted in activist principles. Design has a long history of demanding change (Tharpe, 2014). The activist nature of discursive objects is clear: they freely challenge the conventional and call for change in adopted behaviours and accepted realities. Their interventions purposefully disrupt the routine by revealing and speaking out against societal ills.

Because Discursive Design challenges convention, it gains the quality of an activist tool. Design activism is displayed when buildings, objects, and systems act similarly to social movements by identifying an ethical concern and creating designs that call for social change and seek to influence public opinion. Anne Thorpe (2010) defines activist design as any intervention that "addresses largely progressive social and environmental issues, over and

above profit-driven or aesthetic agendas that are most common in design" (p. 276). Because of its focus on criticizing existing circumstances and proposing different ones, Discursive Design could be described as essentially activist.

The activist role of discursive design takes on the task of promoting a future that is safe for all. The strategy of getting to that future is to conduct research that leads to creating functional or pseudo-functional products that can be used within our current daily lives. Discursive design creates products that are either dystopian, when they represent the result of our destructive behaviour, or utopian, when they represent the possibilities of science. I propose three examples that illustrate this point.

The Huggable Atomic Mushroom, designed by Anthony Dunne and Fiona Raby (2004), was created for people afraid of nuclear destruction. The object challenges people to face their fears of nuclear devastation and provides a reminder of the negative impact of a nuclear explosion, both on people and on the environment. By addressing a genuine concern, this discursive object goes beyond the functional and opens important ethical, social, and political discussions with the goal of creating better future conditions.



Figure 1. The Huggable Mushroom by Dunne & Raby, 2004. (source: http://dunneandraby.co.uk/content/projects)

Between Reality and the Impossible is another example of a project by Dunne and Raby that criticizes overconsumption and addresses the notion of a future parallel but possible world. Foragers 1, 2, & 3, shown in Figure 2, are products that visualize technologically advanced devices that city-dwellers might need in the future as humans run out of food and must develop objects that assist them in filling the gap between the food they have and that which they need to survive (Dunne & Raby, 2010).



Figure 2. Foragers 1, Foragers 2, Foragers 3, Between Reality and the Impossible, by Dunne and Raby 2010. (source: http://dunneandraby.co.uk/content/projects)

In his book *Design Activism: Beautiful Strangeness for a Sustainable World* (2009), Alastair Fuad-Luke elaborates on Dunne & Raby's work and emphasizes its activist dimension. Fuad-Luke defines Design Activism as an agent for change that influences behaviours and facilitates a transition toward more sustainable ways of living. He considers *The Placebo Project,* designed by Dunne and Raby, to be an example of successful activist design.

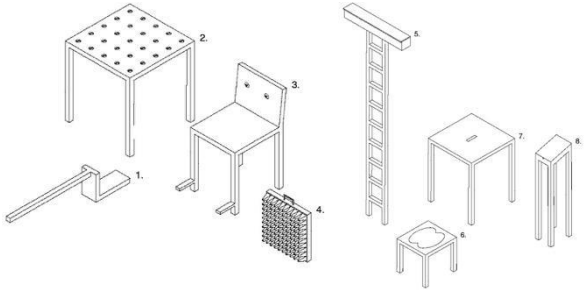

Figure 3. Placebo Project, 2001. (source: Dunne, A., & Raby, F. (2001). Design noir: The secret life of electronic objects. Basel: Birkhauser).

The Placebo Project created a series of functional objects that encourage awareness of electromagnetic fields inside the average home by building pieces of furniture that react when a device that emits an electromagnetic field is placed on or close to them. As opposed to Dunne and Raby's *The Huggable Mushroom* and *Between Reality and the Impossible,* this project does not just speculate about the future, but makes tangible an invisible effect of the industrial world, and thereby calls our attention to its possible negative effect on humans. The project analyzes people's relationship with electronic objects and warns against the adverse effects of electromagnetic waves generated by everyday products like GPS systems, mobile phones, and computers.

Fuad-Luke (2009) explains that these objects

> "stimulate the imagination of the users while simultaneously raising their awareness as to the invisible landscape and territories of electromagnetic radiation, a topic rarely touched upon in social discourse" (p. 121).

Fuad-Luke considers this experimental project to be effective both in delivering a message and in transitioning toward the commercialization of safer electronic products. In this manner, he views discursive products as activist entities that not only raise pressing concerns, but also put forward a new aesthetic and significance to electronic products. These objects redefine our interaction with consumer electronics and reformulate our relationship with the digital, amounting to a visualization of a new kind of technological industrial product.

3.2 The Failings of Discursive Design

The subjects addressed by the Discursive Design world are timely and relevant. Yet, this design approach still has many limitations, most notably limited reach, oversimplified semiotics, and resultant semi-utilitarian designs. The audience of this design approach tends to be restricted to conceptual designers, theoretical thinkers, and highly informed segments of the public.

To make Discursive Design more relevant, its products need to become more usable by the average consumer. The criticism expressed by discursive products needs to be a starting point for design processes, as opposed to the end result of the product itself. A stronger collaboration with the industrial world might partially compensate for the failings of Discursive Design. In this case, industry's expertise could introduce products that address more utilitarian functions, open up new markets, and launch production in large quantities with advanced technologies, all while effecting the social, political, and ethical goals of the discursive designer.

4. The New Paradigm of the Competitive Business World

Long gone are the times when corporations are seen as the avaricious "enemy" to be controlled with penalties and fines (Hart, 2010). The world no longer considers ethical implications as an absolute impediment; sustainability and ethicality are the new values at the forefront of the corporate agenda in order to remain profitable in the long term.

This new kind of global sustainable capitalism, which takes into account natural and social capital, is the new paradigm that helps the industrial world make decisions about the design, fabrication, and distribution of products. Conducting a sustainable business is the new managerial methodology of competitive capitalist economies. To succeed within the new global economic order, businesses are thinking in terms of the "triple bottom line": economic prosperity, environmental quality, and social justice (Elkington, 2002). As a result of this mentality, new partnerships between entities that might have previously been opponents are embracing technological advancement and collaborating to reach these triple bottom line goals.

Corporations are proposing alternative design solutions to benefit communities. This practice is changing the current model of industrial production. Markets open to competition are producing de-materialized, highly technological products that intervene in the political, the economic, and the social (Elkington, 1999). Profitable companies are able to improve their business performance by taking into consideration the environmental and social impacts of their production, resulting in a merging of corporate and societal needs. As a result, creative approaches are allowing for new kinds of collaboration and for social innovation that benefits communities (Hart, 2010).

It thus becomes increasingly clear that industry's new agenda is similar to the values of Discursive Design. Both fields are proposing new and unexpected interruptions to the conventional by taking into consideration the wellbeing of communities and humans' impact on nature.

5. The Agency of Discursive Design Exists in the Industrial

5.1 The Discursive Industrial Product

Discursive objects may be impractical and difficult to grasp, but their real value exists in their intellectual content, researched content, and disobedience. They criticize questionable practices and visualize new findings without any reservations. In order to extend the discursive object's agency beyond the intellectual realm of the elite, product designers and producers need to deepen their understanding of Discursive Design's approach and help it step out of the gallery.

In his book, *Design for Life: Creating Meaning in a New Distracted World*, Stuart Walker (2017) envisions a new kind of design defiant of the existing profit-driven model. Walker's proposal for a different path relies on ethical thinking and creative criticality. He encourages the incorporation of the "pragmatic and the philosophical" with

> "learning to find a more equitable balance between, on the one hand, rationalism, intellectual pursuits and 'progress', and on the other, intuition, experience and expertise" (pp. 184-185).

Anthony Dunne (2008) refers to Jack Kevorkian's Suicide Machine as an example of an industrial design that enters the realm of Discursive Design. Dunne describes this invention as "a powerful 'unofficial' design that materializes complex issues of law, ethics, and self-determination," and "shows how an industrial invention can be a form of criticism" (p. 43). He also proposes a

> "role for design objects as discourse where functionality can be used to criticize the limits that products impose on our actions" (p. 43).

Through his analysis of this industrial invention, Dunne recognizes the power that industry has in creating functional Discursive Design that can criticize existing behaviours and propose new laws. The suicide machine showcases how industry can generate controversial discussion as it defies existing laws by addressing human fears and unusual needs. The more industrial entities succeed in manufacturing discursive products, the more likely it is that alternative models will be able to replace, or at the very least complement, existing industrial systems and reshape the conditions of material culture.



Figure 4. Jack Kevorkian's Suicide Machine. (source: Dunne, A. (2008, p 44). Hertzian tales: Electronic products, aesthetic experience, and critical design. Cambridge, MA: MIT Press.).

5.2 The Immaterial Dimension of the New Discursive Industrial Product

The new discursive industrial product focuses on social issues, introduces new mentalities and behaviours, and will see its impact increase considerably as it becomes designed within social and digital platforms. Discursive Design can become a particularly potent influencer as it embraces technological advancements and allies itself with other complementary design disciplines that are well-established within industrial circles, by developing digital connectivity—namely Service Design, Interaction Design or Transformation Design.[1] A path toward a meaningful consumer culture becomes within reach as discursive designers collaborate with user-experience designers and producers with digital knowledge. By working with industry to apply strategies of co-design and user participation, designers are able to form effective channels of activism.

[1] Transformation Design introduces innovations to encourage more sustainable behaviours within society (Wolfgang, 2016). It encourages the creation of new markets to modify existing ones (Polanyi, 1944). This design approach focuses on an ethical agenda and introduces participatory techniques to tackle the complex challenges of our society and introduce long lasting change (Sangiorgi, 2010).

6. Case Study

6.1 Twenty-First Century Activist Discursive Object

A meaningful collaboration between the discursive and the industrial world would introduce an industrial technological product that rejects unsustainable practices and encourages enhanced participatory citizenship to build continuous change. In the context of this paper, I am referring to a product with the potential to change the status quo and introduce new behaviours relating to a heightened sense of citizenship as the *Twenty-First Century Activist Discursive Object*.

This object would manifest the critical input and activist intention of the research world and be produced and distributed efficiently by the industrial world. The object's influence can increase if the design has a digital component that designers are able to capitalize on to expand its reach via already-existing digital platforms. This product would be able to shape new experiences and create new behaviours, unlike objects limited to a more static function.

A model example of an *Activist Discursive Object* that is relevant to the twenty-first century is the *BuggyAir,* designed by Superflux, a British design practice that defines itself with the words "Translating future uncertainty into present day choices" (BuggyAir, 2018). Superflux describes the *BuggyAir* as "an accurate mobile sensing kit that helps parents understand their children's exposure to air pollution" (BuggyAir, 2018). It is designed to hang easily on strollers and measure ground-level air pollution. Superflux built ten sensor kits, each consisting of a research booklet and the product itself, and made them available to approximately fifty caregivers for two to three weeks. This product that spread knowledge about pollution was developed with the help of industry and saw its activist transformational power realized as users contributed to the design process.



Figure 5. Images of the first BuggyAir prototype, 2014. (source: https://superflux.in/#)

6.2 Discursive Dimension of the *BuggyAir*

By acknowledging the fear that parents can experience living in an urban polluted area, Superflux offered industry an opportunity to address genuine human needs not typically taken into consideration within consumer culture. Rather than clean the air, the design is meant to empower the urban dweller by opening a discussion about ignored situations that, in the eye of the user, need to be addressed.



Figure 6. BuggyAir sensor kits (Source : https://superflux.in/#)

6.3 Digital Activism

BuggyAir is an activist initiative targeted at generating public discourse with the aim of changing acquired behaviours and with the ultimate goal of seeing new laws against pollution implemented. To reach as many people as possible, the *BuggyAir* was introduced to the public as a technological product that exists within a well-designed digital ecosystem, similarly to how the iPod exists within the wider Apple framework. *BuggyAir* is directly connected to the *Internet of Things Academy*, described by Superflux as "a website with a core mission to show how people use their data as evidence for change" (BuggyAir, 2018). The intention is to collect data that measures pollution levels, which would later be put forth as evidence to reshape accepted behaviours, "influence regulation and policy, encourage a culture of civic innovation and change corporate practices" (BuggyAir, 2018).



Figure 7. Images of the first BuggyAir prototype in use (the product) and logo of the Internet of Things Academy (the platform). (source: https://superflux.in/#)

Users become active participants in the design process by walking, measuring, and logging the amount of pollutants *BuggyAir* detects. As users create the content in the research kit and digital interface, the activist and discursive aspects of the initiative merge. Users become a primary actor in designing the object as the co-creation process facilitates the development of a product that reaches a fuller discursive potential through involving the public. In this manner, we see how active citizen involvement and participatory thinking become essential components to creating a *Twenty-First Century Activist Discursive Object.*



Figure 8. Images of the booklets distributed with the prototypes. (Source : https://superflux.in/#).

6.4 Creating a Sense of Global Citizenship

As users become citizen-designers, who share information and inform other users about the least polluted routes, the product becomes an example of how discursive designers can help people connect with the realities around them and take control of their situations. In the case of *BuggyAir,* transformational change becomes evident as caregivers start adjusting their daily routine according to this newly acquired knowledge about pollution that exists in their former routes.



Figure 9. Meeting with users. (Source : https://superflux.in/#).

6.5 Connection to Industry

BuggyAir's initial website came to be with the financial help of Nominet Trust, a company that supports "ventures using digital technology to create real social impact" (BuggyAir, 2018). To develop the product itself, Superflux worked with private-sector partners, ScienceScope and Virtual Technologies. By collaborating with the corporate world, Superflux received the technical help it needed to launch its product while showing producers new possibilities and consequently influencing the mentalities of those who determine commercial culture. It proposed a project to industry that explores and criticizes consumers' impact, as opposed to the more common projects that are designed to ignore or deny their own carbon footprint.

6.6 Value Beyond the Function

BuggyAir is not an air filter; it does not give an immediate solution to the problem of polluted air. Yet, its activist dimension has value that is superior to that of a fully functional object. It refuses the status quo and pinpoints ecological and societal failings. It engages the public in solving one of the biggest issues of our time and draws its strength from direct engagement with communities. The product guides participants in designing their path toward a better future and uses the power of digitized ecosystems to create platforms that link designers, scientists, citizens, and industry.

Product designers face the challenge of breaking away from restrictions of form to explore alternative practice models with the goal of introducing transformative change that allows for a resilient existence. It is the responsibility of product designers and industry to face up to pressing problems, confront change, and explore the power of science to influence the adoption of behaviours that are more fitting with the planet's conditions. Discursive Design has a role to play in this quest for new ways of producing, especially as the field begins to join forces with industry to create the *Twenty-First Century Activist Discursive Object.*

7. Conclusion

This paper proposes how discursive designers and industry can work together to push the boundaries beyond their current collaboration to support our common, ongoing quest to create better conditions for the future. To reach the potential of the progress they both seek, producers and designers need to commit to a wider awareness of each other's fields and the unsustainable realities we are living. Such action will allow for an exchange of ideas that leads to transformational collaborations.

The challenge of establishing a meaningful material culture lies in the active participation of all stakeholders: designers, producers, and users. Discursive Design has an important role to play in this development; it defies the negative impacts of commercial dynamics as they exist and displays the possibilities of scientific progress for the benefit of society. Nevertheless, without close collaboration with industrial entities, the impact of this design approach will remain too limited. Industry has proven itself more equipped to promote and normalize ideologies and concerns born of discursive discourse than designers, governments, or other players. Industry, with input from discursive designers, holds the key to guide society toward an increasingly sustainable and equitable future.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Patient Revolution. New design perspectives in healthcare innovative processes.

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Abstract | This paper explores the emerging role of patients and caregivers as user innovators within design processes. The phenomenon of user-driven healthcare has been recently renamed 'patient innovation' (Olivera et al. 2015). The first part of the paper presents a literature review to explore the phenomenon of patient innovation, especially in Italy. The second part analyses a range of European research projects on patient innovation, carried out and participated by makerspaces and fab labs, according to several indicators, such as the role of patients, the role of healthcare' stakeholders/providers, the design processes implied and the outputs of these design processes. The final part of the paper systematizes the results and use case analysis in order to qualify the nature of collaboration between different healthcare stakeholders as a key to design innovative roles, skills, spaces for patients, doctors and institutions.

KEYWORDS | PATIENT INNOVATION , USER - DRIVEN HEALTHCARE , MAKERSPACES , DISTRIBUTED DESIGN FOR ALL , DIGITAL HEALTHCARE

1. Introduction

Nowadays, we observe an increasing need and willingness for patients, patient associations and caregivers to be involved in cure and recovery processes for economic, time, social, and psychological reasons. However, a major role of patients should not correspond to the absence of the medical staff from the whole process. The involvement of patients in the cure and in processes to envision new solutions might be the right answer to avoid the so-called do-it-yourself care and medicine. Indeed, more than 47,4% of Italian citizens prefer self-diagnosis (Eurispes, 2017) and self-care.

Within the healthcare system, the personal relationship between patients and general practitioners has been reduced and replaced with specialist visits augmenting and disintermediating human relations. Patients and doctors nowadays seem to be more distant than in the past: 54.3% of citizens are not satisfied with our health system, only 57.8% are confident in the effectiveness of influenza vaccines (Eurispes, 2017).

Enabling innovation communities and spaces such as Makerspaces and Fab labs can favour technological and social innovation in healthcare. Design can act as a mediator between different stakeholders, and as a facilitator of innovative processes; makerspaces can act as platforms for co-creation. As the design process and its results are concerned, “Research has shown that many users ‘drop out’ of the innovation process before having realized a prototype and may be doing so too early for what is socially optimal, leaving potentially valuable ideas undeveloped.” (Svensson & Hartmann, 2018: 278). Makerspaces and Fab Labs can act as enablers of patient innovation processes avoiding cases of dropout. Italy can be considered an advanced country in this area, and Italian makerspaces collaborate and operate on these issues together with patient associations, policy-makers and RRI experts in several European projects.

2. Framing the Patient Innovation

Healthcare needs are changing according to society changes. One of the most relevant highlights stressed by OECD Health Statistics 2018 is the need for health systems to be more people-centred, in particular in facing life-threatening diseases and to be able to exploit the potential of new digital technologies to strengthen prevention and care.

The approach to health as a system, the focus on people (both as patients but also caregivers), the exploitation of digital technologies and robotics (Butter et al., 2008; Brose et al., 2010) can be identified as relevant elements that have to be taken into consideration when we talk about Patient Innovation.

In order to talk about Patient Innovation is necessary to frame this phenomenon within the wider concept of Grassroots Innovation, which is defined as “a network of activists and organizations generating novel bottom-up solutions for sustainable development and

sustainable consumption; solutions that respond to the local situation and the interests and values of the communities involved" (Seyfang & Smith, 2007: 585). For the discussion here presented we find in this definition two main relevant keywords: network and sustainability.

The need for communities and networks in order to be able to activate and implement an innovative solution is particularly relevant. Indeed, the capability to have a systemic view and rely on a critical mass of intentions and interests are fundamental elements for the success of an innovative idea. The very first limit to the development of an innovative solution is based on the fact that patients (in many cases) are not experts or entrepreneurs, and their objective is basically and clearly oriented to the improvement of their own critical condition without any regards to the market or other users. For this reason the concepts of "network" and "alliance" are very relevant; first of all this concept refers both to the geographical and value-oriented proximity of members of these networks (Boschma, 2005). In addition to that, even if Grassroots Innovation is primarily generated by civil society (Tang et al., 2011; Hossain, 2016), it has to engage other relevant stakeholders, such as government and business, especially when innovation happens in the healthcare domain. Indeed, these networks include a "social dimension" composed by people who have different needs and goals; hard components, such as tools and devices; normative components like permissions, obligations and power (El-Hassan, Fiadeiro, and Heckel, 2008). This view is very close to what Harvey Molotch (2003) called "lash-up", that is an integrated and networked system which is at the basis of the creation of a product or a design solution: "Tracing the connections in products can show how the social and the material combine to make, depending on circumstance, both change and stability happen in the world" (Molotch, 2003: 3). Every innovation to be effective, in this sense, enroll a socio-technical network, different stakeholders, tools and technologies. Harvey Molotch uses the "lash-up" concept also to address the issue of sustainability, which is very important also for our discourse.

The concept of sustainability is very relevant but complex, as well. Sustainability has multiple facets and does not refer only to the environmental sustainability but also to the economic and social ones. Also sustainability has to be approached with a multidimensional perspective (Davico, 2004). Therefore, when we take into consideration healthcare, it is very important to look at the ethical-social sustainability, which refers to issues of social equity between individuals, groups, between broader social aggregates, fair distribution and equal access to services in order to strengthen the population's capacities and opportunities (Davico 2004).

The Open approach is very much related both with the discussion on network and sustainability. Indeed, innovation owns the characteristic of openness when it is participated by subjects that usually do not enter in these processes (such as patients and caregivers), and when it is free to be used and shared (not for business purposes). As the NESTA report "Open Innovation in Health" (Gabriel, Stanley, and Saunders, 2017) states that innovation in order to be "open" has to involve a wider range of people that "can generate better ideas, at lower cost. They can also democratise innovation, giving a wider range of people a say in

setting priorities" (Gabriel, Stanley, and Saunders, 2017: 4). As the economic sustainability is concerned, the affordability of solutions implemented, according to the Frugal Innovation approach, is connected with low-cost and low-tech productions.

Previous research (Dreier et al., 2016) identified some common characteristics to define a "low level" of Patient Innovation:

1. independence: in most of the cases the idea was born from the personal condition and to face a personal issue;
2. repetition: in many cases the solution identified already existed but the patient did not know;
3. sharing: when a solution was found in general patients tend to share their positive experience with other people in their same condition lack of connection with doctors and professionals.

In this view, Design might act as an important mediator, connector of health services and institutions with patients and citizens, and as an activator, thanks both to tangible (availability of facilities and infrastructures) and intangible (knowledge and networks sharing) factors.

2.1 The "space" for Patient Innovation

Grassroots Innovation and co-creation processes can happen in those places where networking between different actors is facilitated and performed, where knowledge is shared, where experimentation is easily performed (in terms of availability of tools and competences). Focusing on design-driven innovation, Makerspaces and Fab Labs are places where it is possible to face the previously mentioned issues of independence, repetition and sharing which characterize Patient Innovation at a very first stage. Makerspaces and Fab Labs are facilities but also actors of a socio-technical system, where social and economic sustainability can be performed thanks to the adoption of processes of open and distributed production.

The first, open production, refers to an emerging production model, based on cooperation between different subjects. Often this production model is connected to open design approaches that lead to the development of projects (under free IPR Creative Commons license) based on the sharing of digital project files released freely to allow their replication or distributed production (Maffei, et al. 2017). The second, distributed production, is essentially a decentralized form of production developed by organizations or individuals who use a network of structures and production technologies geographically located through ICT technologies. This form of production is the basis of the Maker movement (Anderson, 2013; Dougherty, 2016) or the Do-It-Yourself culture and allows remote production of objects, at a microscale close to the end user. In technologically more advanced forms distributed production is present today in the concepts of Industry 4.0 (Europe) and Smart

Manufacturing (USA) with the introduction of cyber-physical systems or the development of autonomous systems managed by Artificial Intelligence (Maffei, et al. 2017).

From the socio-technical network point of view, we want to stress here the importance of Makerspaces and Fab Labs to be in connection with wider networks of stakeholders; in many cases, Universities, Research Centres, Hospitals, etc. take part in these networks. In addition to that, there are some examples of Makerspaces, Fab Labs, Innovation Centres which are not only located but even promoted and managed by Universities (e.g. POLIFACTORY at Politecnico di Milano, Lab4Living at Sheffield Hallam University, UCL Centre for Co-production in Health Research at University College London, Helix Centre located at the St Mary's Hospital in London but managed by Imperial College London and The Royal College of Art); this means that theoretical and applied research can be performed in very close connection. In addition to that, the reputation of Universities as "reliable" institutions can favour the involvement of different stakeholders, since, according to Quadruple Helix approach (Carayannis & Campbell, 2009), innovation is favoured and better performed thanks to the connection and the collaboration among Academy, Government, Civil Society, and Enterprises. In the following section, we are going to focus on the Italian context, presenting a selection of case studies of Design-driven Patient Innovations (DPI).

3. Patient Innovation case studies

The following case studies were selected looking also at previous research, such as MakeToCare1 and MakeToCare2,(Maffei et al., 2017; Maffei et al., 2019), La cura che cambia (NESTA, 2018), Digital Social Innovation: DSI4EU platform[1].

The 5 selected case studies are: NEXT STEPS, CAREABLES, BODYSOUND, Patient Innovation Platform, Hackability. We are going to present them according to three main sections:

1. DESCRIPTION: which will contain general information about the typology of project and funding, the partner we are going to take into consideration, area of interest of the project, actors involved.
2. PROCESS: will be dedicated to the research and design processes used in Patient Innovation journeys.
3. OUTPUTS: resulting from the process previously described; typologies of outputs and their distribution.

Finally, according to the identification of several variables, a model for the comparative analysis and synthesis will be proposed and used on the selected case studies.

[1] https://digitalsocial.eu/

3.1 NEXT STEPS (Distributed Design Market Platform)

DESCRIPTION. NEXT STEPS is an experimental initiative developed by Polifactory, the makerspace of the Politecnico di Milano[2], within the Horizon2020 project Distributed Design Market Platform[3] (DDMP, Creative Europe Programme 2017-2022) that stimulates designers, makers and patients to co-design and prototype a collection of open source walking aids that can be distributed through digital platforms and materialized in Fab Labs, starting from the Design Distributed Market Platform perspective. The initiative developed in collaboration with AIG – Associazione Italiana Glicogenosi[4], a patient association that represents people affected by Glycogenosis.

PROCESS. The project was divided into several phases involving patients, caregivers and designers through participatory activities and workshops both in presence (at the Fab Lab) and remotely. The results collected by a survey were the starting point for the co-design workshop aimed at collecting project ideas for mobility aid solutions. During the following phase, called "Makers in Residence", patients worked in close collaboration with designers and makers supporting them in the development and prototyping of open source walking aids. Technical and scientific support was provided by Polifactory' researchers; medical and scientific support was provided by Sanofi Genzyme (a pharmaceutical company) with a specialty care unit focused on rare disease.

OUTPUTS. Five solutions have been developed:

- Twistr: a parametric stick generated through a scanning made by a Kinect Cam;
- Taylor: a generative stick based on three parameters: gender, height and weight;
- Wander3d: an hacking project to transform a traditional walker into a motorized and sensorized rollator. Users can decide to activate the motors according to their needs.
- Clip Clap: a family of 3D printable clips for personalizing crutches;
- Crutches adds-on: a system of accessories that integrate on crutches to facilitate users' movements and activities (hooking systems, battery charging systems, lights, tips, holders, etc.).

All projects files and the INSTRUCTIONS FOR FABRICATION are distributed with a Creative Common License (CC BY-SA) on the distribuddesign.eu platform and Polifactory website.

[2] www.polifactory.polimi.it/en

[3] distributeddesign.eu

[4] https://www.aig-aig.it/



Figure 1. Taylor one of the solutions developed within the NEXT STEPS project.

3.2 CAREABLES (made4you)

DESCRIPTION. Made4you it's an Horizon 2020 project (2018-2020) that involves several Fab Labs around Europe, participated by the Italian Fab Lab OpenDot. The project was aimed at connecting local communities of citizens with disabilities, their families, and healthcare professionals with makers and designers. The collaboration between these separate communities was based on the development of open-source interventions and solutions, so called "Careables".

PROCESS. In made4you project people became creators, not only users of innovation. Patients, their families, healthcare professionals and designers were involved in a co-design process as experts in their specific field, and were asked to collaborate with makers, who are -on the other hand- experts in the use of digital tools, such as 3D printers, laser cutters, etc. OpenDot chose a method already tested in other projects on the development of healthcare through co-design. This method is composed of 8 main steps, as shown in *Fig. 2.*

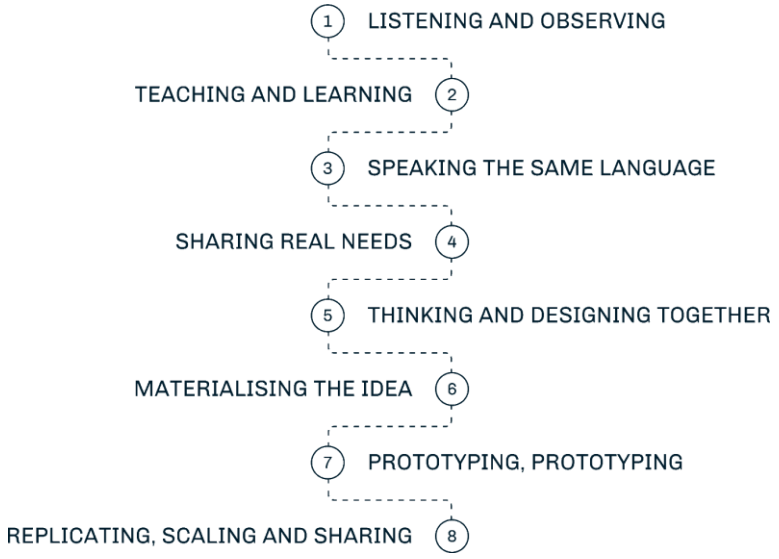

Figure 2. Steps of Method developed by OpenDot from 2015 with the TOG Foundation and other organizations, ranging from patient associations to companies operating in the field of healthcare, extract to "manifesto of co–design for health and care" inside Made4You project.

OUTPUTS. Made4You project had a series of different outputs both connected to co-design, prototyping and open distribution. Careables products are solutions for healthcare co-designed, replicable, accessible, adjustable, and shareable online, using digital technologies. These products are collected and distributed on the platform careable.org, where also a wider collection of open products is available to be downloaded. The platform collects about one hundred products and solutions, such as:

- *Davido*: a musical instrument that allows children with motor disabilities to maintain a rhythm, produce music and play alongside other people;
- *Hack a toy*: DIY low-cost mod to help turn toys into accessibility devices;
- *3D printed orthotic swimming fin* for the arm suitable for rehabilitation after a stroke.

3.3 BODYSOUND

DESCRIPTION. The Horizon2020 project SISCODE Co-design for Society in Innovation and Science (2018-2020) is aiming to understand the co-creation phenomenon that is flourishing in Europe and to analyse the context and conditions that support its effective introduction, scalability and replication. Within SISCODE, 10 pilot projects have been developed, involving different stakeholder in the co-creation of solutions addressing societal challenges. One of

these pilot projects, called BODYSOUND, is run by Polifactory, in collaboration with the Patient Association FightTheStroke; it investigates the physical-motor needs of children diagnosed with cerebral palsy.

PROCESS. BODYSOUND was developed starting from the process developed and proposed by the project leaders (Politecnico di Milano) in collaboration with other partners.

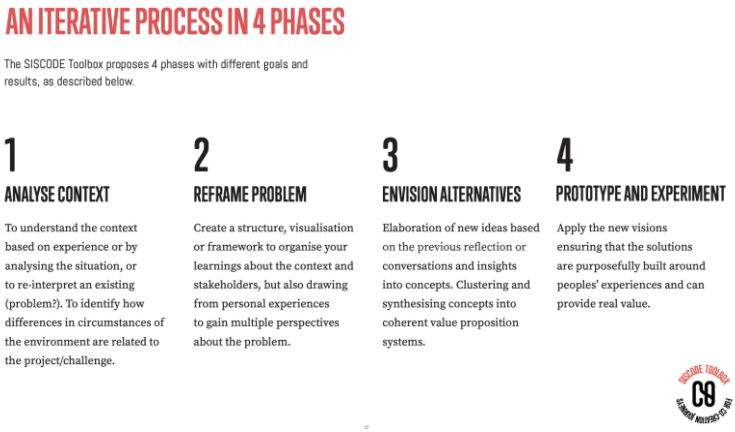

Figure 3. Process within the SISCODE toolbox for co-creation. and co-design.

Different moments of co-creation have been conceived and planned, in order to involve different stakeholders:

- the patient association FightTheStroke, who took part in the whole process from the definition of the challenge;
- children and families who have been involved in co-design workshops, experimental laboratories, and tests;
- therapists, sports doctors and sports scientists who were involved to test the solution and during the service co-design workshop;
- policy makers who were also involved in different moments of the process, through interviews and during the service co-design workshop.

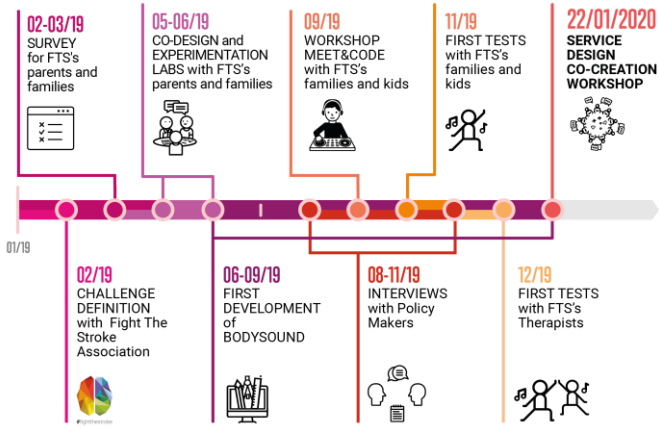

Figure 4. BODYSOUND pilot co-design process timeline

OUTPUTS. The output of BODYSOUND will be a product-service system intended for all children, with particular attention to the needs and requirements of children with cerebral palsy, aimed at motor reactivation through music that uses touchless technologies and will be able to collect data related to the movement. In particular, the product BODYSOUND will be a system based on coreutics and on the transformation of movement into sound. Within this system, children can perform a “choreography” and transform it into a “melody”.

3.4 PATIENT INNOVATION PLATFORM

DESCRIPTION. Patient Innovation platform was an output of the research "Visualizing user innovation in the healthcare" (2011), supported by Pieter Pribila Foundation, The Portuguese Science and Technology Foundation and Carnegie-Mellon Portugal Program, in collaboration with Universidade Católica Lisbon with Università di Roma Tor Vergata and the Universität Innsbruck. The project was aimed at studying user innovation developed by patients and non-professional caregivers. During the project, the need for these innovations to be shared with other patients, researchers and makers, became clear. For this reason, the Patient Innovation Platform was created in order to open distributing these solutions.

PROCESS. The process here presented it has not to do with the development of the platform in itself but with the process that the platform follows to collect (patients) innovations. Anyone interested in sharing an idea or solution can join an existing Patient Group or create a new group and can post information and multimedia content that can be implemented over time. Platform managers enable user-innovators interested in sharing their product-service solutions: solutions are analyzed by the Patient Innovation medical team, only those validated are published, thus ensuring a security check.

OUTPUTS. An international, multilingual, non-profit platform, and social network that connects patients and caregivers, and enables the sharing of their solutions. Since the launch of the platform, over 650 care and disability product and service solutions from over 40 different countries have been presented by patients (non-professionals) or caregivers, validated and then shared online.

3.5 HACKABILITY

DESCRIPTION. Hackability is a Non-Profit Organization born in Italy (2013) that aims to identify, invite, inform, interest and involve makers, designers, technicians, Fab Labs and people with disabilities, in an on-line and off-line community, to realize products for everyday life using new (or improved) digital fabrication processes. The initiative was born in Torino, but today in Italy there are several Hackability communities. The initiative is based on a meeting formula inspired by hackathons aimed at developing solutions based on the needs of patients and caregivers.

PROCESS. The challenge of Hackability is to build strong relationships between the local communities of makers and people with disabilities. This is done by encouraging people of both communities to work together with the aim of developing an assistive device, which solved a specific need expressed by a person with physical impairments. The basic idea behind the process is that people with disabilities already are hackers and makers since they often modify or develop their own ATs solutions.

OUTPUTS. Hackability developed three kinds of outputs:

- *Event*: standardization of a format inspired by hackathons (popular events in the community of makers) to propose systematic occasions where people with disabilities and makers can meet and work together, creating workgroups that are led by patients (i.e., begin-user).
- *Products:* are solutions for healthcare co-designed inside Hackability events by patients and designer/makers, to solve a personal need. These solutions are documented and distributed with on hackability Platform, we mention here only few examples like *Tournée (*folding table for wheelchair completely made by 3D printing), *Hackability Geo* (interactive 3D map of Italy for blind children).
- *Platform:* collects the documentation related to projects developed with the Hackability co-design methodology. All material is released as Open Source, with a Creative Commons License (CC-BY-SA-NC).

3.6 Synthesis

Case studies previously presented are going now to be synthesized according to 5 main characteristics. The variables identified for each of them are limited to our case studies but -

for sure - they should have to be improved if other Patient Innovation case studies would be taken into consideration (see Tab.1).

Table 1. Grid analysis with variables to be considered in designing for patient innovation

The leading subject	Research center
	Fab Lab
	Association
The involved stakeholders	Patients
	Caregiver
	Patient associations
	Healthcare professionals
	Designer and makers
	Researcher
	Policy makers
The process	Co-design
	Co-production
The outputs	Products
	Platform
	Product-services
The characteristics of the outputs	Accessible
	Customizable
	Digitally fabricated
	Open
	Distributed

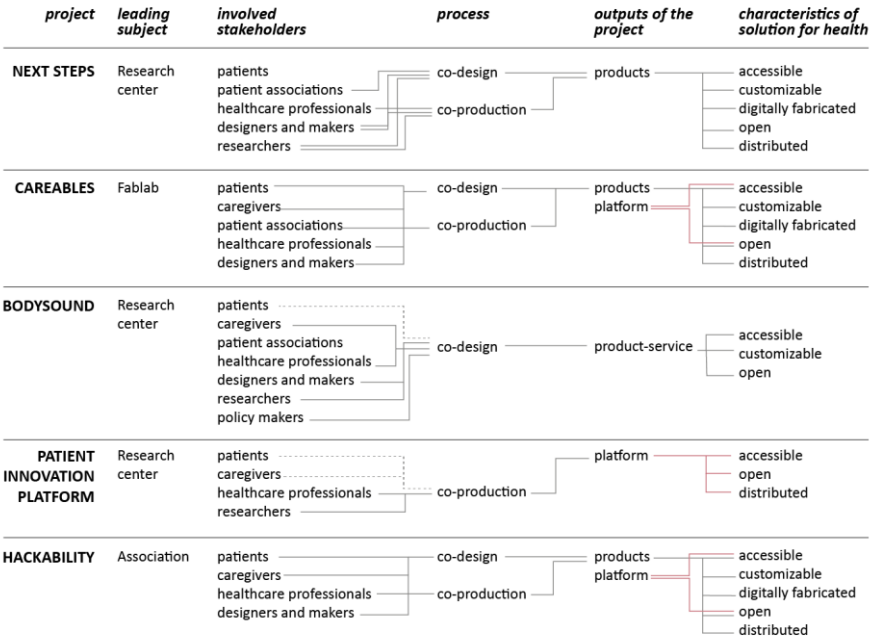

Figure 5. Summary table of the case studies analysed

As it is possible to see in the chart above, design-drive Patient Innovation pays great attention to different stakeholder in the healthcare field. Therefore, both patients and caregivers are involved and often, as we will see later, asked to work in close collaboration with designers and makers. However, innovation, in general, and Patient Innovation, in particular, need to communicate, engage and discuss in order to be efficient and effective both with researchers, healthcare professionals and policy makers.

These stakeholders are usually in co-creation processes. In the wide definition of co-creation, we could distinguish between:

- Co-design processes, which put in place specific actions of co-creation, where collective creativity is applied across the whole span of a design process (Sanders and Stappers, 2008; Sanders and Simons, 2009; Freire and Sangiorgi, 2010)
- Co-production processes, are temporally following actions to co-design and refer to the collective materialization or creation of knowledge.

Co-design and Co-creation processes, which we can collectively name, Co-creation are often *ad hoc* designed by researchers and designers and they can also be very different one from

the others. Since we took into consideration especially Fab Labs (and in one case - BODYSOUND - a Fab Lab which is part of a Research center) outputs are mainly products; however due to the nature of these projects, in many cases platforms are other very important outputs since they represent the virtual spaces were to disseminate and distribute these projects. Looking at the outputs, we could define their main characteristics. The accessibility of these products is very relevant. Indeed, in many cases these solutions answer to needs connected to the economic accessibility of healthcare products.

Accessibility is also very much connected with the possibility to customize these products. The customizability of a solution has to be taken into consideration in the very first-stage of the design process; therefore products have to be thought in parametric perspective to ensure that even a non-expert can enter his/her preferrable measurements.

The digital fabrication consent to use the same "language" which can be easily distributed and shared (open). Finally, openness and distribution are characteristics at the basis of the maker philosophy, as we discussed before.

4. Conclusion

Design-driven Patient Innovation is based on the observation and the recognition of a fact: patients (especially chronic patients) are daily facing issues connected with their disease, of which they become experts. The expertise is very relevant in managing these problems and, especially in cases of physical impairments, they tend to adapt the (standardized) medical aids which they need to use. However, to be so, innovation has to be known and shared, and not all the patients have the knowledge and the power to go beyond a personal level of innovation. To this end, Makerspaces and Fab Labs can act, in connection with other relevant experts, to empower patients who own an innovative idea, providing them the "space for innovation", composed by infrastructures, tools, methods, networks and money, thanks also to public or private fundings, which are more and more taking into consideration Patient Innovation as part of Responsible Research and Innovation domain. In addition to that, research and calls focusing on patients involvement, allow engaging in co-creation processes also those patients who aren't already conscious and confident not only in their possibilities but also of their capabilities and opinions. In order to make innovation possible, design-driven Patient Innovation looks at the whole healthcare ecosystem and to the need of a product or service to be inserted in a socio-technical framework in order to stimulate the conversation between healthcare providers and patients, but also improve the healthcare professional acknowledgment on patients' preferences and values. Finally, another important aspect is to propose more flexible medical aids and even cure processes, taking into consideration patients' general wellbeing and quality of life.

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The transformation will not be televised

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Abstract | The design field has been increasing its efforts to address societal issues with research and initiatives developed to provide adequate response. However, the gap between design's best intentions and the still rather poor effects of ambitious designs for social innovation suggest these responses may not be enough. To overcome this gap the authors offer two design frameworks addressing the growing social and environmental pressures: DEFT and the CONCERN CANVAS. These frameworks were developed based on the authors' research and work in the U.S., Europe and China, where they could witness these issues firsthand. The paper presents preliminary results of applications of the CONCERN CANVAS in corporate and educational contexts, as well as new ways to engage in the fight on climate change through the DEFT framework. While still in progress these frameworks provide tools for the emerging communities that reconnect designers with their roots as agents of change.

KEYWORDS | TRANSFORMATION, CONCERNS, CANVAS, CLIMATE CRISIS, STORYTELLING

I am pitting a world-around, bloodless, constructive, design transformation revolution against a world-around destructive bloody revolution. The Design Science revolution can be won by all. The bloody revolution can be won by none.

R. Buckminster Fuller 1969: Utopia or Oblivion

1. Context and Approach

1.1 Design for social innovation in a new context

In recent decades design has been reconnecting with its roots in social innovation. New fields of design research and practice were established, including design for social innovation, socio-ecological design, transition design, and transformation design. There is already much consensus for these design efforts in the academic world. However, with growing social and environmental pressures these design responses may not be enough. There seems to be a large gap between design's best intentions and the still rather poor effects of ambitious designs for social innovation, suggesting the latter may be ill suited to address the contemporary context.

1.2 Where we stand

The complex challenges individuals, communities and societies face can be designers' opportunity to shine. After all, designers are well equipped to address wicked problems and have expanded their scope beyond products and experiences to designing organizations and systems (Norman & Stappers, 2015). However, designers, as well as design educators are generally hardly able to offer ways for transformation. We believe the crucial point is to better align design knowledge with the changing contexts, so designers can work within different systems to eventually transform them. As current frameworks of design provide only little guidance on how to do this, we propose new concepts of how to engage in strategic design for transformation.

There seems to be much consensus on the WHY and WHAT of socially engaged design, but at the same time there is a lack of understanding on HOW to proceed. Tools and methods are crucial for delivering measurable empirical results, broaden the knowledge base of designers and make them legitimate members of heterogeneous teams working on transformation and social innovation.

1.3 Closing the gap

To overcome the gap between social ambitions and real-world projects, as well as the abovementioned shortcomings we present two frameworks: DEFT and the CONCERN CANVAS. These frameworks were developed based on the authors' research and work in the U.S., Europe and China, where we could witness these issues firsthand. The presented tools are work in progress. They are published open source for co-development by a community that we hope to build of designers and non-designers alike.

The overall goal of these frameworks is to provide designers with new possibilities of action to address society's critical needs, such as the climate crisis. Similar attempts for paradigmatic change in fashion (Fletcher & Tham, 2019) and architecture (Architects Declare, 2019) are still in nascent stages, but at the same time there is a growing understanding that design needs to move beyond focusing mainly on increasing economic value in the narrow sense of the word (Sheppard, Sarrazin, Kouyoumjian, & Dore, 2018). As IDEO's Tim Brown (2019) pointed out recently, the challenge is to redesign design in order to address urgent societal problems.

2. DEFT: Define, Evaluate, Feel, Tell

2.1 A Design Framework for the Era of Climate Crisis

Climate change is considered the most critical issue of this era, but designers do not seem yet up to the challenge, at least not in terms of making the issue central to their work. While there are some emerging signs of designers focusing on the climate crisis[1] and organizing to declare climate emergency (Architects Declare, 2019) — for the most part designers still apply design thinking and other design methods that pay very little attention to climate impacts.

Exploring effective ways to engage in the fight on climate change will require designers not only to be truly human-centered, but also to have adequate tools that are grounded in this new context. The DEFT (Define, Evaluate, Feel, Translate) framework was created to be such a tool, offering a roadmap for designers navigating their way in a rapidly changing environment that is shaped by the climate context. It synthesizes existing design tools (i.e. back-casting, storytelling) together with more radical lens around systemic changes.

The DEFT framework includes four steps:

1. Define the journey – articulating a desired mental model and backcasting to the present

[1] See for example https://www.climatedesigners.org/

2. Evaluate your solution – using affordability, practicality and meaningfulness to assess potential solutions
3. Feel the Bern – deciding whether to accept or reject the system in which you operate
4. Translate your solution into a compelling story (see Figure 1).

The following part will describe each one of these steps in detail.

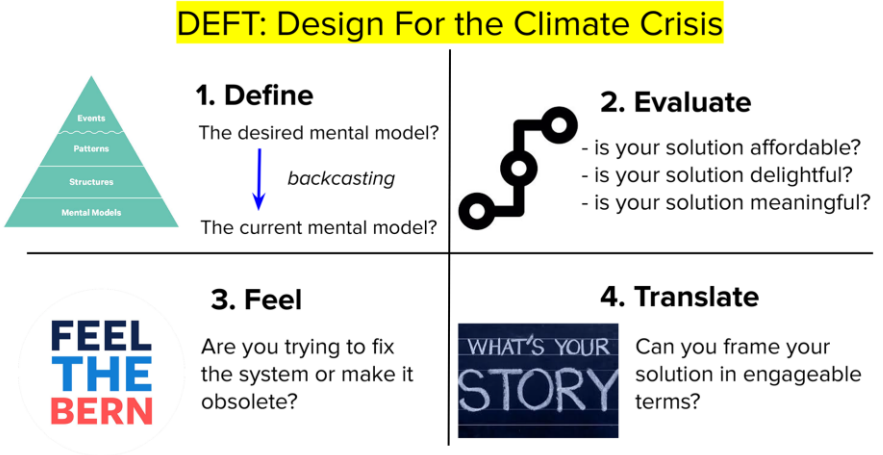

Figure 1: DEFT Framework's Four Steps: Define, Evaluate, Feel and Translate

2.2 Define the Journey

The first step in the DEFT framework is to formulate the journey: Articulating a desired future in terms of a mental model and identifying a desired or ideal future and projecting backwards from it, i.e. starting with the mental model the designer wants to see in place in five, ten or twenty years from now and working their way backwards to the present.

Backcasting through the lens of mental models allows designers to lead from the future (Scharmer, 2009) giving them permission to ignore the (mental) limitations of the status quo. It also allows designers to maintain flexibility – similarly to The Natural Step's process of backcasting from sustainability principles (Broman & Robèrt, 2017) it allows designers to consider different solutions as long as they are aligned with the new desired mental model.

2.3 Evaluate your solution(s)

With the scaffolding provided by the first stage, the designer can move on to consider and evaluate different potential solutions. Choosing the evaluation criteria is critical as it provides a clear understanding of the most important elements we believe the designer should be looking at: Affordability, delightfulness and meaningfulness. These elements are translated into three questions:

Is it affordable? This question reflects the need to ensure equitable access to climate solutions, acknowledging that the climate crisis is a social justice issue. It suggests that designers should redefine climate solutions around affordability and assess when they consider possible solutions in transportation, housing, energy, food, etc. if the majority of people can actually afford it.

Is it delightful? New experiences we are offered are designed to be more convenient, easy-to-use and frictionless. Solutions offered to fight the climate crisis cannot be any different and need to meet the same level expected from all other experiences in order to be adopted at scale. This question requires designers to prioritize innovation offering consumer delight and as little trade-offs as possible.

Is it meaningful? Designers should consider the impact and materiality of the solution evaluated, i.e. does the solution support rapid reductions in carbon emissions along the lines of the IPCC report's (2018) recommendations? This question is also meant to ensure that solutions to be considered offer more than just an incremental response, i.e. "a slow process, which modifies the landscape only slightly" (Roggema, Vermeend, & Dobbelsteen, 2012).

2.4 Feel the Bern

Framed as homage to Democratic presidential candidate Bernie Sanders this step is focusing on the designer's posture. Similarly to the Transition Design framework (Irwin, 2015) it acknowledges the importance of designers' mindset and posture. Designers need to ask themselves a fundamental question: Do they believe in trying to fix the system in which you operate (i.e. mobility, energy, healthcare, fashion, etc.) or in replacing it with a new one?

The climate crisis requires designers not only to consider what is at stake, but also to reflect on their own values and whether they are willing to stand up for them. Designers may need to go against the inherent preference of any system to preserve itself and reject significant changes. Eventually, the real question they may be asking themselves is about courage, reflecting E.F. Schumacher's notion that "any intelligent fool can make things bigger, more complex, and more violent. It takes a touch of genius — and a lot of courage to move in the opposite direction." (Schumacher, 1973, p. 22)

2.5 Translate your solution into a compelling story

In the final stage of the process, after considering the overall alignment with the desired end point (step 1), the assessment criteria (step 2) and the designer's posture (step 3), designers are ready to narrow down and focus on the proposition they find most suitable. The focus of this step nevertheless is not on prototyping or testing, which will be pursued along the lines of the design process, but about shaping the narrative of the proposition.

Storytelling has been key to sustainability and the climate crisis is no different – as Segal explains climate change "has a considerable narrative weight and that it is something we understand through storytelling" (2017, p. 122). For designers it suggests that the effectiveness of the solution also depends on the story developed around it. In order to translate a climate-based solution into a compelling story designers will need to pay attention to three questions: *Is the story clear? Is it relevant (to the audience)? And is it exciting?* Synthesizing these factors (clarity, relevance and excitement) is key to realizing the solution.

2.6 Testing the DEFT framework

The DEFT framework has been initially introduced in a couple of design courses, where students experimented with it to explore questions around the future single-use soda bottles, circular models in the furniture industry, and the value of recycling. These exercises helped refine the framework and further articulate the questions it poses for designers.

Our ongoing interaction with design students, educators and practitioners suggests there is a growing interest in frameworks with the contextualization offered by the framework – grounding solutions in the urgency of the climate crisis, while integrating radical thinking with practicality (e.g., Fletcher & Tham, 2019). We plan to continue testing the DEFT framework in the upcoming months in workshops with different organizations, looking into the value the framework creates for designers in different environments (corporate, entrepreneurial, educational, etc.).

3. The Concern Canvas

The ConcernCanvas (CC) is a diagrammatic tool that helps to render a comprehensive view of complex socio-technical contexts and facilitates to find starting points for design and interventions.[2] The canvas traces the driving forces of the stakeholder's mindset by linking the psychological and material factors and thus overcome a traditional perspective that treated both of these influences separately.

[2] The ConcernCanvas is part of a series of tools for transformation design including the "Hypercycle of Transformation", "Cultural Formats", and the "Two Layers of Scenography", see www.designingtransformation.org

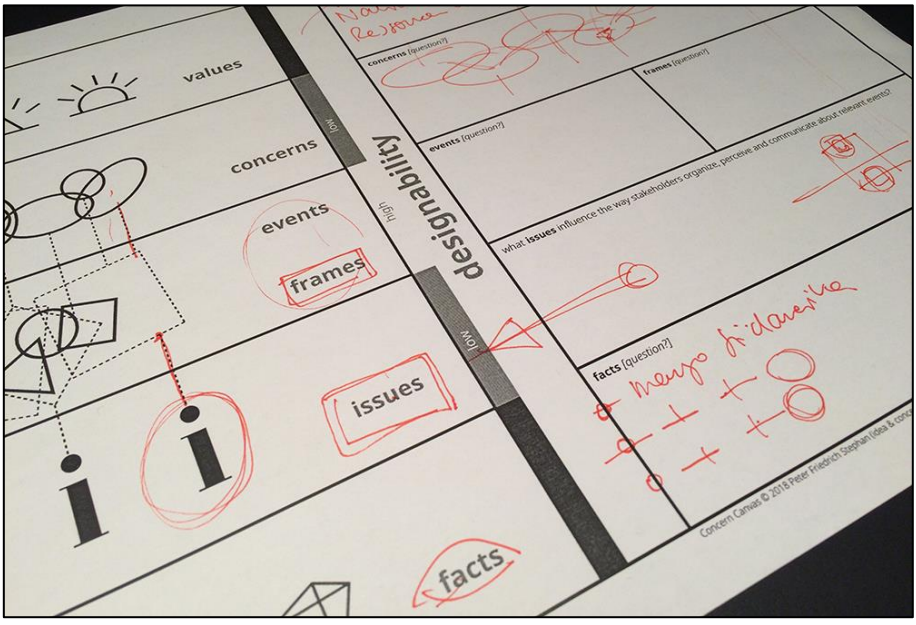

Figure 2 The ConcernCanvas links facts and values and asks for their designability

3.1 The design of the Concern Canvas

At its center the CC asks about the relation of *events* and *frames* for different stakeholders. Observing and discussing relevant events and their impact on the mindset of people is important to build a common understanding of the situation that is the design objective. In the diagram events and frames both are linked symmetrically up to the most comprehensive view and down to the most concrete details. In the direction up frames are influenced by *values* and *concerns*. In the direction down frames are influenced by the mediated or material set of circumstances that are identified as *issues* and *facts*.

The CC challenges the design team to explore the causalities and interdependencies of *values, concerns, events, frames, issues* and *facts* by asking questions that address each of these aspects like: *Which events can you identify in the stakeholder's world?* Or: *What are the facts that determine the stakeholder's experiences?* To answer these questions the design team needs to observe, find, describe and discuss their views on the situation. This is how the ConcernCanvas can work as a catalyst to build a "trading zone of knowledge" (Galison, 1997) for the design team.

3.2 »Concerns« as a foundation for Transformation Design

The ConcernCanvas introduces the new category of »concerns«.[3] Concerns are conceived as »values in action« that drive the motivation and decisions of people. Whereas values are more stable over time and more general, concerns are specific and may change more quickly. An individual's situation at a given time may be described by a set of concerns. Everything that has an impact on your subjective view and feeling of »being in the world« can be considered to be a concern.

Concerns are a mix of rational and irrational aspects, and large- and small-scale topics that raise enough energy to influence your mind and behavior. Concerns are non-normative: The concern »health« might mean not eating too much in some countries, whereas in other places it might mean to have access to clean water. Concerns are non-hierarchical (in contrast to Maslow's pyramid of needs): A lost match of your local soccer team might have more impact than some distant war. Also, for concerns there is no natural or authentic status: »Nature« used to be a threat to man and became a concern. The concept of concerns acknowledges the fact that trends, memes, images and narratives are designed, produced and controlled by an industry.[4]

The non-normative concept of concerns replaces the normative concept of needs and thus opens new perspectives for design especially in its functions as social innovation and transformation. If the concept of Transformation Design is based on concerns it is not limited to socio-ecological issues but addresses a broader range of topics. We suggest using this starting point in order to first describe and understand transformation as a universal process that is happening for better or for worse and that does not wait for designers. We can always bring in normative socio-ecological issues later but the foundation of a science and design of transformation should not limit its analytical perspectives from the start.

3.3 Context, culture and concerns

Especially in western cultures there is still a gap between the humanities on the one hand (concerned with values and sensemaking) and the hardware on the other hand (concerned with trivial materials). Only recently the cultural and social sciences took a *material turn* trying to close this gap. Designers of course were always concerned about material culture and can only wonder that it took the humanities so long to catch up. Designing for transformation and social innovation will largely depend on tools and methods to

[3] The notion of »Concerns« is a *terminus technicus* with a more specific meaning than in its usual use in the English language. It was first introduced by Bruno Latour in his *Actor-Network-Theory* (Latour, 2005) that built upon the difference of *matters of concern* and *matters of fact* (see Author, 2016).

[4] For an example see the magazines at a newsstand with titles such as *Happy Way, Slow* and *Hygge* to push concerns such as happiness, security, and cocooning (see Cabanas & Illouz, 2019).

understand the "two kingdoms" of values and facts comprehensively and provide a starting point for designing interventions.[5]

One of the attempts to do so is the *Causal Layered Analysis – CLA* (Inayatullah, 1998). Here the mechanisms of sensemaking are traced in cultural settings and structures. Another approach aims for "Positive Design" (Pohlmeyer & Desmet, 2013). Both concepts introduce psychological foundations that are more sensitive to the possible impact of design than the "rule of thumb" used in design so much. The notion of *positive* however implies a normative direction that might be naive at best and dangerous at worst. Both concepts, as well as other approaches that are ethnologically inspired, ask the proper questions: As traditional structures, narratives and sensemaking processes vanish how will the new cultural formats be defined? (e.g. What is a workplace? What is a family? How can we design trust and organize mobility, energy, education, and security?).

All of these questions can be addressed by using the concept of concerns and the ConcernCanvas together with the aforementioned approaches. There are differences in focus and direction of the presented approaches. But as for now Transformation Design is still in its infancy we should concentrate on the common goals first and try to build a toolbox as rich as possible. We might shift attention to the differences of concepts later when a more mature field of socially engaged design will have emerged.

3.4 Do we need another canvas?

A canvas is defined as "a two-dimensional, poster-based tool that guides a heterogenous team with a particular challenge or task" (Thoring, Mueller, & Bakde-Schaub, 2019, p. 595). Canvases offer a method to go from linear thought to planar action or even space if used by groups simultaneously and became popular tools used in processes of innovation and creation.[6] Canvases structure group thinking and facilitate involvement. By the means of graphical representation and interaction crucial issues are detected more easily and become more approachable.

If the concept of concerns is adopted a proper way of putting them in context is needed. With the complexity of concerns given there is no way of rendering their context linearly. A canvas however can display the interdependencies of different aspects and can also show the areas that need to be explored. Just like a map that does not only chart the known territories but also gives hints to the address the unknown a canvas can not only show existing issues but can also ask for the missing elements that need to be researched.

[5] This also was Buckminster Fuller's mission: "(…) I am confident that we have, in reality, closed the science-humanities gap with kindergarden conceptuality." (Fuller, 1969, p. 144)

[6] In an empirical study 123 canvases were analysed (Thoring et al., 2019). However there are some approaches that pretend to be a canvas but do not meet the requirements. The "Digital Transformation Canvas" for example is only a list of Do's and Don'ts, see https://kmu-transformation.ch/der-digital-transformation-canvas

3.5 Working with the ConcernCanvas

The ConcernCanvas was developed based on experiences in Transformation Design projects. One of these projects was a redesign of a mission statement and its communication for a German bank.[7]



Figure 3 Mission Statement and visualization for the DEG, a subsidiary of KfW, the third biggest bank in Germany, June 2018

Introducing the concept of concerns opened new ways to articulate the non-normative drivers of people's mindsets that could not be covered by the traditional concept of needs. The ConcernCanvas proved useful as an additional module for the designer's toolbox just as other tools like design thinking, user journey, personas etc. These modules can be combined for an individual set of tools that fits the given task and situation.

[7] See https://www.deginvest.de/International-financing/DEG/%C3%9Cber-uns/Wer-wir-sind/Unser-Leitbild

3.6 Workshop on »Re-starting Development Aid«

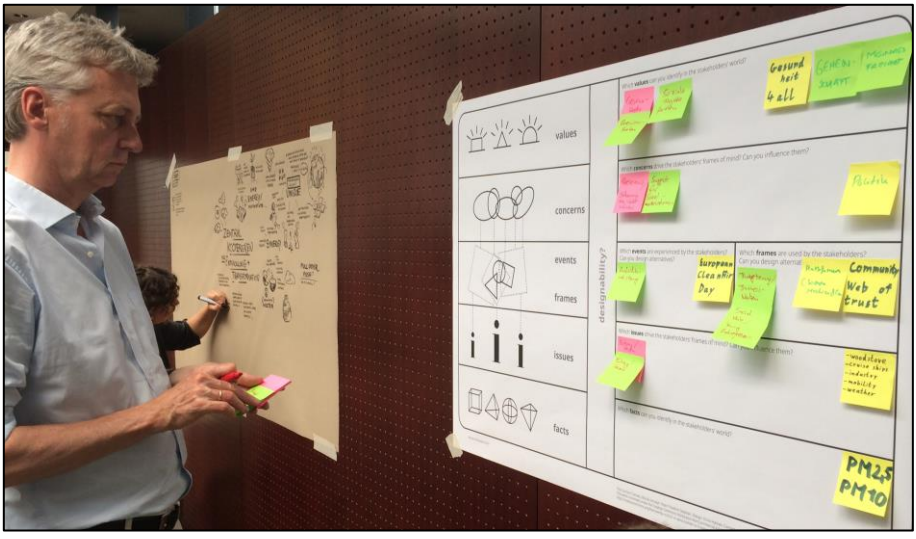

Figure 4 The ConcernCanvas is used in the Workshop »Restarting Development Aid«, Berlin June 2019

At the Weizenbaum Institute for the Networked Society – The German Internet Institute we conducted a workshop on “Re-starting Development Aid”. The ConcernCanvas was helpful for identifying the different stakeholder’s perspectives such as the beneficiaries and the benefactors, political institutions, banks and NGOs.

3.7 Workshop on »21st century design education«

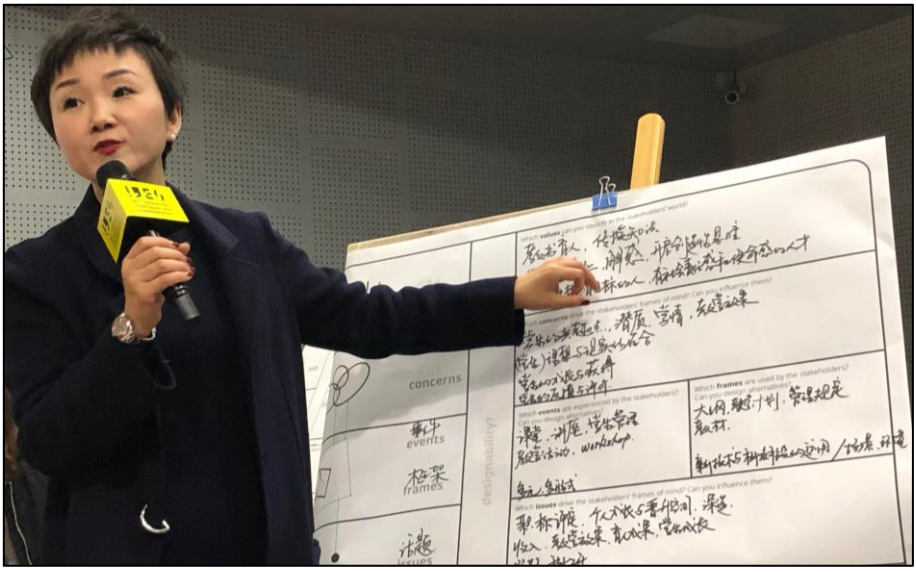

Figure 5 The ConcernCanvas is used in the Workshop »21st century design education«, Beijing/China, October 2019

At the Beijing Institute of Fashion and Technology – BIFT in Beijing/China we conducted a workshop on redesigning design curricula. Stakeholders such as the students, the faculty, the industry, the party, and the family/parents used the ConcernCanvas to articulate their concerns. It was the first time for this Chinese university to articulate these different perspectives and take them as a starting point for discussing further development.

3.8 Results and Outlook

The results of the mentioned workshops were quite promising. The ConcernCanvas proved useful to open new ways for the participation of stakeholders and to deliver new insights for the design team. The Canvas was revised and fine-tuned and is now part of a series of tools for transformation design.[8] Further development is expected from the use of the ConcernCanvas by other design teams. As to date no empirical data is available as there were no means to integrate an independent and parallel observation from social sciences (as is the case most of the time in design). Paradoxically most data on the impact of designing concerns comes from marketing analysts. These inquiries were made for commercial purposes that are fundamentally different from the goals of design for social innovation and transformation. Metrics to measure the non-commercial impact of design are hard to find

[8] see www.designingtransformation.org

but will be most welcomed. We hope to gather empirical data in the future thanks to a growing community of developers sharing their experiences with the new tools for transformation design.

4. Conclusion

The new tasks in the emergent fields of socially ambitious design demand new forms of research, practice, and education as well as new frameworks and tools. We suggest that the frameworks presented in the paper can help close the gap between designers' ambition and results in the emergent fields of socially ambitious design.

The proposed frameworks should serve the community of design researchers, practitioners and educators in coping with the rapidly changing context of their work, adding to their knowledge base and providing them with new lens to address the challenges they work on. We hope these frameworks can help designers play a more prominent role in the public discourse and make a greater impact in real world projects. Educators can use the frameworks as a starting point for discussion and development for a new generation of designers.

Designers are at a crossroads now. They are uniquely positioned to be agents of change (Banerjee, 2008), and the need to fulfill this premise has never been more critical. At the same time, most designers still work on projects with limited societal impact. Designers need to make a choice if they want to shape and drive change or be driven by it, working to execute change strategies and policies created by others. As Fuller noted: "We need the philosopher-scientist-artist – the comprehensivist, not merely more deluxe-quality technicians-mechanics." (Fuller, 2001, p. 114). We agree with Fuller and hope the frameworks we present in this paper will serve as an invitation for designers and researchers to further explore opportunities to reshape this field.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Time and Design. Time as a key parameter for a survey on contemporary design

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Abstract | This paper defines an exploratory pattern that, employing time as a key factor, reviews its recent dynamics, evolutions and interpretations critical to the field of Design, to establish which are urgent issues to be challenged and to select and map relevant approaches, methods and agencies. Starting from an analysis of the obsolescence of the linear conception of time, based on the Modernist ideal of progress and undermined by the manifestation of humanity as a planetary-scale geological force (Anthropocene), it is proposed a contemporary characterization of it. Time is presented as Object-Oriented, Archetypical and Topological and it calls for updated design roles, methods and objectives beneficial to a sharp understanding of our present. Para-fictional and Material Speculation are proposed as suitable approaches and sustainability, information and hybridization as crucial issues for our time. They are explored through the time parameter: Time and Objects, Time and Knowledge and Time and Making. Some case studies are selected to discuss which design practices respond to the contemporary time challenges. This recognition identifies also some tools and modalities which support and help the design to accomplish its critical, reflective and political role.

KEYWORDS | TIME, GREAT ACCELERATION, OBJECTS, KNOWLEDGE, MAKING

1. The Great Acceleration: the linear time of Modernism

The Earth contains, along its whole circumference, a thin layer of radioactive materials sedimented starting from 1945 (Morton, 2013). This layer represents a decisive shift towards a new geological era characterized by an impressive terraforming of our Planet, named Anthropocene (Crutzen et Stoerman, 2000; Crutzer, 2002). After the Second World War, we assist at the beginning of a phenomenon called "the Great Acceleration" (Mcneill, 2014), an exponential increasing growth rate of human progress leading to such an uncontrollable increasing impact of humanity on the planet that "in a single lifetime humanity has become a planetary-scale geological force" (Steffen et al., 2015). The machine became the icon of the progress and the assembly system the base of the Industrial Capitalism. The myth of a global and endless space for both production and consumption generated a model of time associated with the Enlightenment idea of endless progress and with the Modernist ideal of mass production. The nineteenth century narrative in based on a linear conception of time, where the future would automatically bring progress, improvement and endless development.

Today, humanity is facing the consequences of its anthropocentric, modern and technological attitude. Catastrophic scenarios are arising, which are the manifestation of what Morton (2010; 2013) defines the end of the world, intended as the end of what we have been considering, for the last three centuries, as "world", that is the projection of the human being's space, time and activity. He claims that big entities, called hyper-objects, shows up as uncontrollable objects, distributed in time and space, of which we can know, experience and visualize nothing but a very small part of the whole. They can be a black hole, the global warming, the solar system. They make the ecological denialism and the apocalyptic environmentalism obsolete and inaugurate a new phase of hypocrisy, weakness and instability. Man has lost his central position of absolute control and power on the world and he has to rethink human existence on the same level of the existence of nonhuman objects (Harman, 2002). This circumstance asks for a new way of thinking, subvert our certainties and even break them up.

The Design discipline, view its responsibility and role in the anthropocentric vision of global production and consumption, of progress and, above all, in defining the relationships between objects, contexts and the human being, is facing a questioning phase: which are, in this scenario, the reflections, directions and decisions taken or to be taken?

This paper highlights the need to bring the thought, the philosophical reflection and the cultural dimension at the centre of design, starting from an exploration on the concept of time, and its influence on the project dimension. Time is investigated as both a quantitative and a qualitative variable and it is proposed, on the base of meaningful intellectuals' theories, such as Serres, Latour, Jung and Zolla, a contemporary characterization of it.

2. Another Time: Object Oriented, Topological and Archetypical

The loss of an anthropocentric perspective requires philosophical reflections to reconsider human activities and, for the purpose of this paper, design priorities. A valuable support comes from the Speculative Realism, which is a movement in contemporary continental-inspired philosophy that defines itself in its stance of metaphysical realism (Meillassoux, 2008). In metaphysics, realism about a given object is the view that this object is ontologically independent of someone's conceptual scheme, perceptions, linguistic practices and beliefs (Armstrong, 1980). One of its approaches is the Object-Oriented Ontology, OOO (Harman, 2002, 2018; Bryant, 2011), a 21st-century Heidegger-influenced school of thought that rejects the privileging of human existence over nonhuman objects.

The Modernist conception of Time, as a linear sequence of events motivated by the dream and the design of the future and interpreted in terms of human history, is clearly renegotiated according to a new objected-oriented perspective, where time can be considered an object such as the humanity itself. We could imagine time as a hyper-object of which man can only get and experience small parts, moments. This feature of the object-time to be unintelligible in its entirety, escaping the rules of only human will and purely scientific and technological reason, requires an effort of reconciliation and collaboration between science and humanities and the redefinition of archetypal imaginaries, or, in Jung's words (2014; [1968]), of a collective unconscious, to mitigate the sense of anxiety, frustration and helplessness and rather to direct them towards an awakening. As Morton (2013) states:

> "[…] the ostentatious conviction that the world will end if we don't act immediately is, paradoxically, one of the factors that most inhibits an aware and effective commitment of human beings to an actual ecological coexistence on the Earth. The end of the World already happened, and we only have to wake-up from the dream and start acting in a conscious way." (p.20)

In this perspective, an interesting consideration arises to inspire new human professional attitudes: there is no need for acting in a rush; on the contrary, we should accept the reality and take time to reflect and speculate as much as possible on it, breaking the chain of a defective consideration of time as velocity and outrageously future oriented. This seems to be a good starting point for Design to rethink its priorities and agencies. Isn't it the time for designers to make substantial decisions? It's time for reflection, speculation and new commitments.

In order to understand the more intimate human condition, it is beneficial to refer also to theories of recent psychoanalysis. Jung (2014; [1968]) speaks of a loss of a collective unconscious, that is, of archetypes that help man to orient himself in the world, deprived of symbolism by the modern logic. Logic is a prerogative of conscience: man selects, makes sense, recognizes. His unconscious, however, is guided by instinctive tendencies,

represented by those “ancestral” forms of thought, which are precisely the “archetypes”. The “archetypal memory” therefore remains the main structure of our being men.

Our present, in order to be comprehended, needs the invention of new forms of thought. A substantial contribution is Michel Serre’s work about the spatialization and topologizing of time (1995; 1997). He offers ways of thinking time spatially and morphologically. Serres, in fact, discloses topologies of space and time which are inclusive forms holding together science and culture, and incubating new forms of historical poetics (Abbas, 2005). He provides a model, topology, and tools, such as maps and storytelling, for a reinterpretation of history, in order to know and reconciliate who and what we are in relation to the world (Connor, 2004). Topology may be defined as the study of the spatial properties of an object and it is not concerned with exact measurement, which is the domain of geometry, but rather with spatial relations, such as continuity, neighbourhood, insideness and outsideness, disjunction and connection (Croom, 1989). In place of the line of history, Serres proposes a series of different configurations of time, based on dynamic volumes, or topologies. It can be a crumpled handkerchief, in which apparently widely separated points may be drawn together into adjacency (Serres and Latour, 1995, p.60-1).

Through this investigation about a renewed conception of time, it is proposed its contemporary characterization which might drive current design directions and engagement. Our time is Object-Oriented, since we have lost an anthropocentric vision of the world, that is, also, of history and time. In this perspective design must enhance its ecology-driven approach and methods. Time is Archetypical, as we need to restore and redefine an archetypical memory or collective unconscious to face “the end of the world” and to wake up our political actions and decisions. From this point of view, design must focus on its semantic, symbolic, anthropological and social value. Time is Topological, as it is no more based on a linear line but on a fluidity of polychronic connections between local and global and design must engage with complexity empowering its holistic and interdisciplinary attitude. This definition of time is instrumental to outline contemporary design perspectives and to inspire decisions. These three features meet and merge in a state of emergency where the human actions need to be affranchised from the anxiety for the future through a deep critical and speculative focus on the present, intended as the moment of actual knowledge (Zolla, 1981).

3. Design approaches with a Time perspective: from Design fiction to Para-fictional and Material Speculation

Design, operating on the boundaries between technology, science and society and through both cultural, economic and social lenses, has an active role in this current scenario and is called upon to contribute to its understanding and evolution, inquiring the present and forecasting possible futures. The supremacy of a techno-scientific thought has been influencing our society sharpening the contemporary condition with apocalyptic scenarios as

a means to criticize human behaviours and choices in a brutal and destructive way through a sensationalist and dehumanized aesthetic. Above all, the trend of Science Fiction has been proposing scenarios loaded with anxiety and tension, which, thanks to technological potentials, are extremely falsified and deprived of any form of balance, desire and care for the present hopes, the past teachings and the eternal human fears. Here the Design can make the difference. It can intervene with its care for the balance between both technical, semantic, anthropological and emotional variables. To respond to this task, in the last decades, Design has been setting up established approaches, such as speculative (Dunne & Raby, 2001; 2013) and critical design (Ratto, 2011), largely incorporating practices of fiction design (Sterling, 2005; Retzinger, 2008; Bleeker 2009), aimed at exploring and questioning emerging issues to imagine and discuss possible, probable and more suitable futures (Gaver and Martin, 2000). Design fiction works to offer an alternative to science fiction binary utopian/dystopian environments. The co-founder of *The Near Future Laboratory*, Fabien Girardin, distinguishes design fiction from science fiction: "Design Fiction doesn't so much 'predict' the future. It is a way to consider the future differently" (Girardin, 2015). The emphasis of speculative design has been on building alternative versions of the future and constructing different fictional environments within which new objects, products or services can be re-thought and virtually trialled.

This paper, in light of its premise and goal, identifies Design Fiction as a legitimate and suitable design approach, but argues that its evolutions of Para-fictional (Norris, 2018; 2019) and Material Speculation (Wakkary et al., 2015) fit better for our time.

Jane Norris claims that Design fiction is still largely trapped within Modernist linear conceptual structures that continually prioritize the new (Norris, 2018; 2019). What this approach does not address very effectively, are issues focusing on material use in the present, unless it is by inference or contrast. She focuses on the possibilities of a 'para-fictional' approach to design. It is a provocation to rethink how we view materiality. As Leith et al. (2018) state:

> "This use of para-fiction is a design strategy she has developed by assigning narratives to contemporary objects in use, […]. This strategy offers an alternative form of design fiction to the established use of speculative design that is more future orientated. She situated her use of para-fiction, within a current, wider cultural debate on how post-enlightenment thinking might be used to consider fresh design strategies." (p.4-5).

As complementary to design fiction, Wakkary et al. (2015) introduced the concept of Material Speculation and stated that:

> "Material speculation emphasizes the material or mediating experience of specially designed artifacts in our everyday world by creating or reading what we refer to as counterfactual artifacts. Material speculation utilizes physical design artifacts to generate possibilities to reason upon. We offer material speculation as an approach to critical inquiries in design research." (p. 97).

This approach advances the notion that the material existence of specifically designed artifacts situated in the everyday represents a unique and productive approach to critical inquiry.

As we can see, both of the approaches show a focus on the present and on the materiality, which evokes ancestral feelings and impulses laying in the deepest layers of the individual, generating modes of immediate and multi-sensory narrative (Hekkert & Karana, 2014).

The main focus of Design are no longer products, services, systems, but rather ways of thinking and doing that challenge, critically question and design solutions to or opportunities for complex social, environmental, economic and even political issues. In fact,

> "Before being a technique, design is a capacity for critical analysis and reflection, with which design experts produce knowledge, visions, and quality criteria that can be made concrete in feasible proposals." (Manzini, 2016, p.54).

4. Design priorities and practices for re-thinking Time: a recognition through case studies

After the investigation about a new perspective on the present time and the proposal of approaches suitable to respond to the emergent situation, this paper identifies crucial issues to be challenged by the discipline and undertakes to depict contemporary patterns of practices. In light of the analysis on the urgent reflections about a) the human impact as a geological force, b) the lack of an understanding of unintelligible entities, in this paper treated as hyper-objects, and c) the call for reconciliation between humanities and science, which also means for interdisciplinarity, the paper highlights and select three main critical issues: sustainability, information and hybridization. They are explored through the time parameter: Time and Objects, Time and Knowledge and Time and Making.

Time and Objects is an inquiry on the concept of sustainability, in terms of obsolescence and impact of objects and materials on the ecosystem, from the perspective of geological eras and not of historical times, following the Object-Oriented Ontology theories (Harman, 2018) and considering time as a hyper-object (Morton, 2013) of which we can know, experience and visualize nothing but a very small part of the whole. Time and Knowledge highlights the correlation between human awareness and information with respect to past, present and future and responding to human obsession for prediction (Vespignani, 2019). Practices of contemporary design acting as knowledge facilitators that mitigate human fragility with respect to time, through the design of polychronic experiences (Serres, 1997; Herzogenrath, 2012), are illustrated. Time and Making explores experimental practices where time is highlighted as an opportunity for interdisciplinary collaboration and exchange, but also the different connotation that time takes in each discipline, i.e., linear vs. circular measurement, making through temporal sequences vs a non-chronological kind of time (Bennett et al., 2011).

4.1 Time and Objects, Sustainability

Talking about objects, it is necessary, today, to redefine, understand and redesign the material apparatus, the relationship between the user and the products' physicality, in accordance with the new paradigms of a more conscious, ethical and demanding consumerism. At the same time, the experience of the physicality of things is, today, both disorienting and exciting. It is displaced by the lack of connections between the material and the place of origin, fruition and processing; between the material and its place in our individual and collective memory made up of associations between aesthetical and functional properties and resources, geographies, landscapes, traditions, skills, tools and processes. The concept of a non-anthropocentric time asks for design agencies which try to make an understanding of it through empathy and ancestral thoughts and borrowing, from art, the performative dimension of the project. The performance seems to convey the contemporary paradigm. It "happens" in the place of the outdoors, of the displacement, of the fragmentary, of the experience. The performance is a hypertext in which the artist's action and audience experience are mutually inscribed. (D'Alto, 2017). The experience of the event refers to the behavioural and procedural sphere, and therefore actions do not represent something, rather they define or build something.

In the case of design, the performativity of the project consists mainly in bringing to light the process, the phenomenological value, the invisible hidden behind the shape and function of the object, which becomes less critical. The performative aspect represents the political dimension of the project. A significant example is Olafur Eliasson and Minik Rosing's project 'Ice Watch' [fig.1], whose first edition was in 2014. Twelve large blocks of ice, calved from the Greenlandic ice sheet, were harvested from a fjord outside Nuuk and brought to the centre of Copenhagen, and then to other cities such as London and Paris, in response to the publication of the UN IPCC's Fifth Assessment Report on Climate Change. The designer didn't create any objects but displaced "objects". He calls for attention about the hyper-object called Climate Change making the ice itself talk about the consequences of human actions and decisions on the planet and triggering an ancestral, emphatic connections of people with the destiny of the melting ice.



Figure 1. Olafur Eliasson – Ice Watch, 2014, Bankside, outside Tate Modern, London, 2018, photo: Justin Sutcliffe.

In the last years, the exhibiting and narrative choices made by distinguished curators, museums and designers are representative of how the attention and priority are shifting from the physical results to the crucial role that design can play in our environment and its responsibility to look beyond the edges of its borders. Emblematic are the cases of *Geodesign* and *Cambio.* The first is the exhibition platform of the Design Academy in Eindhoven, that, from 2018 carries on a stratified narration about different global complicated situations capturing the deep transformation phase of the productive and cultural system, in an osmotic relationship with the world of design. This year the topic has been "*Sand. The Building Block of Modernity*", curated by Martina Muzi at Van Abbemuseum [Fig.2]. The exhibition uses sand as a raw material in order to narrate the imbalances which dominate the increasingly interconnected global scenarios. It is considered as the second most used natural resource on the Planet Earth after water and its extraction is often one of the primary causes of ecosystems collapse.



Figure 2. Romain Laval and Baiba Soma, "Landscope", Geodesign: Sand. The Building Block of Modernity, at Van Abbemuseum, Eindhoven, 2020, photo: Joep Jacobs

This year, 2020, Formafantasma began an investigation into the governance of the timber industry, called *Cambio* and commissioned by the Serpentine Galleries [fig 3].
It is explored and displayed the evolution of timber's commerce over time, and its tentacular expansion across the globe. It grew during the nineteenth century becoming one of the largest industries in the world both in terms of the revenue it generates and the impact it has on the planet's biosphere.



Figure 3. Formafantasma, Cambio, Serpentine Gallery, 2020, photo: George Darrell.

4.2 Time and Knowledge, Information

Our way of exploring and experiencing the new conception of topological time and also the kind of data we get from the outside, from the natural and cultural world we inhabit, ask for new ways and tools to visualize, interpret and evaluate information in order to produce original knowledge. Moreover, we need Public information, awareness and engagement towards the complex dynamics that regulate our world and society. Design, through its aesthetic production, makes the complex dynamics that regulate our expectations more visible and tangible (Krippendorff & Butter, 2008).

A powerful way that Design exploits, today, for manage and interpret complex systems is that of Data visualization, used both as a tool for analysing the amount of fragmented and networked information in a visual synthesis and as a modality to return that knowledge. An interesting case of design praxis making use of a singular form of data analysis and visualization is that of Polychronic objects by Jane Norris [fig 4]. Her research combines temporal theories with material experimentation to identify possible paradigm shifts in making for a networked society. Norris (2016) uses time-based making strategies to combine materials from different historical eras, integrating these material times into one polychronic object. This approach opens up a different set of making possibilities by folding together

materials and techniques unlikely to have been combined in previously historically linear and hierarchical approaches to materiality. (Norris, 2016, p.2)

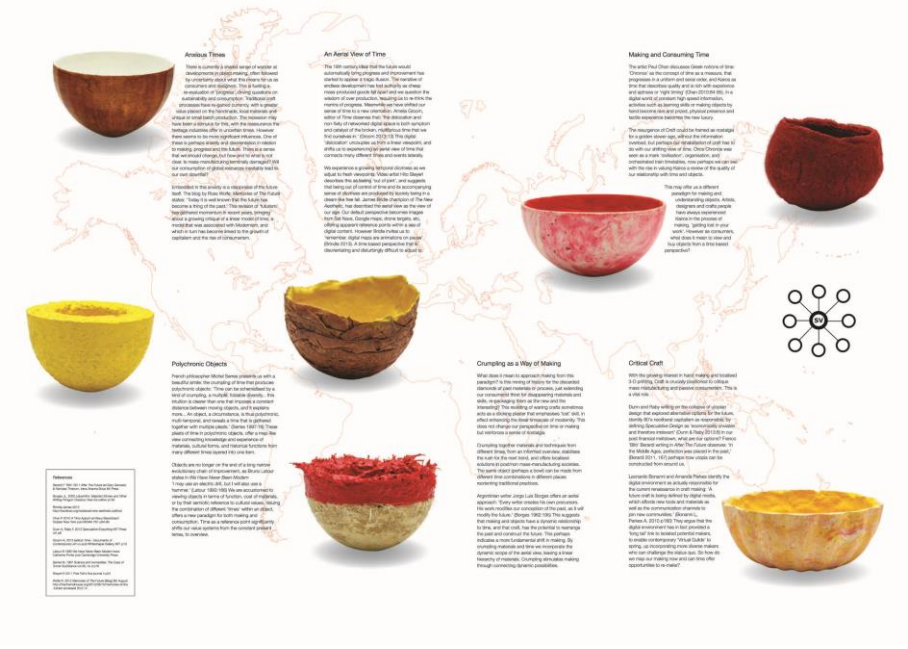

Figure 4. Jane Norris, Polychronic Objects, digital time and our choice of materials, 2014.

She proposes an aerial view that connects many different times and events laterally in a single object, offering a new knowledge about materials and manufacturing through the visualization of unusual, non-chronological combinations.

Another meaningful example is the work of Rhyzomatiks, a Japanese Design Studio with a strong research approach based on digital media and especially on data visualization that makes it simpler to understand very obscure and/or complex systems and phenomena. Their 2013 project named “traders” [fig 5], is an installation with bit coins, which, in addition to experiments using automatic trading system, develops a system to visualize block chains. It is a work raising a problem for contemporary finance and trading system. Another example is the 2016 project "3776: the digital anatomy, Dissecting Mount Fuji" [fig 6]. Data around Mount Fuji were visualized to create a spatial performance and projected on an outside monumental installation 6m tall and 23m wide, made by Seijun Nishihata. There is also a special website made from the 3D data of Mount Fuji.



Figure 5. Traders, 2013, GLOBALE: New Sensorium.

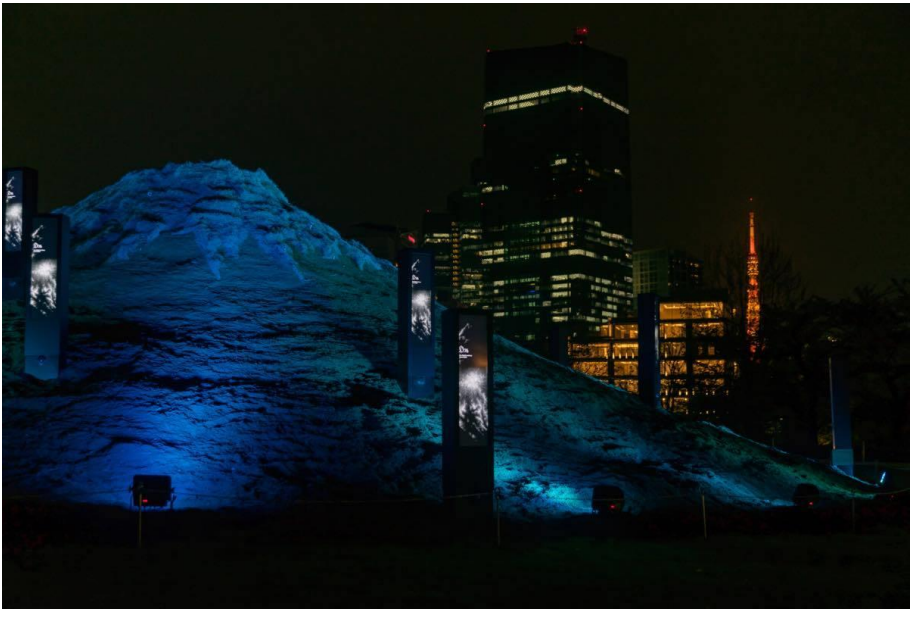

Figure 6. "3776: the digital anatomy, Dissecting Mount Fuji", 2017.

4.3 Time and Making, Hybridization

In order to understand and manage the complexity of our Topological Time, made of infinite connections, we are exploring approaches other than disciplinary, because, as Neri Oxman (2016) says:

> "knowledge can no longer be ascribed to, or produced within, disciplinary boundaries, but is entirely entangled. The goal is to establish a tentative, yet holistic, cartography of the interrelation between these domains, where one realm can incite (r)evolution inside another; and where a single individual or project can reside in multiple dominions." (para.1)

To really succeed handling emergent issues researchers and professionals in different disciplines have to engage with their mutual activities. This paper embraces the idea that, as a method to trigger this engagement, they have to get used to work together, literally meaning sharing the same workspace and work time, even not necessarily collaborating on the same project, but becoming mutual supervisors, because "Each expert knows a piece of the puzzle, but the big picture is too big to comprehend." (Hillis, 2010). An effective way to trigger and enable interdisciplinary practices is to hybridize methods, such as mixing the deductive approach of making experiments typical of science with the synthetic one of creative disciplines. A credible circumstance is to involve designers in projects dealing with hardly scientific content and, vice-versa, scientists in creative ones. This interdisciplinary practice starts to be applied in educational programs in order to shape new figures of designers capable to deal with extremely complex issues, scenarios and topics.

One example, among others, is the collaboration settled by the Paris-Sud University / CNRS and the design school, ENSCI-Les Ateliers, called Design and Physics. Between 2010 and 2017, physicists and designers collaborated on fundamental physics topics such as quantum physics, superconductivity, optics. Each time, a workshop of 4 months allowed about fifteen students supervised by professional designers to explore one of these subjects, in close collaboration with the physicists. Students have produced popularization and science communication tools, in other cases they have been inspired by physics to produce design objects or installations, sometimes they even imagined the future; the results are productions with a hybrid status [as in fig 7].



Figure 7. No-Contact, Marion Gros, Design and Physics, superconductivity demonstrated in sport accessories, Paris-Sud University / CNRS and the design school, ENSCI-Les Ateliers.

A sensible field where, today, this hybridization turns to be useful and meaningful, is that of healthcare. The designer Jetske Visser with the project "Forgotten memory", 2012 [fig 5] steps into the world of dementia. An invisible and hidden world is exposed. She wonders how daily things look like with the view of a demented person. How do they experience their environment? What is a teapot if you don't know what a teapot is? She states that, as a designer, we study how people experience environment and we always should be aware of the perspective of someone else. For this project, she collaborates with the care home "De Landrijt", with scientists and researchers and directly with demented elderly, trying to show their shadowy and uncertain world. The result of this collaboration is an associative movie. You see recognizable objects being transformed combined with demented elderly as a metaphor for the disease.



Figure 8. Forgotten memory", 2012.

5. Conclusions

This paper's contribution to the field of Design consists in a characterization of the present time which helps to identify priorities for disciplinary research and practice and to inspire relevant directions through a critical overview of methods, tools and approaches.

Starting from an analysis of the obsolescence of the linear conception of time, based on the Modernist ideal of progress and undermined by the manifestation of the Anthropocene, it is proposed a contemporary interpretation of it.

Time is presented as Object-Oriented, Archetypical and Topological. In this perspective, man has lost his central position and his certainties (Object-Oriented Time) and needs to rebuild his role in relation with the world, restoring an empathic connection with his present, to identify himself with his time (Archetypical Time). Moreover, he needs new tools and ways to understand a time that is no more intelligible as the Modern linear history, but relative and based on infinite space-time connections (Topological Time).

To deal with this kind of time, the paper identifies Design Fiction as a legitimate and suitable design approach, as an alternative to the Science Fiction binary utopian/dystopian

environments and argues that its evolutions of Para-fictional and Material Speculation fit better for our time. Both of them are based on a focus on the present and on the materiality, which evokes ancestral feelings and impulses laying in the deepest layers of the individual, helping to rebuild a set of values, symbols and believes, archetypes.

After the characterization of the current time and the identification of disciplinary approaches to deal with it, the survey highlights the priority for Design to reflect on three main issues: 1) the human impact as a geological force, 2) the lack of understanding of unintelligible objects, in this paper treated as hyper-objects, and 3) the call for reconciliation between humanities and science. These reflections are addressed as Sustainability, Information and Hybridization and explored through the time parameter: Time and Objects, Time and Knowledge and Time and Making. Few emblematic case studies are selected to provide a recognition of representative design directions, agencies and tools, as, among others, the performative dimension over the representational one, the political engagement of curatorial projects, the polychronic data visualization, both with physical and digital means, and the interdisciplinary hybridization.

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Acknowledgements: I acknowledge JSPS, Japan Society for Promotion of Science, for supporting my research during the time this paper has been written.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Walking the Line: Creative Research as Critical Activity for Design

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Abstract | Most acknowledge a lack of specific and unilateral criteria for defining creative research. In some cases, it is defined by the activity itself (i.e. being creative in how research is conducted by the researcher) and in other cases defined by the outcome of the research project (i.e. as a creative artifact.) Creative research in the world of fine art has often been a means by which to examine the impact of cultural and social attitudes as well as practices on the world. In design, creative practices have been incorporated less into the upfront research process, instead relying on more positivistic methods in an attempt to isolate and examine how users interact with design artifacts. But as designers are increasingly interested in addressing systemic and root cause issues, many of the current design research methods show limitations in their ability to forecast and imagine the future at this larger scale. This paper will examine the ways that creative research is increasingly used in design as well as the humanities, social sciences, math and sciences as a means by which to examine the longer-term impact of design and research activity as a speculative, critical and participatory tool.

KEYWORDS | DESIGN RESEARCH, CREATIVITY, CRITICAL THINKING, DESIGN THEORY, DESIGN PRACTICE, TEACHING

1. Introduction

Most designers consider themselves "creative" but often notions of creativity are relinquished to the conceptualization, ideation and production phase of the design cycle. Research is done as a means to help one become creative, but the activity itself is not necessarily considered creative. We are interested in exploring how creativity, specifically the act of creation, can be a means to engage in the research process. We suggest that creativity itself can help designers gain new insights and be more critical of the conclusions that they are drawing in the research phase because the very nature of it forces us to consider alternatives, test assumptions, and evaluate research as a product that is pressed out into the world for others to engage with—as a form of creative research. But there is little agreement as to what defines creative research, especially in design. By first outlining the various terminology and definitions underscoring how creative research is understood, we provide a preliminary foundation for how creative research is applied across many disciplines, including design. This foundation is then used to define three key outcomes or uses of creative research in design, and to evaluate and explain design-specific case studies that the authors have engaged as further evidence of the multi-dimensionality and unique outcomes that it affords for design research and practice. By exploring creative research from multiple disciplines, we seek to define the specific ways creativity might be used to critically engage with information and findings in the design research process.

1.1 Creativity + Research ≠ Creative Research

There are multiple dimensions and interpretations among all disciplines of the term's creativity and research. In some cases, creativity is looked at as an individual activity—such as Edward De Bono's (1972, 1995) work on lateral thinking. Mihaly Csikszentmihalyi (2015), on the other hand, characterizes it as a much more complex system that expands from individual to field to discipline. Still others look at creativity

> "as a parallel construct to intelligence, but it differs from intelligence in that it is not restricted to cognitive or intellectual functioning or behavior. Instead, it is concerned with a complex mix of motivational conditions, personality factors, environmental conditions, chance factors, and even products." (Feldhusen and Goh, 1995, p. 231-232)

In each of these definitions, that act or state of being creative reinforces ideas of production that are usually associated with ideation. However, they are also useful in thinking about the construction of research because they encourage an approach that is multi-dimensional, multi-scalar and constraints-based.

In a field that relies on novelty and invention, devising strategies for discovery is paramount. Much of the background research used for design practice has relied on more positivist methods that isolate and examine how users interact with design artifacts, thereby testing what exists, rather than what might be. This is not a universal truth—the emergence of

research methodologies like participatory design and design anthropology seek to discover new opportunities for design intervention. While creativity is sometimes used in the design of the research, it is not necessarily central to the methods themselves. Designers acknowledge the value of creative research mostly as a speculative and critical activity. A well-deserved critique of this speculative method is that often its final resting place is in the museum, or in books, rather than out in the world where the artifacts of design are meant to be encountered and manipulated. As designers are increasingly interested in addressing systemic and root cause issues, many of the current design research methods show limitations in their ability to forecast and imagine the future at this larger scale. Designers are trained to be creators, to model phenomenon in form, to visualize patterns, and translate the abstract into the concrete. How then, can we use the relevant components of creativity which are propositional in nature—modeling, visualization, the pressing out of something "real" into the world to act as a mediator? How can these methods also force critical thinking with both designer and participants and act as a primary method for design research? In what ways can this method of research raise critical questions in diverse contexts? The answer is not simply to inject creativity into the research design process, but rather to use creativity as a key strategy for raising questions, interacting with users and reflecting on the discipline.

2. Creative Research Across Disciplines

Reviewing the ways that creative research has been developed across disciplines provides a critical first step to evaluating its usefulness as a critical activity. More specifically, the value of creative research across disciplines might be understood in the following ways:

- Using creative methods as a mechanism of critique and participatory dialogue;
- Using creative methods to engage in data collection, analysis and evaluation, and to facilitate critical discovery.
- Using creativity to look at problems from divergent perspectives.

Different disciplines naturally gravitate towards one or the other of these dimensions. But what becomes particularly apparent is the value that comes from the combination and recombination of them in different disciplines and contexts. Below is a preliminary overview of some of the more innovative researchers and contexts for creative research through the disciplines and across the years. While not necessarily self-characterized as such, they provide interesting insight into how creativity can be used to explore and expose critical questions.

2.1 Creative Research in the Arts and Humanities

Probably the most obvious and notable is the long history of creative research in the fine arts, which began as early as the Renaissance. Research for artists like da Vinci meant the

practical application and deep integration of design knowledge, engineering processes, and the sciences alongside fine arts.

More recently, creative research in the fine arts is a mechanism for critique and participatory dialogue. In 1967, Experiments in Art and Technology (E.A.T.) was started by artists Robert Rauschenberg, Robert Whitman, and Bell Labs engineers Billy Klüver and Fred Waldhauer. In an interview Billy Kluver (2000) stated that "E.A.T. saw itself as a catalyst for stimulating the involvement of industry and technology with the arts" (Kluver, 2000). Over 2000 artists and 2000 engineers were recruited and paired, the collaborators were encouraged to create works that both investigated and catalyzed dialogue on emerging technology. Artist Lillian Schwartz, was a participant in the 1960s group. She worked with computer graphics innovator Ken Knowlton to develop animation techniques that laid the foundation for Hollywood special effects and the computer games industry.

In a more recent example, artist Joe Davis and Dana Dal Bo (2019) partnered with scientists from the University of Kentucky to create the Lucky Mice Project as a means of critique and dialogue on genetic engineering and the human-animal relationship in the sciences by asking the hyperbolic question, "Can we breed luck?" In their work, Davis and Dal Bo set up the conditions to study the correlations of serendipity and genetics by selectively breeding mice that rolled unique combinations of die (i.e. "snake eyes"). The project aimed to address issues of genetic selection while simultaneously questioning the policies that drive the humane and ethical treatment of animals in scientific experimentation. While both of these examples demonstrate the potential for creative research to raise questions, in other fields they are equally as critical for better understanding the dimensionality of complex issues (Davis, J., & Dal Bo, D. 2019).

2.2 Creative Research in the Sciences

In the social sciences, Helen Kara (2017) argues that expanding methodological boundaries across all of the social sciences are driven by the fact that researchers are tackling more complex questions and traditional research methods are too limiting to adequately handle these complexities. Kara states that creative research methods allow researchers to accurately reflect the multiplicity of meaning that exist in social spaces, such as arts-based research, research using technology, mix-methods research and transformative research frameworks (Kara, 2017).

Narrative research—perhaps one of the most widely used forms of creative research—can be defined as using narrative and storytelling as a participatory means by which to collect information (Manney, 2016) or as a methodology for synthesizing, analyzing and ultimately disseminating qualitative data (Crouch and Pearce, 2018)

> "…which place research participants as collaborators and give rise to emotion and sensory understandings of the self as well as allowing for unexpected experiences and knowledges to emerge" (Bryant, 2015, p.1).

This definition is important because it integrates narratives into the information collection phase and gives rise to the potential of unexpected and undirected outcomes.

W. E. B. Du Bois, a famed African American sociologist, academic and civil rights activist practiced creative research in the late 19th century. He along with his sociology students were engaged by the US government to collect and represent data on newly emancipated slaves in the US. They crafted beautiful hand-drawn and colored visualizations. When the government failed to publish the data portraits, DuBois curated them into an exhibition for the 1900 Paris Exposition—in part to reframe American and European perceptions on race and the lives of African Americans living in the south. The authors, Whitney Battle-Baptiste and Britt Rusert (2018) write that,

> "[t]he cross-fertilization of visual art and social sciences here marks an important transition moment in the history of the disciplines while offering alternative visions of how social scientific data might be made more accessible to the populations and people from whom such data is collected." (Battle-Baptiste & Rusert, 2018, p.13)

As a companion to narrative research, the activity of visualization is perhaps the most obvious, and relevant, mode of creative research. Through the crafting of the visual story, critical decisions are made about how content and data is framed. The combination of qualitative and quantitative data most evident in the social sciences provide a rich context for this intersection, as a form of convergent thinking. But there are also opportunities to think about how creative methods might enhance divergent thinking as a complement.

In the physical sciences creativity and creative research is often used to examine problems from divergent perspectives. In the following example, we can see the importance and value of using alternative forms of knowledge, in this case the embodied knowledge that manifests itself in a physical model. Hyperbolic geometry, and also known as non-Euclidean mathematics is the math that underlines general relativity, and helps explain the shape of the universe, animals such as corals, jellyfish, and plants for example, lettuce and curly kale.

The Institute For Figuring (IFF) was begun by Margaret Wertheim, a science writer, and her sister Christine, an arts professor, to explore the aesthetic dimensions of science, mathematics and engineering through the playful use of materials. The Crochet Hyperbolic Coral reef project uses Diana Taimina's (2019) concept of crochet as a means to understand hyperbolic geometry to model a crocheted coral reef, inviting participants to have a hands-on playful interaction with the complex math of Hyperbolic geometry. In a 2009 Ted talk, Wertheim (2009) argued for the value of creative research, stating that "we live in a society that completely tends to valorize symbolic forms of representation, algebraic representations, equations, codes. We live in a society that's obsessed with presenting information in this way, teaching information in this way" (Wertheim, 2009). She continues with the proposition that crochet is a form of play that engages abstract theories and makes them concrete.

In a similar way to the craft of crochet, origami—the ancient art of paper folding—has helped spark a scientific revolution, propelling a wave of innovation related to how we understand both man-made and natural structures. Origami is informing scientists like David Baker, who studies how amino acids fold in our bodies or the engineers building a satellite telescope's star shade at NASA'S Jet Propulsion Laboratory (Allington et. al. 2017). As a creative method, this act of prototyping is another form of visualization, and allows the researcher to iteratively "write" and "read" the model and to test out cause and effect in addition to a divergence of ideas about how something does (or might) work. As we look to the arts, humanities and sciences for evidence of the origins of creative research, the question that emerges is to what degree the mode of creative research is similar and different in design?

3. Creative Research in Design, Principles and Case Studies

Like many of the previous examples, creative research in design is often used to raise questions and test out answers. Nowhere is this more evident than with the interactive design pioneer Muriel Cooper, an educator at the Massachusetts Institute of Technology's Visible Language Workshop—today known as MIT Media Lab. Cooper was highly experimental in her use of tools, and technology, finding new and experimental ways to test out visual interfaces before they existed. She also didn't limit her work efforts to a single format or material—her work spanned from print to software interfaces.

In the early days of interactive and screen-based interface design which Cooper was developing, there were no models for Cooper and her students to interact with—to iteratively test out the cause and effect of certain design decisions. What's relevant for this paper was the absence of a model for Cooper and her students to interact with screen-based interfaces. Cooper engaged in the creative process to form critical opinions, collect data and evaluate the new technology. In a 1994 lecture Cooper states,

> "Our goal has been for a very long time to try to examine in the so-called emerging technologies what the new form and content of design, of communication, might be. And to that end for many years we have been building prototype visualization tools that would allow us to do something that seems relatively intuitive in order to say "What if we did this, then what would happen?" but to really visualize this stuff in as tight an iterative loop as we possibly could. So, we're looking for the new design principles, umm we're not at all sure what they are." (Massachusetts Institute of Technology Media Lab, 2018)

Cooper is a prescient example of the ways that creative research—through experimentation in visualization, modelling and prototyping—can be used to raise critical questions.

Based on the survey on creativity and creative research in the different disciplines outlined in the first section of this paper and related to the three purposes of creative research also

mentioned, we suggest that creative research holds the most potential for design research in the following ways:

- As a means to engage in critical discourse about what is “true” and “factual” and to challenge the biases that are informing design decisions;
- To design better data gathering, analysis and evaluation methods that help designers see a problem from multiple perspectives;
- Building trust and openness between participants and researchers in participatory and co-creative methods.

Most importantly, creative research holds myriad possibilities for opening up new paradigms of design research, challenging the biases that are inherent in any design approach—from the context of the project, to the way we conduct our research, to the solutions that we ultimately propose—and engage people (i.e. users) in both creative and critical research methodologies.

Design research and design research methodologies are still very much in their infancy. Over the past 30 years, discourse surrounding methodologies have been trying to decide if design research is a science, a liberal art, or a new domain in and of itself (Cross, 2011; Poggenpohl, 2009; Margolin & Buchanan, 1996). With roots in engineering, computer science, and manufacturing, the historical perspective of the designer has been to aim for objectivity, using research to “collect data” in order to make informed, and unbiased decisions. But increasingly designers are recognizing the act of interpretation as key to the design research process, and that biases are inherent in any process that is propositional. The use of abductive reasoning, core to the design process involves judgement, and that judgement is closely tied to research, experience and habitus—or the way we view ourselves in the world, and as part of a field of study (Cross, 2011; Crouch and Pearce, 2012). Paramount to decolonizing the activity of design is to situate the act of interpretation at the center of design research and dislodge the notion of the designer as an objective actor. We think creative research is a good opportunity to reframe this, as it positions the designer at the center of the interpretive process, confronting them with qualitative analysis and decision-making as a core part of the research process. As Crouch and Pearce (2012) quote the french philosopher Jacque Bourdieu on the value of creativity—it is an ‘acquired system of generative schemes' (pp.36-37) and

> “[t]hinking of creative practice in design as a dynamic relationship between the habitus and field empowers the researcher because it locates design thinking in the context of a dialectical engagement between ideas and the material world, positioning design in a continuously changing social environment (Bourdieu, 1977, p. 95).” (Crouch & Pearce, p. 37)

Creative research as a critical activity is based on the idea that through the creative process—one that involves making decisions in the very act of productivity—creativity can help designers challenge their own research findings and give a means by which to test the assumptions and conclusions they are drawing. Embedded in the act of creation are the

qualities of framing, orientation, organization and scale, which all contribute to the activity of synthesis, analysis and evaluation. In addition, the process of creativity requires translation from one form to another, which necessarily involves encoding, summarizing and including certain pieces of information while excluding others (Allen & Queen, 2015).

3.1 Case Study: Creating visualizations that illuminate gaps in research and knowledge

In "Groupthink: The Brainstorming Myth", social scientist Charlan Namath argues that "debate and criticism do not inhibit ideas but, rather, stimulate them relative to every other condition…because it encourages us to engage more fully with the work of others and to reassess our viewpoints" (Lehrer, 2012, para.10). Creative Research—and in particular visualization as a means by which to engage in the examination of a phenomena, can be particularly effective in prompting this critical discourse because the visualization acts as a sort of "truth" that can be contested. In visualizing causal relationships, visualizations can also foreground the relationship between cause and effect; as a movement it can visualize the collective consciousness through pattern-creation; and in both structuralism and post-structuralism it can emphasize the myriad network and connections that inform the interpretation of an problem—potentially bringing in more diversity and depth of understanding to similar or related sets of information.

In a graduate seminar at NC State entitled DIY cartography, students created a series of maps that looked at the history of urban development in Raleigh, NC with the aim of better understanding the myriad complexities of how a small southern US city had grown over the last 150 years. In using maps to engage in research, this class used creative research in its most basic form—as a mediator to disseminate and explain research findings. Invisible social issues such as segregation, civil rights, and discrimination are also formally manifested in the map, thereby becoming "real".

In the class, maps were used as a critical tool to raise questions about what the gaps were in the existing narrative of urban development in the city, but also in the student's own research. In one example, a student used the map to examine the role that public schools played in the city of Raleigh's development. Do schools crop up as a result of housing development or is there a concerted effort to develop both simultaneously? Of particular concern was the disparity between neighborhoods where housing value and income was low, and the access those students had to quality public education. Through the creation of the map, the student looked broadly at such data as land value and the proximity to schools (Figure 01). Additional information such as the "score" the school had was included to overlay a more qualitative angle to the research. Finally, the student included a series of case studies that highlighted two houses in close proximity to each other, and where the children in each attended school. These case studies added yet another layer of qualitative examination by visualizing the incredible difference in distance of travel between the two. The lower income student had to travel 3 times the distance as the higher income student. Students then created additional visualizations that looked at the "network" of information that contributed to their findings (Figure 02). Their final visualizations were more experiential—specifically about a site that was pivotal to their research. This final visual was

meant to test their findings “on the ground” (Figure 03). For the student conducting the research, the map itself became a powerfully persuasive tool. It also encouraged the student as well as the whole class to think through the implications of this disparity, and what is “fair.” Of primary concern through these maps was to illuminate gaps in knowledge, to use the map as a creative tool to force synthesis of information and as a critical tool to discuss correlation and causation of observed patterns and phenomena.

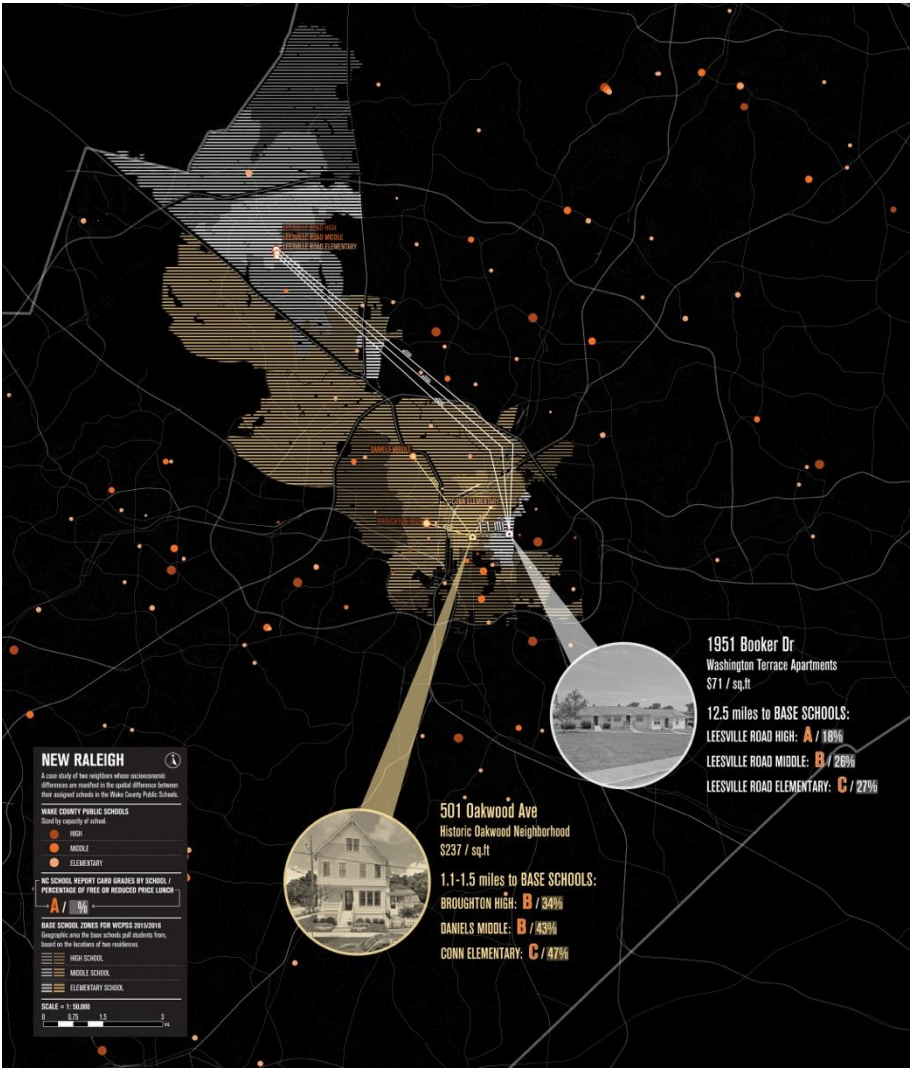

Figure 1. Geospatial Map: Education and Housing.

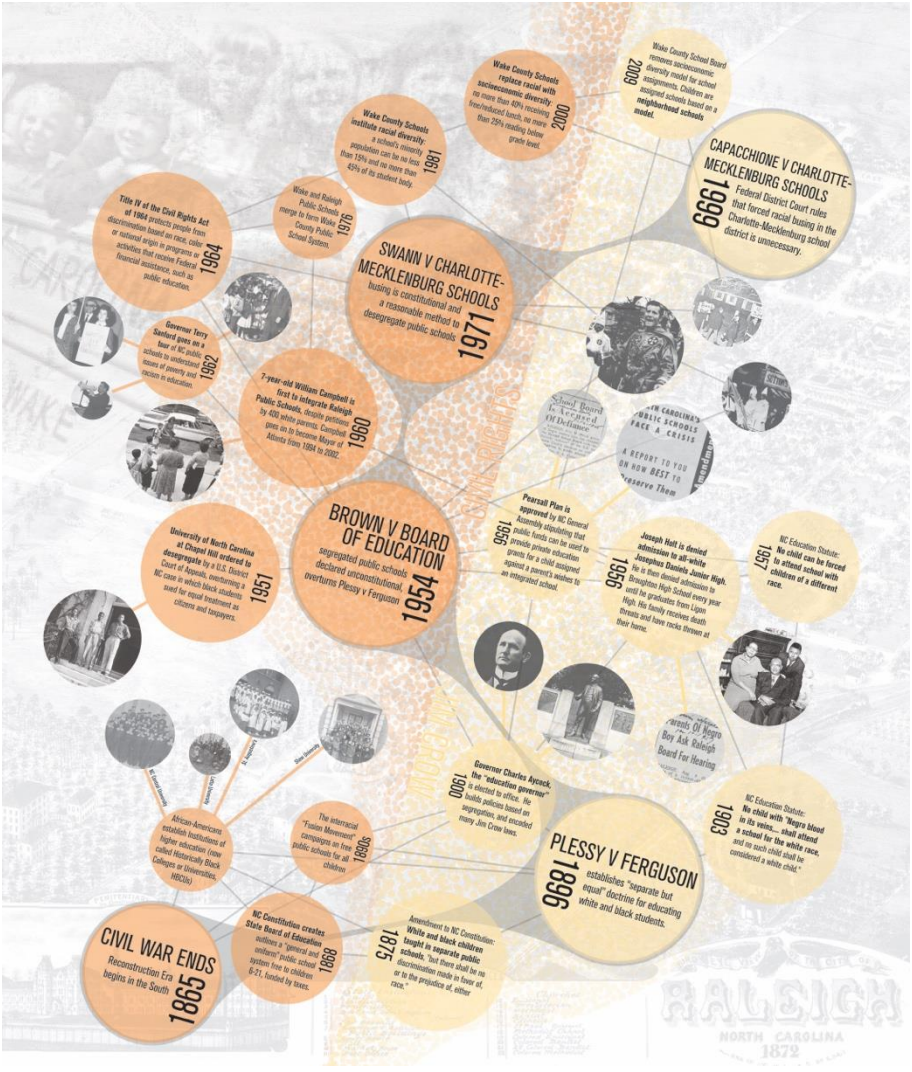

Figure 2. History of Education Access.



Figure 3. Oberlin Village and the History of African American Education.

3.2 Using Creative Engagement in Participatory Design and Co-creation: Building Trust and Critique Through Games and Play

Participatory research has roots in anthropology in the sense that often the researcher is a participant-observer—simultaneously observing the culture or condition they are studying while also recording and interpreting their observations about its "peculiarities" (Geertz, 1973). It often implements a co-creative approach by asking participants to actively engage

in finding the answers to design problems. Participatory methods are inherently creative in the sense that both the designer and the user are making something together.

Creativity within the participatory process could help raise new and novel questions—and potentially set up conditions for entirely new problems to emerge because of the open-ended nature of the creative process. In addition to engaging in a mutually creative experience, the creative process can help engage in a more critical examination of the problem definition. Could creative methods be used to augment or re-define the problem at the end stages of the design process? How might the tools that we are generating as a part of the research process be rethought as more inherently discursive tools? In traditional definitions of creative research, the idea of the research instrument as a mediator between the researcher and subject is not a new one, but possibly one that we can look at again in terms of how to negotiate meaning in novel and unique ways. Especially if we look at the purpose of the interaction as a reciprocal tool for this negotiation.

One of the challenges with participatory research is in building the trust necessary between audience and researcher, and between users themselves. In her Book, *Reality is Broken*, Jane McGonigal (2011) argues that one of the main values of gameplay is the trust that is built between the players—trust that is built as a result of mutual expectations of "following the rules" of the game. McGonigal also argues that games encourage us to take risks because the stakes are contained within the space of the game itself. How can we take advantage of the liberation of the game, and use creative research to build that trust to take risks and engage in meaningful critique as part of a participatory design process?

In a research project examining collaboration in online environments, ideas of gameplay were implemented to help participants build trust and spark conversation throughout the design process. As the study was focused on design collaboration, all of the participants were designers. Each time the group met, there was a different goal for what was to be produced with the end results living in the written journal, *Margin*. The research was also set up for both synchronous and asynchronous work. One of the first tasks was a writing exercise similar to the "telephone" game that children play. In that game, an initial statement is made. In this case, the first participant was given a passage from Shakespeare's *Merchant of Venice*—which they created a response to (Figure 04). Some participants translated line for line, others created a more original piece that responded to the ideas presented in the excerpt. Participants were also tasked with collecting and generating images that would complement the writing. The images were put into a shared repository for all to draw from and ultimately turned into a series of visual essays (Figures 05-07). Ultimately, this charrette provoked important conversations about the nature of collaboration, especially as it related to scale, authorship and outcome. The project was meant to engage participants in deeper conversations about collaboration, and in many ways, it was successful in breaking apart a collaborative process for closer examination. But more so as a creative exercise it helped participants gain a measure of trust with each other, and facilitate conversation. Through the activity of creation, it also gave specific testament to the way that collaboration was happening—as a proof of concept. And because of the

constraints imposed on the participants, it forced a measure of risk-taking and liberation in the process.

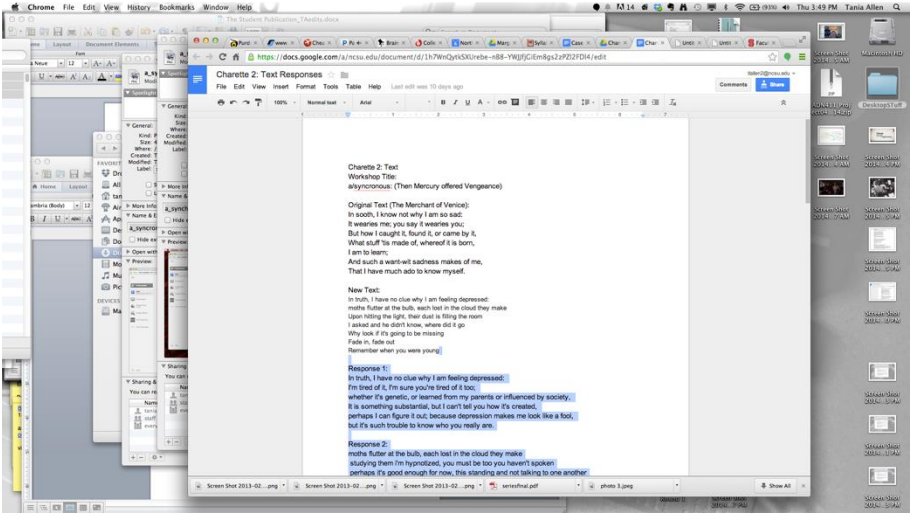

Figure 4. Writing "telephone".

The artifacts generated from creative research are powerful tools that have a multiplicity of purpose. They capture and illuminate the intricacies of a problem, they help synthesize research gathered, recognize gaps in individual or group knowledge and help users form critical opinions on the inquiry.



Figure 5. Visual Essay by Author.

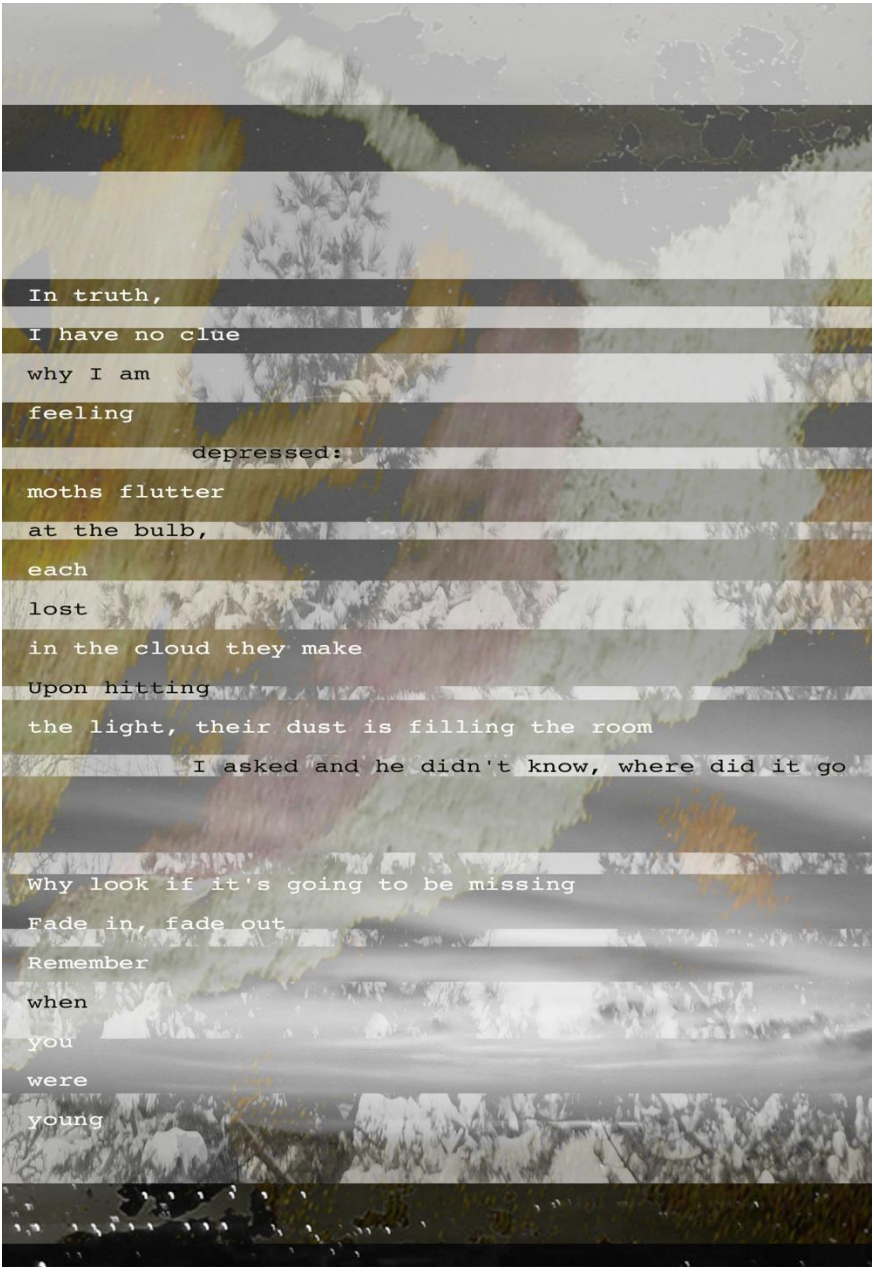

Figure 6. Visual Essay by Erin White.



Figure 7. Visual Essay by Rebecca Tegtmeyer.

4. Conclusion

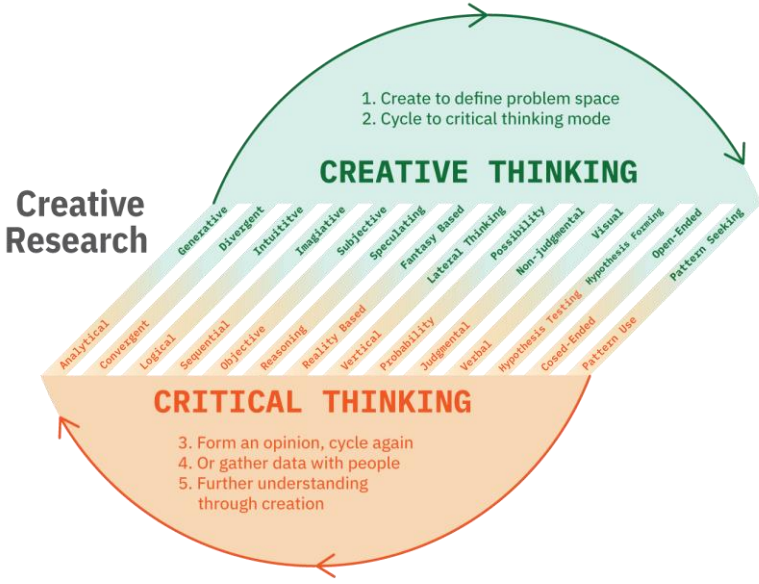

Figure 8. A model for critical and creative research in design.

Looking at examples from the humanities, social sciences, math and science, we start to see the value of using creativity in myriad ways throughout the research phase. We are not suggesting that creative research should be a substitute for other methods, nor that creative research should be the only type of research designers engage with. Rather, we are suggesting it as a critical part of a mixed methods approach that encourages designers to challenge their assumptions, seek new perspectives and engage in critical dialogue with participants and with their own ideas. The figure above (Figure 08) is a preliminary visualization of the way that creativity and criticality intersect, and the reciprocal relationship between the two. The act of creativity, and the thinking that is involved, is directly linked to critical thinking through analysis and selection. Critical thinking is enhanced by creative thinking through the need to remain open-minded, while simultaneously rationally examining what is in front of you.

In her book, *Creativity from Constraints*, Patricia Stokes (2016) argues that, “Successful solutions are reliable, not surprising; predictable, not novel; already accepted, not creative”.

(p. xi). As the problems that we engage with become more complex, messier, more "wicked", it's increasingly critical to move beyond historical ideas of what is successful—and challenge our deeply-held assumptions about how to engage in design and research. Using creative methods to encourage a more open-ended approach to design research might be a critical first step in fundamentally rethinking the approach we take in this regard.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Why we need more somatic culture in design

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Abstract | Drawing from multi-disciplinary literature, this paper argues why somatic culture is essential to designers and can promote a radical change in the way we respond to contemporary challenges. Somatics is "the field which studies the soma: namely the body as perceived from within by first-person perception". Somatic practice can influence design on several levels. It can shift our focus from a neutral point of view to a situated one; prepare us for intersubjectivity; help us develop relational and empathic skills that contemporary designers should be equipped with; and enhance our perceptual skills to widen the knowledge of ourselves and our environment. Finally, in a field where professional uncertainty is ever increasing, it can give us tools to counteract negative side effects. A turn towards somatic culture in design practice and educational approaches can therefore be an appropriate answer to the complexities that design is encountering.

KEYWORDS | SOMATICS, DESIGN EDUCATION, MOVEMENT, PERCEPTION, AGENCY

Introduction

Confronted with the continuous evolution of the social, economic and technological contexts in which it operates, design is a practice in constant redefinition. Studies and reports strive to establish new areas and required skills (AIGA Designer 2025) while designers and institutions struggle to keep cognizant and up to date. Hasty curriculum innovations run the risk of only providing buzzwords and superficial answers; expectations towards design and its ability to bring solutions to complex problems are increasing; new solution-oriented design practices are emerging but at the same time are being criticized for having a weak and reductive culture (Manzini 2016). So how can designers prepare themselves for the inevitable changes to come?
In this paper I will argue that somatic culture can provide a foundation to a new design culture and can also promote radical change in practice and education.

Somatics: a definition

Somatics was defined by philosopher and movement therapist Thomas Hanna as "the field which studies the *soma*: namely the body as perceived from within by first-person perception" (Hanna 1986, p. 341) as opposed to the third-person perception prevailing in science. Somatic learning relies on the ability of the *soma* to sense actively and regulate itself: through focused awareness it allows us to learn the unlearned (Hanna 1986). This term now includes many different methods and practices, ranging from Feldenkrais Method and Alexander Technique to dance forms such as Contact Improvisation, which all share the intent of bringing individuals to a higher awareness of themselves and their environment through conscious movement experiences. According to Hanna, "somatic learning (…) expands the human soma's range of action as well as perception" and "the more [that] is learned in this manner, the greater the range of voluntary consciousness for the constant task of adaptation with the environment" (Hanna 1986, p.351).
The purpose of this paper is to underline the (self)-educational relevance of somatic practices, which are always grounded in experience, which aim at awareness and integration, and which can provide a rich and fertile terrain for the development of design practice.

Contemporary design culture and human experience

The international design community is trying to address the changing scenarios affecting it by way of discussion and debate, most often through the forms of scholarly conferences, papers and reports. One such example is AIGA's Designer 2025 report, which proposes seven trends that should inform the evolution of design and its education in the medium term,

listing what college students and educational institutions should do to respond to each of these expectations (AIGA Designer 2025).

Design is a collaborative practice and requires practitioners to be receptive towards people, behaviours, environments, materials, and much more. Any kind of design, even at the smallest scale, requires interaction with a number of "others" – be they institutions, clients, regulators, collaborators, experts, producers, publishers, distributors, etc. – along with the great number of other people who, in many design projects, are still placed at the receiving end of the process: users, citizens, audiences, consumers, participants are only some of the different names designers use, according to their culture, to define the people they design "for", or sometimes "with" and, unfortunately, even "against" (Sfligiotti 2011).

Many methods have been developed over time to interact with and account for this "receiving end". As a result, essential words originally used to define human life and relationships, such as *empathy*, *experience*, *collaboration*, *sharing*, have been co-opted into the design vocabulary with a purely functional – if not perfunctory – intention. For instance, in *design thinking* methods (as if anything such as a unique way of thinking shared by all designers actually existed), a designer is usually asked to "empathize" with someone as a required step in the process of delivering a new or better product or service to that individual or entity. In order to develop this empathy, activities are suggested such as conducting interviews with users and visiting their living environments (IDEO 2015). This approach, however, seems to take it for granted that a designer who uses specific methods, will automatically be able to empathize with others - indeed a questionable assumption. As discussed by Devecchi and Guerrini, the heart of the issue depends on what we mean by "empathy". We can see it as a tool for "understanding others' experiences and emotions", or we can give it a deeper meaning as an intersubjective experience, as "the skill to be (...) really involved in the face-to-face encounter with a concrete Other, acquainting and accepting his/her otherness"; in short, from empathy as a tool to empathy as an end in itself, as a response to a widespread need for meaning, dialogue and sociability (Devecchi & Guerrini 2017, p. S4361-2).

Several authors agree that these empathic skills can be developed through somatic practices. Albright (2019) believes that we can "learn how to engage with one another in the face of (rather than in the absence of) difference" (p.15), and Höök (2018) claims that somatics "connects the self (…) with empathic engagement with others" (p. XVIII).

Methods and processes

Designers and design institutions rely on methods to improve their effectiveness, to claim authority over their field of practice, to gain credibility, and to promote their brands. Design methods are usually presented as procedures, with steps to be undertaken in order to find a solution to a given problem: their description seldom takes failure into consideration. Whatever method we adopt, however, needs to be supported by our capacity to see its limits, to adapt it, and to consider each situation at hand whilst engaging with it and acting

within it, without being blinded by assumptions and preconceptions (which are usually a side effect of methods learnt top-down in abstract environments). As dancer and scholar Ann Cooper Albright (2019) points out, “practice is a way of committing oneself to being present in a situation, no matter what the outcome. In this sense, it is always an act of improvisation” (p. 5).
This requires abandoning the idea that design should always be fast and deliver predictable outcomes. In order to develop an open and receptive attitude, designers can use somatic practice to reach a state that – borrowing a title from psycho-somatic therapist and educator Thea Rytz (2009) – could be described as “centred and connected”, where they can “attune their awareness toward themselves, others, and their environment” (p. 15) and learn to be responsive instead of reactive.
It also implies allowing more time for the process: only over time can relationships be established, situations understood, and proposals organically developed without recurring to default, standardised “solutions”. This slowing down might prove itself revolutionary because it requires a radical change of attitude over the whole spectrum, and it is surely something worth investing effort in.

“The privilege of partial perspective”

The way we conceptualize knowledge and practice shapes the way we design. For instance, while the notion that design should be impersonal, objective and neutral was central to the development of Western Modernism, ever since the late 1960s the notion has been seriously questioned. To quote feminist designer and educator Sheila Levrant de Bretteville, “‘Designed’ has almost come to mean exclusive, universal, clear and simple, rather than inclusive, personal, ambiguous and complex” (De Bretteville 1974, p.115). I propose adding two adjectives to the discourse, “situated” and “intersubjective”, which I believe can contribute to a more articulated account of design.
In 1988 feminist scientist and philosopher Donna Haraway introduced the term “situated knowledges” in an attempt to contribute a new perspective to the debate on scientific objectivity. As she argued, knowledge is never separated from its subject and location, and only by embracing our situated, partial point of view can we make rational, responsible, objective claims: “the view from a body, always a complex, contradictory, structuring and structured body, versus the view from above, from nowhere, from simplicity” (Haraway 1988, p.589). This perspective seems to resonate with Hanna’s viewpoint when he states that “the soma has a dual talent: it can sense its own individual function via first-person perception, and it can sense external structures and objective situations via third-person perception” (Hanna 1986, p.346).
If we adopt this perspective, we are likely to recognize that it is impossible for our individual experience and (physical and ideological) position in the world not to shape the way we act as designers; thus, it helps us to eschew the perception of our opinion and ideology as neutral or absolute. At the same time, it allows us to acknowledge other people’s own

"situatedness" and their multiplicity of experiences: that is, it prepares us to design with, and for, a plurality of human beings.
Intersubjectivity is a concept used in philosophy and psychology, defined as "the sharing of experiential content (e.g. feelings, perceptions, thoughts, meanings) among a plurality of subjects" (Zlatev et al. 2008, p. 2). It was used in design theory by Giovanni Anceschi in his discussion of Josef Albers's teaching approach, which was based on guiding students through a shared observation and evaluation of effects: "the validity of the results is based on a method of acquisition and judgement that is neither objective nor subjective, it is an intersubjective approach" (Anceschi 2010, pp. 45-46).
Somatic practice can facilitate situated and intersubjective attitudes; Höök, for instance, emphasizes how "focusing on our own soma is a preparation for intersubjectivity" (Höök 2018, p. 147).

Movement, knowledge and learning

The fact that forms of tacit knowledge acquired through movement and perception exist in addition to discursive, language- and mind-based knowledge has been part of philosophical and psychological debates for several centuries, just as it has been a principal concern in art and design education. Architecture historian Zeynep Çelik Alexander (2017) coined the term "kinaesthetic knowing" to identify an idea of embodied, experiential knowledge developed over the course of the 19th century and within a German lineage of educational-reform to which the foundations of the Bauhaus can in part be traced.
Introducing somatics in design culture is a way to acknowledge the relevance of this tacit knowledge in learning and in the design process. Moshe Feldenkrais, the founder of the somatic method of the same name, described a "learning in which quantity grows and turns to a new quality, and not the mere accumulation of knowledge". He affirmed that "most truly important things are learned this way", referring to all our essential human abilities (Feldenkrais 1977, p. 7).
Furthermore, somatic practices provide us with unique information coming from proprioception (Hanna 1986). According to psychologist James L. Gibson (1968), proprioception "considered as the obtaining of information about one's own action" does not depend on specialized receptors (p. 34) but is the result of combined (muscular, articular, vestibular, cutaneous, auditory, visual) information. This ecological view goes beyond the traditional idea of the senses working separately in a specialized way and can help us transcend the primacy of the visual that tends to guide many design choices.

Movement and perception at the Bauhaus

The belief that breathing and movement exercises should be an essential part of a designer's education was a defining feature of the early Bauhaus.

This belief did not emerge in a vacuum, but related to ideas that had developed previously in Germany – such as those promoted by German education reformers in the 19th century (Alexander 2017) and by the *Lebensreform* movement, which became newly relevant in the wake of the First world war (Ackerman 2019, Wick 2019) – and was parallel to other utopian projects from the same period, such as the Loheland and Schwarzerden women's communes (Neugärtner 2019). These examples, however different from each other, all shared the conviction that the body was central to the development of a new idea of humanity and society.

In the early Weimar period, Johannes Itten in the *Vorkurs* and Gertrud Grunow in the *Harmonisierungslehre* proposed breathing and movement exercises to improve psychical and physical capabilities, to activate artistic expression and to achieve a "spiritual enhancement of the body" (Burchert 2019). Both teachers, even if they relied on different theories, saw regulated, rhythmic physical activity as a remedy to the negative effects of modern life, and as a way to find balance and achieve individual development. Inspired by Mazdaznan philosophy, Itten put an emphasis on the three human spheres of body, spirit and intellect (Burchert 2019); thus bodily care and practice were essential as a means to a higher goal, to develop "the human being as a physical, mental and spiritual entity" (Wick 2019).

In 1923, with the arrival of László Moholy-Nagy – who along with Lucia Moholy had already visited the Loheland and Schwarzerden communes – his organic, integrated view of senses and human experience was introduced at the *Vorkurs*.

Moholy-Nagy embraced modernity and technology, but believed that – in order to fully participate in modern life – human beings need to develop an "organic confidence" before approaching specialized education; his belief was that "each human being is gifted" and has the capacity to "participate in all the joys of sensory experiences" (Moholy-Nagy 1929, p. 11). He rejected, as the Futurists before him, the traditional distinction of the five senses (Botar 2014). His exercises addressed visual, spatial, equilibrium and especially tactile explorations (Wick 2019) with an experimental, comparative, rational approach (Alexander 2017). However, these *Grundlerlebnisse* (elementary experiences) were not aimed at achieving a direct design outcome because "not the object but the human being is the purpose" (Moholy-Nagy 1929, p. 14).

Even if these early examples of the centrality of the body in design education cannot be considered "somatic" the way we intend it here, Moholy-Nagy's idea of "organic confidence" strongly resonates with the integrated awareness that can be fostered through somatic practices; they also remind us that any real change can only start from the ground up, by giving a new base to our learning and doing: this is in fact what the Bauhaus' *Vorlehre* – also known as *Grundkurs* – was about.

Training somatic skills for design

Interaction designer Kristina Höök (2018) discusses several aspects of the connection between somatics and design: in her view, somatic practice can both lay the ground for and be an essential part of design research processes. Even if the author's research originates in the field of Interaction design, I am convinced that many of her theses and proposals can apply to all fields of design. While it is easier to establish a one-to-one correspondence between specific movement practices and their application to interaction design, in other design fields the relation between somatic training and its effects on design projects is less obvious; it can be found, as discussed above, mostly in a different attitude throughout the design process, and in the capacity to deeply relate to others and the environment, which in turn will affect the outcome of a project.

Höök draws on Richard Shusterman's concept of Somaesthetics – "the critical, meliorative study of the experience and use of one's body as a locus of sensory-aesthetic appreciation (*aisthesis*) and creative self-fashioning" (Shusterman 1999) – to invite designers to learn how to direct and deepen their own experiences and be thus able to use them as a source of information in the design process: "learning about your soma is a prerequisite to designing with it" (Höök 2018). The richer and more articulated the experiences we have are, the better we will be able to fully understand and respond to complex design situations.

Albright (2019) describes six states of being that can be experienced through somatic practice: *falling*, *disorientation*, *suspension*, *gravity*, *resilience* and *connection*; these can be seen as different ways to respond to contemporary conditions, such as social uncertainty, attention overload, digital hyper-connection, and disembodiment, which have consequences on the way we design. She also underlines "how perception is a learned behaviour and how intentional practices can structure new ways of thinking" (p. 7).

"Ways to defy the pressure to perform"

The contemporary design context gives us other reasons to turn to somatics for a new grounding. Many of the current narratives about design describe it in an idealistic way, as if it were always a successful process, where designers act as respected consultants providing effective solutions to like-minded clients. These narratives are often reinforced in design education, both in mainstream institutions educating the next generation of corporate designers and in niche schools catering to a smaller audience of independent practitioners.

Reality is often very different, and designers find themselves operating in the midst of complex power negotiations – where economic, political and social powers come inevitably into play in the decision-making process, adding to and interfering with the design process (as it is expected to be). Moreover, young designers often work in a precarious position (Design Census 2019), frequently as freelancers or interns, and feel forced to adapt to a self-

promotional attitude, moulded on a success- and performance-driven narrative which – even when harshly criticized (Verwoert 2008, Elzenbaumer & Franz 2015) – still dominates the conversation.

In his aptly titled article *Exhaustion & Exuberance. Ways to defy the pressure to perform*, contemporary art critic Jan Verwoert points out some of the contradictions that haunt the so-called creative professions: "In a high performance culture, we are the avant-garde but we are also the job-slaves" (Verwoert 2008, p. 90). It is essential to counteract the side effects of this unstable position and develop the capacity to stand one's own ground; in order not to be continuously pushed off-centre designers need to find their own balance and autonomy: "(…) we then face a two-fold challenge: 1. to understand the conditions of our agency in order to enable us to define them according to our own terms; and 2. to imagine another logic of agency, an ethos, which could help us defy the social pressure to perform and eschew the promise of the regimented options of consumption." (Verwoert 2008, p. 91).
These issues are not entirely new. Moholy-Nagy (1929) expressed similar concerns: "Today's creative human being knows (and suffers from it) that the deep values of life are being destroyed under external pressure (moneymaking, competition, business mentality)" (p.13). It was extremely clear to him how this suffering was deeply connected to each person's body, to the "exploitation of his vitality, from the flattening out of his instincts, from the levelling of his biological tensions".

Somatic practitioners might easily agree with this idea: the body is the place where the problem is most strongly felt, and can therefore offer the path to overcome it, a way to find one's own agency. Albright (2019), for instance, suggests embracing physical experiences of falling and disorientation as an opportunity to reorient ourselves and rethink our own assumptions. Hanna (1986) describes "somatic freedom" as "a state of autonomy" and "the optimal human state". To me this means we can develop the capacity to respond to uncertainty without uncritically accepting the conditions that cause it.

Somatics in design research and education today

In and outside academia, there are a number of design research projects, courses and workshops that take a somatic or body-centred approach.
One remarkably articulated example is the Somaesthetic Design project that Kristina Höök and her team have been working on at the Royal Institute of Technology (KTH) in Stockholm. Their approach has led to the development of a prototyping and testing method, a teaching curriculum (Tsaknaki et al. 2019) and several interactive design projects, such as Soma Mat, Breathing Light and Sarka (Höök 2018). In spring 2019 I had the opportunity to participate in one of their workshops in Milan. Before and after a session guided by Elisa Ghion, a Contact improvisation teacher, we were asked to record our bodily sensations on specially made "body sheets"; we were then asked to engage in the testing of several interactive

prototypes. The heightened awareness achieved through the initial session allowed us to give a detailed feedback on the quality of interactions, and the shared experience facilitated the exchange of ideas. This way of working also provides a valuable common ground for teamwork, which is key to all design work.

Other cases, just to mention a few examples in Europe, are Riccardo Blumer's courses at the Accademia di Architettura in Mendrisio, Switzerland, where students practice specific body movements to prepare themselves to design objects around them (Seratoni 2017); Lotte van Gelder's teaching in several departments of the Gerrit Rietveld Academie, which includes group movement sessions and individual project work (van Gelder 2016); Emma Hoette's courses at Goldsmiths and other universities; and Amanda Montanari's "From body consciousness to design praxis" at the Design Academy Eindhoven.

An analysis of such cases would call for separate research and discussion; nevertheless, these are signals of a growing interest in the centrality of the body in design research and education that cannot be easily dismissed.

My position and experience

I myself have been practising as a designer since I was in my early 20s, and I began teaching just a few years later. This early start made my approach dogmatic at first: I tended to rely on established rules that could give me "authority" towards clients, colleagues and students. In my thirties I started a regular dance practice (Release technique and later Contact improvisation) and more recently began practicing the Feldenkrais method.
At first, I thought these activities were only addressed at personal well-being, while designing and teaching were something I did with and for others. Over time, though, the information I acquired through somatic experiences ended up influencing my daily life, my professional activities and my teaching. Once I acknowledged this, I started creating open and informal spaces for movement in my teaching and developing research workshops (outside the academic context) to test somatic activities that addressed design-related themes such as perception of space, relation with others, and collaboration in a group. These experiments, carried out in 2018 and 2019 and now collected under the name *es_ design somatics*, have provided me with many useful insights that I can use in my teaching and research thanks to the participation of a supportive group of artists and designers.

Somatic practice can also bring visible changes in teaching attitudes, modifying the quality of interactions with students; in my experience it has caused a move away from typical educational settings and hierarchical roles, a clearer positioning and expression of my views, and a greater openness towards the possible outcomes of the projects I propose.

I must admit I feel slightly awkward discussing somatic subjects in the form of an academic paper; without direct experience many of the statements made here may sound abstract.

However, I decided to take up this challenge anyway, in an effort to add my contribution to the existing attempts at including these issues in academic discussion.

Proposals and conclusion

Since most educational institutions tend not to be open to radical change, especially to the kind of innovation discussed here, I invite whoever is interested, students or educators, to pursue this field of inquiry independently and informally. Several somatic disciplines, after initial training, can be practiced in self-organized research groups or labs, where participants work together experimenting, developing and discussing "materials" around commonly chosen subjects. The presence of students and educators who adopt a somatic culture and practice will inevitably – albeit indirectly – bring change to the institution itself. Therefore, I believe a somatic turn should not be an individual endeavour but a collective one, going beyond personal well-being to aim at making a wider and deeper impact. As Martha Eddy described in writing about "Social Somatics" (Eddy 2017), this process can have substantial social and political implications: its potential is explored, for instance, in the practice of Generative Somatics, an activist organisation using a soma-grounded approach to social change and trauma healing. In their view, "a politicized somatic theory understands the need for deep personal transformation, aligned with liberatory community/collective practices, connected to transformative systemic change. (...) A politicized somatics can act as a fundamental collective practice of building power, deepening presence and capacity, and developing the embodied skills we need to generate large-scale change" (Generative Somatics 2014). A political perspective on somatics is gaining relevance in the face of the growing attention to racism and other forms of systemic oppression: its use in the context of design is worth further research and discussion.

A somatic attitude based on self- and collective care can be applied in everyday life. Simple questions such as "How do I feel today?", "What do I need?", "What happens around me?" and "What does this situation require?" can activate a conscious and sensitive attitude towards any activity to be undertaken during the course of a day. Allowing time for the observation of ourselves, for recognizing the repetitive patterns we often fall into and imagining alternative ones, for connecting to the needs and desires of the people we interact with, are just a few examples of what can be achieved through practice and what can have a positive impact on our learning and doing.

I would like to conclude with the words of Anna Halprin – ground-breaking dancer, choreographer and educator – as quoted in an article on the pioneers of postmodern dance: "Halprin, who early on saw dance as a social corrective and pathway to personal healing, creating community-based work (...) is also attuned to the more minor injustices of modern life. 'That one's a graphic designer,' she said to me of one of the students in her California studio. 'When else does he get a chance to connect to his spirit? He doesn't'" (Guadagnino 2019).

It is now up to us to create space for these possibilities to happen.

Postscript

This paper was written and delivered to the Cumulus platform in February 2020, immediately before the first Covid-19 pandemic outbreak in Europe, and the notification of acceptance came in Autumn, at the beginning of a second wave. As with many other aspects of our lives, our habits and practices in both education and the professional world were disrupted. The international community is still working to figure out better methods for communicating and collaborating in the new conditions, and although these collective efforts have successfully supported professional and educational activities, our daily life experiences have lost breadth and depth, and our perceptual reality has been further limited; most of all, many people have undergone traumatic experiences. The current situation makes a somatic approach even more necessary; when being physically close to each other is not possible, adjustments and new strategies will be required. However, there is still a wide space to be explored, with new motivations adding to the pre-existing ones: through somatics, we can find other ways to achieve presence and closeness, and to preserve intersubjectivity.

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Acknowledgements: This paper and the research behind it owe much gratitude and thanks to a group of people who shared their ideas and practices with me and who supported my research with their presence and advice: Barbara Boiocchi, Claudia Broggi, Alice Devecchi, Elisa Ghion, Emma Hoette, Amanda Montanari, Norbert Schatz. I am also deeply indebted to Giovanni Anceschi for his groundbreaking work towards a somatic turn in design theory.

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Paola Bertola,
Polytechnic University of Milan, Italy
“There is a growing need for 'research through design approaches' to face contemporary challenges, that is to say we should structurally embed the ‘culture of thinking’ into design practices.”

Pier Paola Peruccio,
Polytechnic University of Turin, Italy
“What are the new theories that gave shape to the discipline? What are the limits (geographical, cultural and temporal) of a World Design History? What are the contemporary places (e.g., magazines, fairs, museums) for debating on the problems and achievements of the designer's profession? What are the new challenges of the design education?”





Márton Szentpéteri,
Moholy-Nagy University of Art and Design, Hungary
“In the age of unsustainability, theory, criticism and history writing are not only about reflecting upon, but of changing the world in practical terms.”

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Always ordinary, never straightforward: Considering the work of Lorraine Wild

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Abstract | Designer, educator and writer Lorraine Wild has had a distinguished career that spans nearly 40 years. While she has maintained a prodigious output of design work and writing, her contributions remain critically unexamined. Beginning with Aldo Rossi's *L'architettura della città* (1966) and Robert Venturi's *Complexity and contradiction in architecture* (1966), and later, Venturi, Denise Scott Brown and Steven Izenour's *Learning from Las Vegas* (1972), this essay touches upon the impact these books had on visual culture on a broader scale. Lorraine Wild's affinity and support for the mundane and vernacular or "unschooled" forms of graphic design falls in line with what would become postmodern narratives of the 1980s and 1990s, narratives put in motion by Rossi, Venturi, et al. This essay will consider a number of Wild's designs with respect to how they reflect the conditions of modernity circulating at the time of their respective production.

KEYWORDS | LORRAINE WILD, VERNACULAR, BOOK DESIGN, CRITICAL PRACTICE, MODERNITY

1. Introduction by way of a detour

I wish to start this essay with a detour. The years 1966 and 1972 saw the publication of a number of books which were to have a significant impact on the production of architecture: Aldo Rossi's *L'architettura della città* (1966)[1], Robert Venturi's *Complexity and contradiction in architecture* (1966), which was followed by Venturi, Denise Scott Brown and Steven Izenour's *Learning from Las Vegas* (1972). Among architects, claims about their significance are rather self-evident, but what is not so self-evident is the impact that these three streams of discourse would have on other disciplines.

For a short period in the early 1970s, from 1972 to 1975, Rossi was asked to teach at the Eidgenössische Technische Hochschule (ETH), also known as the Swiss Federal Institute of Technology in Zürich. Prior to Rossi's presence at the school, labour unrest and the protests of 1968 had shaped discourse at the ETH — like many schools of architecture across the globe — with a deference to the social and behavioural sciences. Given this context, Rossi presented an about-face bulwark of resistance to the growing influence of the social sciences. His insistence on architecture's primacy as a form of material and cultural production has been described as nothing less than traumatic for a generation of architects. (Davidovici, 2018; Caruso, 2012)[2] Rossi's emphasis on architecture's autonomy, where form and history were the only things worth thinking about, struck this group like a bolt of lightning. Rossi linked form with the collective memory of a place, which is to say that past architecture and urban forms have a way of "cascading forward," a kind of domino-effect on future architectural production. For Rossi, form was always a reflection of a singular moment structured by an organizing principle: Form is a manifestation of a particular place during a particular time, which was by default linked to the social and political conditions which brought about its existence. Each era manifested form differently based on the particular conditions which resulted in its actualization, but whose cohesiveness is steered by common patterns of social habit and custom. (Aureli, 2012) While Rossi's emphasis was on form per se, it was not devoid of social intent. By grounding architecture in the manner by which form had developed over the course of hundreds of years, Rossi sought to heal the rupture Modernism had generated between form and society.

Post 1968, many architecture schools linked the role of the architect with that of the social activist: form was a secondary — if not residual — concern. The impact of Rossi and Venturi's respective books was to instil a revived interest in history within architectural

[1] While Diane Ghirardo and Joan Ockman's English translation of *The architecture of the city* would not appear until 1982, Rossi's writings were familiar to a number of North American-based architects and architect educators who could read Italian. For an excellent study of the early link between Italian historicism of the 1950s and Venturi's contributions which postmodernism of the 1970s

[2] A few of the luminaries of this generation include Jacques Herzog, Pierre de Meuron, Roger Diener, Christian Sumi, Kaschka Knapkiewicz, Axel Fickert, Miroslav Šik, and Marcel Meili.

discourse, but while Rossi emphasized the traditions of the southern European city, Venturi looked to broader horizons. Venturi's first book, *Complexity and contradiction in architecture*, included examples from the traditional European city as well as the commercial chaos of main street America. But it was Venturi's later book, co-authored with Denise Scott Brown and Steven Izenour, *Learning from Las Vegas*[3], that resonated with Swiss sensibilities. *LLV* brought a more pragmatic or realist sensibility to the discussion. In contrast to Rossi's emphasis on the urban forms of the southern European city, *LLV* recognized the state of the contemporary city as it exists, full of suburban commuter centres, urban sprawl and the car's dominance in urban planning. And while *Complexity and contradiction* recognized the messy reality that informs architectural decision making, *LLV* sought to remind architects of architecture's forgotten tradition of communicating symbolic value.

This Rossi/Venturi influence fostered an interest in the mundane forms that comprise our world. In contrast to the heroic Modern quest for grand statements and self-absorbed spectacle buildings, the Swiss pursued an architecture of simplicity. Today, the works of Herzog & De Meuron, Diener & Diener, Peter Zumthor, and Marcel Meili among many others, are celebrated for their understated nature. From an urban design perspective, many of their built works follow Rossi's sense of design decorum, his respect for the city and the forms that enhance activity on the street; and similarly, many of their works can be described as examples of Venturi's simple "decorated shed": spatially banal "boxes" that direct architectural pleasure to an articulation of the building's surface treatment. The forms of these architects are *common*, which is to say that they might otherwise be indistinguishable from the commercial construction that makes up the majority of the urban fabric. While some may see their emphasis on mundanity a limitation, it recalls American poet William Carlos Williams' claim that it is through contact with local conditions that gives rise to truth. It is a position that opposes the heroic modernist stance that from Williams' perspective, represented a long distant world. An appreciation for the mundane brought one closer to the truth of life which included the subtle, nuanced world of "things seen."

2. Post detour: The ordinary in graphic design

A fascination with the charms of common or vernacular form has always existed in graphic design, so it should come as no surprise that a book that presented a meaningful context for the mundane reality of commercial design practice should be of interest, especially a book such as *LLV* which deals with the manner by which form visually communicates[4]. But overall,

[3] Hereafter referred to as *LLV*.

[4] It must be noted that in the late 1980s through the 1990s, while graphic design underwent a significant technological transformation, it was (and continues to be) resistant to self-reflective critical discourse. The introduction of the personal computer (Apple introduced its first computer in 1984) and PostScript printing language (Adobe introduced PostScript in

graphic design was slow to formally embrace the ideas found in *LLV*[5]. In the 1990s, "vernacular" was equated with "unskilled" rather than "ordinary." The work of luminaries David Carson and Ed Fella was considered avant-garde design because it ignored accepted conventions. It seems a cliché to call it that now, but it was groundbreaking at the time because entrenched rules of propriety set limits on what was acceptable and the above designers, among others including Art Chantry, Elliott Earls, Jeff Keedy, and Carlos Segura, purposely flaunted the limits of acceptability — so much so that their work was deemed "ugly" in the infamous essay, "The cult of the ugly" by Steven Heller (1993) (Figure 1). But times change.



Figure 1. Design work included in Steven Heller's essay "The cult of the ugly," 1993. [left to right] Ed Fella, Menno Landstra (with type by Jeff Keedy), Art Chantry and Carlos Segura (also using type by Keedy).([left to right] Fella, E. (designer), (1988). Review committee selections: Stephen Zatto, Pamela Del Aura, Chuck Richards, Laura Reed Kinney [Announcement], The Cooper Hewitt/The Smithsonian Institution. Retrieved from http://cprhw.tt/o/2DAnX/; Landstra, M. (designer), (1992). Cover of De best verzorgde boeken 1991/The best Dutch book designs 1991. Amsterdam: CPNB/Stichting Collectieve Propaganda van het Nederlandse Boek; Chantry, A. (designer) (1991). The night gallery, COCA Cabana Performance Cabaret. Center on Contemporary Art, Seattle, WA [Poster], The Cooper Hewitt/The Smithsonian Institution. Retrieved from http://cprhw.tt/o/2DAye/; Segura, C. (designer) (1992). Interior spread from Creative Vision, Chicago design conference [Promotion booklet]. Retrieved from https://www.printmag.com/post/how-conference-brochure-by-carlos-segura/)

While current graphic design tastes do not reach the same levels of visual excess produced in the 1990s era of "grunge," the fact remains that today's work draws from some of the same sensibilities, including irregular word spacing, malformed typefaces, gaudy colour choices, and awkward text placements (Figure 2). Graphic designers are fascinated by the

1986), granted graphic designers unprecedented visual freedom. Typesetting was no longer constrained to a right-angled grid, and typeface design was no longer solely the domain of "experts."

[5] Also noted by Katherine McCoy in (1990) The evolution of American typography: American graphic design expression. *Design Quarterly*, (148), 13–14.

vernacular because it is without pretence (Caruso, 2008). Unlike graphic design that is a product of a formalized education, the vernacular exists outside the self-conscious parameters defined by institutionalized learning. It is about presence rather than appearance.



Figure 2. A selection of recent book cover designs that self-consciously make use of "vernacular" design features: irregular word spacing, handwritten typography, lowbrow typefaces, random word breaks, word breaks without hyphens, or the lack of a grid. ([left to right] Roettinger, B. (designer), (2013). Cover of In the good name of the company: Artworks and ephemera produced by or in tandem with the Colby Printing Company. Los Angeles: PictureBox/ForYourArt; Roettinger, B. (designer), (2018). Cover of B. Roettinger, No Age & Brian Roettinger: Graphic archive 2007–18. Chicago: Hat & Beard Press and The Pacific Design Archive, Los Angeles; Donnelly, N. (designer), (2015). Cover of J. Graham (Ed.), 2000+ The urgencies of architectural theory. New York: Columbia GSAPP Books on Architecture; Lange, C. (designer), (2012). Cover of C. Lange, Lange Liste 79–97. Leipzig: Spector Books; Mevis, A. & Van Deursen, L. (designers), (2008). Cover of Andino Velez, M., Joanelly, T., & Frei, H., Conflicts politics construction privacy obsession: Materials on the work of Christian Kerez. Stuttgart: Hatje Cantz Verlag.)

3. The Persistence of Lorraine Wild

It is here that I wish to draw attention to the work of a designer who has always had an interest in the vernacular, as poet William Carlos Williams describes, "the essential contact between words and the locality that breeds them." (1920, p. 10). Lorraine Wild has always sought out complexity in her work, often purposely juxtaposing conflicting ideas of propriety against orthodox Modernist sensibilities. *Perspecta* 19, the Yale School of Architecture student journal (Figure 3), is an early example of Wild's interest in "the richness and ambiguity of modern experience, … elements which are hybrid rather than 'pure,' compromising rather than 'clean.'" (Venturi, 1966, p. 22) Wild's design drew the ire of her faculty at the time, most notably the strident Modernist Paul Rand.

Wild's design was ground breaking. Contrary to Modernist "rules of clarity," Wild used a single typeface to typeset the journal: The body text was set in Bodoni roman, but the various levels of hierarchy (pull quotes, subheads and footnotes) make use of Bodoni bold and bold small capitals. The darker colour applied to such secondary information goes

against the grain of convention, but in no way impedes legibility. Perhaps most revolutionary for the time, Wild's use of Scotch rules reintroduces a historical motif newspapers used to divide sections of information and aid navigation. The design was "impure" because it mixed both modern and historic design vocabularies, or more accurately, design tropes. To Wild, design can be viewed as a repository of figurative allusions. Hers is an engaged approach to design because it places the designer at the center of the visual communication process. The designer acts as both the conductor (in the sense that one orchestrates visual content through a conscious will) and conduit (in the sense that the designer provides the means for visual expression) through which form is generated.



Figure 3. Wild's design for Yale Perspecta, no. 19. (Wild, L. (designer), (1982). Cover and interior spread of B. Healy, & N. McBride (Eds.), Perspecta: The Yale Architectural Journal, (19).)

Wild's interest in the immediacies of context and the ambiguities that are otherwise passed over can be traced to a formative experience she had while still in high school:

> "I think it's really funny that I spent the last three months of my high school education working on a paper about Michael Heizer — he had been invited to do a piece at the Detroit Institute of the Arts, and he ended up tearing up the museum grounds by dragging a giant piece of stone across the lawn. This caused a major fuss in Detroit (and got the curator, Sam Wagstaff, fired) but the whole incident inspired me: *how could such a simple act carry so much meaning and elicit such an intense exchange of ideas?"* (Wild, 2018) [6]

Her question underscores the inherent complexity (and contradiction) of unified narratives. Even at this young age, Wild understood that moments of conflict are symptomatic of a bigger issue. These moments of acceptability or repression, reflect the limits of a discourse,

[6] Emphasis in italics is mine.

or as has often been the case in Wild's writing, they reflect the discipline bearing down on what it is willing to accept.

Wild has always maintained theoretical underpinnings, either explicitly through her writing, or through more diffuse forms in her design work. Her writing has ranged from optimistic, "I'm interested in how designers strategize for the future." (Wild, 1998, p. 15) to the less sanguine, "[S]uddenly, the 'graphic' in graphic design seems constrained or parochial." (Wild, 1996, p. 21) But all times, she has looked to the affairs of culture and society, imagining a place where graphic design most vividly communicates the tone of the present. The presence of theory may not be explicit, but her past work — whether writing or design, on through to her current output — reflects an awareness of contemporary directions in design. It is an awareness of shifting societal interests displayed in many of her essays, which often begin with a narrative that describes some mundane or seemingly innocuous personal experience that slowly builds to a unveil a significant conflict currently percolating in graphic design. Wild's approach to writing falls in line with one of her idols, the multifaceted designer Alvin Lustig who asserted that "My relationship to all subjects is unfortunately always personal, so I will start out in that fashion." (Lustig, 1958, p. 12) Lustig first penned those words in 1952, at a time when the cool detachment of Modernism was just beginning to make an impact on visual culture. Lustig's apology runs counter to the universal flattening that Modernism was to level against personal experience.

Wild uses personal experience as merely a symptom of a greater problem that she will soon unpack through reflection and analysis. It is a method to approach design in an oblique manner, not through dogmatic declarative statements or dry academic analysis, but rather though local idiom. Her *contact* (with language – to borrow yet again from William Carlos Williams) is through lived experience, not the language of the ivory tower, and this makes sense given Wild's own explanation of writers whom she admires:

> "When I think of my own critical writing, I think of three people whose criticism I love(d): Alvin Lustig, whose writing always sounded like you were in the room with him, and he was telling you what he thought, then and there, and his thinking was not polemical, but wide-ranging and open (as opposed to Paul Rand's essays, which seemed like he had worked them over to the point that he could then chisel them into stone tablets). Lustig made me realize that it might be more useful to write about what I was experiencing, instead of writing on historical subjects (although I've done that). My other model (and I know this sounds now like a cliché) is Lester Bangs — but I was reading him while I was at Cranbrook already, his criticism in the *Village Voice* was alive, hilarious, committed... again, evidence of someone who really, really cared about what he was writing about. Another writer whose work I admired at the same time (or maybe a little later, the '80s) was Michael Sorkin. He had the nerve to say things that other people would say but not commit to paper." (Wild, 2018)

It is fashionable to describe her work as critical, but I abhor the word (though I have used it). "Critical" is a word which elicits respect, as though somehow, its use bestows greater depth and insight upon whatever it is attached. But no, in fact, "theoretical" is more appropriate.

To be attuned to the vicissitudes of modernity is to be theoretical. In this regard, I share the same view as Mark Wigley, former Dean of Architecture at Columbia University, that "Theory is by definition critical, in the sense of opening up to the other. Critical theory just means not being asleep." (2015, pp. 265–266) (Full disclosure: I was taught by Wigley when I attended Princeton University.) In a constantly shifting landscape, the ability to absorb, digest and apply current tenets of culture in the production of contemporaneous work is extremely difficult. Wild has an uncanny ability to "read the tea leaves of culture," as it were. This is a proposition Wild openly admits, all of which is the reflection of a conscious effort on her part.

> "As I began to read post-modern theory I began to think more about the web of communication, ambiguity, and the opening up of singularity — all of which resulted in more pluralism. And by eventually ending up in California, it was clear that the plural, the impure, the synthetic, and the multi-cultural were more 'true' to both the time and the place that I was working in." (Wild, 2018)

Wild's sensitivity to the "time and the place" of her local context is to be a recurring theme in her work. Her high school experience turned out to be formative one. She recognized that ambiguity was closer to the reality of life than stringent adherence to abstract concepts:

> "I realize by bringing up the Heizer piece it sounds like I'm only talking about art, but that experience helped me to see what the intentions in avant-garde modern design were as well. And as much as I love it, I could not help but notice that the intentions of modern design were either subsumed into the greater commercial culture or it was simply overwhelmed by commerce. But to my mind while this does not cancel out the power of avant-garde modernism, *it does place it in a context that admits that the ideas in modernism were not "timeless" but instead reflected their moment in as vivid a way that I would hope my (or my students') work would also reflect the realities of our moment."* (Wild, 2018)[7]

While this explains the structure that guides Wild's content, there is a much more telling reason which explains the origins of her interests in the continual discord that shapes culture:

> "I think my introduction to real 20th-century modernity came in the form of my very astute AP English teachers at Lake Shore High School. They combined the reading of largely 20th-century literature with readings of criticism. The call-and-response of that experience set me up to understand the trajectory of Modernism; and this was followed by additional readings on contemporary art of the '60s (Minimalism, conceptualism)." (Wild, 2018)

It is a given trope to link the timeliness of a given catalogue's design with the timeliness of the exhibition itself. Afterall, curators often plan exhibitions as a reflection of greater societal interests and public engagement (Burdick, 1996). At the centre of Wild's work, what

[7] Emphasis in italics is mine.

makes it both pleasurable *and* lasting, is a concern with *form*: “I love form, sometimes for good reasons, and sometimes for bad: if I didn’t, I couldn’t function as a designer.” (Wild, 2000) Given the premise that Wild’s work harbours theoretical content, what aspect of modernity preoccupies her thoughts and shapes her practice *now*? The question is not merely rhetorical. It is a key to understanding the development of her work over time. Such a premise is not immediately fulfilled by the single artefact, as Michael Rock surmised, “Because the nature of the designed object is limited, individual objects are rarely substantial enough to contain fully rendered ideas.” (2013, p. 95) Unlike architecture, whose singular and opaque nature shields it from explicit representational statements (unless the client has an interest in one-liner gag architecture), graphic design is ephemeral and in general, communicates a client’s message in a direct manner. In order for the graphic designer to interject her own theoretical position, she must do so over time, via numerous projects, and without supplanting the intentions of the client. “Ideas develop over many projects, spanning years. Form itself is indexical.” (Rock, 2013, p. 95) If we examine a number of pieces from Wild’s oeuvre, common themes and preoccupations slowly emerge (See also Blauvelt, 1998, pp. 60–75).

In the 1980s, Postmodernism was at its zenith, and viewed in a this light, her poster for the Rice Design Alliance (Figure 4) is perhaps one of the strongest examples of Wild’s response to local context. A relatively early work in her career, this poster for a conference on gardens displays a mannerist treatment of the text, which is shaped to echo the forms of the topiary in the accompanying photograph. Classicism is further achieved using Perpetua, a typeface modelled on inscriptional lettering, and the use of capitals and small caps (the use of italics throughout also recalls their use in early printed books, when the italic form was considered equal to the roman (upright) variant and used to print entire books). Another break with Modernist convention: the poster is essentially typeset in relatively small point size. Only the title is set in a large display size, and that too achieves a classical tone via the use of Gill Floriated whose self-conscious reference to a “plant-like” imagery still retains classical inscriptional proportions. What is unusual about Wild’s designs is that while she rejects the aloof or detached nature of Modernism, the quality of her designs — its attention to detail, its response to content, and its awareness of history — means that it still retains its value as an elegant solution without appearing “dated.”



Figure 4. For a short period after graduating from Yale University, Wild taught at the University of Houston School of Architecture and produced for a number of Houston organizations including the Rice Design Alliance (Lynam, 2020). (Wild, L. (designer), (1984). Rice Design Alliance Gardens [Poster].)

Wild's design for *Perspecta* was noticed by American architect John Hejduk, who subsequently asked her to design his monograph, *Mask of Medusa*. (Lynam, 2020) The book's cover typography makes use of American woodtype vernacular (Figure 5). The letters are uneven in proportion. Certain details of the letters are awkward, such as the lack of overshoot on the tops and bottoms of the "O" and "S," resulting in overly compressed counterforms. A dark agonism or alienation underscores much of Hejduk's architectural work at its heart. Hejduk found the notion of the ideal New England small town to harbour currents of hidden psychological darkness: terror is never explicit, but rather exists just below the surface. As if tapping into this unease, Wild's design for Hejduk's monograph is structured in a way that presents an enigma. The reader is thrust into the book if approached in conventional means: an illustration of the head of Medusa, followed by permissions and two separate "Introductions" written by Daniel Libeskind in 1984 and 1978. These are followed by a series of texts written by Hedjuk arranged in chronological order. But the table of contents is located nearly one third of the way into the book, at page 158. The contents spread splits the book in two: Texts are found to the left (pp. 1–157), and design work is placed to the right (pp. 159–457). It is a subtle play on the conventions of book design, but one with great effect: Texts and architectural designs are given equal weight, neither is subservient to the other. They are two books to be read in tandem.

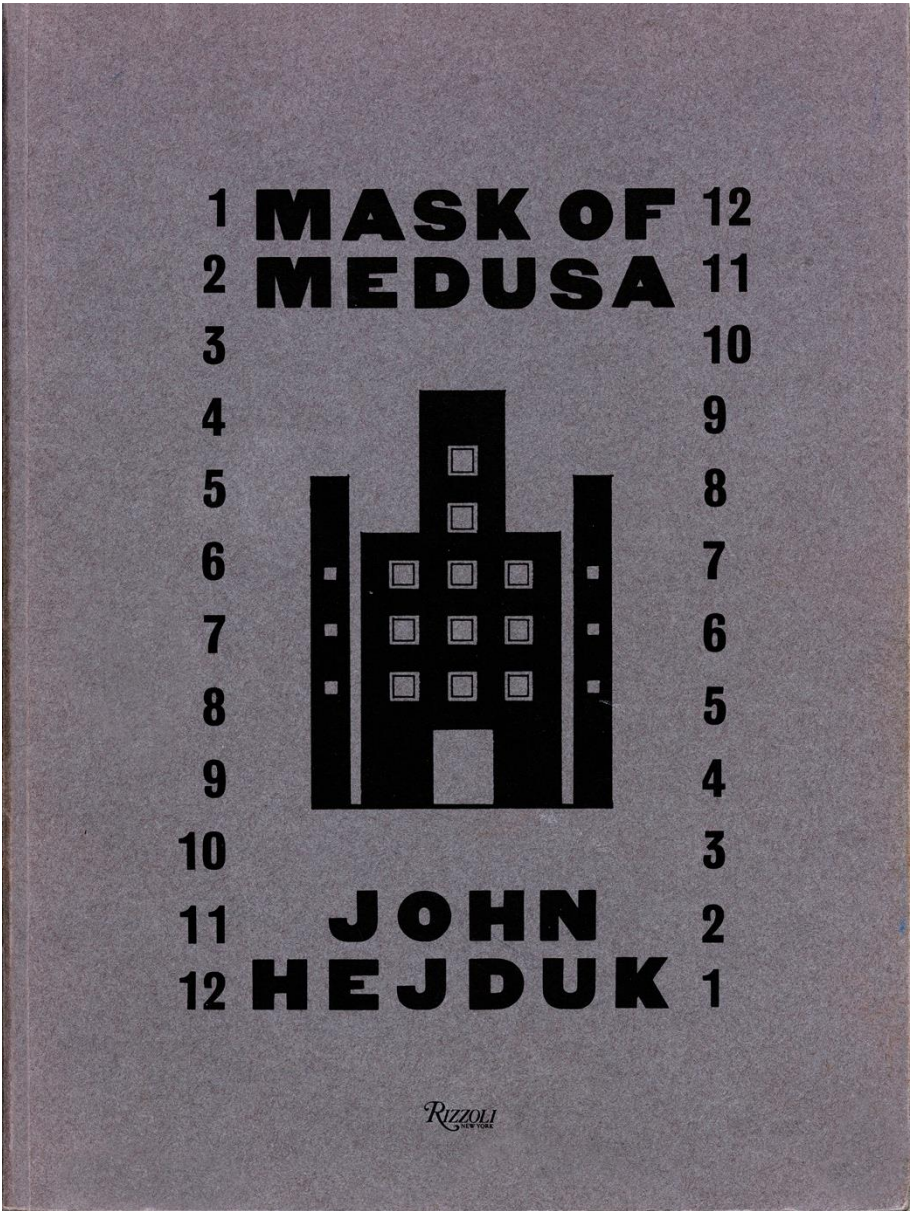

Figure 5. Wild's cover for John Hejduk's monograph, Mask of Medusa. (Wild, L. (designer), (1985). Cover of K. Shkapich (Ed.), John Hejduk, Mask of Medusa. New York: Rizzoli International.)

Wild's choice to use an American vernacular woodtype is an oblique nod to the reintroduction of historicism and the "unskilled" vernacular that would soon take centre stage in graphic design.

Continuing the theme of an "unskilled" context, the CalArts recruitment poster for the Program in Photography (Figure 6) makes use of an Alan Sekula photograph framed by a conventional typeface (Gill Sans), a dot matrix printout, and puerile hand scrawled text. The coarseness of the typography is offset by the masterful interweaving of the differing paragraphs in line with their respective hierarchy. This complex weaving of texts is further enhanced by changes in rag alignments, point sizes and leading. These purposeful misalignments and paragraph intrusions recall the mistakes of a typesetter who has miscalculated and run out of space yet in Wild's hands, they create a delicate visual play without hindering communicative value. The underlying message is that CalArts — and by association, its students — is not afraid to take chances. And while the school welcomes experimentation, it still demands a high level of technical proficiency.

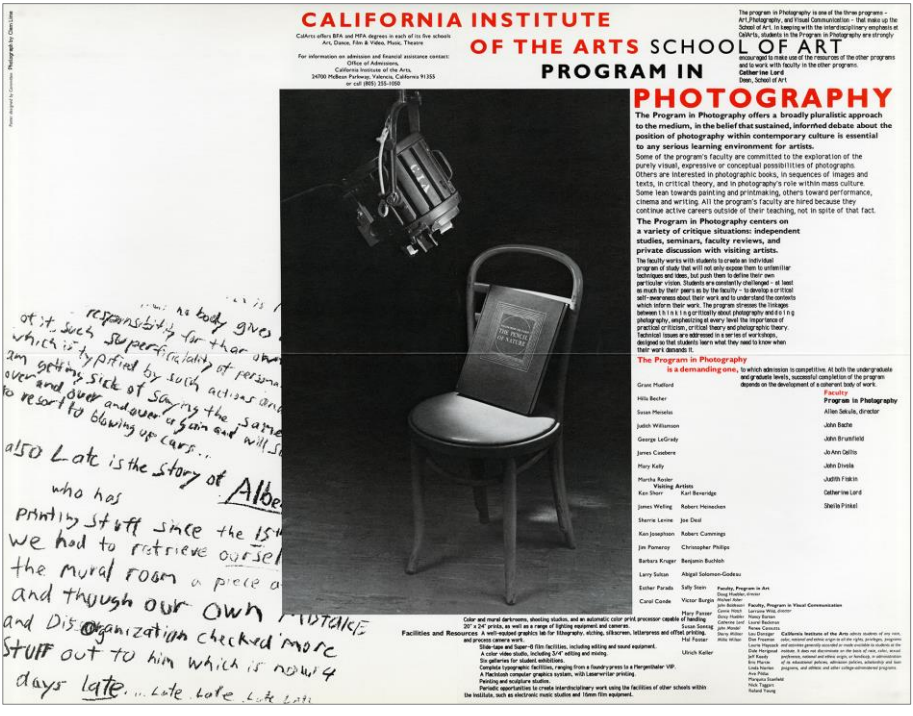

Figure 6. (Wild, L., & Keedy, J. (designers), (1987). California Institute of the Arts Program in Photography [Poster].)

The USC Dean's Hall housing poster is perhaps one of the clearest examples of Wild's ability to read the whims of contemporaneous culture (Figure 7, left). When compared with the poster by Müller-Brockmann of 1958 (Figure 7, right), the two designs share similar diagrams — they merely differ in their respective dressing. Both are responding to the state of modernity at the time when they were produced: Müller-Brockmann's vision is clear, authoritative, and monolithic; Wild's is similarly confident, but her design rejects the mould of universality, its imperfections harbour a growing dissatisfaction with unified narratives.



Figure 7. ([left] Wild, L., & Nugent, L. (designers) (1992). University of Southern California Dean's Hall [Poster]; [right] Müller-Brockmann, J. (designer) (1958). Tonhalle Musica Viva [Poster]. Retrieved from http://socks-studio.com/2016/11/30/joseph-muller-brockmann-musica-viva-posters-for-the-zurich-tonhalle/)

And as a final example, the catalogue for John Baldassari's exhibition at the Los Angeles County Museum of Art is quintessential Lorraine Wild (Figure 8). The book dances ever so lightly between bland corporate anonymity and indulgent idiosyncrasy. Wild has achieved a balance that is so fine-tuned that it is easy to dismiss her design as straightforward. But an examination of the details tells a different story. The book is printed using five colours — the regular CMYK process inks plus an extra Pantone™ blue to match a tone often used by Baldessari in his artwork. To further maintain a link to Baldessari, section dividers are "cut short" using a toned paper akin to cheap newsprint, but owing to the use of the extra blue ink, dividers could never be mistaken for a cheap photocopy or print job. Perhaps most smartly, Wild presents a detail of a Baldessari painting on the cover, the eponymous title for the exhibit, "PURE BEAUTY". Wild uses one of Baldessari's paintings to headline the book, and as both a wink and a nod to painting and book title, the "white painting" book jacket wraps a raw half linen book cloth, like a taut canvas stretched over a wooden frame.

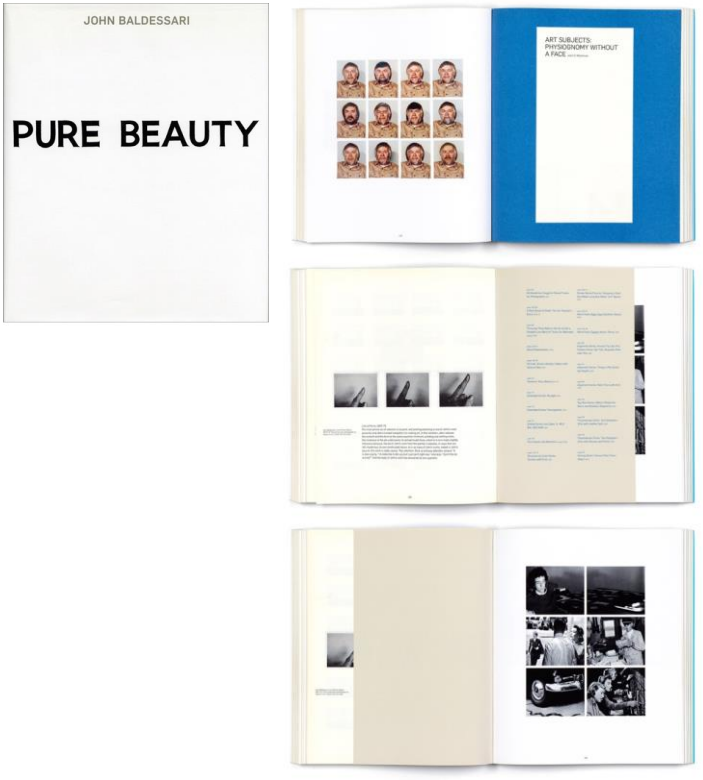

Figure 8. (Wild, L., Hu, V., Lam, V., & Rider, J. (designers) (2009). Cover and spreads of N. Butler, T. Frick, & J. MacNair (Eds.), John Baldessari: Pure Beauty. Los Angeles: Los Angeles County Museum of Art and DelMonico Books.)

At this point, I wish to return to my opening. Ed Fella made the vernacular into art, but Lorraine Wild made the vernacular into graphic design. Like the vernacular, her work is ordinary. This is not a pejorative description. Wild's work is ordinary, but never plain or straightforward. It makes use of numerous mannerist tricks to elevate design beyond the banal defaults of utilitarian commercial taste. Wild has always "skimmed the surface" of commercial design, to be situated just slightly "off" the conventional and banal. It is what has always made her work interesting. "Ugly and ordinary" was a phrase used to condemn the work of VSB, but like Denise Scott Brown, I choose to adopt it as a badge of honor (Scott Brown, 2007, p. 16). Venturi and Scott Brown sought not to condemn the America around them, but to learn from it, to see it as a potential source for design invention. Similarly, Wild continues to look to the state of design — the design of the *now* — with each commission. It may seem dismissive to refer to visual styles, but she has navigated Modernism, Postmodernism, Grunge, Neo-Modernism and the current label, Global Style, and as she has done so, Wild has always presented something more, something to remind the observant reader that the design they hold in their hands is an example of "both-and" — its truth is in its totality. It embodies the difficult unity of inclusion rather than the easy unity of exclusion. (Venturi, 1966, p. 23)

As a historian and educator, Wild is by definition preoccupied with history. And as an active practitioner, she is already operating from an intellectually robust position. Part of architecture's locus of operation involves an awareness of precedent, of what has come before. Such an awareness or self-conscious directive mandates that the architect designer simultaneously define herself in the present and distinguish herself from the past. But while graphic designers are not taught to operate with the same level of self-consciousness, Wild has always maintained an interest in the context that surrounds her, whether it is an immediate needs of a design solution, or current tastes of the general public, or a filial position within the canon. The ordinary appearance of Wild's designs belies the richness of their actual complexity.

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Acknowledgements: The author wishes to acknowledge that this paper draws on research supported by Canada's Social Sciences and Humanities Research Council (SSHRC).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Anticipatory Design and Futures Literacies: A Need and a Hope

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Abstract | Design universities face challenges to their curricula, pedagogies, research and professional practices in the context of a world beset by increased complexity and rapid change. In this framing type paper located in an experimental relational ontology we take up the context and conditions of such change and the development of what we term 'design futures literacies'. These are literacies that are realised in and through designing within a futures view that engages with transformation in the here-and-now, but are linked to near and far futures, and ways to encompass these in the present. We frame this in an experimental, emergent transdisciplinary pedagogy that joins systemic and cultural aspects of 'taking care ahead of time' or anticipation, and how it is connected to design futures literacy development. The paper is situated within an integrated design view of a large educational research project into design futures literacies.

KEYWORDS | ANTICIPATION, DESIGN FUTURES LITERACY, ECOLOGY OF DESIGN FUTURES PEDAGOGY, 'BECOMING-IN-THE-MAKING', 'FUTURES NEGOTATION BY DESIGN'

1. Scope and Status

It is 2020 and as we gather to celebrate CUMULUS' achievements in contributing to design education, practice and research it has become even more undeniable that we live in a world that has increasingly become more complex, systemically and politically (Attali, 2011). We are heading rapidly towards the storm of climate disaster in which scientific evidence gives us just a decade to avert irreversible rises in temperatures and resultant environmental, human and economic demise. At the December 2019 UN Climate Change Conference COP25 in Madrid, leading wealthy nations blocked key agreements about the urgent need to limit carbon emissions and halt irreversible climate change. Within just a few months the Covid-19 global pandemic spread rapidly ushering into the present numerous challenges, intersecting uncertainties and unprecedented consequences. These contexts and conditions, and their present and emergent demands have accentuated that design education needs to urgently encompass critical, active and prospective futures literacies.

We suggest that Design and specifically Design education cannot sidestep these global, societal and environmental contexts, conditions and challenges, as Findeli (2001) argued in the context of 21st century literacies almost a decade ago. Concerning young design students' education, much remains to be done to augment and alter current curricula to prepare them with skills, competencies, tools and methods to work professionally and in research and consultancy. We see this as a matter of helping demarcate for and by design not only what the future is but what it might become (Urry, 2016). How might Design work to creatively and productively offer and proffer inspiring, potential and actual alternatives in shifting the very shaping of survivable futures?

We take up this challenge in a position type paper that addresses two key propositions. The first is design education that is placed in the context of increasing global complexity and change in an age of the Anthropocene, that may be understood through what we term 'anticipatory design' (Celi & Morrison, 2017; Celi & Colombi, 2019). Given the focus of this conference and this track on 'Design Culture (of) Thinking', anticipatory design may be understood as emerging via dialogue between Design Studies and Futures Studies (Celi & Morrison, 2017). On the one hand is the approach of thinking through designing and prospective inquiry of Design Studies. On the other hand, is knowing arrived at via strategic foresight and decision-making of Futures Studies. Between the two lies Anticipatory Design that allows us to focus on 'taking care ahead of time' (Morrison, 2019) within conceptual, systemic and action-oriented learning designs and designs for learning.

The second, related proposition is that design education may be further framed in terms of context and conditions through the development and application of the notions of 'design futures literacies'. These are not only literacies, as skills and competencies, centred on knowing about the future but ones located in design processes, practices and artifact creation.

This entails also recognising that we are entangled in 'the present of the future' (Witzgall & Stakemeier, 2017). Here, the global pandemic has literally dropped the complexity of systems and adaptive futures needs and responses into our present educational realities and their linkages to social, economic, political and cultural contexts. Design education more than ever needs to draw prospective speculative inquiry and design back into actions today. It must question profit and expansion-based logics (e.g. Frase, 2016). Equally, it needs to explore potentials and alternates to growth ensconced in approaches to the circular economy (Charter, 2019). This is important when the environments within which students and graduates live, work and generate design are themselves in flux and are in sore need of deep and durative systemic actions for not only human sustainability but also planetary survival (Wallace-Wells, 2019*).* In the transformative context of South African design education, Snaddon and Chisin (2017) present such an approach within a 'futures-oriented design pedagogy'. Such a pedagogy, as Adam and Goves (2007) noted, is about 'future matters', that is both materially and in importance. In educational terms, for Osberg (2010) this is also a primarily a matter of 'taking care of the future'.

For us such a view on care and education incorporates an anticipatory design view on design pedagogy as 'taking are ahead of time'. This refers to what is central to notions and practices of anticipation and to its materialisations and performances of 'design futures pedagogies'. Conceptually and pragmatically, this is to make bold, informed choice and change in risky times, as Biesta (2013) addresses in his book *The Beautiful Risk of Education*. We argue that design educational risks needed to be framed and enacted in what we call 'design futures literacies'. These are knowledge and practices that are not only about multimodal 21st century literacies and complex and emergent futures, but ones that are realised in and through design. At one level they are encounters and enactments and reflections that acknowledge 'future matters' within design. Meta-cognitively and pedagogically, these design futures literacies are themselves modes of making and shaping futures (Yelavich & Adams, 2014). They are part of Design increasingly understood as a pluralistic making and shaping profession linked not separated form transdisciplinary analytical knowledge building. In the contexts of complex changes in climate, culture and capital mentioned above, Design is compelled to engage, productively and reflexively, with given and emerging demands, needs and potentials for rapid change. What is of great importance is how to develop, trail and review design futures literacies that may critically generate future prospects (Candy & Potter, 2019) while learning to adapt to complexity and uncertainty. Design needs to continue to more valiantly and forcibly cast off its modernist, functionalist planning and consumerist origins.

In this paper we address this through transdisciplinary relational ontological exploration of design pedagogy between anticipatory design and futures literacies. We adopt this perspective to allow for a view about working with design futures literacies that is in a process of creative yet pragmatic becoming. In *Deleuze and Design,* Brassett and Marenko (2015: 1) see this becoming as a matter of materialising possibilities, realising creative activities and enacting of layers of affect.

The paper is supported by developmental pedagogical material and processes within emergent design educational discourses and practices in a European level design educational research project called FUEL4DESIGN (see below for details). The project was established to investigate design education in terms of anticipatory design futures literacies. We were then jettisoned into them by COVID-19. Consequently, as Anderson (2020) notes, this has involved a digital pivot from existing pedagogies to online adaptive ones. This has meant attention to adapting design materialisations and formats from print and face-to-face resources to digital and online environments, resources and pedagogies.

2. Anticipation and Design

Attention to anticipation has been propelled by a recasting of the approaches of forecasting and foresight central to Futures Studies. Championed by Roberto Poli and in the related International Conference on Anticipation series, the notion of anticipation has developed from two primary directions. The first has been from with systems perspectives (e.g. Poli, 2010) and the second from more culturally inflected views (e.g. Morrison, 2017). The approach has argued for an alternate space and means to address matters pertaining to expectations and aspirations, co-creativity and prospective inquiry in addressing, shaping and understanding futures connected with the present (Poli, 2014a; 2014b; 2015). Poli and Valerio (2019) have highlighted the importance of agency in shaping futures, though their focus is not from within design and anticipatory knowledge making but systems theory frames. Design has emerged in the past three decades in particular as a diverse, rich mix of methods and tools, theories and concepts. The large, heterogeneous and transdisciplinary body of research in design also needs to be accessed in a changing, anticipatory informed Futures Studies we argue (Snaddon, et al. 2019; Morrison et al., 2020).

Recently, in its pedagogy and its research, Design has sought to address futures as cultural (Appadurai, 2013), participative and realised via prospective iterative inquiry located in shaping sustainable and survivable futures. This propels us into the complexities of systems, participants and stakeholders, non/human agency, interests, identities and cultural dynamics. Together the making and analysis of design futures needs care-ful attention (Vaughan, 2019). This entails perceptive, imaginary thinking and design-ing (Lury, 2018), the latter about attention to the dynamic practices and reflections of making and shaping futures. We argue further that this is a matter of ‘urgent design’ (Morrison, 2019).

Design education is one domain that is future facing; it needs to face-up to working with uncertainty. Here, there is no ‘future proof’ solution but a set of anticipatory skills and attitudes that we should encourage students to develop. As with creative processes, the ability to anticipate also needs to be trained. This includes keeping an open mind, recognising cultural biases, imagining contexts where concrete solutions make occur, while always mindful of possible engagement, influences and impacts along with connected responsibilities. Design education thus garners a mix of domains and approaches in a layered

and linked curriculum that is increasingly informed by numerous other disciplines and practices as it works within and between them. If we follow the formulation of anticipation being about caring ahead of time, we are able to invigorate the term through design with the temporal, the spatial and the performative.

Further, we suggest the term allows design to access and appoint anticipation to design as making and shaping futures, a reflexive mode of 'becoming-in-the making' as it were. In short, this is about not merely an adjectival antecedent to design or a dismissal of other domains and views. It allows us to engage more fully with devices and tools from Futures Studies such as Voros' (2003) generic foresight process framework and access Celi's notions and framings of Advanced Design that are concerned with long term perspectives and ongoing innovation. This may be in the uptake of design fiction (Celi & Formia, 2015), regarding aesthetics (Celi & Formia, 2017) or with respect to politics, publics and design co-creativity (Mazé, 2019).

Taken together these aspects amount to what Zamenopoulos and Alexiou (2007) labelled 'an anticipatory view of design'. By this they meant design is about both envisioning futures and working as a catalyst for change. More recently, Celi and Morrison (2017) mapped differences and overlaps between Futures Studies and Design Studies in their contribution to the *Handbook of Anticipation*. They note that:

> Design deploys prospective techniques such as sketching and prototyping to carry concepts, potential and possible directions further into development and distribution, thus making visible products, services and interactions that are embedded in designerly processes of abductive reframing. (Celi & Morrison, 2017: online)

Building on design's abductive, assemblage-like modes of inquiry, amongst others, design research and education have also been characterised as making and shaping anticipatory knowledge. This Celi and Colombi (2017) interpreted in relation to trends, as shifting between potential futures and concrete actions. Such views have been further framed in terms of the changing conditions and forces of the Anthropocene. Here Celi and Colombi (2019) address issues of design futures literacies as needing to build awareness.

3. Design Futures Literacies

Design education is central to the genesis and the longevity of CUMULUS. As Design Studies has emerged in its own right as a transdisciplinary domain, research into design has flourished. However, research into design education and attention to design literacies has been less evident than other areas of inquiry at a time when literacy studies in education have blossomed. There, literacies have morphed into a complex of digital and multiliteracies (Cope & Kalantzis, 2009, 2015). Most recently this has extended to connected learning (Ito et al, 2010) and learning out of school via the concept of learning lives and a fluid ontology (Erstad, 2013) as well as 'learning futures' (Facer, 2011).

Design education has also morphed from the original industrial design-infused Bauhaus studio models to digitally tooled and mediated design education (Ehn, 1998). Design education has moved into real world settings, though innovation in participative design methods and modes of research. In learning terms, Jornet and Roth (2018) argued such changes can be understood as transitive and intransitive, where the focus is on growing or coming into being. For design education, this is possible due to its fluid disciplinary ontological processes and pedagogies that place the learner at the core of activities and articulation.

Just as language-based and book-centric literacies in higher education have been augmented by a mix of media, modes of making and producing (Sheridan & Roswell, 2010), so too have design educators and students been shifting design pedagogy and research beyond the studio and gallery and into the work place and popular and public cultural arenas. Design today is multimodal; it has shifted into intangible services as well as tangible activities in the world; it encompasses individual and shared expressions and is materialised through co-created experiences, in making, consumption, mixing and reorientation. At the same time design is seen to be pluralistic (Escobar, 2018) and in need of more fully acknowledging and accessing diverse cultures and knowledge forms, such as Burns (2015) argues on learning about sustainability from ecological systems and indigenous wisdom.

Many of these matters are also future matters and matter for the future to return to the earlier notion. The term 'futures literacies' (FL) has been championed by Miller (2007, 2018) especially via UNESCO. Futures literacy 'is the capacity to explore the potential of the present to give rise to the future' (Miller 2007: 347) in a sequential model of awareness, discovery and choice. For Miller (2007: 360):

> By combining an openness to the potential of the future with a greater ability to invent stories that make sense of the present, FL produces strategic insight without prejudicing the autonomy of people in the future to see different options and hold different values. Still, FL is only a tool.

Most recently Miller has assembled a collection of writings on futures literacies from across the globe. They point to the growing awareness of learning with and for futures. However, and despite it featuring in the field of Anticipation Studies, Miller's work seldom connects directly with or is co-authored with the field of design.

We see an urgent need for design to develop 21st-century design pedagogies that are anticipatorially reframed as 'Design Futures Literacies'. We coin the term to highlight that design is central to these literacies in domain area knowledge and experience but in that design is also a verb and a means and series of rich methods for realising futures literacies. Here we could further demarcate a set of 21st century literacies that are easily located online. However, these too do not include design as a making mode of expertise and understanding.

Missing for us is that design is an ontologically relational and fluid knowledge domain (Marenko & Brassett, 2015) that uses a variety of senses, modes of representation, mediation and communication. It makes material in material experiments; it seeks to find ways rather than merely map found routes. For Stuedahl (2015) this is a matter of making connections and relations between design, participation and learning. We ought here to heed the earlier words of Margolin (2007: 15) who cautioned us to consider how to create an ethics of designing as 'a collective task for the design community whose grasp of the future will continue to determine how we live in the present'.

Grasping the future in terms of connecting anticipation and futures literacies via designing may further be understood as creating 'new perspectives of how individuals, groups, institutions, systems and cultures use ideas of the future to act in the present' as is posted in the *3rd International Conference on Anticipation* (anticipationconference.org). The agency of educators and students in realising their ideas and collaborations is central to this pursuit (Morrison et al. 2019). Soo too, is the making, manifestation, creativity and critique that are needed in imagining, developing and assessing relational ontologies in 'futurescaping' via design (Raymond, et al., 2019). This may entail a radical rethinking of design education where pressures and needs - climate to resources to pandemics – will have to be reconfigured to meet earlier presumptions of boundless consumption, exponential growth and profit before planetary sustainability.

5. An Ecology of Design Futures Pedagogy

We take up such views in a transnational, transdisciplinary design educational research project called FUEL4DESIGN, with focus on discursive, pragmatic and design cultural core elements and relations to situating design knowing. The design futures literacies we address connect teaching and learning to provide an education for young designers for designing for complex tomorrows through six related actions and open access tools (Figure 1).

Recently, in education research (Jackson, 2016; Cope & Kalantzis 2017), and in design-based pedagogy entailing futures (Snaddon, et al., 2019), interest has emerged on learning ecologies. The FUEL4DESIGN (F4D) project may be positioned as an exploratory and experimental project, rich in envisioning, keyed into action via developmental design processes and reflexive modes of becoming in and through design activity.

The main objectives of the project are to develop, test and implement new approaches and resources to provide learners and educators with innovative and adaptable tools to imagine, perform and enact a plurality of futures by design. This is to equip design learners and educators to deal with real-world issues on techno-digital futures, climate crisis, and political instability. We will connect experimentation and design theory via invention, imagination, speculation, and through design-making activities such as via prototyping, scenario building, and foresight, with the aim to insert and hybridise futures methodologies into design creative processes.

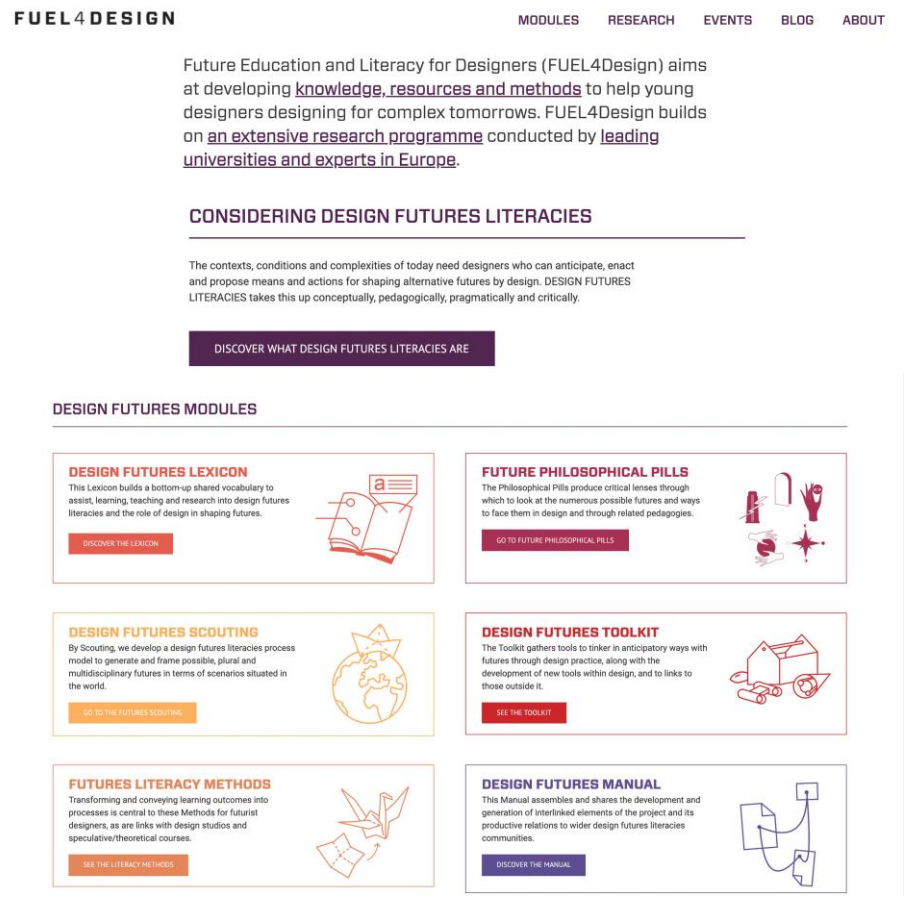
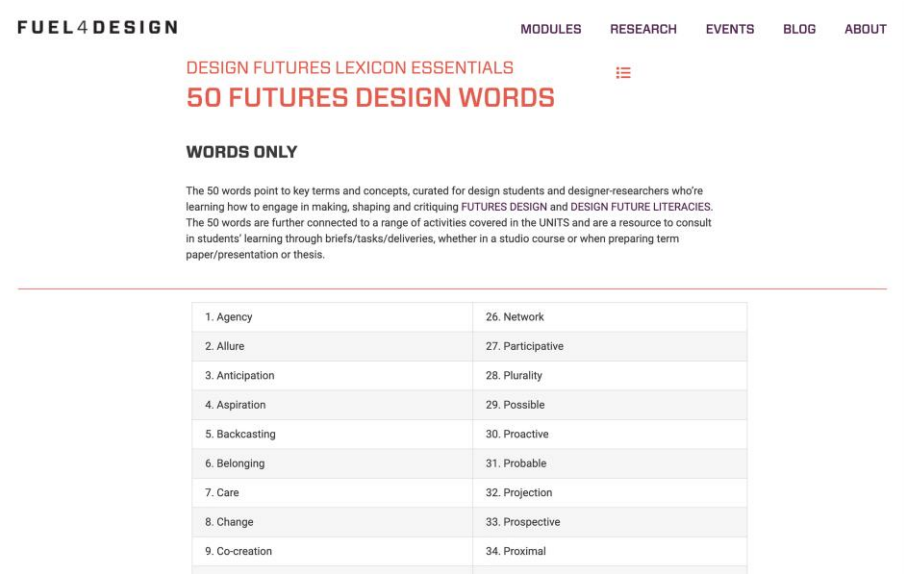


Figure 1. Screenshot of FUEL4DESIGN website. The modules represent work-packages where all resources produced are archived. The website serves as a communication device as well as an open-access platform.

Focusing on anticipatory skills and future making actions, F4D addresses the professional development of educators actualising and nurturing a design teaching approach through the exchange of good practice and cooperation inside the project network and with stakeholders, and using educators as multipliers of anticipatory design inquiry. To support this, the project offers specific 'devices' for a Design Futures Literacy initiative that includes a *Design Futures Lexicon* to build a bottom-up and shared vocabulary for working with design futures, supported by a set of *Futures Philosophical Pills* that allow educators to better diagnose ideas, and practices of the future to inform prospective design education.



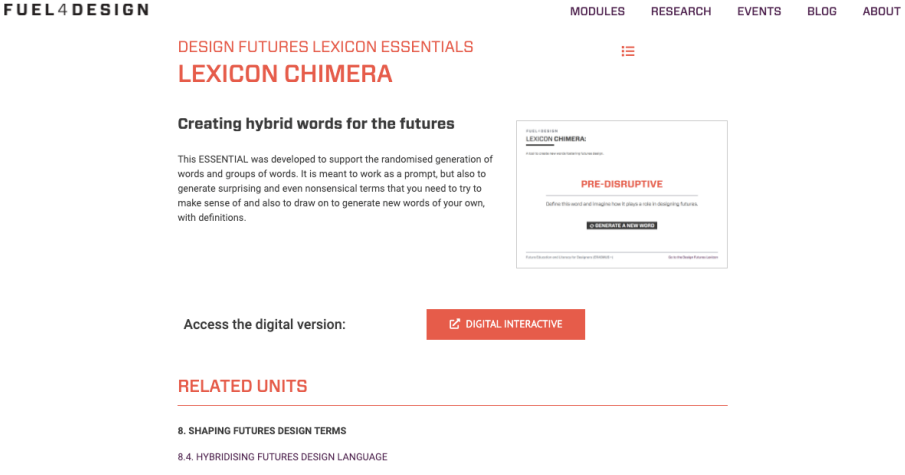


Figure 2. 50 Futures Design Words, one of the many resources from module Design Futures LEXICON on FUEL4DESIGN project site (top); the CHIMERA combines words from the LEXICON randomly online (bottom).

We have developed student-centred, hands-on training approaches called *Design Futures Scouting* to support iterative methodologies for futures making through design and empower teachers to teach future related design providing skills to generate and frame future scenarios that are plural, performative and multidisciplinary. A '*Design Futures Toolkit* is also being delivered, with innovative practices and pedagogies to nurture and connect design curricula with design future driven activities. The tools will allow both the students to tinker with future through design practice and the educators to activate and to assist reflection on the project processes and practices through a roadmap.

Futures Literacy Methods will in 2021-2022 provide a training course of modular units in multidisciplinary futurist design learning. The methodologies will be gathered in a *Design Futures Manual* that will draw together content and experience and provides routes to work with other HEIs, policymakers and EC level futures literacies strategies and programmes. The *Design Futures Manual* aims to increase the uptake of design future and anticipatory subjects to address skills shortages affecting future thinking, and - as a final output of the project - can be considered as an instrument to tackle gap between design education for futures and emerging and pressing societal and environmental challenges.

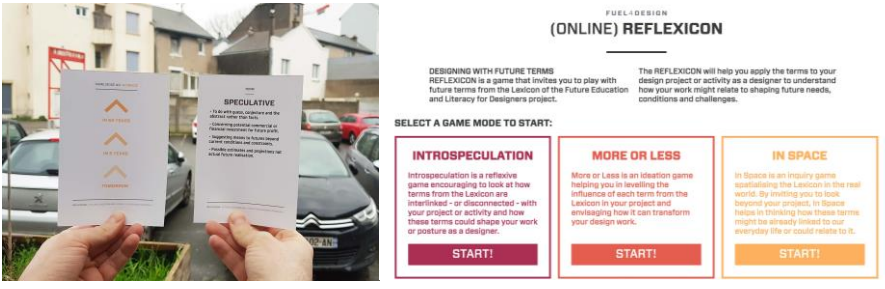


Figure 3. The REFLEXICON card game from the LEXICON (left); turned into a web-based interactive (right).

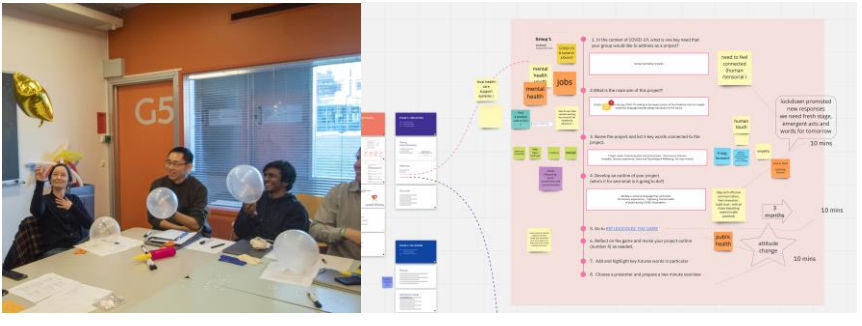
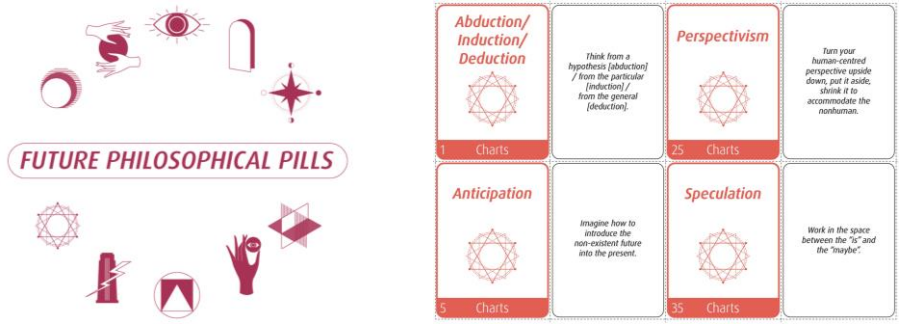


Figure 4. BALLUSION Workshop from the LEXICON with AHO PhD students (left); a Zoom and Miro Lexicon Workshop at the RSD9 Conference (Dudani & Morrison, 2020) (right).

The project has completed the first two devices with work underway on the next two on process redesign and futures tools. The *Future Lexicon* addresses matters of futures inquiry in design to better demarcate what is meant in the growth of terms connected to potential, probable, possible and projected change. It moves beyond traditional static glossaries and is designed to engage students through novel design learning activities, needed in sharpening the definition of concepts and their application in contexts (Figures 2-4).

Philosophical Pills furnishes educators with a systematic matrix of philosophical insights in ways which are tailored to expand, deepen and intensify the criticality and reflectivity in futures design education. Each Pill can be read in a systematic grid and theorical framework where concepts descriptions intersect with fields of application, clarifying potential use through various practice narrations (Figure 5).

Connected to these two items, we have delivered two short term design teacher training events and two intensive study programmes with Master's and PhD students (Figure 6). This was done to trail and circulate our inputs and their outputs, and will be connected with two proposed trans-national 'multiplier event's for futurists, design educators and professionals.



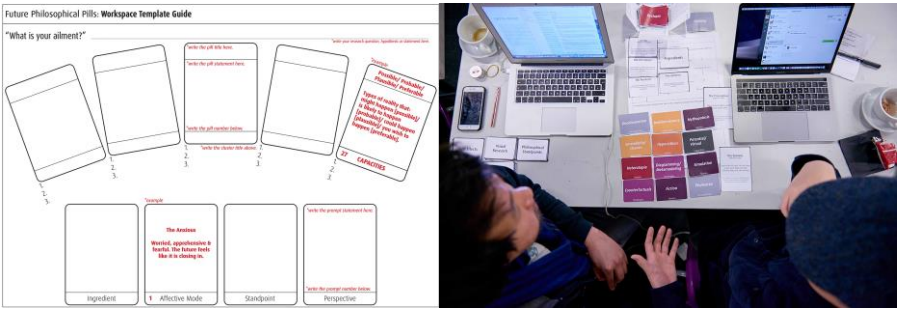


Figure 5. (Top) Introduction to Future Philosophical Pills (left); Future Philosophical Pills shown as cards (right).
Figure 6. (Bottom) The workspace template for using the Pills (left); Design Master's students trying the cards in a classroom setting (right). Photo by UAL.

The Design Futures Scouting module has a generative approach to describing futures scenarios rooted in design practice and it is designed to be forward looking, student-centered and participatory.This Design Futures Scouting module proposes an exploration of emergent futures by integrating disciplines using methodological tools that encompass quantitative and qualitative methods, and desk and field research, acknowledging design action as the main driver and tool which engages in materialising futures. Through this process, students will enact their own framework of futures.

The *Design Future's Toolkit,* is being built on a systematic methodology and extensive research on the current available methods collections and toolkits for futures and design. A selected but expanded set of tools was trailled in a transdisciplinary workshop in order to understand their usability (Figure 7). The kit consists of different devices that can be associated with different functions and different outputs and objectives. The intent is to offer designers, students and teachers an array of guided opportunities starting from the goal they want to achieve.

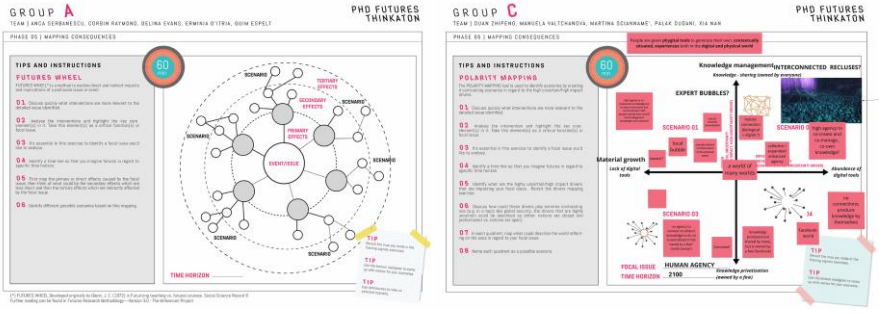


Figure 7. Screenshots of tools explored by the module The Design Future's Toolkit (left); one selected tool trialled with PhD design students in an online workshop (right).

6. Conclusions

Design is one of few multi-disciplines that works creatively and pragmatically with the future. It does so through acts of making and projection to produce products, services and interactions beyond the strategies and demands of the here-and-now. Design is poised to play a far more vibrant and proactive, yet prospective, role in addressing real, emergent and unforeseen needs where literacies of and for tomorrow need our shared attention today and in medium- and long-term futures. Yet we are 'designing in dark times' (Staszowski & Tassarini, 2019) and as we stated earlier there is an urgency for design in the window of opportunity to avert unstoppable climate change. That said, our future products and services will likely demand increased attention to care and ethics while design will continue to be experienced as a matter of problem finding (Marenko, 2018).

Design may work with what is just beyond reach, with the emergent and the planned, but also with the imagined and the prospective. These are its best capacities. Yet, when a Master's in Design takes five years, today's intake of new students will only start work in 2026 with four year's direct contribution to what we might go so far as to label the 'Decade of Urgent Design'. Yet we will have 10 sets of master's graduates in that period. In 2019, 299 design school members from 56 countries were listed in CUMULUS, so this could amount to a massive series of graduates during the five-year period. These are design graduates that typically go into work with design companies and bureaus, with various public sector interests, community stakeholders and public participation.

These students will work directly in this decade of urgent need and rapid change. It is this they need to be prepared to meet and to work within by their teachers and via research and knowledge of changing professional practice. To some extent, along with others they will work to avert the storm; in other senses they will find themselves right in the heart the storm as they strive to confront, re-negotiate and co-creatively fathom and fashion alternatives to assumed practices and values.

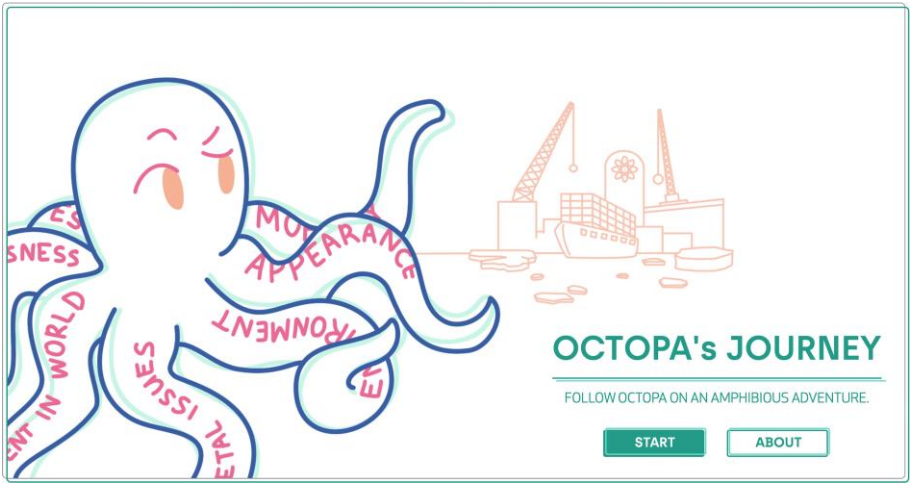


Figure 8. The LEXICON was embedded in a narrative based game-like activity called OCTOPA'S JOURNEY. Developed in collaboration with the Amphibious Trilogies project and design-friction.com, the activity involves participants in an interplay of movement words from the LEXICON and satirical scenarios switching between time, place and personal choice.

This is apparent in a collaboration between FUEL4DESIGN and a related art practice project into extended choreography and mediated design communication. This is realised in a satirical and playful online activity relating to amphibious adaptability in the context of the Arctic, movement related language, historical and emerging geo-politics and the changing trade and cultural dynamics of the Northern Sea Route (Figure 8).

For our graduates and ourselves as educators, a 'futures negotiation by design' will need to be enacted when expectations and pressures mount as the 'deep-time' and systemically intertwined forces of the Anthropocene become manifest. This is especially so while we are adapting to and together working our way through the uncertainties of the global pandemic. Our design futures literacies do not seek to propose solutions or patterns but a critical set of opportunities to ask apposite, awkward questions and support diverse debate (Poli, et al., 2020). They reach onwards and outwards to collectively imagine and discuss possible futures paths through envisioning practices that are anticipatory and remain hopeful in character.

As we end the tumultuous 2020, it is undeniable that we face urgent needs to prepare students to be able to work, prepare, meet, imagine and anticipate futures. These are days and worlds, lives and interactions, actors and systems that we need to envision in the short term, in the mid-range and for the distant future. It is these timescales that need to be connected and related, located and projected if we hope to design within, into, for and with creative and critical futures shaping that will ensure survival. We see design education as central to wider collaborative societal and planetary futures. In these wider futures, design futures literacies are ones that elaborate on futures literacies. Design futures literacies work to connect purposes, forms and practices of reflexive design education realised through continual, critical and anticipatory 'becoming-in-the-making'.

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Acknowledgements: This paper is an outcome of the FUEL4DESIGN project (Future Education and Literacies for Designers) (www.fuel4design.org) funded by the ERASMUS+ Strategic Partnership Programme of the EU (Grant Agreement 2019-1-NO01-KA203-060181). The project members are: Oslo School of Architecture and Design (AHO) (project leader, Norway), ELISAVA (Spain), Politecnico di Milano (Italy) and University of the Arts (UAL) (U.K). We would like to thank the anonymous conference reviewers together with our colleagues, students and participants who contribute to the project's dynamic present and futures.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Authorship and automation in digital design culture

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Abstract | The nature of the transformations produced by the diffusion of digital technologies within design, production and construction in architecture is radically reconfiguring the architect's role as "author". The contribution aims to analyze the cultural implications of this assumption, examining the consequences that both building process management systems, such as Building Information Modeling, and parametric form-finding strategies by algorithm-based technologies are affecting the traditional authorial model in architectural practice. The text compares some significant theoretical positions and design experiences to highlight the epistemological changes in contemporary approaches to design process which, from an eminently intellectual activity that can be traced back to the work of a single defined author, is seemingly shifting to a different authorship that operates in a collaborative environment, thus determining a co-evolutive relationship between man and computer, to which is delegated an increasingly wide range of autonomy.

KEYWORDS | AUTOMATION, AUTHORSHIP, BIM, PARAMETRIC DESIGN, DIGITAL ARCHITECTURE

1. Introduction

Since their first diffusion in the ‘70s, ICTs in construction industry are becoming a consolidated reality and are today experiencing an even wider adoption. Despite many researches, by the second half of the last century, were already underway to investigate the relationship between computer science and architecture (Russo Ermolli, 2020), the development of computational machines to process ever increasing amounts of data at lowering cost is allowing digital technology to find application where the growing complexity of design-related issues, together with the fragmentation and the raising number of actors and of specific skills involved in the construction industry, is expressing a demand for change in design process management (Campioli, 2017).
Indeed, the “atomization” of the building supply chain seems no longer suitable to deal with the general need of construction quality, especially in consideration of the technical potential of file-to-factory technologies and computational design processes, which are leading to the progressive dissolution of traditional professional figures and are shrinking design with its implementation, bringing conception and production together and making the design, engineering and construction phases more interdependent. In their overlapping, therefore, digital building processes are increasingly configured as activities of "complex thinking", characterized by being dialogical, as a result of an interdisciplinary comparison that goes beyond the specificity of one single discipline; hologrammatic, incessantly animated by the comparison between the whole and its parts; recursive, so that the sequencing of phases is replaced by a reiterative deepening, in which each local update involves a global modification, and vice-versa (Morin, 1977).
Hence, digitalization implies profound transformations in design culture, changing the identities of the operators involved and their mutual relations, the tools used for design concept, development and management and, eventually, the goals of the building process itself.

2. Digitalization and the role of authorship in design practice

2.1 Digitalization between informatics and information

According to Lluìs Ortega, the dissolution of authorship caused by the progressive automation of design processes is one of the main issues emerging from the introduction of digital technologies in architecture. Digital is undoubtedly a "challenge" for established praxis in the construction industry, which is impossible, in any case, to ignore: whether it is considered, as a mere instrumental update, to be devoid of a substantial cultural impact on architectural practice; whether it is understood as a communicative medium with an influence on the whole design process, from conception to realization, up to the introduction, already in the heuristic phase, of automatic thinking and artificial intelligence procedures; eventually, whether it is associated, as a co-evolutive system, to a new way of

considering the relationship between designer and computer, whereas man and machine collaborate in an epistemic extension of design (Ortega, 2017).
Among these paths, undoubtedly the most debated in contemporary design is the latter, which opens to the understanding of the different ways digital can take within design processes, in terms of morpho-technical exploration, design optimization and performative control. Moreover, it is above all the presence of data, in ever raising quantities and of increasingly quality, to require the designer's ability to extrapolate those "structures" of information that, regardless of the technological nature of the tools in use, have always been essential for communication within the ecosystem of operators responsible of design's physical realization.
Engelbart describes, in the Sixties, an "augmented architect", foreseeing some of today's topical elements: the importance of data and information; the relationship between man and machine in terms of demand and response; design as an automated creation of multiple scenarios. In this vision, the architect's figure seems to hover between the observer and the examiner of different options deriving from the automatism of computational systems' generative potential, which replaces the representative capabilities of traditional tools (Engelbart, 1962).
In this sense, the very cognition of digital, from a "tool" to mere speed up operational processes, is evolving towards a greater awareness of how it constitutes a design "ecosystem", within which computer is no longer just an object, but it's rather becoming an "intelligence" with which architects can start a real dialogue, based on a grammar of data and information. In this way, we can consider the emergence of the potential attributed to digital design tools and the transformation of designer's role closely related to each other. Digital in architecture would even trace new epistemic boundaries of design disciplines, proposing itself as an alternative value system to traditional principles of design culture, reframing a unique cultural environment.
In this regard, Negroponte underlines that the difference between "computerized" (merely digitalized) and "computer-aided" processes lays the foundations for a "New Humanism", in which human being can "exploit the unprecedented potential of computers to create and solve problems in a completely different way, collecting and analyzing in a short time a huge amount of data and using new techniques and tools to guide and improve the design and quality in construction, in order to save time, money and reduce waste of materials and resources" (Negroponte, 1969; 1995).

2.2 Digitalization and Automation as a style

The ease, made possible by the first CAD systems, to create complex geometries from curves generated as interpolation of control points (Spline) and the subsequent manipulation of surfaces with multiple curvature degrees (Nurbs) triggered the birth of a proper architectural style, known as "Parametricism". For Patrik Schumacher, "Parametricism" was born out of a global convergence, rooted in digital animation techniques and programming methodologies

(scripting), configuring itself as the latest style to succeed the Modern Movement, pointing out the effects that digitalization would have on the way designers work and their formal results (Schumacher, 2009). As a style, defined by the aesthetic outcomes of his process, Neil Leach questions the meaning of terms such as "digital design" or "digital building", referring to objects and artifacts that can be recognized in terms of style.
According to Neil Leach, digital can be related to certain types of tools, as well as to certain types of processes that lead to the definition of a project: a building can be designed through digital methodologies and tools, but, as a physical fact, it cannot be defined itself as digital. Digital could therefore not be related to an architecture, a product, but rather to a process, or to the tools allowing to operate in that process (Leach, 2015). From a stylistic, and therefore phenomenological point of view, Leach wonders whether a building produced by digital processes could be defined digital, and what characteristics do these methodologies attribute to digital architecture, to "digitalism" or "parametricism", so that it is stylistically recognizable and referred to digital architecture. The Guggenheim Museum in Bilbao (Figure 1) and the Disney Hall in Los Angeles (Figure 2), both works by Frank O. Gehry (recognized as one of the inspirers of the parametricist movement), present similar stylistic traits, although they were built in two different decades (in 1997 the first; in 2003 the second) and were designed using completely different instruments.

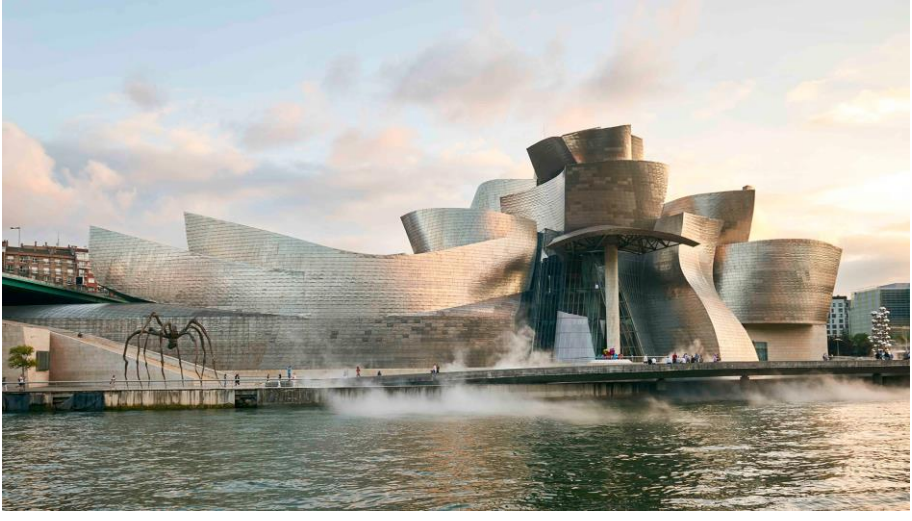

Figure 1. Guggenheim Museum Bilbao designed by Canadian architect Frank O. Gehry and inaugurated on 1997.



Figure 2. Walt Disney Concert Hall designed by Canadian architect Frank O. Gehry and inaugurated on 2003. As pointed out by Neil Leach, though almost ten years passed between this project and the Bilbao one, their style looks similar despite only the latter was designed using digital technologies.

Calling into question the theory of affordance (Gibson, 1979), Leach addresses the birth of digital architecture to a misunderstanding of the role assigned to digital technologies, which might allow innovation in architecture, but only in an indirect way. The question, in these terms, is about the new relationship established between meaning and signifier, that is, to a perceptual mechanism: an architecture may be considered digital if, from an aesthetic point of view, we find it as the result of a digital process, thus it is possible to make a transliteration from the technique that contributed to its creation to its phenomenological and stylistic characteristics.
Scott Johnson poses two questions about this: the first is the possibility that designers may begin to think differently because of the use of digital tools in design, and the second, consequently, is if the very outcomes of digital design processes should seem different, i.e. whether the digital has phenomenological characteristics that can be read as such, regardless of the awareness of the process that led to its creation. In the form of "binary oppositions", in which two representatives of "yes" or "no" present their positions, Scott Johnson's contributions do not give an univocal answer, but rather the sense of a debate that, to date, is still ongoing (Johnson, 2000). Yet, it shows how digital in architecture is often

read in terms of design aesthetics, determined by our understanding of digital processes, rather than design knowledge.

2.3 The Author as a Selector

Computational design allows a different transposition between thought and action, between reading and interpretation of phenomena, opening the possibility to analyze multiple scenarios in search of a wide range of solutions. The shift to a simulative paradigm from a representative one (Ross Sheer, 2014), driven by the rise of computational tools of form-finding and topological optimization as well as file-to-factory production systems, has lowered the access threshold to the exploration of unusual morphological solutions, resulting from evolutionary and selective processes (Frazer, 1995). In these cases, the traditional approach, typical of the authorial design method derived from the Renaissance tradition and based on the priority of design over its physical realization, seemingly loses its centrality in view, on the one hand, of the collaborative logics supported by the diffusion of BIM-based simulative platforms, on the other hand, in the forehead of the growing weight that automation assumes in computational processes. In this sense, the contribution of digital machines and software is topical, as they "are devices to get together wide design freedom and strict control over creative outcomes" (Corbellini, 2016). If in the first case this is made possible by the "automatic feedback" that parametric design systems, based on algorithmic scripts, can manage in the relationships between local and global modifications in the model, in the second case an ambiguous cause-effect relationship of generative processes emerges, in which the "cultivation" of forms assumes autonomous and random connotations, while the role of the designer is to check the plausibility of the "fruits" of these evolutionary mechanisms. One of the most interesting examples of recent years is, in this sense, the MaRS project, developed by the Living Lab design unit of Autodesk (2017; Figure 3, 4, 5).

The reconfiguration of the new offices at the Innovation District in Toronto has been led through the generation, evaluation and evolution of thousands of different design solutions, developed by the computational power of visual programming software according to the interaction of multiple constraints.
In Notes on the Synthesis of Form, Christopher Alexander already warned about how design problems of such complexity risk remaining unresolved, rather discouraging designers and leading to arbitrary solutions (Alexander, 1964): the post-digital era designer is confronted with a selective process in which the risk is to make a choice that, eventually, finds its justification not in a logic based on the evaluation of results, but rather in the very fact that it has been made. Digital design should, instead, always be the result of a considered choice, albeit among a wide range of possible outcomes. These solutions, however unexpected they may appear, are the result of a research driven by the designer himself, who has the task of "freezing" a configuration, in the "infinite" generative dynamism of algorithmic systems, establishing when the design process is really "finished" (Mitchell, 1990).

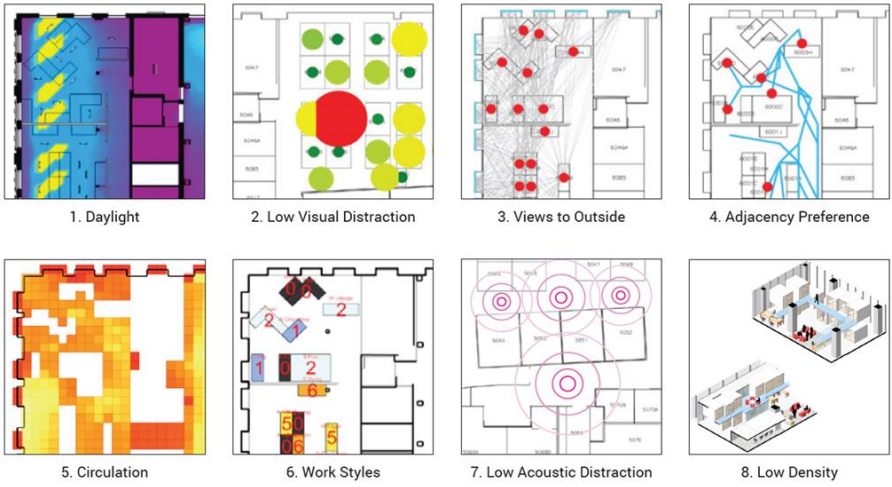

Figure 3. The Autodesk new offices project in the Toronto MaRS innovation district exploited the potential of generative architecture design, introducing qualitative assessment systems in the quantitative processes of space programming. The power of computational systems has allowed to generate, evaluate and evolve thousands of design options, in order to satisfy all the performative architectural requirements.

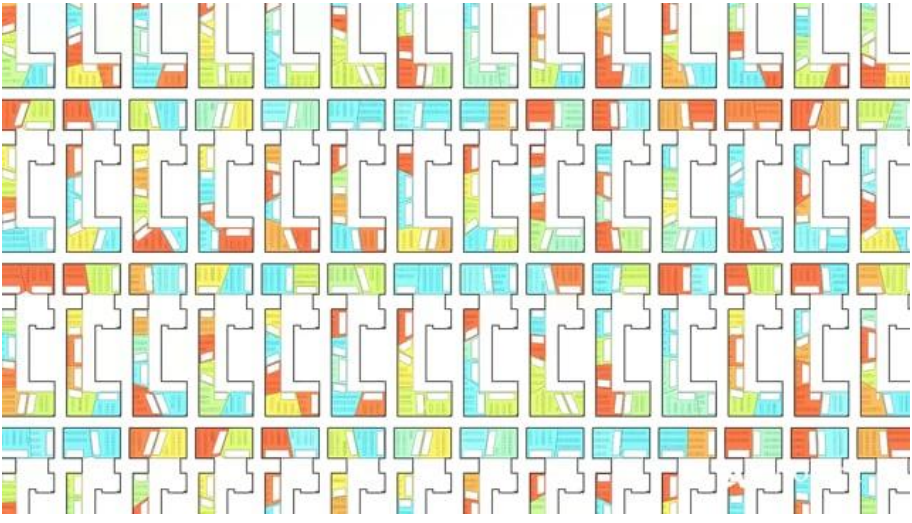

Figure 4. In the case of The Living project, an advanced unit of Autodesk for research and development, the many parameters involved (acoustic comfort, solar lighting, visibility, aggregation preference, minimization of disturbance factors, etc.) worked as input drivers,

selected by the architect, for the generation of thousands possible outcomes, selected by the software.

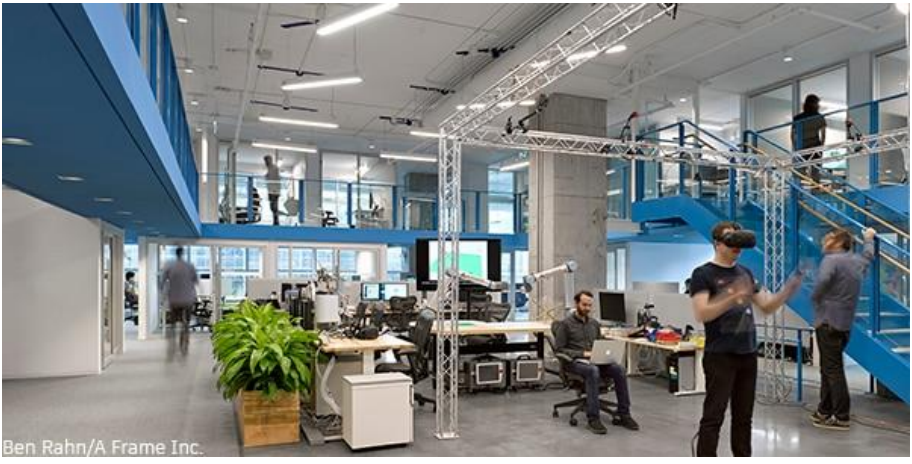

Figure 5. The well-being of workers was the declared design goal: new ways of working required new ways of designing working places.

If, according to John Chris Jones, digital represents the key to a scientific reconfiguration of design process, through which overcome the artisanal paradigms of "trial and error" also typical of heuristic design processes (Jones, 1970), according to Chris Anderson digital would open the door to an epistemology based on algorithmic, abductive and non-causal methods (Anderson, 2008), which, as Mario Carpo points out, allow to consider a computer not as a good engineer, but as a good craftsman. The main feature of digital design methodologies is in the possibility of "searching without sorting", delegating to the analysis potential of computers the burden of verifying infinite design solutions to allow the architect (a sort of post-digital craftsman) to select the “best fit” according to automatic procedures, but also to his own sensibility (Carpo, 2017).

3. Sharing authorship between Automation and Collaboration

3.1 The Authorship of processes

The multiplicity of agencies involved in digital processes, in which the traditional disciplinary boundaries dissolve in the wake of an ever-increasing demand for innovation, implies first of all, as Giovanni Corbellini observes, a greater weight assigned to process than to design itself, often explicitly manifesting its role through the emphasis on the use of diagrams,

schemes, simulations and analysis in the formulation of operational strategies, opening the doors of the so-called "project kitchen". Corbellini affirms: "What was once jealously hidden today is made explicit; in other words, the processes of conception and negotiation with reality have reached an importance comparable to that of their formal outcomes and physical concretization itself" (Corbellini, op.cit.).
While the movements associated with parametricism, as postulated by its theorist Patrick Schumacher, aim to explore the morphogenetic potential of computational tools through the use of selective and evolutionary criteria for the implementation of form-finding processes, BIM-oriented tools have evolved from a mere managerial system to a real collaborative, integrated and simulative design tool, in the direction of an increasingly effective control of the building process in relation to a closer link with industry and standardization. From a systemic, object-based point of view, such as BIM, one must "start with the end in mind". That is, if in this case emerges an absolutely teleological view of design process, in Bruce Mau's vision, for example, design should keep completely heuristic. As Bruce Mau affirms: "the process is more important than the result. When the result guides the process, we will only go where we have already been. If the process drives the result, we may not know where we are going, but we will know that that is where we want to go" (Mau, 1998). In this sense, Ortega notes that: "Computer's capacity to serve as a mediator between designer and design turns the designer into a controller of controls, a catalyst, a meta-systematizer. Instead of a deductive linear teleological process, design becomes an inductive process with a systematic and circular approach that feeds back into itself and prioritizes performative aspects over that which is merely descriptive" (Ortega, op.cit.).

3.2 The Authorship of Objectile

The possibility of generating infinite design variables by the increased computational power of the computers available today allows designer to pose himself in a completely new way towards the role of automation. Architect seemingly acts as a selector of alternatives generated by the automatic combination of parameters that designer himself has decided or deduced from the results of computer-aided simulative evaluations. According to Bernard Cache's definition, in turn borrowed from the book that Gille Deleuze dedicated to Leibniz and the Baroque, the architect is no longer an author of objects, but of "objectile", i.e. systems of variable relationships that change according to the variation of the informing parameters (Deleuze, 1988; Cache, 1998). As Ortega writes: "Parametric systems mean that designers develop algorithms rather that objects. The model of the designer as author of objects is replaced by the model of the designer as author of objectiles. The term objectile (or "object-matter") is contrasted in geometric terms to the concept of subjectile. The second has to do with open surfaces, while the first has to do with closed surfaces or solid volumes. Objectile designates non-standard objects, which are variable and numerically designed". On their participation in the exhibition Non-Standard Architecture, inaugurated at the Georges Pompidou Centre on 10 December 2003 (Figure 6,7), Bernard Cache and

Patrick Beaucè proposed a theoretical manifesto, "Vers un mode de production non-standard", which states that "the writing of software is at once the major genre of contemporary culture and at the same time the privileged terrain of a confrontation of the forces which organize production in our societies" (Cache & Beaucè, 2007). Considering the actual rise of AI and the worries about a progressive automation in decision-making, the first generative design experimentations in the 2000s pose a relevant question about sense-making in computational design processes, which seems strictly related to the role of designer and his awareness about consequences of digital technologies in the construction ecosystem, in the socio-economic contexts and in urban planning.



Figure 6. Asymptote (USA), Hani Rashid and Lise Anne Couture. BMW Event and Delivery Center, Münich, Deutscheland, 2001. "Non- Standard Architecture" exhibition, Paris, 2003-2004.

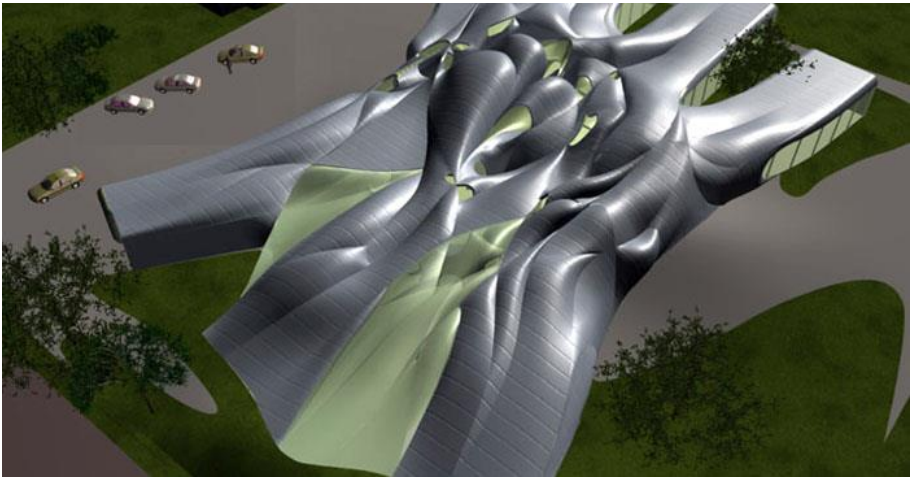

Figure 7. NOX (the Netherlands), Lars Spuybroek. SoftOfficeUK, Warwickshire, UK, 2000-2005. "Non- Standard Architecture" exhibition, Paris, 2003-2004.
The aim of the exhibition "Non-Standard Architecture", was to investigate how the "digital chain" is likely to change the whole economy of architectural production, from conception to

realization, with social implications in the establishment of new relationships between designers and performers and between designers themselves (Donà, 2004).

In spite of an aesthetic and stylistic recognizability of digital processes in architectural works, it is legitimate to dwell, as Bernard Cache does, on the real need to contribute to these "metamorphoses", beyond the technical possibility of doing so: "Under what conditions can a term like non-standard architecture have meaning? Perhaps it is easier to begin answering in a negative way. If, indeed, non-standard architecture consists of generating more or less soft surfaces which will be then called a building by transferring them to a battery of production software in order to create very expensive kinds of sculptures which no longer have any relation to the historical and social sedimentation that makes up a city, then we are only perpetuating the Romantic myth of the artist-architect" (Beaucè & Cache, op. cit.).

3.3 The Authorship of the Many

As described by Carpo, Cache and Deleuze's objectile theory implies a "multi-layered" model of authorship, or "split agency", where there is a so-called principal author, the creator of the generative algorithm, of the first genetic code of the design, and a theoretically infinite number of other authors who interact with it and modify its parameters with the original models' variables. In this way, the "first" author has the task of establishing the model variability and the range within which its values can be modified, while the others can adapt the model to local needs (Carpo, op.cit.).
In the same technical definition of parametricism, therefore, there is a crucial reconfiguration regarding authorship: if algorithmic design is based on the creation of variable systems, who does materially design each variation and who will choose the best solution? At the dawn of the so-called "Web 2.0", it was considered that the best vehicle to share responsibilities was the mutual collaboration through the participating actors, whose role would tend to transform as the very sequentiality of the processes abandoned a telescopic development through linearly organized phases in favour of an iterative circularity of exchanges and sharing of responsibilities. The possibility to leave every decision to a Google-like search of already existing solutions, no longer through science but through searching, places the architect's role within a sort of collective intelligence (Levy, 1994) for which the value of the most recurrent element among a group constitutes itself the best solution.
Since the nineteenth century, with the first industrialization and the birth of specialized engineering professions, building became an activity denied to the community because it was no longer linked to artisanal crafts, but to industrialized practices of the mechanistic era (Nardi, 1986). This led to the birth of new professional figures who had to carry out distinct activities and, at the same time, as Tomàs Maldonado outlines, the shift of the "creative will" of people towards the "phenomenon of patents" (Maldonado, 1992), of which the maker movement seems to be a revival. In the same way, as Mario Carpo notes, the evolution of BIM Based collaborative platforms, file-to-factory production systems and digital mass

customization are determining a widening of the concept of authorship in architecture, which had remained substantially unchanged since Leon Battista Alberti, in his *De re aedificatoria*, marked the difference between the architect and the master builder.
As Carpo wrote: "The family of software known as Building Information Modeling (BIM), originally a management tool used to facilitate cost estimating and the exchange of information between architects and contractors, is fast becoming a fully-fledged design platform, and imposing its collaborative logic on all involved. BIM's faster, interactive feedback loop between designers and contractors transcends the traditional separation between conception and execution inherent in the Albertian model and embedded in most current business models. Yet digital designers, who so often resent - more or less overtly - the diminishment of their modern authorial privileges, appear to be keen to envisage a lesser degree of design determination when this is to the benefit of a higher order of indeterminacy, which they often like to attribute to nature itself" (Carpo, 2012).

4. Conclusions

Rather than a sudden "force of nature" to be resigned or opposed to, digital should be understood as a phenomenon, the result of a long evolution, to be "shaped" through an informational interpretation that allows to transfuse in the contemporary age the centuries-old legacy of knowledge, practices and techniques of the "oldest discipline in the world". Digitalization has involved in the same way both professional and industrial realities of recent birth and those more deeply rooted (Russo Ermolli & Galluccio, 2021; Figure 8). The cognitive principles underlying digital technologies do not arise from the use of computer devices, but could allow digital to trigger a transition in construction industry, rather than a revolution, taking into account the peculiarity of a sector characterized by the coexistence of established traditional practices and structures and methods typical of advanced industry. The integration of digital culture within the consolidated processes of design, production and construction seems a matter of identification of languages and techniques according to their acceptability from the culture of our time, assessing the risk that, in the wake of a "positivism" in digital key, the discomfort and alienation that has connaturalized the relationship with architecture in post-industrial society.
The complexity of design instances and the collaborative nature of the new digital tools for integrated design stimulate an open approach to innovation, starting from the dynamics that exist between the different operators throughout the supply chain. In this context, in spite of the fatalisms that follows the rise of Artificial Intelligence and computational automatism, the role of the designer is crucial, for he assumes the task of evaluating the conditions of innovation sociotechnical acceptability: a human, ethical and political sensitivity at the same time, particularly aimed at intercepting vectors of transformation in changing and emerging contexts.

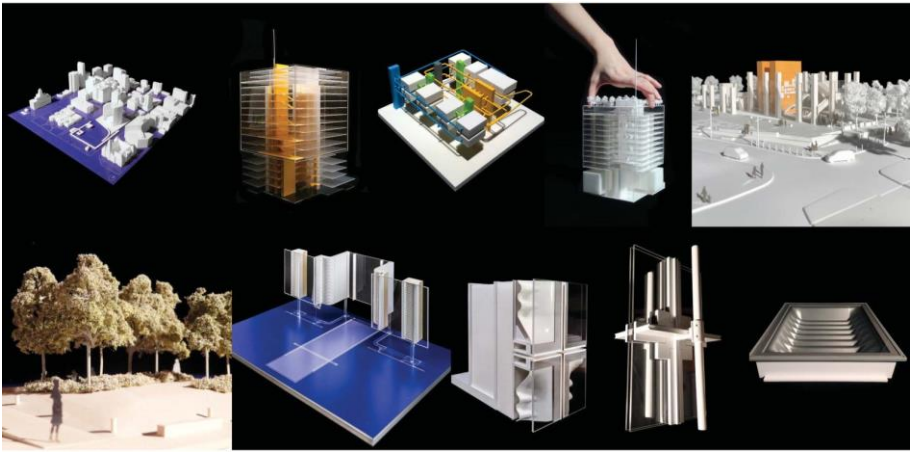

Figure 8. New Toronto Courthouse, Toronto, by RPBW (2016). Even within a long-term architecture firm such as RPBW, where the artisanal and personal sense of authorship is deeply felt, BIM-oriented collaboration has allowed to take into account the different specific skills required, helping to create an effective outcome resulting from a collaborative sharing of design responsibilities. BIM, digital design and file-to-factory processes are integrated in the Workshop's workflows, which continue to evolve through a critical selection by architects of the most advanced technologies.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Banham's 'Unhouse' as Anti-Interiority: Towards Twenty-First-Century Theories of Design and Domesticity

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Abstract | The British architectural historian, critic and writer, Reyner Banham, formed the concept of 'unhouse' in a period of intense technological transformation during the middle years of the twentieth century. His unhouse proposed the seemingly radical idea to dematerialize the walls and roof of a house, to remove the strictures that tie buildings, and thus people, to the encumbrances of what he termed: 'the dead weight of domestic architecture' (A Home is Not a House, 1965). This paper situates Banham's unhouse within a category of dominant architectural and design theory that suppressed or diminished the importance of interior spaces and their relevance to human wellbeing and social relations. It suggests that in exploratory designs from contemporary projects, including Philips' Microbial Home (2011) and Superflux's Mitigation of Shock (2017-19) the designers create immersive experiences in future interiors, pointing to the development of new theories of design and domesticity in the twenty-first century.

KEYWORDS | BANHAM, UNHOUSE, TECHNOLOGY, DOMESTICITY, INTERIORITY

1. Introduction

When the British architectural historian, critic and writer, Reyner Banham, proposed the concept of the 'Unhouse' in 1965, it appeared to be the inevitable conclusion to a number of themes and ideas that he had been researching, writing and commenting upon for many years. In his essay, 'A Home is Not a House', published in *Art in America*, in 1965, Banham argued that technology was now able to provide the answer to human needs and therefore the idea of what constituted a home was not necessarily a house, or a building. His Unhouse proposed the seemingly radical idea to dematerialize the walls and roof of a house, to remove the strictures that tie buildings, and thus people, to the encumbrances of what he termed: "the dead weight of domestic architecture." (Banham, 1965, p.73) Banham had been ruminating on the promises of technology and the implications of this on new ways of living in the middle of the twentieth century. He had previously feared the demise of the Modernist project in Italy, where he had criticised architects and designers in that country for reverting to architectural styles of the previous century. Referring to this 'backlash' as Neoliberty, Banham highlights how design styles such as Art Nouveau had become anachronisms in the twentieth century; such forms had been replaced by technology, he argued:

> "Art Nouveau died of a cultural revolution that seems absolutely irreversible: the domestic revolution that began with electric cookers, vacuum cleaners, the telephone, the gramophone, and all those other mechanized aids to gracious living are still invading the home, and have permanently altered the nature of domestic life and the meaning of domestic architecture." (Banham, 1959, p.235)

Therefore, by 1965, Banham had already imagined how modern technology would replace the need or desire for any historical or historicising architectural or design styles, promoting the work of avant-garde artists and designers, such as Alison and Peter Smithson, in Britain, before turning his attention to the work of modern architects in the United States of America. 'A Home is Not a House' is the culmination of these ideas, suggesting that buildings themselves would become obsolete in the near future. Presented as an accumulation of technological services, including landscape flood lights, TV and stereo speakers, radio and tape deck, electric cooker and refrigerator, the unhouse would cater for all essential human needs, providing a convenient and transportable 'standard of living package'. Combined with a 'power membrane', which would furnish a curtain of hot or cold air around the Unhouse, the design proposed that the exterior building or fixed structure might be dispensed with altogether. (Banham, 1965, p.77)

While recognized as deliberately provocative and slightly eccentric at the time, Banham's ideas have acquired a certain currency again, in the early years of a new century, in a similar period of immense technological transformations. Faced with the challenges of climate change, mass movement of people, and globalized economic systems, the Unhouse, which suggested new features of solar power, natural insecticides (the universal pest lure and destructor) and environmentally-friendly noise reduction or anti-noise pollution,

demonstrates certain practices of sustainable design behavior that has influenced some recent architects and designers, perhaps most notably are those architects and designers engaged in speculative or critical design projects and methodologies.

Overall, however, the Unhouse does not represent a freeing up of humans from their environment, with a low-cost, itinerant lifestyle choice. Rather, this paper proposes that Unhouse exists within theories or ideas that might be described as 'anti-interiority', themes that originate within Modernist architecture and that have been challenged over recent decades. (See, for example, Reed, 1996. Colomina, 1996, Sparke, 2008, Hollis, 2018, Bachelard, 2014). It situates Banham's Unhouse within a category of dominant architectural and design theory that suppressed or diminished the importance of interior spaces and their relevance to human wellbeing and social relations. This paper argues that architecture and design in the twenty-first century, whilst acknowledging the prescient nature of Banham's concept, accounts for the significance of social meanings that are ascribed to the interior. For example, in exploratory designs from more contemporary projects, such as Philips's *Microbial Home* (2011), and Superflux's *Mitigation of Shock* (2017-19), the designers seek to create immersive experiences in near future interiors. Subjective encounters with internal spaces are incorporated with much thought and consideration for human patterns of behavior; of domestic rituals, self-sufficiency, comfort and embodied materiality. Banham (and others) sought to expunge the interior of historical 'weightiness' but in doing so merely avoided the intrinsic, and sometimes, difficult nature of our relationship to our interiors, and the ways in which physical interiors are not simply reflective of our personalities but are, importantly, the summation of our interiority as human beings.

In his biography of Reyner Banham, Nigel Whitely describes the Unhouse as a shift from "form and hardware to service and software." (Whitely, 2003, p.208). Effectively, Banham might be said to be simply repeating Modernist attitudes to domestic life in the interior, as elements of our being that ought to be streamlined, updated and restructured, in an: "almost universal expendability." (Banham, 1965, p.79). The Unhouse neglects or deliberately rejects consideration of the 'mess' and subjectivity of life in the domestic interior as this was not an important factor in the delivery of new technologies. However, the opposite might be said today as domestic technologies are grounded in user experiences and are described in this paper to explain how new theories of interior space are emerging from architecture and design practices engaged with the many layered meanings of interiority, embracing the significance of 'home' that Banham and others appeared to overlook.

2. Philips's *Microbial Home* 2011

Philips' Microbial Home project in 2011 proposed a cyclical consumption/production process that returned the space of the kitchen to the sorts of sustainable functions familiar to nineteenth-century homes, with home-grown produce, minimal waste and often

incorporating the raising and slaughtering of home-grown livestock. The concept for this kitchen is far removed from the industrialised efficiency of the Frankfurt Kitchen, the prototype for all modern kitchens subsequently, concerned with the speed, productivity, and accuracy within which a housewife could carry out domestic tasks. (See designs by Margarete (Grete) Schütte-Lihotzky, 1926-1927). Not only is the Microbial Home probe striking in its rejection of serialized, systematic tasks, but its design concept foregrounds human-centred actions that place significance on domestic activities often associated with 'chores' and suggests empathetic attitudes that relate to domesticity as lived experiences. For example, in their press release, Philips describe:

> "Using a variety of tools, the group started to define a design direction for more "human" appliances. The result was a "new domestic quality", with characteristics such as "affection", "ritual", "reliability" and "ease of use". These factors were used as criteria to assess designs throughout the process. And it was decided that four products were to be made. Not lookalikes but individuals with certain resemblances." (Philips's Press Release 2011).

The purpose of Philips's Microbial Home is to suggest new ways of creating sustainable, energy-efficient, homes that reconnect humans with the natural environment. The probes designed consisted of: a bio-digester kitchen island that would breakdown human and vegetable waste, producing and capturing methane gas that would then be used to light the kitchen; a larder in the form of a large preparation and/or dining table that incorporated a central section, divided into smaller compartments for storing fresh food, this would be cooled by evaporation, another by-product of the bio-digester system; a machine called a 'Paternoster' that would grind down biodegradable plastics, incorporating mycelium, a fungus used to speed up decomposition, and that would, in turn, produce edible mushrooms; a beautiful sculptured glass beehive, or 'urban beehive', that allows the viewer to watch the bees build natural honeycomb and harvest the honey produced.

All of these different components are free-standing, although they are interconnected by their shared function of recycling of waste and energy, each piece of furniture is autonomous, reminiscent of kitchen or household furniture before the introduction of modern 'fitted' kitchens. While these objects present rather strange, almost anachronistic shapes and structures, with one British newspaper reviewer commenting that Philips's design represents a 'Steampunk' kitchen style, it is the language used by the designers to describe this project that is most pertinent here. (McGuirk, 2011). In the twentieth century it would be difficult to imagine kitchen designers placing such significance on words such as 'ritual' or 'affection' and the emphasis placed on a 'new domestic quality' signals a shift in attitudes to the ways in which domestic life is considered in current design practice. Philips's designers attempt to re-introduce gas lighting to the modern kitchen, an obsolete technology which, by necessity, may require to be utilised in the future. However, the glimmering, soft glow emitted from the gas mantle over the dining room table of the microbial kitchen seems appropriate, enhancing the features of the ritualised performance of 'slow' dining in a sustainable household. In this sense, Philips's Microbial Home

incorporates many features associated with domestic life before Modernism's rationalizing processes sought to eradicate the 'wasted labour' expended on washing up, preserving and preparing food, sweeping, dusting, and dealing with waste more generally. In the twenty-first century, architects and designers are revising attitudes and proposing solutions to these domestic tasks in order to counter the unsustainable practices ushered in by Modernism's obsession with technological answers to human inconveniences. (Dilnot, 2011, pp.119-121). In doing so, architects and designers are considering the social elements of life in the domestic space; those kinds of activities that Modernists tried to disassociate with a productive home life, the routines of housework familiar to many women in particular, and how these connect to durational processes of familial bonds and relationships.

3. Superflux's *Mitigation of Shock*, (2017-2019)

While Philips's Microbial Home represents working prototypes, functioning objects that propose future real-life solutions, Superflux's project, *Mitigation of Shock* (2017-2019) applies methodologies developed by critical or speculative design, to imagine near future scenarios but based on current reliable data. (Dunne and Raby, 2013, pp. 2-3). Superflux chose the domestic interior as a space to imagine a how human life will be sustained in the near future. The focus of the project was a typical London apartment in 2050. The designers describe their aims to create an interior that is both familiar and unfamiliar:

> "We built an entire future apartment situated in the context of climate change and its consequences on food security. People could step inside this family home and directly experience for themselves what the restrictions of this future might feel like. Instead of leaving visitors scared and unprepared by the challenges of this world, we shared methods and tools for not only surviving, but thriving there". (Superflux, 2017).

With Unhouse, Reyner Banham also imagined the near future, where technology would answer to every human need, helped along with one or two 'natural' processes, such as a Darwinian 'pest lure' which would eradicate any bugs and other wild creatures that might try to cross into the perimeter of the Unhouse by means of capture and natural destruction between prey and predators. Little did Banham imagine that in 2050, insects and other small mammals would be encouraged into the home as a vital food source, as speculated by Superflux.

Banham's Unhouse was clearly a product of his own political and social beliefs that humans should be liberated from the encumbrances of property owning, home maintenance and the historical burden that home ownership entails. His counter-cultural generation embraced a whole range of new experiences that liberated them from the constrictions of previous generations and while Unhouse might appear to offer the owner of a 'standard of living package' a nomadic lifestyle, situated within open country, offering individuals the opportunity to be 'in nature', the extent to which Banham attempts to obstruct nature in the

Unhouse is surprising. For example, the most extraordinary feature of the project might be the 'Power Membrane':

> "The basic proposition is simply that the power-membrane should blow down a curtain of warmed/cooled/conditioned air around the perimeter of the wind ward side of the Unhouse, and leave the surrounding weather to waft it through the living space, whose relationship in plan to the membrane above need not be a one-to-one-relationship". (Banham, 1965, p.77)

Of course, this incredibly wasteful use of energy, even if it is imaginary, is typical of the kind of drain on natural resources that Clive Dilnot describes in his history of how we became unsustainable. (Dilnot, 2011, pp.119-121). No such luxury of resources is afforded the inhabitants of Superflux's 2050 apartment. First exhibited at the Centre for Contemporary Culture in Barcelona, in 2015, the design of this apartment foregrounds the interconnections between humans and the natural world. As with Philips's Microbial Home, the future sustainment of human life will depend on bringing nature into the home, cultivating crops, growing vegetables, and sourcing alternative food stuffs, including roadkill and snaring urban animals. Much of the living space in the apartment is given over to enormous computers that monitor the growth of these domestic crops, using hydropnics and fogponics, methods of growing crops that use a minimum of water and energy. The apartment hums with the noise of primitive technology (hacked together from everyday consumer items and outdated computers), the lighting is harsh, projecting a clinical, purplish glow throughout the apartment. Superflux managed to grow mushrooms, cabbages and chillies, among other vegetables, in this space and there are scattered signs that sourcing other kinds of food preoccupy its inhabitants, 'city foraging, breeding mealworms, and canning foodstuffs' are all part of domestic life in this place. Superflux explain that their project is intrinsically hopeful, despite its dystopian vision:

> "By focussing on a residential space in an urban environment in the Global North, we were able to communicate with demographics who have the capacity to minimise climate change by changing their current patterns of consumption and who might assume they won't personally be impacted by the effects of climate change." (Superflux, 2017)

The constructed interiors of the apartment reflect this statement by Superflux, they have been designed to look very much like an ordinary 'open-plan' London flat:

> "Once a comfortable living space designed for a world of automated living, global trade and material abundance, the apartment has been adapted to a future it was never meant to inhabit … Scattered around the apartment are fragments from a future that never quite materialised". (Superflux, 2017).

Despite this unintended purpose, the apartment maintains an atmosphere of optimism, of family life continuing on in this space, with children's toys placed alongside daily newspapers displaying headlines warning of impending food shortages. The well-used sofa, discarded clothes and mugs of just-finished drinks also indicates that people inhabit this place, people

who are thriving and not just surviving. Importantly, and in contrast to Reyner Banham's future vision, in this space, where the word outside presents extreme challenges, the emphasis is not on a 'standard living' or basic living idea, but on the ways in which humans might adapt to different kinds of existence while, at the same time, nurturing close human and non-human relationships. Banham's world is very much that of the single man and he emulates a 'bachelor lifestyle' in his Unhouse, unhampered by any sorts of dependents such as children, elderly relatives or even pets. In the Unhouse technology makes the fantasy of the 1960's single, male lifestyle achievable:

> "But a properly set-up standard-of-living package, breathing out warm air along the ground (instead of sucking in cold air along the ground like a campfire), radiating soft light and Dionne Warwick in heart-warming stereo, with well-aged protein turning in an infra-red glow in the rotisserie, and the ice-maker discreetly coughing cubes into glasses on the swing-out bar – this could do something for a woodland glade or creek-side rock that Playboy could never do for its Penthouse." (Banham, 1965, p.76)

Such a standard of living package may seem luxurious but its focus remains on meeting basic human needs and, in this instance, the basic living needs of a single male with aspirations to live an alternative lifestyle whose understanding of this seem as conventional and mainstream as any other, slightly hippy, single male of the period. With hindsight, Banham's goals for his standard of living package are hardly radical at all. Fifty or so more years later, it is Superflux and other twenty-first century designers and architects who are proposing radical solutions or responses to real world problems. Encountering the apartment in *Mitigation of Shock*, the viewer or participant understands the significance of the interior to the wellbeing of its inhabitants, not just as shelter from the elements, but as a space that exists as a consequence of human and non-human co-dependence, within the walls of this fabricated interior are the combined hopes for the existence of living species, orchestrated and coordinated by human beings' potential for empathy and compassion, encouragement, development and adaptability. What is sometimes referred to as human-centred design is palpable in *Mitigation of Shock*, whether intentional or unintentional, as the designers state:

> "Whilst the project is based on gaining better understanding of the ground level implications of global warming, it also acknowledges coexistent trends and forces such as infrastructure, transport, energy, water, housing, individual tech savviness, autonomy and agency of communities, amongst others. The ensemble of these core influences skillfully manifests within the finest details of the space, pointing out the complexity of the projected future world and the interdependencies between various game-changing factors." (Superflux, 2017)

In fact, *Mitigation of Shock* reveals a sharp of awareness by these designers of the meanings associated with ideas of the social in design. Their emphasis on 'interspecies relationships' and 'direct engagement with these living entities' account for an understanding of the social aspects of life lived within interior spaces, and the ways in which reconstructing or reflecting on such spaces need not lead to a "shrinking of definition of the social itself." (Latour, 2005, pp. 6-9). In contrast, it might be argued, that Banham's Unhouse, by releasing itself from the

encumbrances of home, stability, rootedness, situatedness, is deliberately 'unsocial', its existence needs no connection to any social meanings that are usually associated with home or interior spaces where home-life is conducted. In many ways this is a complex position as interior spaces ought to reflect the richness of our lives as social beings; homes are the repositories and animated states of our interactions with other beings and, in this sense, homes are constructed from the consequences of our existences as social beings and therefore require to be considered as expressions of our interiority, our interior lives.

4. Anti-interiority in Banham's Writings and Unhouse

If Banham's Unhouse is unsocial it is also argued here as inherently anti-interiority, or a deliberate attempt to overlook or not consider the ways in which buildings and their interiors shape our interior selves. In his anti-historicism, Banham is also indulging in a kind of revelry in 'throwing the baby out with the bathwater', neglecting to understand the emotional and visceral attachments that many of us feel towards our homes and interiors and how these, might, indeed, constitute an embodied materiality, a storehouse of all of our subjective experiences. (Ionescu, 2018, p. 2). It is clear that in forming his concept of the Unhouse, Banham was interested in progressing some of the main objectives of Modernist ideology that he understood would change society's adherence to cultural conventions, particularly historical styles of architecture, but also to the manners and patterns of human behavior that he believed tied us to out-of-date, burdensome domestic obligations. This is demonstrated by the type of architectural influences that he refers to in his writings. For example, in his essay, 'Neoliberty: The Italian Retreat from Modern Architecture' (1959), he cites, Adolf Loos, Frank Lloyd Wright, Herman Muthesius, Cubist painters, as well as Futurist leader, Marinetti. He writes that Modern art and architecture makes possible:

> "The promise of freedom from having to wear the discarded clothes of previous cultures, even if those previous cultures have the air of *tempi felici*. To want to put on those old clothes again is to be, in Marinetti's words describing Ruskin, like a man who has attained full physical maturity, yet wants to sleep in his cot again, to be suckled again by his decrepit nurse, in order to regain the nonchalance of his childhood. Even by the purely local standards of Milan and Turin, then, Neoliberty is infantile regression." (Banham, 1959, p.235).

As with Adolf Loos, Marinetti here casts the nurturing aspects of domesticity, of a man's memory of his childhood nursery and the association of this with a backwards looking sensibility. Longing for the past is connected to nostalgia and infantilism; especially for Loos, as the interior spaces of previous decades, or those reflecting period styles, represent for him all that is abject and wretched about domestic life:

> "His [Loos] 1903 review of interior designs by a competing architect mocked their studied tastefulness by imagining them as settings 'for birth and death, the screams

> of pain for an aborted son, the death of a dying mother, the last thoughts of a young woman who wishes to die'." (Reed, 1996)

Loos's now notorious essay 'Ornament and Crime' (1908) is an extreme attack on historicism and significantly aligns ornament with uncivilised culture and behaviors. However, Loos' language, like Marinetti's is expressed in a fierce anti-domesticity, and as Christopher Reed has argued, led some Modernists to suppress domesticity in all its subjectivity; as a means of revealing interior thoughts and emotions. In this sense, Reed and others have suggested that Modernists' critique of ornament is, in fact, a criticism and rejection of interiority overall.

For Reyner Banham, writing in the 1960s, in a period defined by technocracy, the promise of new materials, new technology and international communications, appeared to offer up new ways of living which he enthusiastically embraced. Nevertheless, this paper has argued that in his zeal for an alternative lifestyle choice, he disregarded the significance of the material connections that human beings develop to our interior spaces. In recent years, challenges to Modernism's dominance of theories of architecture and interiors have revealed the layered meanings that are incorporated in domestic interiors in particular. For many, significantly for women's lives and associations with the interior, much has been uncovered by this reassessment of the history of domestic spaces and domesticity. Such revelations mean that for designers and architects today, the subjective experiences of lives lived in homes and houses must be considered, and the development of domestic technologies are signaling the way for very different theories of design and domesticity in the twenty-first century. As described in this paper, projects such as Philips's *Microbial Home* and Superflux's *Mitigation of Shock*, point the way in imagining more pluralistic theories of design and domesticity, where technology acts as a facilitator or mediator in domestic roles, acting in tandem with human and non-human activities, rather than dominating these. Unlike Banham's Unhouse, technology in the near future will not be harnessed to exclude domestic life but to encompass home-life, reinforcing and enhancing domestic rituals, acknowledging the durational processes of daily life within the home.

When Banham writes: "Recall too the homeless, starving couple in *Miracolo a Milano* (1951) whose first wish was a crystal chandelier, and you know something bitter about Milanese mental processes", he is most revealing of his misunderstanding of the nature of human needs and wants. (Banham, 1959, p.232). In her book, *Crafting Design in Italy From Post-War to Postmodernism*, Catharine Rossi remarks that Banham's disparaging 'tag' of Neoliberty was also a misreading of the situation in Italy during the period. She explains that: "Neoliberty proponents challenged orthodox modernism's industrial progressivism, and rejection of history but also reflected the desires of a largely middle-class market that preferred historical warmth to modernist asceticism." (Rossi, 2015, p.108). Therefore, the emphasis that Modernists placed on domestic technologies of the future were misplaced and for many, in fact, represented an alienating experience. The opposite might be said today with the development of digital technologies that foreground human experiences in their design and production. For a younger generation of architects and designers, Banham's Unhouse might appear to be a radical departure from conventional ideas of home and

domesticity but it is worth reminding ourselves of his generation's attitudes to home life and domestic obligations as the reverse of interiority or anti-interiority and of Modernist self-denial of the intricacies and messy nature of our interior lives.

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About the Author:

Helen McCormack add an author bio that describes research interests and main achievements in a maximum of 40 words. [LEAVE BLANK UNTIL FINAL ACCEPTANCE] [_DCs Author Bio and Acknowledgements]

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Bodies of Evidence: making in/visible histories in South African Design Education

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Abstract | This paper explores the transformative potential of first-year design student's co-affective encounters with ancient Greek vases within the context of calls to decolonise the academy in South Africa. Located at a university of technology, the research engages critical arts-based strategies that disrupt the Eurocentric cultural hegemony that is embedded in art and design history. Given that ceramic pot making is a familiar art form in Africa, the lesson invited students to make the own visual/written narrative vases in response to ancient Greek counterparts. Unlike mimetic exercises that reproduce the same elsewhere, the assignment afforded students an opportunity to 'figure out' knowledge for themselves. The process of learning-through-making had ontological affects as students positioned themselves as generators of knowledge and becoming-designers. At the same time, the paper explores the transformative potential of critical arts-based pedagogies within the current debates around decoloniality and ethical practices within design education in South Africa.

KEYWORDS | CRITICAL ARTS-BASED LEARNING, RESPONSE-ABILITY, ETHICO-ONTO-EPISTEMOLOGICAL, DECOLONISATION, DESIGN EDUCATION

1. Introduction

This paper responds to the recent South African #Rhodesmustfall and #feesmustfall student protests that called for equitable access to higher education, Africanisation and decolonisation of the academy. Concerned with developing design education strategies that seek to work affirmatively with difference, the paper critiques art and design history as a disciplines that are both founded on and embody Eurocentric cultural hegemonies that are 'embedded in both theory, institutional and pedagogical practices' (Braidotti 2013:2). In thinking about what decolonising design might look like, the research concentrates on *what* content is taught and *how* content is taught in order to understand the ontological effects of dominant Eurocentric discourses and practices within South African Higher Education (SAHE). Accordingly, the paper draws attention to the relationship between epistemology, ontology and ethics.

The discussions around decolonising the curriculum in SAHE include an interrogation of pedagogical practices and experimentations with different modes of learning. As a design educator for example, I seek to work with art and design histories in ways that do not render those students whose indigenous knowledges and histories that have systematically been excluded to experience feelings of deficit due to lack of cultural capital (Bourdieu 1979). Moreover, contrary to deficit discourses that tend to position students as unable to deal with complexity, the pedagogical challenge becomes one of engaging open-ended processes that build students' confidence in engaging with discourses without fear of getting 'them' wrong.

Grappling with the inherent paradox of working within the western art history paradigm – whilst simultaneously trying to dismantle Eurocentric cultural hegemony – is a useful starting point for the inquiry that explores curriculum and pedagogical strategies that conceptualise difference as an ongoing differentiation in which new commonalities are imagined (Thiele, 2014:202). Located in a first year design theory course at the Cape Peninsula University of South Africa (CPUT) the case study describes a pedagogic intervention that invites students to think-make with ancient Greek vases in order to draw attention to their subjectivity in relation to the ancient objects. In/formed by Roth's (2014) post-constructivist curriculum*-in-the-making and Sellers's (2014) becoming-curriculum, the intention is to position students' lived experience as central to their learning and becoming as young designers in contemporary South Africa. In paying attention to these co-affective encounters, I think with Oliveira who proposes a decolonizing ontological framework that posits design as a "socio-technical mechanism of inquiry, re-enunciation, and re-narration" that is not only directed at "looking back and re-framing certain material practices" but is also "a project of understanding the relationality of things beyond their mere objecthood" (Shultz et al, 2018:93).

To begin, I discuss some of the complexities associated with the teaching and learning of art and design history, thereafter I provide background and context to the course that I teach. This is followed by an elaboration of the critical posthumanism/feminist new materialism

theoretical framework in which the research is located. I then discuss pedagogical imperatives and methodological strategies before addressing the case study itself.

2. Art History Teaching and Learning

The teaching and learning of art and design history in South Africa is both a complex and ambiguous practice. As the gaze of art history shines light on the mantle of Western European superiority, so it simultaneously obliterates indigenous cultural production. On the one hand there is an overabundance of images and research to draw from within the Western canon, yet at the same time there are gaping holes of absence of history here at home. It is within these lacunae that the research explores co-affective encounters with art and design history with a view to making visible students experiences and knowledges and showing how these knowledges are central to their learning.

Following Kiem' s conception of "decolonizing design" as a political project in which design is "both an object and medium of action", the inquiry adopts strategies that put art and design history to work in order to reveal the generative possibilities that these disciplines, or practices, offer teaching and learning. To put it differently, Kiem underscores the need to interrogate the ontological effects of design in order distinguish between designs "that facilitate the productivist drive towards devaluing and appropriating human and non-human natures, and designs that facilitate a process of delinking and redirection into other modes of being/becoming" (Shultz et al:82). By the same token, Ansari argues that the thrust of decolonising design rests in the way that "design brings into being new ontologies and ontological categories and their corresponding subjects and subjectivities". In this regard, he critiques the predominant trend in design education that prioritises a representational approach to history whereby students learn about individual movements and their associated aesthetics as opposed to conceptualising history as performative which would allow students to develop a better understanding of how "modern technical systems came to mould and shape modern humans" (Shultz et al:88).

3. Background and Context of the Course

3.1 The Extended Curriculum Programme (ECP)

The case study is located within the Extended Curriculum Programme (ECP) of the Design Foundation course of the Faculty of Informatics and Design at CPUT. The aim of CPUT's ECP is to increase the throughput rate of "at risk" students who, due to their secondary education backgrounds, are not adequately prepared for higher education/university study. In addition to providing students with extensive pedagogic and curricula support, ECP also offers students psycho-social support as they make the transition from school to university learning, towards the mainstream programmes that they will join the following year[i].

Typically, the ECP course comprises seventy students most of whom come from previously disadvantaged backgrounds. Not only are the majority of them learning in their second language, but many have never studied art or design before.

3.2 The ECP Design Theory course

Rather than follow a chronological approach to teaching history, that reinforces Western Enlightenment notions of linearity and progress, the ECP Design Theory underscores critical thinking skills, response-ability (Ettinger, 2006); (Haraway, 2016) and an understanding of the ontological effects that are generated through encounters with art history in and across time. In paying attention to the aforementioned criteria, the course sets out to disrupt the dominant norms and practices in higher education as well as within design education in particular. In giving prominence to students' indigenous knowledges it is hoped that the dominance of Eurocentric modernity within the institution is weakened and that students will produce artefacts that materialise different futures and imaginaries.

4. Theoretical framework:

Located within critical posthumanism/feminist new materialism theoretical frameworks, I refer to three feminist theorists who theorise the process of diffraction as a way of conceptualising difference differently in order to spotlight the ethical affects that thresholds of interconnection, co-existence and becoming offer curriculum design in a differentiated world. They are Donna Haraway, Karen Barad and Bracha Ettinger. I will discuss each of them in turn.

4.1 Haraway's situated knowledges and "staying with the trouble"

In her seminal theory of situated knowledges (1988), Haraway exposes the unequal power relations embedded in the Western Eurocentric ideology that conceptualises knowledge as being rational, abstract, universal and value free. Instead Haraway considers the material specificity of situated knowledges, and thereby positions theorisation and conceptualisation as embodied and contextualised lived practices. In other words, following Bozalek & Zembylas, "the knower's social location and subjective embodiment is seen as having a direct effect on the knowledge produced" (2016: 115). In her critique of prescriptive and homogenised Eurocentred knowledge production that reproduces the same elsewhere, Haraway brings into play the process of diffraction as an optical metaphor to explore the effects of the patterns of difference rather than reproductions of the patterns of difference themselves (1992:300). More recently, Haraway advocates "staying with the trouble" and "recuperation in complex histories that are as full of dying as living, as full of endings, even genocides, as beginnings" (2016:10). She writes "I am deeply committed to the more modest possibilities of partial recuperation and getting on together" (2016:10). In this regard she subsribes to sympoesis as "a carrier bag for ongoingness, a yoke for becoming-with, for

staying with the trouble of inheriting the damages and achievements of colonial and postcolonial naturalcultural histories in telling the tale of still possible recuperation" (2016:125).

4.2 Barad's Agential Realism

Barad's agential realist model reveals the entanglements between knowing, being and ethics, that she terms the ethico-onto-epistemological and, in so doing, highlights the implicated roles of both the material and the discursive in the production of knowledge. Building on Haraway's reading of the process of diffraction, Barad proposes diffractive methodology as a process of "reading insights through one another" (2007: 25). A key element of Barad's agential realist framework is the notion of intra-action (as distinct from interaction). Arguing that the latter is premised on separate individual agencies that precede their interaction, "intra-actions" are conceptualised as the mutual constitution of entangled agencies. In other words, discrete agencies do not precede their intra-actions, rather they are generated through encounter and are therefore only "distinct" in relation to their mutual entanglement, as opposed to an absolute sense (Barad, 2007: 33). In adopting diffractive methodology, the research explores the affective mutually-transformative ontological and epistemological encounters between the ancient makers, students, their vases and myself in order to show how they matter.

4.3 Ettinger's Matrixial response-ability

Feminist philosopher Bracha Ettinger's matrixial theory of trauma, aesthetics and sexual difference is grounded in her practices as psychoanalyst and visual artist (Pollock, 2010). Modelled on the co-emerging and trans-subjective relationship of the becoming m/other and becoming child in the final trimester of pregnancy, matrixial theory offers insights into ethical teaching and learning practices that, like Haraway, hinge on the notion of response-ability. Characterised as compassionate, hospitable and asymmetrical, Ettinger argues that this relationship is humans' primary relational model that is non-verbal, pre-phallic and conceives of subjectivity as difference-within-difference rather difference based on binary splits between self and others. Importantly, she argues that humans can access the matrixial the through encounters with art – both as artist, or viewer. Coining the term 'artworking', Ettinger draws attention to the performative function of art as the "transport station of trauma", which offers the potential for healing as an "ethics-in- action".

5. Pedagogical imperatives

5.1 Inclusion/exclusion; assimilation

The calls to decolonise were spurred in part, by the pressure exerted on students to assimilate into the dominant culture of whiteness in the academy. In addition to feeling

marginalised due to lack of social and cultural capital, the epistemic violence perpetuated by Eurocentric curriculum and pedagogy further entrenched the process of othering. How then can we develop pedagogies that redress feelings of inclusion/exclusion and assimilation? It follows that in addition to *doing* things differently, decolonising design pedagogies need to *undo* the ongoing damaging effects of the past. In this regard, Canli proposes undoing "as an act of passivating, unravelling and no longer contributing to material-discursive configurations that privilege certain bodies while oppressing and dehumanizing others" (Schultz et al, 98).

5.2 Making visible invisible histories and challenging stereotypes.

As previously touched on, one of the ongoing effects of coloniality is the double action of obliterating indigenous knowledges and replacing these with stereotypes that further dehumanize and humiliate those who have been colonised. It is the task of educators and students alike to undo these practices and generate relatable futures and imaginaries that speak to indigenous heritages and culture practices. One way of encouraging students to insert their subjectivity into their designs, is to work with personal narrative.

5.3 The importance of Narrative

Guided by Haraway who writes "it matters what stories we tell to tell other stories with" (2016:12), the design theory course gives prominence to students' visual and written narratives in order to celebrate individual stories and at the same time to trouble homogenising stereotypes of "African" or "South African" styles.

6 Pedagogical strategies and methodologies

6.1 Critical arts-based teaching and learning

While a growing body of literature on critical arts-based research explores the relationship between arts-based learning and socially just pedagogies in the global north (Finley, 2014; Bagley & Castro-Salazar: 2012), not enough local research has been conducted around the kinds of learning and knowledges that can be generated through critical art-based pedagogies within institutions of higher education in South Africa. This is particularly relevant in the context of the debates around decolonising the academy because arts-based research offers a/effective possibilities of responding to the challenges that teaching and learning face on many levels.

Bolt's investigation into how we come to know the world through handling it provides a useful starting point for the discussion on how arts-based teaching and learning practices can support marginalised students in utilising diverse means of expression of their lived experiences beyond the limitations of written and spoken language (2004: 49). In other

words, the process of learning through making can afford the time/space for students to 'figure out' knowledge for themselves (Bolt 2007:30). These spaces are not defined by writing and drawing, nor are they limited to writing and drawing. Instead they become spaces of potential where the split of either/or expands to accommodate the multiplicity of and/and. Consequently, the coded language of academic discourse that renders invisible other forms of knowledge creation "entrenches hierarchies of relevance whose work it is to include that which is seen to advance knowledge" is troubled (Manning, 2016: 32). This approach is particularly useful for ECP design pedagogical praxis which aims to support academic and visual literacies that challenge the dominance of the discursive approaches over embodied learning-through-making and therefore resonates with some of the concerns raised within the decoloniality debates.

6.2 Relationship between the scripto-visual

Concomitant with critical engagement is the need for students to articulate and express their ideas and beliefs with confidence both in spoken/written and visual language. This can be challenging for many of our students who, as previously mentioned, are learning in their second, sometimes third language and have had minimal exposure to the disciplines of art and design at secondary school level. Furthermore, the decentring of language, and in this case the foregrounding of the visual, not only offers design students modes of communicating that they feel more confident in, but it also challenges the cultural hegemony of language embedded in the academy.

One way of overcoming a sense of deficit is through embodied creative pedagogical engagements that offer transformational potential for students who are encouraged to find modalities and forms of expression other than those that reproduce stereotypical constructions of their subjectivity or dominant tropes of representation (Hickey-Moody et al, 2016:213–214). For example, arts-based research practices extend beyond the restrictions of logo-centric modes of research and therefore offer the possibility of surfacing other resources and materialities that would otherwise remain invisible. This is particularly useful for design education praxis that draws on students' affinities and resources with those literacies that are not necessarily understood as traditionally academic.

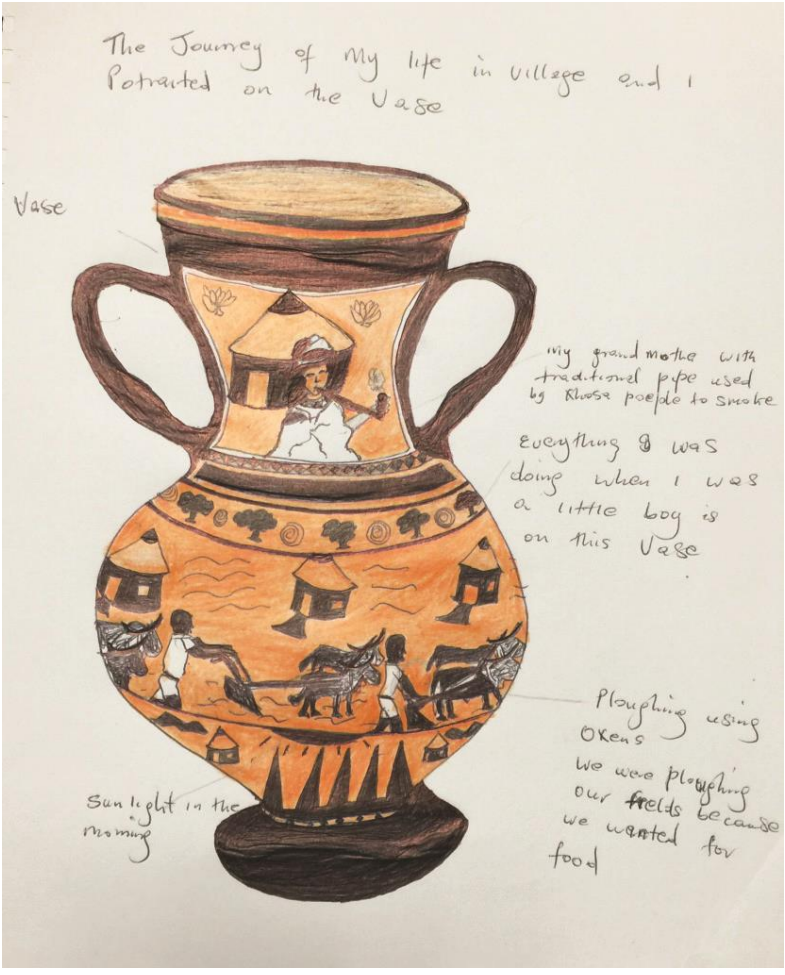

Figure 1: Story entitled The story of a village boy

Another important contribution as suggested by Liamputtong and Rumbold (2008) is that in addition to offering rich ways to access experiential knowledge arts-based research methods blur the boundaries between researcher/practitioners because they are predicated on relational exchanges that cast teachers/students/researchers as equal participants within the research process. In the spirit of decolonisation, students and educators need to examine how our modes of seeing have been shaped by the dominant culture of the historical moment (Boler, 1999). Given my own privileged positionality, this is particularly helpful in considering my own complicity in colonial and apartheid structures from which I continue to benefit. Hinging on the characteristic features of critical arts-based research that

include fluidity, reconstructions of relationality, critical resistance and positive social change, Finley conceptualises the critical arts-based research as a democratic form of practice that enables a critical examination of visual cultural codes and ideologies to resist social injustice (2017: 24). Similarly, within the current context the contested space of inequality in SAHE, it becomes necessary for teachers and learners to co-create socially just pedagogies that acknowledge, respect and work affirmatively with differences in order to open up spaces in which transformation can flourish.

8. Case study

The case study that is outlined below is based on a project that has run annually for the past five years. It describes an art history intervention that is structured around ancient Greek vase painting that seeks to illicit student's personal narratives through their encounter with Ancient vases. Given that ceramic pot making is a cultural practice which is an established tradition in Africa, it made sense to engage students' familiarity with this art form whilst they learned about the history of ancient Greek vase painting. To begin the students compose a personal narrative about an important life event. Once they have finalised their story, they translate it into a visual narrative in the form of a story board. Thereafter they choose a silhouette of an ancient Greek onto which they trace their story and create a final artwork. The project is structured in such a way that students assess their own work and compare their designs with the ancient counterparts in an effort to distinguish their work rather than to try and imitate the ancient designs. I am hesitant to generalise the themes that students have surfaced in the making of their vases. However, some of the themes that recur each year include rites of passages – such as the birth of child, initiations marking the transition from boyhood to manhood, and death of a loved one. Themes of violence are also prevalent, for example many students write about their experiences of domestic violence, gender-based violence and crimes associated with rampant gangsterism. There are also many references to sporting achievements and disappointments as well stories about love and romance, unrequited love, heartbreak, regret and remorse. While a more detailed account of this case study can be found in my previous chapter (Author: 2018), this paper will engage with the following concerns. The first deals with the notion of transformation. The second focuses on ontological effects of learning through making. The third expands on the ethics of response-ability.

8.1 Transformation

Following hooks (2009) who places emphasis on the role that educators play in nurturing students' critical thinking skills as students bridge the gap between learning and lived experience, the assignment sought to find ways in which student could actively respond to the imperatives of decolonisation through their design practice. In other words, through their embodied critical engagement with both academic and visual literacy skills, students

troubled dominant discourses and engaged our visually dominated world by both "reading" images, and “writing” with them (Freire et al, 1987; Giroux, 2013). By prioritising student's visual and spoken/written voices in relation to the ancient vases, the assignment set out to mitigate the effects of marginalisation and feelings of "deficit" arising out of a sense of lack of cultural capital (Bourdieu, 1979). Put differently, the bringing to the fore of their ‘non-dominant’ subjectivities both disrupted oppressive discourses and the power relations that reproduce them, thereby transforming both ‘dominant knowledge’ and the power relations that produce and benefit from it (Hempel-Jorgensen, 2015: 539).



Figure 2: Story entitled My journey in becoming a designer

8.2 Ontology

Coupled with an interrogation of the relationship between the written and the visual, the case study investigates the ontological and agentic role of drawing. In this regard, I draw from both Bolt, who advocates a materialist ontology of the work of art that is not simply enacted discursively, but rather "as material and somatic processes that implicate the life of matter" (2004: 173) and Barad who conceptualises the material-discursive as neither "articulated/articulable in the absence of the other", in other words, she argues that matter and meaning are mutually articulated (2003: 822).

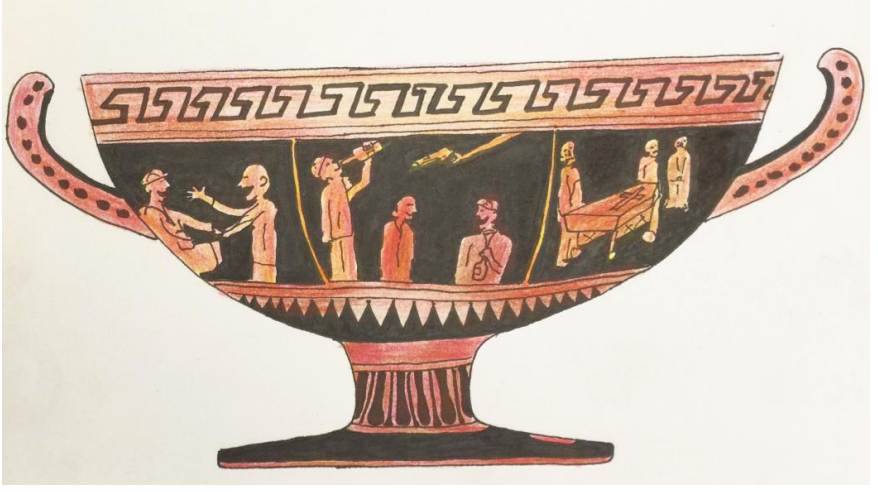

Figure 3: Story entitled Expect the unexpected in life

8.3 Response-ability

Leavy (2015) argues that arts-based methodologies generate embodied engagements through which students are able to think-make with the complexities of lived experience. These encounters not only encourage us "to see and think differently" but offer affective ethical possibilities that build empathy and resonance (2015: 21). However, in her writings about pedagogies of discomfort, Boler (1999) interrogates the limitations arising out of the practice of resonance and empathy and cautions that individual passive empathy alone is neither transformative of existing power relations, nor does it bring about justice. Of particular relevance is her proposition of "collective witnessing" that is premised on relationality between others as well as “to personal and cultural histories and material conditions" (1999: 178).

Returning to Ettinger’s matrixial theory, in which she proposes artworking as an aesthetic and “ethical working-through that occurs when subjective emergence is woven within a trans-subjective borderspace" (2005: 708) an opportunity is opened up for “a compassionate

encounter-event of prolonged generosity". In other words, she puts forward "artworking" as a space and process that offers the potential to generate co-affective trans-subjective ethico-ontological encounters between the artist, artwork and viewer. Concerned with establishing co-poetic aesthetic relationships, Ettinger proposes the neologism wit(h)nessing, as a 'being with' and bearing witness to the trauma of the other, that offers compassionate response-ability that risks vulnerability yet does not give way to assimilation with the other (Ettinger, 2009; 2005); (Pollock, 2010). Given South Africa's traumatic past, and the current crisis within the university, this offers helpful insights for pedagogical praxis in which response-ability becomes key to building trust and solidarity within the learning environment.

In her reflections on Ettinger's praxis, de Zegher (2010: 118–9) conceptualises the process of drawing out and sharing of stories as a core moral responsibility to the world in which art is "congruent with our acting in the world: art draws from life as much as life draws from art. It enables attention to what surrounds us and for some understanding of our life" (de Zegher, 2010: 118–9). In other words, art is part of, rather than separate from, the unfolding of life in which we, as makers and viewers not only participate, but are ethically implicated.

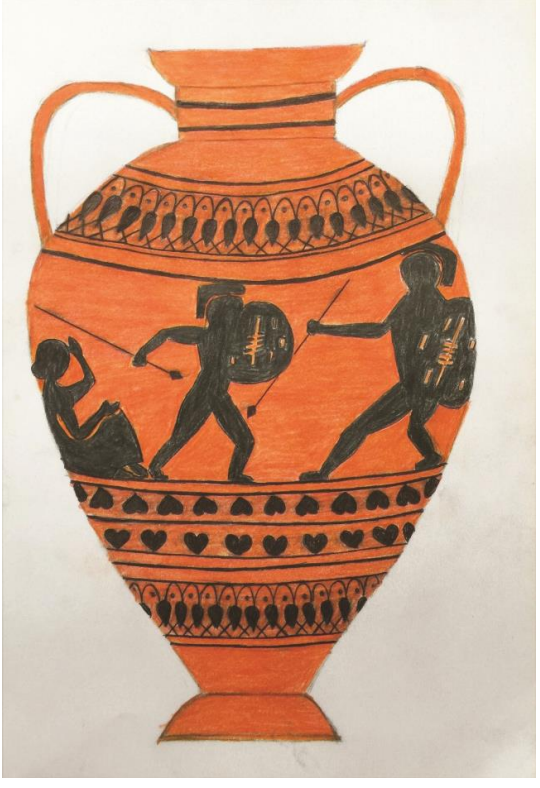

Figure 4: Untitled story about gender-based violence.

9. Conclusion

The inquiry has underlined the important roles that students and educators play in co-transforming curricula, pedagogies (and wider social) relationships and practices (Hempel-Jorgensen, 2015). By utilising diffractive methodology, the research has shown how the intra-actions between the ancient makers, students, their vases and myself have generated mutually-transformative ontological and epistemological encounters that reconceptualise the ethical relationship between the past and present that in turn produce affective outcomes for the future.

As visual and written narratives, not only do the vases showcase histories that have traditionally been excluded from design history, but they become bodies of evidence of the ontological effects of thinking-through-making. Applying the analogy of the body to both humans and their vases, the project seeks to make visible what is held or carried internally as well as what is externalised and made visible. In other words, the students' vases carry both the weight of the past and make visible possible futures that are not prescribed or dominated by western Eurocentric values. On the grounds of this, in addition to becoming markers of their subjectivity within the academy, the students' vases challenge Eurocentric cultural hegemony and the predominant culture of whiteness within the academy.

In drawing attention to the performative affects of the vases, as narratives, as containers, as markers of subjectivity, students perceive themselves as generators of knowledge as they disrupt mimetic practice and become-with their entanglements with the ancient vases and their own narratives. At the same time, the research prioritises the need for educators to practice response-ability (Ettinger, 2006) by developing curriculum strategies that support students becoming within the university.

Finally, by sharing what matters most to them, students add to the pot of complexity that characterises contemporary design. In so doing, they contribute to finding new ways of connections within difference and responding to Thiele's provocation of "how to live in a world of difference(s), a world in/as ongoing differentiation, in such ways that the outcome is not ever more separation and antagonism, exclusion and the fear of others, but so that new senses of commonality are envisioned?" (2014: 202).

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Acknowledgements: Thanks to my supervisors Professors Vivienne Bozalek and Kathrin Thiele for their ongoing support, generosity and encouragement of my PhD project. I also thank the Design ECP students of who generously participated in this project and who taught me much more than I could ever teach them. This work is based on the research supported by the National Research Foundation of South Africa (Grant Number: 120845).

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Culture and Relationality. Moving towards 'post-rational' modes of design.

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Abstract | This paper argues that practices of design, both in education and in professional practice, are becoming increasingly conservative and risk averse. They are perpetuating 'normative' and 'affirmative' practices that prioritise functionality and economic viability over higher values of 'responsibility', 'ethical practice', and the broader concepts of 'prosperity'. The paper proposes 'post-rational modes of design' as a purposeful realignment of design research practices towards more complex and contestational expressions of possibility as a counterpoint to normative practices of a given design situation. Design is never neutral (Papanek, 1974). Instead, it is a social, cultural, and material force (Adams, Keshavarz, & Traganou 2019) that embodies entangled assemblages of ideas, customs and social behaviour. Design is fundamental to culture(s), politics and the socio-material practices of everyday life. A two-minute film accompanies this paper as a co-expression of the described concept. The film was a way of developing, illustrating and articulating this argument through design.

KEYWORDS | RELATIONALITY, SOCIO-MATERIAL, PRACTICE, POST-RATIONAL, SYSTEMIC

1. Introduction

This paper argues that a shift towards ‘post-rational’ modes of design will help push new insights and new practices that benefit economic, ecological, political and social systems. Post-Rational modes of design embrace plurality, multiple relationalities, and multi-sensoriality as fundamental components of future-focused design practice.

The text is a purposeful shift away from the often-banal predictability of reductive, problem limited, concepts of design. Instead, we seek to prioritise agonism as a purposeful process of productive negotiation and expression. The film was produced in parallel to writing this text and is an expression of collaboration, negotiation, and actions of thinking.

The structure of this paper presents three examples of contemporary design research practice that provide insight into what we consider to be examples of 'post-rational' modes of design. The projects are Mathilda Tham, Åsa Ståhl and Sara Hyltén-Cavallius's *BOOST Metadesign*; Unknown Fields *The Breastmilk of the Volcano*; and Lise Amy Hansen's *The InnArbeid Project*. In each case, the use of design differs from traditional [rational] approaches to the discipline, that present new forms of practice that offer new opportunities for the future of design.

By producing the film and analysing each of the case study examples, we present three fundamental characteristics that offer insights into post-rational modes of design. These are 'complexity & plurality'; design ‘beyond outcome'; and design ‘beyond-solutionism'. The paper discusses design practice as part of 'socio-material assemblages', before critiquing what we consider to be problematic within dominant and populist approaches to design.

The paper is written for an academic audience and discusses design in the theoretical and cultural contexts of the discipline. The text is a proposition and invitation for others to consider and critique the prospect of post-rational modes of design.

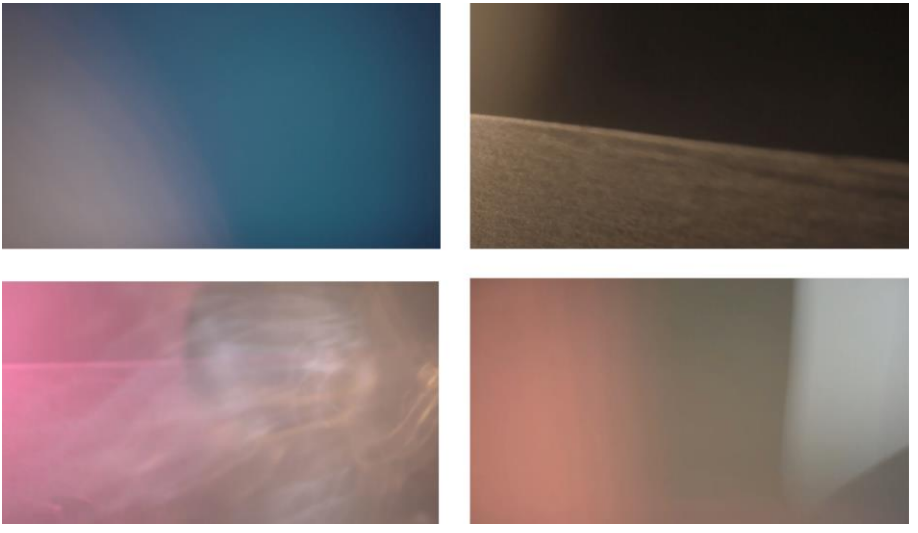
1.1 The film

Accompanying this paper is a short film (see vimeo.com/495553583 and figures 1,2,3,4). The footage presents an abstract visual landscape of flickering colour fields accompanied by a transient, familiar but unknown soundscape. The piece is representative of the complex and unpredictable elements that constitute the contexts that we are designing within. The true value of this process, to the development of our ideas, cannot be authentically summarised in paragraphs of text. Our thinking about post-rationalities in design developed, in part, through the act of making and collaborating. The exercise was context-specific, interpersonal, and performative.

The film was co-composed through the physical act of moving light sources and reflective materials. The process was an unchoreographed dialogue performed through sound and light. Postproduction editing was limited to selecting 'scenes' that we considered to be suitable for our purposes. Terminology relevant to both the film and our thoughts about post rationalities in design includes transitions, complexity, texture, relationality, exploration

and uncertainty. The film is a record of our conversations (audible and non-audible), thinking, editing, describing, and presenting.

This process of incorporating practice-based enquiry to explore non-tangible ideas enabled us to embrace purposeful and open playfulness. It was an act of 'letting go' (Tham, 2020) that helped us to foreground intuition by stepping into a situation of complexity and uncertainty. As researchers, this process was, at times, unsettling. Nevertheless, for us, this 'letting go' led to more explicit understandings of our interests and questions when considering modes of design that take place beyond purely rational frameworks.



Figures 1, 2, 3, 4. Still images taken from the post-rational modes of design film that accompanies this paper.

2. Examples

2.1 Example 1 - BOOST metadesign

Our first example is BOOST metadesign, a design-research project within a larger three-year body of research titled BOOST (Tham, 2019, p.19). The project seeks to mediate the complexities of building and homemaking through metadesign and co-creation. Metadesign, defined by John Wood as “an emerging framework that will enable designers to change or to create behavioural paradigms”(Wood, 2017, p.503), was used in this study to address concepts of building and homemaking by positioning sustainability as a central theme of the work. Tham defines sustainability as “the health of all species on Earth today and in the

future" (2019, p.23). The project works with the needs of migrants, students and the ageing population, to support a diversity of perspectives and narratives that examine ideas of home. The project utilises multiplicity to intersect specific contextual understandings and create new insights of homemaking. Complexity and relational thinking are embedded throughout this project and are used to examine intersubjectivities at multiple scales - from products to systems, to paradigms (Tham, 2019, 30-31).

One result of the project is the consideration of 'design cruxes' - questions, itches and dilemmas considered necessary to negotiate through design but, importantly, not framed as problems to solve (Tham, 2019, p.47). The concept of 'design cruxes' presents a useful theory for design researchers as a reminder of what Haraway describes as 'staying with the trouble' (Haraway, 2016). Haraway introduces 'staying with the trouble' as a way of learning to be present as mortal earthly creatures, entwined in "unfinished configurations of places, times, matters and meanings" (Haraway, 2016, p.1). Tham uses 'staying with the trouble' to honour complexities such as, in this case, diversity, accessibility, and staying within the planetary limits (Tham, 2019, p.47).

Design(ing) is practiced within BOOST, in various ways, through creative methods of engagement, collaborative workshopping and making. The work is disseminated as "a slideshow-performance-talk show-exhibition-film-book." (Tham, et al., 2019, p.175). Part of this dissemination is a book containing recipes and practical design scores, provocations and examples. The book is a resource for people (personal or professional) who are engaged in making homes (Tham, 2019a, p.9). As a portfolio of disseminated works, this project reaches outwards beyond the traditional realms of design scholarship and dissemination. It challenges the legacy ideas that design activities should lead to objects and solutions (Tham et al., 2019, p.177).

In the context of post-rational modes of design, BOOST metadesign, is characterised by its acceptance of unknowability and its commitment to maintaining complexity. The project prioritises ideas of responsibility and ethics while working with frustrations, doubts and differences of opinion. While tensions and frictions present themselves throughout the project, the centring of sustainability and focused ethical responsibility towards those who had co-created with the research team (Tham et al., 2019, p.174) remain the prevailing themes of the project.

The diversity of dissemination activities, which actively seek to engage multiple networks through counter conventional media and communications, further expresses how this research engages design beyond the traditional transactional model of problems and solutions. Arguably, this approach enables this work to present more honest, sensitive, and responsible outcomes than they may otherwise have been had the project sought to superficially reduce this reality's intrinsic complexities into efficiently 'knowable' problems to solve.

2.2 Example 2 - The Breast Milk of the Volcano

'The Breastmilk of the Volcano' is the second example of work that we consider to offer insight into post-rational uses of design. The project, developed in 2016, by the nomadic design studio Unknown Fields. Kate Davies and Liam Young, the Architectural Association School of Architecture's joint programme heads are directors of the studio. The project tells stories of the global and local implications of new technologies in the context of the Salar de Uyuni, the largest salt flat in the world, which until recently remained an untouched landscape of salt lakes and volcanoes.

Unknown Fields investigate uncertain worlds by embedding relationalities, intersubjectivities and pluralities through design research. Their exploratory approaches engage with the subject matter through undefinable scales including landscapes, systems and people. An incredibly diverse range of elements features in this work. Including stories of materials; everyday objects - lithium batteries, telephones and electric cars; places and landscapes; Bolivian politics, an indigenous activist group and ancient mythology.

The project integrates Indigenous cosmologies into the work, providing the project with its title ‘The Breast Milk of the Volcano.’ This title comes from the Incan mythology of Turana the Incan giant and how the Salar de Uyuni came to be. Turana’s story features volcanos, betrayal, loss, and motherhood, which lead to the creation of the salt flats through a combination of her breast milk and tears (Unknown Fields, 2016). Language, photography, film, drawings, embodied objects, and performance are brought together to tell these tales of ‘breastmilk’ and ‘lithium.’

Together these narratives transverse times and spaces, histories, and futures, and promises of technological utopias. The work does not seek to separate or conclude relational understandings but instead explores these relationships as complex 'entanglements' i.e., interwoven, and interdependent relationalities.

> “...we can start to imagine redesigning our gadgets not based on how they slide into our pockets, or feel in our hand, but perhaps for the networks that they set in motion, or the economic resources they might distribute. What could the alternative design criteria be for supply chain design if it weren’t engineered around cheap labour cost and material availability.” (Young, 2018)

For post-rational design, one of the most significant aspects of this work is the questions generated about the role of design and the act of designing. The work makes explicit the relevance of uncertainty, complexity, and shifting positionalities through its formulation of assemblages.

This mode of practice creates the means to engage more complex challenges than those comprehensible by any individual or single point of view. The possibility of multiple, potentially contradictory, readings of the same situation allow for plurality in meaning and relational, context-specific, ways of understanding.

2.3 Example 3 - The InnArbeid Project

The design research within 'InnArbeid' forms the third example in this paper.
The InnArbeid project is an ongoing three-year Norwegian innovation study which aims to promote improved work participation for individuals with developmental and intellectual disabilities (ID) (Hansen, 2019, p.170).

This research is situated in a networked context and with participants who are vulnerable and labelled 'hard to reach.' The project examines the complex systemic challenges faced by people with reduced cognitive abilities. As such, the study embraces a holistic approach to the enquiry to engage with complexity and fundamentally incomplete situation (Hansen, 2019). The study design adopts an unusually long timeframe for a design research project - working with participants from school age to finding work and remaining in work. The study also engages with multiple key informants and stakeholder participants.

Significantly, the project also utilises a 'forstyrrergruppe' - disruptive expert group (Hansen, 2019, p.179). The forstyrrergruppe, made up of designers and researchers, is tasked with critiquing the work as a way of protecting the study from its own good intentions – a form of constructive agonism.

The InnArbeid project uses explorative and adaptive design processes. The research team prioritise language that asserts the moral position of 'working with' its research participants, rather than 'doing to' (Hansen, 2019, p.174. Ingold, 2011. Sanders & Stappers, 2008). Within the study, design methods were used to visually present the voices of the people with intellectual disabilities, while also seeking to avoid stigmatising clichés (Hansen, 2019, p.174). The team utilised video, visual materials and physical prototypes to support alternative ways of communicating. Hansen highlights tensions in this work that relate to how we recognise design.

> "...the propositional nature of design [vs] that of a deductive, rational, progression towards innovations [vs] the diverse insights from such hard-to-reach people." (Hansen, 2019, p.181)

This project highlights the value of design research as a cultural and performative endeavour (Hansen, 2019, p.181). It is an example of design research that seeks to benefit people who are often marginalised in society by including the lived experience and personal motivations of those that the work seeks to benefit. The study embraces the complex social and cultural realities and applies principles and practices of design to support systemic change.

Importantly, the project presents a distinctly different mode of practice than the typical short term design challenge narrative of 'problematise' then 'solve'. Instead, the study seeks to engage in a sustained process of not knowing by utilising a diversity of critical feedback to maintain a balance between action and understanding.

3. Discussion

The summary review of the case study examples outlined has enabled us to identify three characteristics that offer ways of considering design that are not constrained by normative and operational practices of design. These are 'complexity & plurality'; design ‘beyond outcome'; and 'beyond-solutionism'. The following section expands on these ideas further before providing a brief overview of what we mean by 'Design' in the context of post-rationalities.

3.1 Design complexity and plurality

In this paper, we argue that designers and design scholars are increasingly concerned with ever more complex ecological, political and societal, challenges. The evolution towards practices that are socially engaged, research-driven, and aligned with 'wicked problems', is now widely accepted as being within the remit of design (Sweeting et al., 2020). Unfortunately, populist discourses in design, tend to over-simplify the discipline and focus purely on design outcomes. This emphasis on interventionistic solutionism serves to perpetuate the narrative of design heroism – placing the value of design primarily on the individual rather than the broader benefits of its application, or the progress of the discipline.

At their worst, designers are guilty of designing ever more elaborate solutions to the wrong part of the problem - the symptom rather than the cause. To put this another way, answers are irrelevant if the questions are wrong. While there is undoubtedly both value and need for practical solution-focused design, there is also a need to evolve the discipline so that it can continue to engage with the increasingly complex and uncertain challenges that are faced globally.

> “Design theory, practice-based design research and critical design practices increasingly contribute to critical accounts of design as an instrument of power, discipline and oppression.” (Mazé, 2019, p.34)

Furthermore, it is increasingly recognised that knowledge and insights are generated because of the doing (process) rather than the done (outcome) (Lambert & Speed, 2017, p.105). This possibility rather than problem-driven approach to design will now be discussed further.

3.2 Design beyond outcome

Since the 1800s, Design has been dominated by technological and commercial forces and modernist ideals popularised by organisations such as Bauhaus. However, the discipline has always operated beyond these rational and reductive modes of practice. And, increasingly, as the limitations of reductive solutionism become more apparent, there is a renewed need to adopt modes of design that are more flexible and inclusive of social, cultural and political aspects of society.

> "In creative exploration, ideas tend to emerge and develop on the move—sometimes impulsively, sometimes reflectively—rather than arising from the investigation of a hypothesis in controlled conditions." (Lambert & Speed, 2017, p.104)

Design theorist Anne Light argues that within this recent social turn in design, the materials are no longer material (Light, 2019). Furthermore, John Wood argues for a move from products to relations.

> "In seeking an alternative to consumption-based systems of production and disposal I advocate a profound conceptual shift from products to relations" (Wood, 2017, p.512).

While we consider this a positive evolution of the discipline, we must not disregard the fact that relations and practices are mediated in the material world, as such design has material implications and offers access to multi-sensory situations. Practices of design now have access to the politics and cultures of the everyday. Design can be used as a socio-material tool for research to illuminate, interrogate and influence the invisible rules within socialities and across cultures.

The evolution of Design towards something more responsive and transcendental raises new possibilities for how we conceive of the outcomes of design practices. We will now discuss ideas about design beyond solutions.

3.3 Design beyond solutions

The paper adopts the position that for the discipline of Design to maintain relevance and purpose, it needs to continually seek novel modes of practice that are purposely diverse and responsive to emergent normative practices. It is the agonistic tension, adaptability and breadth of approaches that characterise the discipline of Design. They enable it to be agile, adaptive, and capable of engaging with the complex and rapidly changing challenges facing societies, cultures, and species globally. Mazé argues the qualities of designed visions of the future in 'opening up' and 'thinking otherwise'.

> "As designers, we may not only put forward shallow claims of 'solving problems' or making a difference', or even important critical reflections on the question of "What difference does it make?", we may use designed visions of the future to open up for thinking and doing otherwise, including handing over the question to others (as a political act)."(Mazé, 2019, p.34)

Post-rational design modes seek to promote further discourses that celebrate intersubjectivities, pluralities and relationalities in design theory and practice. It is a celebration of playfulness and uncertainty as central features of the discipline. This position is, in many ways, a counterpoint to norms within the design discipline that uphold the dominance of reductive, problem-focussed, approaches that characterise much of design

education and research under the guise of 'progress' and 'efficiency'. Tony Fry argues for the need for relational thinking in design (2009, p.32).

> “Transposed into a theory of knowledge, relationality contrasts directly with the linear notion of cause and effect which has been such a dominant feature of Western rationality. In that the ability to sustain depends absolutely on relational interactions its development and deployment as a theory of knowledge able to direct design will become increasingly critical.” (Fry, 2009, p.31)

Building on the ideas of relationality, complexity and plurality, we will now elaborate on the idea of design as a form of ‘socio-material assemblage’ and discuss the relationship of this framing to post-rational modes of design.

3.4 Socio-Material Assemblages

Post-rational design modes positions design practices within 'socio-material assemblages'. This positioning provides design research with a framework for discussion situating design as part of the complexities, and how design research engages beyond outcomes and solutions. The three examples in this paper highlight very different ways that design research transcends traditional disciplinary classifications. The explorations in these works converge across materialities and socialities.

Design of all kinds intervenes in material and non-material configurations that make up everyday life. As such, Design mediates our interactions; and is 'entangled' with the socio-material assemblages (Muller, 2015) -these include politics, norms and cultural identities of time and place (Delanda, 2016, p.9).

Drawing on the theory of Karan Barad, we argue that the social and material elements (which form all design research contexts) are inter-relating and inseparable (Barad ,2007); that matter and meaning are entangled and cannot be disassociated (Barad, 2007, p.3). These assemblages are relational (Muller, 2015, p.28), constantly in flux, forming, mutating and transforming (Muller, 2015, p.29). Acknowledging that Design is within socio-material assemblages and that these are uncertain states, allows us to discuss design as both part-of and working-within the living systems that surround us. Humans (together with non-human species) shape our environments, and these environments, in turn, shape us (Tham, 2019a, p.8).

Some may argue that working with complexity, including relationalities and pluralities in this way is not possible; that it is impossible to understand the networks that are designed within fully. We argue that separating and not attending to these socio-material complexities can lead to ineffective design, or lead to harm (Tham, 2019, p.25). The examples used in this paper illustrate the way that Design can be paying attention within these networks, which we argue is particularly relevant when Design is engaging with contexts of sustainability including wicked challenges of social and environmental justice.

3.5 Rational Design

The ideas of post-rational' presented here do not seek to undermine or undervalue the need for rationality - or using reason and logic in design. However, we seek to highlight the limitations of narrow concepts of design, arbitrarily formulaic design processes, and an overenthusiastic acceptance of measurability.

Increasingly, it is that which is measured that is valued. This axiom gives priority to that which is easily measurable, to the expense of that which is not. However, measurability is not neutral. The tools used to provide measurement and politics used to guide decision-making profoundly affect what is valued and prioritised.

As design becomes increasingly engaged in environmental, societal, and cultural situations that are ever more complex and wicked, measurability's limitations become increasingly problematic. Within many western commercial practices of design, it is the functional approach that has come to characterise the discipline's value. This de-contextualised rationality has come to dominate design culture; consequently, there is little space for modes of practice that push beyond these superficially robust frameworks. We seek to emphasise the importance of promoting a diversity of design cultures to support new, more capable, ways of knowing.

One common oversimplification is the alluring definition of design as a discrete practice. For example, when communicated as a specific method or approach - "I have designed 'x'". While helpful in some circumstances, these definitions only capture design as an action in response to a challenge, i.e. 'designing' - applied to accomplish assigned targets. While incremental improvements are favourable when compared to non-action or selective ignorance – they only really engage with the symptoms of the problem. More significant reforms are required if we are to achieve meaningful, lasting change.

Here, we argue that the value of design is situated within its ability to mediate multi-sensory experiences, materiality and the everyday. It is presented as a way of knowing and understanding personal experience that is distinct and which prioritises sociality and shared togetherness. While this definition may be familiar to many design practitioners, the full scope of design practices remain restrained and restricted - side-lined by unhelpful outdated models of problem-solving and reductive research protocols.

4. Conclusion

We presented a short film and three example design projects that, through critique, illustrate ways of working that we consider to be examples of post-rational modes of design. We argue that each of these works engages design in novel ways and lead to unique insights that reach beyond the 'problem-solving' stereotype that is often given to design. Instead, in each case, significant complexities, including context and circumstance, are embraced and celebrated. The works foreground relationality, the practice of designing (rather than design

as outcome), and, although not described explicitly, attend to the more significant challenges of responsibility, morality and ethics.

Interest in post-rational modes of design has come from observations that the academic discipline of Design is often misrepresented and oversimplified. Catch-all framings such as 'design thinking' and 'human-centred design', while appropriate in some circumstances, create monoculture understandings that stifle the evolution of the discipline. Post-rational is an attempt to acknowledge the value of practices that stimulate action beyond the predictability of the (purely rational) design and to seek alternatives to the, primarily western/colonial, design cultures that currently dominate the discipline. In doing so, we are arguing for more diverse and alternative conceptions of rationalities within design.

By analysing each of the case study examples, we present three fundamental characteristics that offer what could become foundations for discourses that examine ideas of ‘post-rational’ modes of design. These are 'complexity & plurality'; design ‘beyond outcome'; and design ‘beyond-solutionism'. Further work is needed to elaborate and develop the ideas presented here fully. We believe this is a useful starting point and an invitation for others to critique, respond to, and develop further.

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Acknowledgements: We would like to give our thanks to Charlie Kew, a key collaborator in the making of the film. Thanks also to the AHRC Design Star DTP, Radical Methodologies Research and Enterprise Group (RaMREG) and the Design Research for Change strand of the Centre for Arts and Wellbeing at the University of Brighton for their ongoing conversations and support.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Design History and the Decline of Historical Thinking

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Abstract | A study published by Benjamin Schmidt in 2018 has shown that history majors have been declining over the past decade in U.S. colleges. According to Schmidt's study, after the economic crisis of 2008, history majors, among American Colleges, are the ones whose numbers have seen a more dramatic and consistent decay. This matter arises the question about the role of history in strongly project-based disciplines in which, the field of history was recently established. Unlike architecture, the history of design is a discipline relatively new, especially in the context of Latin America where most design majors were established during the second half of the twentieth century. Such short history, represents a challenge for both researching and teaching, especially because it was under the scope of an art history driven approach. This proposal presents an overview on the way the design history curriculum at Universidad de los Andes has faced these challenges and the strategies developed to tackle them using both, information technology and a pedagogical approach that concedes more agency to students, while broadening the traditional scope of design history to design studies for its redefinition in a historical moment when historical thinking seems to be on decline.

KEYWORDS |DESIGN HISTORY, CURRICULUM, LATIN AMERICA, DESIGN STUDIES, SYLLABI

1. Introduction

A study published by Benjamin Schmidt in 2018 has shown that history majors have been declining over the past decade in U.S. colleges. According to Schmidt, the number of bachelor degrees awarded reduced approximately 28% between 2008 and 2017 (Schmidt, 2018). Alterman (2019) picked up from Schmidt's study and further asserted that this has led to some authors to conclude about the declining process historical thinking have gone through over the last years.

This conclusion arises the question about the role of history in strongly project-based disciplines such as design. In 2009, there was an intense discussion about the future of design history and its role in the formation of future designers. Thinkers such as Dilnot (2009) and Lichtman (2009), adamantly posited the question on how to further develop the area and presented a critical approach as well as some opportunities in design history as part of design practitioners curricula. Banu (2009), also raised the idea about the role of design history within a post-colonial framework and its possible role in the development of regional identities in addition to the necessity of decolonizing its narratives.

Around the same time, the first comprehensive work to try and understand the history of design in Latin America was made by Fernández and Bonsiepe (2008). A decade later, Lara (2016) presented her findings on the development of the discipline in the region, stating that it was still emerging and trying to find a balance between the quest for modernization and globalization while struggling to preserve local identities. Colombia has taken part of these reflections and has undoubtedly been part of the global reach design history has acquired over the past years, according to Lara.

One of the challenges implied in teaching the history of design, is to keep up with the teaching duties and balancing it while also furthering the production of knowledge in the field of studies. Another set of challenges is represented by issues common to this era, related to the access to information; the use of technology in the classroom; the changing boundaries in the professional exercise of design; the crisis and change of paradigm in production, infrastructure and labor; the relevance of design history for present-day practitioners; and new methodological approaches related to class, gender and race. In this proposal, I offer an overview on the way the design history curriculum at Universidad de los Andes has faced these challenges and the strategies developed to tackle them using both, information technology and a pedagogical approach that concedes more agency to the students while broadening the traditional scope of design history to design studies or design culture for its redefinition in a historical moment when historical thinking seems to be on decline.

2. The Art History Legacy

Taking as a starting point the legacy of art history to understand the teaching processes of design history, seems obvious and even almost naive. However, from that naivete, essential questions arise about the profession of the historian, researcher and professor. For example, how is it possible to historicize something as popular as design from the perspective of art history, especially when most of its intellectual tradition, at least up until the sixties, is based on the analysis of high culture? What could have been the implications for the history of design, both in Europe and the United States and in Latin America, to build curricula based on this premise?

In the nineteen eighties, Dilnot (1984) wondered about the relationship between design and other areas of study, particularly confronted with art history. According to the author, before 1939, apart from the history of architecture there were some approaches to what we would call today the history of design, in the decorative arts as a branch of the history of architecture, this particularly pointed out in the pioneering work of Nikolaus Pevsner of 1936, Pioneers of modern design (Pevsner, 1968). But beyond trying to identify the exact origin of the discipline, what matters the most in this section, is to identify the legacy and influence of art history in the construction of design history curricula. This situation was emphasized by Margolin (1988) regarding his initial reflections on the relationship between art history and decorative arts. While Margolin recognizes the importance of the guidelines drawn from art history to the history of design, he also quickly identifies the limitations of this approach whose parameters were established by Pevsner and then were continued by the Museum of Modern Art in New York (1988, p. 57). That is, a formalistic and iconic line of great movements and schools, which also aligned with key authors of the first half of the twentieth century such as Warburg, Panofsky and Wölfflin, among others. According to Margolin, most of the doctoral theses in the eighties focused on styles, schools and movements such as Art Nouveau and Bauhaus that could somehow establish a closer dialogue with traditional art history school. Works such as D. Bush's on popular culture and consumer products had a poor reception within the community of art historians (1988, p. 58).

In Latin America, the recognition of the area of studies in design history is even scarcer and still moves within the margins of academic recognition. In this sense, it is important to recognize the belated industrialization process of the region thanks to the ISI program implemented through ECLAC and which remained active between 1930-1980 (Fernández, 2006). According to the research and the map presented by Silvia Fernández, the first design programs were established in the region from the sixties. This despite the existence of evidence on some background of courses and specific talks given in some universities by former students of North American and European universities or even by the same teachers of schools such as the Bauhaus and the hfg Ülm as is the case of Josef Albers, Walter Gropius and Paul Linder, among others.

Ten years after the publication of Silvia Fernández and Gui Bonsiepe's research on the origins of design education in Latin America, Lara-Betancourt (2016) presented a balance sheet on the state of design history teaching in the region. Among the points highlighted, the author stresses the incipiency of the process of industrialization in Latin America. She also stresses the scarcity of studies on manufacturing and design processes associated with industry. In Colombia, and despite having been officially recognized as one of the central components of design education (Colombia - Ministry of National Education, 2003), history and theory, is still a declaration of good intentions that still, allow at least a reflection on the role of history in the teaching of design.

Personally, during my formative years as an industrial designer in the 1990s, I witnessed the prevention with which art historians faced the teaching of design history, making a great effort to identify the communicating vessels between one and another area, but always giving prevalence to an approach similar to the one pointed out by Margolin, based on formalistic approaches and through the study of personalities, schools, and movements.

However, the legacy of art history for the history of design –beyond its strangeness towards the industrial, commercial and, consumer aspects of design– lies in the chronological and stylistic structure of the curricula, as well as in teaching formats such as lectures and methods of analysis.

3. The Cultural Studies Approach

Without a doubt, the most important contribution of cultural studies to the understanding of society through its cultural manifestations was the identification and redemption of popular expressions of culture. In addition to the work of authors such as Gombrich[1] and Baxandall[2], both of whom introduced elements of cultural history, the popular and everyday life in the understanding of the work of art, work from cultural studies from the seventies, was fundamental to broaden the spectrum that, from the academy, allowed to validate the study of expressions of the consumer society without having to go through the legitimizing filter of high culture.

The role of cultural studies theorists such as Raymond Williams and Stuart Hall, was paramount in defining the basis for generating the theoretical framework that bring the popular as topic of academic discussion. Williams, on the other hand, insisted in showing the ever-changing role of culture and coined the terms *residual culture* and *emerging culture* to refer to the historical dynamics of transition between cycles of acceptance and rejection of

[1] Cf. Gombrich, E. H. J. (1984). *The Sense of Order: a Study in the Psychology of Decorative Art* (2nd ed.). London: Phaidon Press.; Gombrich, E. H. (1963) *Meditations on a Hobby Horse: and Other Essays on the Theory of Art* London: Phaidon Publishers.

[2] Cf. Baxandall, M. (1972). *Painting and Experience in Fifteenth Century Italy; a Primer in the Social History of Pictorial Style*. Oxford: Clarendon Press.

cultural phenomena. In the field of the arts and the relationship with society, Williams assured that the relationship is not of simple domination but dialectic and interactive between art and society in a process in which they mutually shape each other (Leitch, 2010, p. 1423). In this sense and within the framework of an industrialized society, the cultural productions of the consumer society represent the ecosystem that by nature defines both its cultural productions and the individual and society. Stuart Hall on the other hand, and for the particular case of the look from marginal societies to great industrialization processes, provides a look from the difference that does not necessarily deny the dominant culture but understands it as a fundamental part of the equation through which power negotiations are held (Leitch, 2010, p. 1779).

In the framework of understanding design as an essential cultural manifestation to twentieth-century society, Guy Julier (2006) contributed in his widely cited article From Visual Culture to Design Culture, the elements that were largely derived from cultural studies, which they served as a framework for the consolidation of design studies. Guy establishes the traceability of areas of study such as material culture and visual culture from a mix between cultural anthropology, cultural studies, and art history. Both material culture and visual culture must provide, according to Guy, the basis for the consolidation of what he calls *design culture*. Its definition of design culture, aims to go beyond the scope of visual and material culture to the extent that the experience of contemporary design encompasses the entire sensory spectrum and understands it as the system that structures and is situated at the intersection between the visual and the material (2006, p. 67).

The challenge that it has represented and still represents for Latin American scholarly production in the area of design studies in Latin America, lies in: 1) To keep up with European and North American academic production in Latin American Design Studies, and, 2) To produce a body of knowledge to consolidate master's and doctoral programs in the area, just as consistently proposed by Margolin (Margolin, 1995, 2002, 2010). The challenge also consists in decolonizing the narratives around the history of design, which poses challenges, starting from the definition of what design means within the region, through the recognition of its scope, ethos, pathos and logos for Latin American societies. From my perspective, this search should focus on acknowledging design as an omnipresent manifestation, which acts as intermediary in everyday negotiations in a region with complex inheritances, linked to its colonial past and countless unsolved complex problems. Posited this way, this proposal seems to leave behind many thematic scenarios that have traditionally been explored in the region by design history. Particularly, I refer to the epistemic discourses about the object and culture, heritage, local artisanal production and economic movements of the region at the mercy of hegemonic macropolitics. However, the interest is not to leave them out but to frame or complement them based on the inclusion of these variables determined by geography and historical processes. Lara-Betancourt's (2016) approach, seems to head in the same direction since is based on the connection between Latin America and the consumption of goods and technology from both, Europe and the United States. This is a phenomenon that has been taking place in the region since the

nineteenth century, and it also had an impact in terms of the construction of local identities but also in terms of race, class, and gender. Taking into consideration all these variables, are paramount in order to be able to understand the complexities of the region.

4. Design and History at University of los Andes

The history of design programs of study in Colombia, date back to the 1970s when most of the programs were created in Universities, mostly in Bogotá and Medellín (Peña, 2009, p. 125). The creation of these programs, coincides with the period of deindustrialization indicated by Bejarano et al., (Bejarano, Tirado Mejía, & Melo, 1989) and with the final phase of implementation of the Import Substitution Industrialization (ISI) program. Compared to the early creation of design departments at Universidad Nacional de Colombia, and those of two private universities, the Javeriana and the UJTL, the creation of the undergrad program at Universidad de los Andes, belated, in 1994. Back then, de-industrialization in the region was no secret[3] but in spite of that, the program was still formulated to serve the industry.

In spite of having been created in 1994, the program was not completely created from scratch and some of its antecedents are worth to mention: 1) The feminine section; 2) The architecture department 3) The art and textile department. In the essence of these three instances, the genetic code of design in the Andes is inscribed. The women's section, emerges as an initiative of the founder of the University, Mario Laserna, for basic study of the arts and humanities. The arts section of the women's section was in charge of the sculptor Hena Rodríguez and later when the Faculty of Philosophy and Letters was created, Marta Traba was in charge of teaching art history classes (Peña, 2009, p. 140).

On one hand, architecture was responsible for summoning the concept of design based on the adoption and circulation of central ideas of modernity. The School of Architecture was part of the founding project of the University in 1948 and many of the professors arrived with clear influences derived from CIAM (International Congress of Modern Architecture) and from study abroad experiences. Architects such as Álvaro Ortega, were responsible for introducing concepts such as modularity and serialization as well as having contributed at some time to manage Josef Albers' visit to the newly created university campus. In the First Colombian seminar on the teaching of architecture, the postulates of Walter Gropius were the central topic of study, which in turn contributed to the definition of architecture curricular plans in the country. Gropius' and the Bauhaus' influence can be seen reflected in the prevalence of basic courses of design that were effective in most design programs since the 1970s.

[3] "In 1984, 762 companies were created compared to the barely 57 companies, created in 2001[…]" (Peña, 2009, p. 125).

Finally, the department of arts and textiles allowed the university to establish a direct connection with modern design education. Marlene Hoffman, Olga de Amaral, and Stella Bernal, Cranbrook Academy alumni, directly brought the methods and pedagogical influence from the Scandinavian design tradition of the Saarinen, Eliel and Loja.

Addtionally, design practice naturally took place in spite of academia. Consumer society, although incipient, naturally forced the emergence of commercial artists that, most of the time, had a background in arts. The modernization process naturally required, but by leaps and bounds, the product of the intersection between art and industry. Most of the so-called vernacular design, was produced outside the academic circuits. Paradoxically, it took a while time for both vernacular and academic design, to acknowledge each other's importance as part of the modernizing agenda. Since the 1970s, both, the Bauhaus and the hfg Ülm, have shaped many of design curricula, not only in Colombia but in Latin America. In particular, the influence of hfg Ülm that had a great impact bringing forth a scientific approach to industrial design curricula.

5. A case study: DISE1204 Design History

After theoretical framework, let's discuss some of the aspects pointed out through the case study and challenges implied in teaching history of design at the Universidad de los Andes. Initially, the undergrad program has changed from Industrial Design in the most classical sense of the term, to merge with textiles, through simply being called "Design", without epithets. To make a long story short, the succession of names, summarizes to a great extent, a different and more comprehensive understanding of the context in which the process of de-industrialization was a major consideration.

Regardless of its name, the program has always offered at least one design history course. Until Fall semester 2019, the undergrad program offered just DISE1204 History of Design, as the only history-based course. Since its creation, this survey course, has had different versions depending on the lecturer. Overall, the course followed a fairly classical structure based on a chronological structure. In 2015, with the advice of two experts, one in technology and the other in pedagogy, and as part of the CONECTATE (Information and Communication Technologies) program, a major reform was introduced. In order to synthesize and facilitate its understanding, I will divide it into three: Pedagogy, technology and findings.

The pedagogical reflection is mediated by the concern that this article establishes as a starting point and has to do with the relevance of historical thinking in design teaching. This issue is particularly sensitive in a discipline that is characterized by its pragmatism and production of aesthetic experiences through sensory-experience manifestations. In the age of information society, when everything a designer needs to know about history and its aesthetic references seems to be within reach of a couple clicks and glances, the question remains about the sense and meaning of design history curricula. Similarly, many questions

arise from the teaching practice: from generational gap kind of issues, related to learning processes and information management, to the same pedagogical model of design teaching, which has been traditionally based on a long tradition of Art History lecturing. To tackle this problem, the first iterations of DISE1204 focused on provide the students with an opportunity to conduct outdoor activities that would allow them to generate connections between concepts –not events– and urban everyday life. In order to implement this idea, eight topics were defined as the course structure that revolves less around the great events, movements, characters or icons on the history of design, but more around problems related to contemporary design practice. Therefore, the criteria to define the themes or topics, were based on studio practice and their expectations as designers in formation, rather than focusing on canonical structures that make sense for art historians but that do not necessarily resonate with contemporary design practice.

On the other hand, there was a curatorial process to create contents through which a great deal of the regular topics, images, and content, was significantly trimmed. Rather than focusing on the content, a crucial part of the exercise, was to articulate pieces of information to bring about concepts from history under the guise of contemporary design practice problems. In order to accomplish this goal, short videos were carefully but also amateurishly crafted. The script writing was exceptionally useful in the sense that contributed to make me conscious about the structure and articulation of my own historical narrative in order to get a streamlined version of it. The videos were lined up around eight topics, namely as follows: 1) The Power of Images, 2) The Quest for Order, 3) Everyday Life, Experience, and Ideology, 4) Gaze and Performativity, 5) Progress and Cities, 6) Transitional Aesthetics, 7) Domestication of Modernity, 8) Innovation, Serialization, Consumption.

CONECTATE played a fundamental role in the implementation of technological innovation in the classroom. Their guidance was especially useful in identifying the technology to be incorporated in the different activities for students that, at the same time, would help them to produce and contribute contents to bring for discussion during sessions. Another mechanism to stimulate student participation, had to do with the use of clickers and platforms such as Kahoot (Sánchez & Barreto, 2018). City tours were accompanied by augmented reality tools such as Blippar or through the use of QR codes. Most of these implementations were available on Blackboard which constituted the virtual environment thought which most of the contents but also tests, surveys, communications, and readings, were delivered. The platform was central in securing reliable communication between students, professor and teaching assistants.

Lastly, we were able to evaluate the innovation in three moments during the implementation phase, that took part mostly in 2017. Forty two out of seventy five students took part of the last survey about the course (Sánchez & Barreto, 2018). The balance was satisfactory insofar as they effectively identified an opportunity to exercise their autonomy through the performance of activities that most of them described as interesting. The Blackboard platform also contributed to strengthening the impression of transparency in the

management of the course and valued the videos produced by the teacher to deliver the contents.

6. Conclusion

The demystification of design as a cultural expression and a living art, is essential to consolidate learning processes. While the role that art history has played in teaching design history is important, it is necessary to understand the particularities of local epistemes in order to generate new frameworks for understanding its own dynamics. In the same vein, the exercise of understanding the history of design from the perspective of the contemporary practitioner allows us to navigate the past with clear questions about a more empathic historical investigation. The approach to historical problems through the lens of critical theory and cultural studies, contributes to bring to the history of design and the arts in general, discussions that at least in the Latin American context, are perceived as uncomfortable as are those about race, class, and gender. Especially in the field of arts, discussion on this topics has been marginalized and deemed uncomfortable to say the least, in order to preserve the asepsis of the study of arts. However, I deem this tendency as part of systemic inequalities deep rooted in the history of the region that are usually disguised as high culture and supposedly intellectual rigor. The history of art, architecture, and design in Latin America, largely corresponds to what Antonio Gramsci characterized as power systems backed by the notion of cultural hegemony that are legitimized at the same time, through the authority of the intelligentsia.

In the case of the history of design, there are still not known statistics to let us make an assertion about its decline. Based on just impressions coming from social media and overheard conversations from my students, I could even argue that there is a renewed interest in history based on the increasing interest aroused by social media and digital platforms such as Netflix, Pinterest, and others. History seems to be very appealing for aesthetic capitalist purposes but that same phenomenon can also represent its decline. Not because is going to lose importance, but because it runs the risk of ending up turning into pure entertainment and senseless sensory stimuli either for creation or consumption. Design history and history scholars can run the risk of keep talking to each other while consciously or not, ending up legitimizing the prevailing system of power which is highly problematic in postcolonial societies. Keeping up with the inertia of design history teaching, not only translates into a type of intellectual and cultural inequality but is also harmless in terms of promoting agency to individuals and fostering meaningful changes in society.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Designers-Thinkers and the Critical Conscience of Design

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Abstract | The tension between artistic expression, the ideal product, and the inevitable compromising that is required through mass production has been powerfully verbalised and illustrated by two world famous designers from geographically distant design cultures: Kaj Franck (1911–1989) and Enzo Mari (1932–2020). Both designers speak about design priorities and essential functional forms with a purpose. Both 'moralist designers' have been named 'the conscience of design' by their colleagues for their critical voices on design practice expressed towards a professional environment, which had become too superficial. What does conscience mean in design cultures today? Is a superb moral backbone sign of a 'design inquisitor' as Alessandro Mendini wrote on his *Domus* editorial "Dear Enzo Mari" 40 years ago, when he defined him as the *conscience of the professional community*?
This study on two critical 'thinking designers' (considered important for their moral messages on design ethics, a responsible way of working and communicating in design) is a part of a comparative study on design approaches in two different design cultures.

KEYWORDS | DESIGN PHILOSOPHIES, THINKING DESIGNERS, DESIGN APPROACH, DESIGN PRINCIPLES, DESIGN ETHICS

1. Introduction

What do we know about the world map of design philosophers, theorists, and writers who are not active in the anglophone research context? In non-anglophone European countries (such as Italy and the Nordic countries), a strong design culture and identity is bound to local language and visual grammar. Design is a system of communication beyond boundaries, but many central figures in design history have not been able or willing to speak foreign languages. The question of Design Cultures is very much a question of approach: whom you relate with, how ideas travel and are subsequently transformed when adapted to a new context.

The history of theorising design discipline and its moral foundations goes far back to politically active practitioners, such as William Morris (1834-1896) and internationally active 'transnational' figures like Tomás Maldonado (1922-2018) developing definitions of industrial design and curricula for Industrial Design education in the US, Germany and Italy. The timeless design theories and philosophies developed by *practicing designers* – such as Dieter Rams' 10 Principles of Good Design or Bruno Munari's cooking metaphor and mind-blowing thoughts by Ettore Sottsass – are important food for thought for design students as examples of coherence between ideals and practice, research and implementation.

This paper compares two central ***'thinking designers'*** considered important for their moral messages on design ethics, a responsible way of working and communicating design. This way of developing theories through practice and teaching work is different from the design critic's or the art historian's approach. The tension between artistic expression and mass production, the ideal product and a compromising marketing proposal have been powerfully verbalised and illustrated by world famous designers Kaj Franck (1911–1989) and Enzo Mari (1932–2020), both belonging to geographically distant design cultures, but expressing similar design ideals. Both of them have been called the '*conscience of design'* by their colleagues for the reasons of critical view of design practice in the professional community which they consider had become too oriented towards a superficial market-driven design practice, or towards a system obsessed with celebrity. The products by both designers are about design priorities; essential functional forms with purpose. These two masters of design are effectively spiritual guides in design philosophy.

I compare the ideas of these '*moralist designers*' and their timeless thinking in two apparently different design cultures of the second half of the XXth century.

The criticism of kitsch and irresponsible products has been a topic for over 50 years. While Victor Papanek spoke about the "most harmful profession in the world" (Papanek 1971, 1985, 1997), these designers were busy with their utopias and their (design) activism: social justice and design projects which respected the labour force in the factory that manufactured them, and design principles that took into account consider economy, ecology, ethics, aesthetics, and ergonomics.

1.1 The Context

This article is a part of a broader comparative study of design cultures and relative thinking in two 'design nations', Italy and Finland. The theoretical framework on a rich amount of data regarding design philosophy and design communication (literature, interviews, experiments and empirical data) in different cultural contexts, is based on Grounded Theory (GT), the method adopted from the social sciences, that allows one to build a theory on discovered data by coding and comparing one's findings (Glaser, 1998).

The reason to compare the design philosophies of these two protagonists is their unique role as nationally recognised *ethical designers* calling on the professional community to respect moral values and good design principles, almost like design priests.

This year is a perfect moment to reflect on Enzo Mari, whose retrospective exhibition will be finally open at the Triennale in Milan. This is the last occasion to see Mari's extensive work before it will be locked in the CASVA archive for forty years. When donating his archive of 2,000 art and design projects, Mari set a condition to the City of Milan: "it will take forty years before a new generation would be able to make good use of it, and understand the profound meaning of things".

2. Cultural differences in design: Italy and Finland

The reason I have studied different *design approaches* and theories developed by practitioners is because of academic curiosity: the diversity in approach related to international design students, and the surrounding institutional way to communicating design matters.

Some clichés related to our cultural mindset and psychology as consumers and producers can be questioned or approved, but everyone working with design has an idea of what constitutes "Italian design" (sport cars, plastics, Castiglioni, Sottsass, Olivetti) or "Finnish design" (wood, glassware, Aalto, Marimekko, Iittala, Nokia).

The national design branding influenced by architectural & design magazines, institutional design promotion and design industries may remain apparently unchanged for decades, while educational institutions and researchers are approaching a completely different reality. Thus, communicating design ("what design can do") and its possibilities in a post-industrial society depends on our ability to explain it to a broader audience of those who can implement good practices e.g. in the public sector and politically important strategies.

We know Italians for the artistic genius and superb manufacturing skills, the elegance of every detail. Many designers all over the world would love to work with Italian design companies, so unconventional in experimenting with new technologies and radical innovation (Verganti, 2009).

This reputation in the field of industrial design and fashion is unfortunately disappearing owing to globalisation taking away manufacturing from Italy. Some kind of chaos (albeit of a typically Italian creative kind) has become a serious problem with the downturn in the Italian economy following the prosperous eighties. While the surrounding world is reacting to serious environmental problems by adopting new clean-tech industries and ambitious carbon-free solutions, Italy, with all its creative manpower seems more like an eternal talk-shop. The gap between politics and research, education and industry, is alarming when a new EU Green Deal is considered to be an annoying imposition. The call for equality and democracy through design is a design ideal in the Nordic countries – and as such, better implemented in public sector design challenges of Northern Europe.

2.1 National design heritage

In talkative Italy (with the deep roots in architecture, arts & poetry) there has been an open debate for design criticism on the pages of several architectural magazines discussing the concept of "*cultura del progetto*" (design culture or culture of design).

It is easy to name influential design theorists writing in Italian and architect-writers such as Mendini or Branzi, and philosophical designers such as Sottsass, Castiglioni or Munari – reflecting the state of design on magazines and books. The 'design discourse' works in some ways like politics: the art of research, writing and teaching is done by practicing designers, art historians or researchers who develop a design theory through their design work and communicate it while at the same time explaining its purposes.

The idea of Finland and Finnish design is almost the opposite to the loud, hot, eye-catching, speed and life loving Italy: pure, clean, calm, silent and humble, simple and natural, introverted and honest, reliable and resilient. According to Pekka Harni (2010), Finnish design at its best is as least designed as possible, with an essential design grammar developed from traditional objects with their natural bond to the material and function. This has been a mainstream modernist *Form Follows Function* approach. Alberto Alessi called it the "orthodox design legacy of Finland", talking to Eero Aarnio (b.1932), one of his master designers, "a kind of 'ludic Finn', very far from the austere professionality prevailing in North European design" (Svenskberg, 2016).

The Scandinavian social democratic idea of functional, beautiful everyday objects, affordable for everyone, has filled almost all the Finnish homes with quality design objects and furniture since the sixties. (MoMA, 1992; Aav, 2011; Korvenmaa, 2009) The homes with Marimekko textiles, Arabia ceramics and Iittala glassware might have wooden furniture designed by Tapiovaara or Aalto. The Finnish taste for natural simplicity and extremely functional objects can be seen as practical given the climate conditions (a luxury car is worthless if it does not start in temperatures below zero).

So, frequently a Finnish design object can appear as a bit clumsy given that it must have durability, strength, safety and unbreakability attributes. In Finland and Scandinavia, the

etymology of the word *design* (*muotoilu*: *form-giving* as in the sense of shaping) does not refer to drawing or planning and thus the term itself shapes the local understanding of design culture. The tradition of craft schools has been stronger than the influence of architecture, despite the great heritage of Alvar Aalto, the most well known master of Finnish design and one of the major verbalisers of the poetry of natural materials and human scale in architecture and design. Aalto was one of the first modernists to speak about democratic design and human scale in every project.

Aalto had a very close relationship with Italy and admired places like Siena. His design philosophy was influenced by Italy and is a perfect interpretation of international ideas adapted to a local context. His natural design philosophy can be seen as the main identity builder of postwar Finnish design along with the most appreciated design teacher Kaj Franck (head of design course since 1960 in the Institute of Arts and Crafts). Franck developed new inter-trans-departmental teaching methods and the basic course of design foundations. He developed into a manifesto his criticism of an industrial products celebrity culture proposing a return to anonymity in the late sixties. (Korvenmaa, 2009; Aaltonen, 2008)

Another Finnish friend of Italians – especially with Gio Ponti (1891–1979), architect and director of Domus magazine – was Tapio Wirkkala (1915–1985), one of the most versatile designers who spent a lot of time in the Venini glass factory in Venice. Also Timo Sarpaneva (1926–2006) had his art glass team in Venice. Today the same factories are an experimental playground for younger generation designers such as Harri Koskinen and Ilkka Suppanen. Italy has been a source for inspiration for many Finnish artists and designers, and the role of Milan Triennials was determinant in the national export success and design reputation of the 'Golden Age', when designers received international media attention. (Korvenmaa, 2009; Pigliafreddo, 2012)

3. Conscience of designers

The ethical design discourse covers themes from social and inclusive design to sustainable design and design activism. In many cases the right strategies could be adopted in the public sector, while in others, only legislation can push for the optimal design strategies. For the new generations of designers civic consciousness is mandatory.

The ethos of Good Design (Valtonen, 2006) has been replaced by other design priorities. Design prizes challenge the companies and designers to be ambitious and to do their best instead of competing with lower prices. Can a designer refuse commitments with producers who do not share the same values? Does one aim at optimal solutions as doctors do? The problem of an unprotected profession is the lack of real rules. The professionals who have agreed on a code of conduct usually belong to trade associations and respect the ethics that protect good conduct in design practice. Beyond the code of conduct and fair play in the workplace, we respect certain values that may be bound up with our local (design) culture, aesthetics and ethics.



Fig 1. Enzo Mari (1999): Barcelona Manifesto: The ethics is the goal of every project.

> *"The utopizing tension of the origins of design must be recovered. If this is the allegory of a possible transformation, then it should reach as many people as possible. Those people who build our environment in a state of alienation and thus remain partially responsible of its transformation.*
>
> *The mechanisms led by the IT revolution are presently devouring all ideas in order to spew out sellable goods. To begin with, in the coming decades we must find the right ways to isolate from this redundancy the ideas of transformation. In order to achieve that, we must separate them from all those ideas generated by irresponsible anarchies that deny and trivialise the drive towards utopia, thus making it impossible to get people involved. In the meantime, it might be worth generalizing the idea that every project works towards ethics (which can be compared to the Hippocratic Oath.)"* (Enzo Mari, 1999: The Barcelona Manifesto)

The idea of becoming famous in fashionable, creative professions has generated the phenomena of new bad design and irresponsible design education.

3.1 Critical vision on design expressed to the community

The designers I chose to study for their role of *conscience of the professional community* have been extremely coherent with their views – working as product designers with different manufacturers and doing part-time teaching and generating an impressive amount of publications regarding their design philosophies. Moreover, the both were active in their national design associations, the Finnish Ornamo and the Italian ADI, the context of professional debates and shared code of conduct.

Kaj Franck and Enzo Mari, the two famous purist designers and poets of timeless beauty, come from completely different family backgrounds. They may appear as opposites with their personality traits and still have many similar interests, such as gardening and traditional craft objects.

Franck was born in a wealthy and well-instructed family of Swedish-speaking Finns. His grandfather was an architect and his mother, with whom he lived until Sixties, was drawing for furniture manufacturers. Franck could read such texts as the Swedish Crafts Association's first propaganda publication, Gregor Paulsson's "Better things for everyday life" (1919), marking the foundations of the modern Scandinavian design culture of equality. Franck graduated from furniture design department of the Central School of Craft and Design in 1932. (Designmuseo Helsinki, 2011; Aav, 2011)

Mari had a proletarian childhood with a very poorly educated family migrated from Southern Italy to the North, where he was born in 1932. He had to leave the school at 15 to help his family doing all kinds of jobs. Fortunately, the high-school diploma was not requested at the Brera Academy of Fine Arts, where he studied in 1952-1956. His career-path is quite unique compared to his colleagues coming from architectural schools. Hard working, obsessed with knowledge and research in every single project to find the essence of it like a hidden truth, Mari became a self-taught designer with a special eye on the psychology of perception and manufacturing skills. A political approach is evident already in his early artist career (Fransoni, 2019), when Giulio Carlo Argan was the most influential art historian and art critic in Italy.

3.2 KAJ FRANCK: ”necessary, functional, justified, right”



Fig 2. Kaj Franck, the conscience of Finnish design and design teacher for 29 years

Finnish designer Kaj Franck (1911–1989) was trained as furniture designer, but became one of the most famous glass and ceramic designers working with the most important Finnish manufacturers. Every Finnish family has Franck’s beautiful utility-ware objects, but his legacy as design educator is even stronger than the presence of his minimalistic functional tableware or colourful glass objects.

Franck, an excellent story-teller, verbalised topics of basic design principles and good design solutions in so fascinating a way that his students and readers understood the variety of possibilities in solving a design problem (and not creating new ones by solving one). The goal of a designer is to solve the problem, not the object itself. He wrote about the surrounding material culture, praising the beautiful vernacular archetypes of everyday objects and recommended smashing the porcelain dinner service – those objects we do not use every day. (Aav, 2011; Kalin & Wynnes, 1992)

The work as art director of the Arabia ceramic factory gave him the opportunity to rethink tableware for post-war Finland. His *’optimal objects’*; *Scandia* knives and forks (1952–1989, 1996–1998, re-released in different measures in 2016 to the present), *Kilta* ceramic ware (1953, since 1981 *Teema* stoneware), and *Kartio* drinking glasses (1958) express the peaceful simplicity of basic geometric forms, that fit any socio-economic context. The natural formal

grammar of bowls and pots recalls Japanese inspiration and the harmony of tea tables.



Fig. 3. Kaj Franck and timeless, essential archetypes still in production.

Franck did not want any decoration on his industrial objects. A very strange commercial decision by the Iittala Glass factory producing Kartio glasses, was to add the name of Kaj Franck on the glass bottom in 1990s. One of the most famous protests or criticisms by Franck in 1965, concerned the marketing of the industrial objects with the names of designers who had been award winners at the Milan Triennials. He wrote in the magazine of Glass and Ceramics that industrial products should remain anonymous. (Korvenmaa, 2009; Aav, 2011; MoMA, 1992)

Franck, who was called a 'social designer', advocated the designer's responsibility as well as the equality of workers in any position in the factory. In this 1960's–70's discourse he is very close to his Italian colleague Mari, although Franck did not express such politicised opinions as Mari. Internationally active Franck took part in the Italian *Compasso d'Oro* juries after his

own award *Gran Premio Internazionale* in 1957 (ADI, 1979, 57–59). After another important design award of those years, the *Lunning Prize* in 1955, Franck could travel and visit several universities and art schools in the USA. He wanted to understand how so called industrial design was taught. He adopted some Bauhaus principles from his American colleague John Arnold to experiment with his basic design course in Helsinki, such as an open-minded attitude in design process.

3.3 ENZO MARI: "Design is only design if it communicates knowledge."



Fig. 4. Domus covers dedicated to Mari in 1968 and 1980. Perpetual calendar Timor, Danese 1967, is one of the objects against throw-away consumption.

Enzo Mari (1932–2020), one of the last Italian design *maestros*, is best known for his collaboration with Danese since the fifties, on playthings like the 16 Animals puzzle and iconic sixties posters (silk-screen prints *Serie della natura, The Nature Series*). He started his artistic research with programmed art, and ever since as a self-taught designer with fine art studies, he prefers defining himself an artist. Art and design critics have defined Mari as a philosopher-designer (Grassi & Pansera, 1980, 284).

The first time Enzo Mari was defined '*the conscience of all of us designers'* was in the editorial of *Domus* (607/1980) by Alessandro Mendini (1931–2019), the most influential figure in Italian design culture since Gio Ponti appointed him his successor to edit the famous

Domus magazine. This 'public letter to his colleague' is my preferred quotation, as Mendini sees clearly what makes Mari so unusual a figure in the Italian design landscape. Mendini represents an ideologically opposite approach to Mari's Marxist vision on design, launching Italian Post-modernism widely on the pages of his *Domus* – the style that Mari considers redundant, object-sculptures, and 'Luigi-style furniture' (referring to the Louis XIV style) as the worst cases of kitsch creations.

Mendini describes how he should respond to the international public who is asking, who is Enzo Mari? *"Mari is not a designer; if his objects did not exist I wouldn't particularly mind. Mari, instead, is the conscience of us all."* and continues:

> *"Now I am not a moralist and a demagogue like you. I cannot and I don't want to distinguish the good form from the bad, as you do. […] You're not interested in the drawn project, except as an arrow to be shot at the illogical logic of the productive mechanism, as a theorem to demonstrate the incongruities of the system. What you are interested in is the design for the design, or rather the design for the design for the design. In other words, you seek, propose and meditate only on the 'project of man'. And this means occupying yourself with morality, maybe even through the objects you do for Danese." (Mendini, 1980, p.1)*

In her article "Il Savonarola del design" (1988) the Italian design journalist Cristina Morozzi describes Mari as a figure like the famous monk Girolamo Savonarola (1452–1498), the Italian Dominican friar and preacher active in Renaissance Florence. Those who know Mari's attitude in preaching for the causes he adopted in his early career can understand this. For Mari's design students his approach may seem unbearable heavy when he opens with the declaration: *I am a Marxist*. His criticism of design schools mass-producing 'designers' who cannot design, but want to become famous, was one of his pet topics; another was "the internet is rendering us stupid".

His design philosophy starts with Greek philosophers and finds a culmination in the French Revolution 1789 with *Liberté, Égalité, Fraternité* – before the importance of Marx and Lenin – changing society for the better with human rights and equal opportunities. Substantially it is the same idea of the Nordics with social democratic principles of equality through design. A kind of 'Lutheran' or protestant aesthetic and rigour in problem solving, is notable in Mari's work, every time re-inventing the way an object can be designed without a banal re-styling.

The search for *an essential form* and the essence of a typology or archetype (like the Panther) can be interpreted in his design motto: "*Il progetto si attua individuando progressivamente ciò che è prioritario nell'ambito di tutto ciò che interferisce".* One of his central thoughts is about the 'proper or improper project'. Mari's teaching method is well described in the exhibition catalogue "Enzo Mari. Arte del design" (2008, 156-157):

> *"The features of 'improper' design (the knowing repetition of an existing design) and those of 'proper' design (derived from the refusal of existing designs because of their technical, expressive or social inadequacy. Where the form of the design cannot be*

predefined but is discovered unexpectedly based on multiple hypotheses of research) are all listed.

Teaching improper design is relatively easy, but must an architectural school produce designers or copiers?"



Fig. 5. Top: La Pantera, 1965. The Nature Series prints for Danese (8 different images between 1961–1967) had very accessible prices in 1967: 10 000 lire (Trini, 1968, 31-40). Left: 16 animals puzzle in its original packaging, Danese 1957. Right: "Panettone", a traffic pollard which can be removed only by municipal vehicles, an eighties project for the City of Milan.

4. Conclusions

Both Franck and Mari have pursued a similar design philosophy concerning a kind of purity of projects with responsibility: the ideal or optimal form in using materials with the right properties, the idea of democracy with good design available for everyone. The awareness of environmental problems due to a careless overconsumption is a topic they carried out 50 years ago and which Mari has continued ever since to the new Millennium.

Mari highlights the importance of communicating knowledge and culture through design. Some of his provoking designs are statement projects, like the DIY toolkit for Autoprogettazione (Simon International, 1974). The rough wooden furniture looked like a Finnish normality already in 70s – and became an Artek product some decades later. Ecolo plastic vases project for Alessi was a similar DIY design project: one can create his own design item with instructions and a 'design label'.

Franck was an anti materialist and advocated recycling and immaterial solutions.
In Finland the critical voice of Franck became a design ethos for new generations. The theme of designers' 'E's (Aesthetics, Ethics, Ecology, Ergonomics, Economy and why not Equality?) has been the backbone of Finnish design education for decades. The close relationship with nature (the woods) and a very craft-based curriculum in design schools and universities (with workshops permitting a close contact with machinery and materials) have been a key for hands-on designers producing their own prototypes. Practical and functional, timeless modernism is still the mainstream design grammar in Finland and matches perfectly to consumers' preference for easy-to-care-of objects. Funny, playful or elegant design does not come naturally – the rare exceptions in this genre might be Eero Aarnio with his photogenic plastic objects such as Ball Chair and Oiva Toikka (who took care of Kaj Franck's legacy in the Arabia factory).

However, an intellectually honest, strong design philosophy is a great legacy to those students who are trying to understand how to design a better world. The thinking behind every design choice is the core activity of our profession.

The critical voice within the professional community may sound uncomfortable, and make one feel guilty and less free in creative choices. The 'the village idiot' role results in a reputation as an angry business spoiler and hearing the truth of the stupid things one does is not nice.

> *"So I tell people who ask me about you that you don't seem to be the usual designer, that you are like a* ***'design inquisitor' who launches ecumenical and laconic appeals to us*** *architects, prodigal sons: "Empty everything, change everything, reinvent everything!". Although I am not sensitive to the rhetoric of calls to order and to the seriousness of the man who never contradicts himself, I want you to know that your periodic messages reach the depths of my conscience." (Mendini, 1980)*



Fig 6. Enzo Mari in a video interview: "Because I was an artist". "Art is desperation, it means a life totally dedicated to developing hypotheses, tests, attempts, which cannot be resolved in terms of project making." Mari's work has been analysed by several art critics and journalists mainly in Italian language. Listening to his long monologues is the best way to understand his philosophical approach and mission.

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Acknowledgements: Thank you Patrick Richmond Nicholas for proofreading, Marco Petrus per la fotografia, and all the friends sharing your memories of important design teachers. Photo courtesy of Danese, Designmuseo, iittala & Kaj Franck. Grazie Enzo Mari.

DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

De-signing Ambiguity

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Abstract | The present paper challenges the way ambiguity is made understandable in William W. Gaver, Jacob Beaver, and Steve Benford's disambiguation of ambiguity (2003). Rather than assuming ambiguity to be an epiphenomenal relation between designed artefacts and their users, which seems to be the argument presented in *Ambiguity as a Resource for Design* (2003), the present paper finds ambiguity to exist firstly, and at a higher intensity, in the primordial stages of design practices. As such, this paper proposes that ambiguity is primarily a condition of the not-yet-designed artefact. In this way, whilst celebrating their innovative work, the present paper differs from Gaver, Beaver and Benford on two accounts. Firstly, by claiming that all things in the world are inherently ambiguous, and secondly by prioritising the role of ambiguity in the process of designing.

KEYWORDS | DESIGN ONTOLOGY, AMBIGUITY, GLASS FRIGGERS, BRICOLAGE

1. The purposeful noise of ambiguity

In Ambiguity as a Resource for Design (2003), ambiguity is presented an effect that happens between networked entities. Gaver, Beaver and Benford's world view proposes that designed artefacts exist in a cultural world-space, and that people — as audiences and users — are social in that world-space with those artefacts and each other. From this quasi-atomist perspective, ambiguity is framed in three broad classes. Firstly, "ambiguity of information" concerns the designed artefact. Secondly, "ambiguity of context" concerns the cultural world-space. Thirdly, "ambiguity of relationships" concerns people's relationships to the artefacts in that space (2003, p. 233). Surprisingly, considering they are arguing for the resourcefulness of ambiguity in design, with each of these broad classes, the role of the designer and the process of designing have been largely under-acknowledged.

As such, this notion of ambiguity resonates closely with the now much derided Shannon-Weaver mathematical model of communication (1948). In that model, a form of information (the artefact) is distorted by a source of noise (ambiguity) before reaching its destination (audiences and users). At a cosmetic level, if using ambiguity as a resource for design, the designer would ostensibly intensify the "noisy" qualities of communication. Gaver, Beaver, and Benford give an example of Desert Rain, a virtual reality game installation that features "rain curtains" which are "screens made of water through which performers and players physically pass" (2003, p. 234). The shimmering spray of water interferes with displayed images. As such, in an attempt to make sense of the images, a participant must "decode" the ambiguous "messages" displayed and distorted by the "noisy" screens.

Whilst on the surface there is something primitive in this metaphor of disturbed linear communication, their paper also proposes something more complex. They daringly concede that designs are not closed units, which for a long time has been the modernist designer's ideal illusion. Instead, they claim, designs are open and multistable, and may exist beyond the designer's intent. Consequently, when they undermine the apotheosis of artefacts confined to exist within designer-given determinate possibilities, they are in the same motion also emphasising the indeterminate kinetic pluralism of designed artefacts. They give an example of Projected Realities, which is a project designed to increase the awareness and presence of elderly residence in Bijlmer, a Dutch housing estate. Projected Realities is made up of "Sloganbenchs" and "Imagebanks", which are installed in the Bijlmer area. A scroll of fabric with handwritten slogans from the elderly residents is inserted into the back support of the benches, each slogan is associated with a set of images which are displayed on the Imagebank's five monitors. These two elements were also wirelessly connected so that "the slogans on local Sloganbenches could be summarised by the images showing on a single roadside Imagebank" (2003, p. 234). In this way, the designers have intentionally made an ambiguous open system that insists on an audience's interpretation.

However, it is curious that Gaver, Beaver, and Benford do not consider the presence of ambiguity before the more determinate production of a system of benches and monitors.

For example, the ambiguity of the brief, “to help increase the presence of older people in a large Dutch housing estate” (2003, p. 234), or the necessary material ambiguity of a bench to afford both sitting and displaying, and so on. As such, because it is not considered how these uniquely ambiguous artefacts came into being, their paper appears to be taking artefacts for granted. It is surprising that Gaver, Beaver, and Benford do not review the consequences of this dynamic open ambiguity for designers specifically. Instead, they generally focus on how audiences and users are now charged with a sense of agency when needing to interpret uniquely ambiguous artefacts. The authors almost exclusively consider the audiences role as the interpretative “decoder” of ambiguous designs, such as “rain curtains” or “Imagebanks” and “Sloganbenches”. They propose that “the work of making an ambiguous situation comprehensible belongs to the person” (2003, p. 236). Whilst this undermines the ambiguous world as it is encountered by designers, it does emphasise the pluralism of designed artefacts and the responsibility of audiences as independent sense-makers (2003, p. 233).

The limit of their study is becoming apparent, it focuses on people interpreting purposively open, and therefore ambiguous, designs. Characteristically, these are designs that — in Shannon and Weaver’s terms — are intentionally “noisy”. Speculatively, however, what happens when closed designs are considered to be open? In other words, from a designer’s perspective, what happens when interpretation does not meet intention? The present paper emphasises an overlooked aspect of the ambiguous world for designers. This is done by considering the creative encounter between a designer’s interpretation and an inherently ambiguous world of potential. This notion is contextualised in the work of Estonian bricoler and model maker Fyodor Šantsõn.

2. The world as a collection of oddments

Fyodor Šantsõn is a designer that subverts the closed intentions of everyday designs. Since 1992 Šantsõn has been constructing an enormous model of Narva, a city on the European-Russian border, which was levelled during World War II. The Narva model is laid out in his workshop, which is housed in a now mostly empty town hall — one of the few buildings reconstructed after the war. Šantsõn is a bricoler twice over, first in the original sense as a tinkering handyman, and secondly in Anthropologist Claude Levi-Strauss’ definition as someone who finds a constructive usefulness in seemingly unusable and unrelated artefacts (1966, pp. 16-36). The objects Šantsõn collects, which litter his workshop (Figure 1), are defined by their unforeseen “potential” rather than their determined “given” properties. This is a result of Šantsõn’s designer-interpretation encountering a world of ambiguous potential. By selecting choice elements, and holding them in his studio, he is cutting back the vast surplus of potential resources and is defining his own set of unique materials (Figure 2).



Figure 1. Fyodor Šantsõn's workstation

Šantsõn's models are carefully made up of these choice indeterminate bits of stuff, it is what is readily available and easily sourced in Narva, such as Styrofoam, corrugated cardboard, twine, and aluminium foil. Levi-Strauss may have called these ambiguous materials "a collection of oddments" (1966, p. 16). For example, a plastic wallet for holding papers has the potential use, for Šantsõn, to be a windowpane on one of his models, and off-cuts of lace give an effect of chiselled stone filigree. As Levi-Strauss claims, in the tongue of the bricoler, this collection of oddments "may always come in handy" (1966, p. 16). As a designer making sense of his imminent world, Šantsõn is working out of phase with other designer's intentions and adrift from semiotic convention. Even in his construction process, Šantsõn uses medical syringes to clamp and pin parts of his models down whilst he glues them (Figure 3).

Šantsõn also uses archival photographs and architectural drawings, as well as witness testimonies with elder residents (Nikitina, 2013), to lever the ambiguous bric-à-brac into even more determinate and comprehensive forms. To an extent, once the materials have been applied to the model their fluid indeterminacy starts to harden and their newly determined purpose begins to make more sense; twine as window lead, Styrofoam as landscape and brick, cardboard as walls, and so on.



Figure 2. Fyodor Šantsõn in his workshop.

It is only after the model gains an apparent totality, after it has shifted from a collection of oddments to a seemingly unified artefact, that Gaver, Beaver, and Benford's classes of ambiguity — as information, context, and relationship — have a foothold. As such, due to their delimiting focus on people's interactions with actual designed entities — in this case, what would be Šantsõn's finished model — the primordial intensities of ambiguity in the design process are misplaced. For example, the word of mouth testimonies, drawings, photographs, written histories of Narva, and Šantsõn's ad hoc practices, are under-acknowledged as a "resource for design" (Gaver, Beaver & Benford, 2003).

The present paper argues that Šantsõn's primary materials are inherently ambiguous. They then become more determinate once they are arrested in a scheme of meaning, in other words: once they are "de-signed". The loss of ambiguity in that design process is the gain of a set of increasingly determinate properties, such as a 1:100 scale model of Narva. However, the model is not in a state of permanent fixity, rather, it is loose and contingent.

For example, on close inspection, the familiar materials that makeup the model are still clearly recognisable (Figure 4). Such as, the characteristic fluffy edges of cut Styrofoam, the creased aluminium foil laid across an uneven surface, and the ripples of corrugated card, which have absorbed the moisture of acrylic paint.

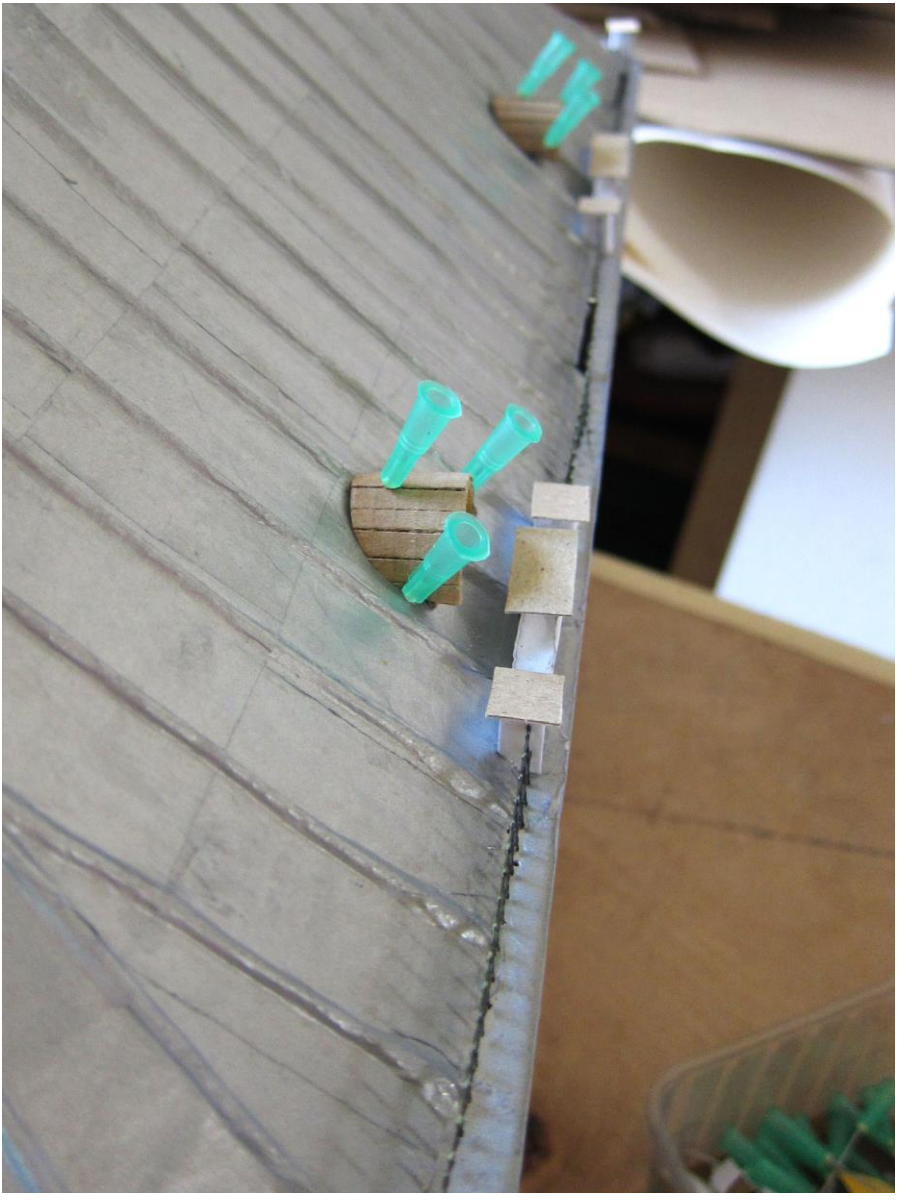

Figure 3. Close-up of model in Fyodor Šantsõn's workshop.

The dynamic difference between ambiguously open materials, on one hand, and their more closed de-signed forms, on the other hand, establishes a contrast between the present paper and Gaver, Beaver, and Benford's focus of ambiguity. This can be framed as an ontological disparity, and is reviewed in the following sections, with a specific case study of 19th century British glassblowing. Firstly, a further ontological framing of ambiguity is developed.



Figure 4. Close-up of Fyodor Šantsõn's model in Narva Art Gallery

3. From complexity to simplicity to plurality

Gaver, Beaver, and Benford claim "things themselves are not inherently ambiguous" (2003, p. 235), they make a distinction between "ambiguity" and notions of "fuzziness or inconsistency". They claim the latter are "attributes of things" and the former is "an attribute of our interpretation of them" (2003, p. 235). Arguably, they are positioning ambiguity to be more or less an epiphenomenal quality, as if it were a characteristic that arises exclusively from the interaction between an audience and a discrete artefact. They clearly distinguish this from "fuzziness or inconsistency" to mean something more or less ontological, therefore, they seem to be disregarding the actual makeup of a thing's being. This distinction is justifiable, however, because of their inherently user-oriented focus at a quasi-consumerist cultural level. After all, they are writing form the perspective of the Interaction Design Research Studio and The Mixed Reality Lab. If we take seriously the idea that the process of designing products is about de-signing and therefore about reducing the indeterminate surplus of a sign — as they claim, "product designers work to eliminate ambiguity" (2003, p. 236) — then the authors are effectively "de-signing" ambiguity and consequently compromising the key tenet of their enterprise.

From a more designer-centric perspective, a fault line can be exaggerated between intentionally designing ambiguous things and interpretively designing with ambiguous materials and methods. The present paper finds the dynamic complexity of the world to be ambiguous and defines the design process as a practice of abstracting that complexity towards a point of relative simplicity and stability. Alternatively, Gaver, Beaver, and Benford are more concerned with the social plurality of those already designed artefacts. For example, it is clear that the authors are concerned with the *possibilities* of ambiguous cultural artefacts for users. When describing ambiguous information, they claim "ambiguity arises in the way that information is presented" (2003, p. 236). As such, they are asking what the possible interpretations of information are, but not how the information came to being. Similarly, when defining the ambiguity of context, they think of it as the "reconceptualisations of existing technologies" (2003, p. 237), which sounds as if those "reconceptualisations" will always in some way be tethered to the original design's scheme of meaning. Evidently, the more dynamic radical contingency of these designs is being overshadowed by their relatively stable status as already "existing technologies". Finally, they claim that ambiguous relationships "push us to imagine how we might personally use such [ambiguous] products" (2003, p. 237) and that these relationships create the "condition for a deeply personal projection of imagination and values onto a design" (2003, p. 239). Again, their definitions of ambiguity rely on an audience's "projection" onto, and user interaction with, already pre-existing designed artefacts.

Alternatively, from a more theoretically charged perspective of design, is it possible to consider ambiguity as an equally rich *potential* quality in actual practices of designing? That is to ask, can ambiguity not also exist in the primitive stages of design before the possibilities of informational, contextual, and relational ambiguities even manifest? If this is feasible,

then the authority of a designer — traditionally, as someone that casts objects into the world charged with their unique designerly intentions — is diffused into something more situated. Before expanding on this further, a more detailed distinction between the *possible* and *potential* is necessary to further understand what is at stake.

Process philosopher Brian Massumi distinguishes what is "potential" and what is "possible". He characterises "potential" as "the conditions of emergence" (2002, p. 10) and the "possible" as the "reconditioning of the emerged" in such a way that it will "define normative or regulatory operations that set the parameters of history" (2002, p. 10). Considering what is "possible" is the dominant treatment of artefacts in *Ambiguity as a Resource for Design* (2003). Gaver, Beaver, and Benford seem most concerned with ambiguity being mysteriously "evoked" by "the possible interactions of determinate individuals and groups" (2002, p. 10) rather than ambiguity being the "potential" from which designs "emerge". As such, for these authors, ambiguity only happens when we already have cultural artefacts as rigid things that exist in the world, such as slogans, image banks, and benches, for example, in the *Projected Realities* exhibition (2003, p. 234). Therefore, ambiguity is limited to be a thing that can only be "evoked" when the expectations and anticipations of audiences are not met. For example, in their illustration of Anthony Dunne's "unusual" *The Pillow* (2003, pp. 234-235), or when audience's experiences are disturbed and "disoriented" such as in *Desert Rain* (2003, p. 234). In this way, things must have already existed in a "usual" or pre-determined capacity. That is to say, audiences must already know of a "normal" bench, screen, or pillow, for them to later be considered disorienting, noisy, or ambiguous. Arguably, a kind of "and-also" additive quality emerges in this treatment of ambiguity, which promotes the open pluralism of cultural artefacts, but only on a superficial level.

For example, from their interpretation of ambiguity, the artefacts of a pillow, chair, and urinal take on a multiplicity of possibilities when they are "reconditioned" (Massumi, 2002, p. 10) to be display ports, message boards, and sculptures. However, this pluralist ambiguity still relies on a more essential referent for them to be considered "unusual" and "disorienting" in their ambiguity. From Gaver, Beaver, and Benford's perspective, it seems that to be considered culturally "ambiguous", the display port must still essentially be a pillow, and a message board must essentially be a bench, also the fountain sculpture must still essentially be a urinal. It is conceivable that this is what Massumi means by the "reconditioning" of the "emerged". The authors prioritise the ambiguous possibilities of the artefacts external form whilst protecting an essential (non-ambiguous) inner core-like matter of the artefact. This starts to sound like Bruno Latour's, self-admittedly naïve, formulaic definition of design as being "not only ... but also" (2008). For example, "not only" is this a pillow "but also" an "unusual" display port.

Whilst the present paper is in admiration of Gaver, Beaver, and Benford's work in foregrounding the virtues of ambiguity, and presenting this ubiquitous quality of nature as a positive resource for design, rather than a malignant characteristic, it differs specifically on

one particular aspect. It is claimed that things in themselves are inherently ambiguous at an ontological level. It should be made clear at this point that the present paper is not defining an ontologically foisted impasse in this argument for ambiguity in design. Rather, by drawing focus to the process of making designs, rather than the effects of interpreting designs, the role of ambiguity in the pre-production of designs is emphasised. The notion of ambiguity as a primordial design resource that comes from surplus, as is argued in the present paper, as well as a material effect of interpretation that comes from finite cultural abstractions, as Gaver, Beaver, and Benford appear to propose (2003), is best illustrated by 19th century glass "Friggers", which are ambiguous materials of design that also come from ambiguous design practices.

4. In the Glasshouse out of hours

In the 19th century, industrial glass production was not mechanised. Instead, glass products were made by skilled workers manually manipulating molten glass from furnaces. During breaks, and after hours, glassworkers were free to use the surplus of molten glass. In Britain, the artefacts the glassworker created from that surplus are known as "Friggers", "Nailsea glass" or "end-of-day" glass, but the term "whimsies" is also used in North America (for an account of Friggers in contemporary contexts see: Zetterlund, 2019). Other than being made of glass, there is no definitive characteristic of a Frigger. As such, the glass artefacts are only classified as Friggers based on their circumstance of production. Glass manufacturer Harry J. Powell bitterly recounts the popularity of Friggers in 1923:

> "The great Nailsea works were famous for the fine quality of their crown window-glass, but are unworthily commemorated in museums and private collections by the rude vases, flasks, jugs, candlesticks and rolling-pins originally made by the glass-blowers in their spare time. They are colourless or coloured, and many are marked, spotted, streaked or roughly threaded with opaque white enamel or crude-coloured glasses." (Powell, 1923)

The indeterminate molten glass that the Friggers are made from, the surplus of the day, is an ambiguous glowing lump. As if through a process of reductive abstraction, by cooling, shaping, rolling, and hardening into more familiar shapes, such as "vases, flasks, jugs, candlesticks" (Powell, 1923) the more definitive Frigger is educed out of ambiguity. A type of Frigger glass that Powell mentions are typically unusable cultural items, such as glass canes, gavels, and hats. These explicitly useless novelties were the glassmakers' offhand exercises, allowing them to show off and hone skills. With Friggers, we can see how ambiguity is a resource for designers in terms of the use of ambiguous (molten-like) materials. The Frigger is a design that arises from ambiguity with no provision, practicality, or use beyond a process of actualising surplus potential into something finite and more recognisable, much in the same way as Šantsõn's practice.

In practical terms, Friggers demonstrate how the ostensibly formless and surplus qualities of ambiguous molten glass can come to actuality as graspable designed artefacts — pipes, flasks, vases, etc. — through a process of abstraction. There is, however, an inevitable loss in the reductive process of abstraction. In *Ambiguity as A Resource for Design* (2003) the more kinetic characteristics of artefacts are lost. As such, the way that the supposedly ambiguous artefacts they cite — such as the pillow, urinal, and bench — come to thought, as an entity in discourse, is by dismissing their primordial "potential", in Massumi's terms (2002). However, with the Frigger, the possibility of informational, contextual, and relational ambiguity is dependent on the primordial condition of molten excess.

For example, because Friggers have no explicit utility, historically they became loaded with an implicit superstitious aura. There are several examples of Frigger glass being ascribed "apotropaic" properties. Frigger walking sticks (Figure 5) would be hung by the front door of Victorian homes and cleaned daily to supposedly ward off evil spirits. Similarly, Frigger "Witch balls" (Montani, 2019) would be hung in chimneys to protect the houses occupants from the supernatural. Breaking these Friggers was considered bad luck. Gaver, Beaver, and Benford may define this as "informational ambiguity", whereby the "imprecision" of the artefact requires the audience to draw a unique "conceptual focus" and determine their own independent meanings. Furthermore, as an example of "contextually" ambiguous things, which are defined as "products that implicate several interpretations at once" as a sort of "mingling of discourses" (2003, p. 237), the Friggers are not only ornaments, experiments, and superstitious instruments, but they are also props and costumes. Glassworkers from the North Somerset town Nailsea, and Stourbridge in the Midlands, would parade their Friggers. The prominence of the event is apparent in an 1823 advertisement. It details, each participant will parade with "Glass Feathers in his Hat, Glass Stars suspended by Chains and [...] some kind of Glass Ornament in his Hand" (1823). In this context, the Friggers were a proud celebration of the glassworker's creative talents. Extending from this, into the ambiguity of "relationships", defined as designs which provoke their audiences and users to "form intellectual, aesthetic, emotional, and moral judgements" (2003, p. 237), Unionised North American glassworkers would also parade with their Frigger canes. After their Labour Day parading, they traded the canes for drink at local pubs. As a result, many pubs had back-bar displays of glass canes (Magrath, 2018). In fact, most Friggers produced by the glassmakers are presumed to have been sold at the end of the day in pubs to other punters that would use the Friggers as doorstops, paper weights, and ornaments. In this way, the Friggers, which clearly had an emotional value for the glassworkers, were also being judged for their trade value with bar workers, as well as their negotiable utility value with other punters.



Figure 5. 19th century glass walking stick frigger.

5. Conclusion

Šantsõn's model making illustrates how seemingly rigid substances can be made indeterminate by exploring their ambiguous potential as an infinite resource of design. In this way, by being a designer that works close to the buzzing confusion of the world, he demonstrates the constructive capacity of the design process to materially transform seemingly "given" entities into alternative unintended designs. Friggers, on the other hand, demonstrate that already ambiguous formless things can be made more comprehensible and still have a cultural plurality — as established by Gaver, Beaver, and Benford in terms of contextual, relational, and informational ambiguity — without needing to exist in a hermetically definitive way, or hylomorphically with an essential referent.

Notably, both of these examples come out of a kind of playful and ad hoc resourcefulness. Šantsõn's curiosity to collect seemingly trivial materials allows him to playfully make sense of a seemingly lost history of Narva. Also, glass Friggers, as a culture of exploration with ostensible waste, have etymological ties to the verb friggle, meaning to muck about, or to masturbate. Despite the seeming disorderly playfulness and lack of formality or structure to these practices, both Šantsõn's work and the craft of Frigger making have been recognised as having genuine cultural and commercial value. Šantsõn's project has earned him the *Valgetähe teenetemärk* (Order of the White Star) (Martínez, 2018), Estonia's highest decoration. Friggers, as end-of-day glass, eventually became a term for commercial glass products with marbling or splatter pattern effects, which has notably been carried over into glasshouses adopting Frigger designs into their commercial product lines.

As such, it has been demonstrated that designers are always already working with ambiguity in varying capacities, such as de-signing ambiguity from complexity to simplicity, and designing for ambiguity by complexifying simplicity into plurality. Furthermore, both of these transformative practices have concrete socio-economic consequences. One aspect of ambiguity that has not been addressed in the present paper, however, is the ambiguity of the designer. Accepting their now diffused authority, designers seem to be themselves increasingly ambiguous figures. In the examples used here, they appear to be archivists, researchers, historians, eccentric performers, trade negotiators, and so on. This confused

identity emerges in line with the recent conceptual reframing of contemporary design, such as being makers of connected ecologies and conditional systems (Maurer, et al., 2013) as well as ontologists designing processes (Kim, 2017).

Gaver, Beaver and Benford have admirably established a constructive connotation to the often-considered odious notion of ambiguity in design. They have critically interrogated and undermined the — surprisingly still popular — notion of hermetically closed designed artefacts. However, as the present paper has argued, it is the preliminary ontological conditions of ambiguity that must now be foregrounded as inspiringly problematic, as Henry Hongmin Kim proposes in *Graphic Design Discourse*, for the sake of innovation and sophistication, designers must become ontologists (Kim, 2017).

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Disruptive Thinking in Design Education

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Abstract | This paper aims to discuss the future of design education and the role of designers discussing the rationale and the pedagogic paradigm shift toward a "disruption based design education", the definition of transdisciplinary methodology compared to other methodologies, the framework of a MA in Transdisciplinary Design and its interactions with the UN SDGs agenda, and finally the way to implement it within a Private Design Institution

KEYWORDS | DISRUPTIVE, TRANSDISCIPLINARITY, SDGS, DESIGN EDICATION, DESIGN DRIVEN INNOVATION

1. Introduction

1.1 A new role for design?

The role of design as language and mind-set (apparently beyond its disciplinary boundaries) has become central in the contemporary cultural debate, with an exposure to more and more fields and industries, demonstrating a high plasticity in the possible extension to a wide range of applications redefining itself as a new approach to introduce disruptive solutions to highly complex scenarios, typical of the today's global planet issues.
The transition from an industrial society to a digital society of information and creativity, confronts future generations with difficult and exciting challenges at the same time.
Technology progresses exponentially and radically transforms entire parts of society and markets.
Artificial intelligence and automation replace repetitive, low-creativity jobs, while creativity and innovation are at the heart of the contemporary world, combined with the fact that internationally the economic and cultural models of industrial society are outdated, obsolete, ineffective to address the uncertainty of the present and the challenges of the future.
This has allowed us to reflect and to understand that the majority of schools and academic institutions are still linked to a past conception of knowledge and work.
The new market demands different skills from those required by industrial society, it requires flexibility, autonomy, divergent thinking, creativity, capacity for innovation: these are the skills of the twenty-first century that the traditional school is not prepared for and struggling to teach.

1.2 Spreading the design mindset

To value, share and progress on this change, it is useful to reflect on a set of paradigms to frame academic portfolios of institutions, mapping the grey areas that sound weak for disciplines and strong for global problem settings.
It is foreseen that design can be the effective mindset and should take the responsibility to address global issues, outlined by a shared agenda; this is the SDGs agenda.
Historically, change has been viewed as something that can be "managed" through centralized, top-down design processes that produce clear, predictable outcomes. This type of linear, cause-and effect thinking has influenced the design and development of societal infrastructures and policies in the developed world and has contributed to many of the global wicked problems previously mentioned (Irwin, Tonkinwise, Kossoff, 2016).
Design deals nowadays with different aspects related to sustainability and global change and is considered as a primary engine for innovation in our society on industry, local communities, and government.

1.3 Sustainability and design: evolution of a relation

Ceschin and Gaziulusoy (Ceschin, Gaziulusoy, 2016) describe the evolution of the design for sustainability: from product innovation to product-service system innovation to spatial–social innovation and socio–technical system innovation.
Design has culturally embedded the value of sustainability in its methodology: if we accept that design is a key differentiator introducing or addressing innovation, it is a matter of fact that communities and society at large deal with innovation in non-predictable yet sustainable

way. In other terms, not sustainable innovation is always rejected by communities. The process can last many years, and the effect might be worse than the rejected solution: nevertheless, there is an embedded need of balance in large communities.
Design has evolved towards dematerialization and is approaching more closely to solutions for complex social, environmental, and even political problems, as suggested by Papanek (Papanek, Fuller 1972).
At the same time, design activities are by nature complex, where multi-dimensional level of constraints, limited resources, layers of subsystems intertwined must be considered at the same time: designers' ability refers in somehow to spot emerging phenomena – the creative act – able to convert constraints into resources.

1.4 Complexity: a trigger to change perspective

There is a heightened awareness of a myriad of wicked problems challenging us in the twenty-first century and an increasing acknowledgment that if they are seen as interconnected and interdependent, the scenario for possible interpretations becomes richer.
In this light, global issues cannot be addressed or solved from within a single discipline perspective, and multiple interventions over time are not likely to result in a clear solution (Irwin, Tonkinwise, Kossoff, 2016).
In order to face this complex issue, a circular, iterative, disruptive and error-friendly process could be used to envision radically new ideas that serve to change and inform the future mind sets and lifestyles: the solution is a transdisciplinary approach.

1.5 SDGs: the designer's agenda

Transition and Transdisciplinary Design proposes that in order for designers to act as agents for change, new approaches to design and problem solving must be based upon a deep understanding of the dynamics of change within complex social and natural systems (Irwin, Tonkinwise, Kossoff, 2016). SDGs intent is to outline axis for an interpretation and understanding of our contemporary condition.
The disruptive approach introduced by transdisciplinary as a paradigm, improves design methodologies in the first phase of problem definition and research, makes the holistic view a relevant tool for designers to address problems and framing complex scenarios within an innovative and transdisciplinary approach, thereby promotes a horizontal dialogue among all involved components – shareholders; ultimately, fosters synergies between disciplines or bodies of knowledge like design, technology, economics, and sociology, which are fundamental for finding innovative and anticipatory solutions for holistic and complex changes.
The major change introduced with the shift of the design paradigm from being a body of knowledge to propose solutions and applications becoming an interpretative tool to act as a disruptive but effective problem setter. It is in fact recognised as a fruitful way to foster solutions where the implications of impacts on a global scale are more relevant than the finalized and defined applications: variables' interaction analysis becomes central for the correct setting of questions and briefs, recognized as the key point in the design process facing sustainable goals.

2. Methods

2.1 A paradigm shift for design disciplines?

In the light of such a disciplinary expansion, the role of design is moving from its disciplinary and professional comfort zone, and designers take the role of facilitators rather than solvers: design language becomes an arbiter – interpreter among different systems of knowledge, decoding and recoding the chaos of intertwined global issues clustered by the Sustainable Development Goals (SDGs). Products, services, processes and business models as outcome of briefs outlined with a disruptive perspective can trigger real cultural change; nevertheless, it requires an attitude open to interpretation rather than solutions, and the potential counter-effect is that design disciplines overwhelm other bodies of knowledge misleading to unilateral perspectives.
During this transition, designers have expanded their field of action from a single user to communities as users, thereby becoming a more participatory discipline and delivering sustainable services and systems. Thinking in systems means looking at the whole, analysing single components and focusing attention on relationships and connections.

The discovery of the interdependence between each part of a system and between the system and its environment also allowed us to define the system's boundaries, thus creating an identity and no isolation. Systemic thinking, in practical terms, means zooming out from a single part and considering that part's relationship to its surroundings and other ecosystems and mapping the situation more than measuring it, by using a multidisciplinary approach (Battistoni, Giraldo, Barbero, 2019).

Design has changed from an activity often undertaken by an individual professional designer to a highly collaborative, co-design activity that involves a variety of actors, including professional designers, experts from other fields and disciplines and users/co-creators (Manzini, 2015).

Successful and highly impacting outcomes of such an approach are already populating everyone's life. But is it still possible to define a discipline or body of knowledge as the relevant area to start with? Which methodology should be put in place to educate future professionals to a disruptive problem setting? Which impacts on the curricula, on the design educators and on the profession? Are we looking for an evolution of a methodology or an integration of the body of knowledge?

If sustainability is accepted to be the key differentiator for successful processes of global issues problem setting, design education should consider reviewing curricula where core topics and disciplines still can be considered necessary and fundamental yet not sufficient. The academic curricula review process cannot be limited to the introduction of new topics: the paradigm shift requires subjects, methods and organization variations. Visibly, the Institutions' organizational models are required to shift from a vertical disciplinary vision based on domain/profession based model to a cross cutting issue/impact based approach, which programs and delivery units should refer to.

2.2 a new role for designers, not the end of design

Such an awareness stimulated our institution to question the role of design and designers (and thus curricula) when dealing with complex problems and when shifting from a design centred disciplinary approach to transdisciplinary design translated approach: design becomes one among other disciplines, a facilitating subject that uses techniques and a body of knowledge in a cross fertilized mode. Such a role requires an attitude open to interpretation rather than solutions; on the other side this may introduce a threat, when design disciplines might overwhelm other bodies of knowledge misleading to unilateral perspectives and solutions (Moreno, Rogel Villalba, 2018).

The definition of a program able to test a transdisciplinary methodology has been considered a milestone: a program, generated from a specific design school, to be compared with other analogue programs delivered in non-design focus educational environment.

To train visionary and future leaders capable of facing complex problems and to provoke positive social, cultural, environmental and economic changes is born the need to develop a MA in Transdisciplinary Design with the goal to enhances the knowledge acquired in the first university cycle, measuring it with the complex dimension of contemporaneity and global instances (SDG's).

2.3 Transdisciplinarity: a program for design driven innovation

The MA in Transdisciplinary Design aims to use design mind set as a filter of interpretation among different cultural mind-sets to tackle global issues, codified by the SDGs challenges and seen through the light of a multi-dimensional paradigm: technology, people and economy, is the multiple observatory set to students to start with.

With their different backgrounds and from different domains, students are gathered in a non-disciplinary pastoral environment, to reflect on problem settings, experimenting in a participatory connective and collaborative practice studio like and involving actors who are also external to the disciplines (incorporation of non-systematized knowledge): institutions, universities, laboratories, governments, social groups and individuals. This should allow to search for solutions from a wider perspective, capable of integrating diverse bodies of knowledge in a series of results that may ultimately not be the best solution possible, but an initial solutions improvement (Bliemel, Van der Bijl-Brouwer, 2018).

The ability to understand and anticipate the demands of contemporaneity and to apply the acquired technical and technological skills are central elements to face the phase of project problematization (problem setting).

The knowledge of project and research methodologies and how to apply them in an original and innovative way in the different design sectors gets stronger, in particular attention to innovation in areas such as project culture, applied research (design research), techniques and technologies, interactive processes and transformation and cultural and social change. The types of project outcomes are products (material or intangible), strategies, services and multimedia communication projects.

To understand the methodology and how it is providing an operative interpretation to the rationale and the aim previously described, it can be useful to refer to the program structure as a loose fabric where only threads are defined. Compared to a more traditional program (we might say finished woven fabric), where all the topics are pretended to be covered, in order

to provide a solid body of knowledge, the Transdisciplinary Design program aims to fix and cover only several areas identified as crucial in the exploration of contemporaneity; through different lenses – society, technology and economy – students are expected to fill the gaps of topics they need to fill during the design studios. While the modules are defined to bring disruptive point of view on global topics (impacts of innovation, cultural economy, ethic of communication), the studios are defined as eco systems where the knowledge co-creation process (either for individuals and cohort) follows the rules of implicit and explicit knowledge (Nonaka, Takeuchi, 2018)

2.4 The program structure for "problem lovers"

At the centre of this programme is an evolved model of delivery and engagement with teaching and learning based around the idea of a living lab for future mobility allied to a network of 'crucible cities' (challenges).
The programme aims to train future professionals in transdisciplinary tools, methods and approaches (mindsets). It seeks to equip students with sophisticated approaches to addressing complex challenges and prepare them for a wide scope of potential positions of employment and self-employment.

An underpinning assumption is that everyone engaged in the endeavour at hand is, and can be, an expert. Each individual has their own unique contribution to make. The didactic delivery of knowledge from teacher to student is at times necessary, but no longer sufficient to future needs. Addressing complexity demands a systemic approach not only to problem solving, but also to articulating the nature of the problems to be confronted in the first place whilst also embracing diversity of response and considered risk-taking.

For this reason, the program wants to expand its horizon of enquiry outwards from the school towards the dynamic crucible of the living ~~city~~ environment.
A design-led, transdisciplinary approach harnessing business, people and technology on a focused project basis –where the project definition unfolds under the scrutiny and ingenuity of the team
engaging with multiple stakeholders -will ignite discourse, deliver insights, provoke and evolve collective new approaches to scoping problems and uncovering solution pathways.

Transdisciplinary design teams move through live challenges sourced through the cities and city stakeholders (environments) to act as a conduit to inspiring problems for student and faculty teams alike.
Students will be encouraged to root their enquiry in solid research whilst 'staying in the unknowing' – that is flexible and comfortable with unpredictable outcomes. Process management and openness will therefore be critical on the design journey, as will highly developed collaborative working skills, continuous evaluation and the flexibility to adapt quickly to changing circumstances whilst staying true to design values.

Each project cohort behave akin to a living lab for future offering a rich mix of people, talents and ideas to identify and confront complex challenges that can respond to transdisciplinary design approaches.

The rich field of exploration and development will be made available through many different areas of interest, offering inspiration and access to a diverse range of students who will benefit from an open
culture of participation, exchange and debate.
Projects will attract and inspire small international 'network-hubs' of digitally connected teams comprising students and faculty alike, together with expert contributors from relevant stakeholders operating on a day-to-day basis in the host context.

In year one, emphasis therefore will be placed not only on transdisciplinary design methods and models but also on team working, the nature of complex problems and on the dynamics of change in organisations. Students will also be encouraged to 'horizon scan' for future projects and to synthesise research into credible propositions - designing problems to be solved.
Students will be encouraged to scope and assess sustainability agendas, referencing the SDGs, as sources of future challenges and to scan start-ups to cast light onto the leading edge.
Year two will seek to consolidate and amplify the learning from Year one. This will be galvanised by the identification and pursuit of a living crucible challenge that will be multi-layered, resistant to solving and demanding of a transdisciplinary approach.
Engaging as an international team of faculty and students the living lab approach will generate new avenues for exploration; new ways of framing existing challenges and proposals for change. Shaping the right questions, facilitating client groups and continually challenging the status quo rooted in strong research will be facets of successful outcomes.
Throughout the programme students will be encouraged to develop their own skills as designers and design thinkers. They will learn resilience in the face of seemingly intractable problems and evolve through practice, the necessary skills and mindset to work in transdisciplinary teams.

A core attribute of the programme is its flexible, collaborative, open and dynamic approach to gaining access to talent and expertise to unlock students' talents and intelligence through a more democratized and evolved approach to where and how multiple intelligences are empowered and where ideas come from.

3. Conclusions

The research around these questions has brought as a pedagogic outcome the idea of a program that combines a methodology based on a transdisciplinary "loose" eco-system, along with a redefinition of topics and syllabus mainly focusing on reinterpretation of contexts and phenomena rather than super skilling. The idea laying under a Master of Art in Transdisciplinary Design recently defined in fact meets the intention aiming to use design paradigm as a bridge among different knowledge, and cultural mind-sets to face wicked global problems.
These are read through the paradigm of the economic– society– technology relationship to build an innovative and transdisciplinary designer profile able to anticipate the needs of the community in terms of unexpected design outcomes. In parallel, since the course transfers interdisciplinary methodologies and project autonomy, the aim is to build continuity towards

the fields of research and experimentation, elements that structure the formation of the third university cycle.
Students acquire cross-disciplinary and cross-cutting knowledge and skills necessary to trigger processes of innovation and change through interaction and hybridisation of knowledge in the humanistic and social areas, in the technological and digital area and in the economic and entrepreneurial area.
The course in Transdisciplinary Design develops critical reading skills of elements, instances and phenomena not systematized and at times incomplete, typical of the contemporaneity and the digital channels that– even if belonging to different domains of knowledge– constitute complex networks, messy but rich and unpredictable: the student is constantly exposed during the two years to a daily comparison with such complexity that is central in the development of innovative solutions.

The general philosophy describes a profession characterized by some main skills:

- Complexity management: analysis and vision capacity to systematically address large and complex project scales, anticipating problems, opportunities and solutions, not only by solving specific isolated problems;
- Sharing: ability to work in a group;
- Integration of multidisciplinary skills (humanities, techniques, financial economics, managerial and organizational) to enable an organic and systemic view of problems;
- Responsible results: search for sustainable solutions.

The program structure aims to provide answer to the signals that come from the field of the creative industries and the productive fields to high planning content (design driven industries) as well as public and social organisations which are increasingly calling for professional profiles which are often not codified: professionals able to adapt quickly to change and at the same time be promoters of change in a perspective of sustainability and responsibility, who can read contemporary phenomena in a perspective of complexity and who are agents of innovation, not only through projects and processes where design is a language before being an outcome, but also through the ability to design visionary scenarios and to imagine the future.
The areas of application can be many, among them: design for smart media and technologies, design for social impact, design for cultural complexity, design for new business models, design for sustainable development. Professional goals can be (for example, but not exhaustive): business strategist, strategist design, design thinker, design manager, envisioneer, user researcher, service designer.

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Acknowledgements: many thanks to Michael Thompson (Design Connect), Lorenzo Foffani (AKQA) and Sigurdur Thorsteinsson (Design Group Italia).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Diversified Orientation and Design Value in Safeguarding of Intangible Cultural Heritage

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Abstract | Increasing the awareness of Intangible Cultural Heritage (ICH) safeguarding is significantly important for the development of social sustainability. Design discipline has participated deeply in it, because design plays a key role in creating tangible objects and intangible lifestyles. However, the role of design in safeguarding ICH seems vague. To clarify the role and value of design, we reflect on a ten-year practical research and use case studies as the main research methods. By adopting the perspective of cultural ecology, we combed through the theory and practice of safeguarding from the 1970s onwards and concluded that ICH safeguarding has different value propositions, pathways, and challenges in the manual production stage, industrial production stage, and digital intelligence stage. These three stages are progressive, and also parallel each other, which together forms the current ecosystem of ICH. Design was found to have different roles in digital ICH platforms, and we concluded that ICH would evolve into new cultural forms with publicity and vitality due to the participation of design.

KEYWORDS | INTANGIBLE CULTURAL HERITAGE, ICH ECOSYSTEM, DIGITIZATION, CULTURAL CREATIVITY

1. Introduction

According to the *Convention for the Safeguarding of Intangible Cultural Heritage*, Intangible cultural heritage (ICH) is defined as the practices, representation, expressions, knowledge and skills that are recognized as part of communities, groups and individuals' cultural heritage, and ICH is critically important in maintaining cultural diversity and sustainable development (UNESCO, 2003). Culture is a necessary agency in the transformation towards a more sustainability society (Soini & Dessein, 2016), and cultural vitality is a major dimension which points at the inherent value of cultural diversity and of a vibrant cultural life of human communities (Hawkes, 2001). As parts of the whole social life, ICH is urgently in need of safeguarding measures since it is quickly abandoned and now endangered in modern society. The question of how to make ICH subjects maintain their own cultural roots while also integrating with society as a whole is a major challenge facing social sustainability and social cohesion. According to Stren and Polèse, to achieve social sustainability, we need to foster an environment conducive to the compatible cohabitation of culturally and socially diverse groups while at the same time encouraging social integration, with improvements in the equality of life for all segments of the population (Stren &Mario, 2000). Scholars, researchers and governors in different countries developed various safeguarding models with their own characteristics, for example, it is tied with cultural tourism in Italy and associated with community development in Japan. Until now, there are 549 elements corresponding to 127 countries enlisted into the *Representative List of the Intangible Cultural Heritage of Humanity* since it was firstly issued by *United Nations Educational, Scientific and Cultural Organization* (UNESCO) in 2009. Manifesting the diversity of the world's culture, ICH safeguarding has received a high degree of participation from various disciplines, including Anthropology, Sociology, Economics, and Design. Among all participants, designers have their natural advantages since they see themselves as the creator of the 'ways of life' which is in consistence with ICH bearer's role. Both designers and ICH holders share the responsibility of producing varieties and novelties (Comineli & Greffee, 2012). Modern design involves ICH safeguarding in different aspects, including the construction of eco-museums, participation in developing creative industry, adopting gamification in developing cultural and educational Apps and environments (Yang, Zhang, Ji, et al., 2018; Weng, Shen, Chen, et al., 2019), applying WebGIS technology in intangible cultural digital management (Lai, Luo & Zhang, 2012), using Augmented Reality or Virtual Reality to enhance user experience in cultural heritage presentation. Different design measures for ICH safeguarding bring in a series of disputes and discussions, especially concerning terms like 'authentic' and 'evolution'. In this paper, we aimed to clarify the role and value of design participation in ICH safeguarding.

2. ICH Safeguarding in Ecological Perspective

2.1 The connotation of ICH safeguarding

Since the 1970s, the intangible part of 'cultural heritage' has gradually attracted people's attention. Through a series of protection measures from UNESCO, such as the *Living Human Treasures* program launched in 1994, the report published by *World Cultural and Development Commission on Our Creative Diversity* in 1996, the *Proclamation of the Masterpieces of the Oral and ICH of Humanity* made in 2001, and the *Convention for the Safeguarding of Intangible Cultural Heritage* was finally adopted in 2003. Since then, 'safeguarding' is usually used to refer to protection and preservation of intangible cultural heritage, and the convention clearly defines that it includes 'identification, documentation, research, preservation, protection, promotion, enhancement, transmission, particularly through formal and non-formal education, as well as the revitalization of the various aspects of such heritage'. It can be seen that 'safeguarding' is not a static concept, it implies the goals of 'booming development' and 'sustainable development' (Alivizatou, 2016). The object of safeguarding includes not only physical products and spaces, but also processes and people.

2.2 The ICH ecology

The term 'Cultural Ecology' originated from the discipline of Cultural Anthropology, which systematically reveals the formation and changes of human culture from the coupling relationship between the human cultural system and the natural ecological environment. The interpretation of the term can be divided into three levels. From a macro-level, ecological studies explain culture change through researching the relationship between culture and natural ecosystems during evolution (Steward, 1955). From the meso-level, ecological studies use the ecosystem as an analogy to culture. From the micro-level, ecological studies explore the internal microstructure of a certain culture. For this paper, we adopted the above meso-level understanding, which applies the thinking of natural ecology into cultural study by comparing cultural systems to ecosystems and by trying to use descriptive approaches for natural ecology to explain the similarities and differences in culture. This approach considers that cultural phenomena, like natural phenomena, also have their own conditions, context, structure, order, and laws for survival and development (Ji, 2004).

Corresponding to the above definition, when discussing a specific ICH, the reflection on it needs to be connected with another culture form because different types of culture gather and finally form a cultural chain (Fang, 2001) and an interactive whole (Sun, 2003). The interrelationship and mutual influence among them need to be considered within a certain historical period and a certain social and cultural system (Sun, 2004). Also, the interactions generate the internal renewal mechanism including assimilation and alienation, as well as heredity and variation (Li & Sun, 2003). Focusing on the social structure, Sima points out the

following elements that influence the culture's dynamic: the natural environment, science and technology, economic system, social organization and values (Sima, 2011).

In considering these points, when we talk about ICH, the following questions need to be addressed under the mindset of Cultural Ecology: (1) Since the concept of ICH originated from the end of the last century, how has the whole cultural chain changed through the past 50 years around ICH? (2) How does ICH interact with other cultures in this process? What part is stable and what part is erratic in ICH? (3) What are the fundamental factors during this process and where will ICH go next? Only through figuring out these questions can the role of design can be clarified.

3. The Evolution of ICH Ecology

In this section, we talk about our understanding of the above questions based on our research carried out in China since 2009. In the past eleven years, we have worked on the continuous design project *New Channel* in many ethnic minority communities (including Dong, Yao, Tibetan, Mongolian, etc.) in China, where there are abundant intangible cultural resources. We have proposed and implemented various design methods and processes, from 'Cultural Intermediaries Paradigm' to 'Product-Service System Paradigm' to 'Community Engagement Paradigm' (Wang, Bryan-Kinns & Ji, 2016). During the long period of field study, we have seen that modern design and traditional intangible cultural heritage have undergone a variety of mutual learning and interweaving in the community, and different levels of impact have been generated in and out of the ICH community. Based on these real field practices and observations, in the face of different evaluations and voices towards this project, we have summarized the following three ICH Ecology to discuss ICH and design participation. Looking at the evolving socio-technical system, the origins of these different approaches arise from different social, cultural, and scientific and technological situations.

3.1. ICH 1.0: The manual production stage regards human rights and authenticity as the core

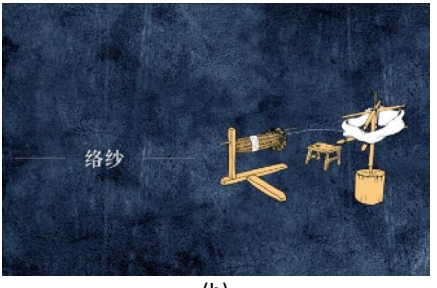
When discussing ICH in the early days of cultural understanding, terms like 'traditional culture' and 'folk custom' were often used. Some experts and scholars believe that the problem with these terms is that they come from the early colonial ideology (Seitel, 2001), which reflects an external viewpoint with which to evaluate ICH; therefore, regarding the bearer as the core subject, the *Convention* especially emphasizes the 'human rights' when talking about safeguarding. As a kind of culture, ICH can be sustained only when locals enjoy production and re-creation (Van Zanten, 2004). Communities, Groups, and Individuals (CGIs) dominate the creation, maintenance, and dissemination. The host communities and institutions need to decide their ICH's content and protecting methods in the social process. At this stage, as a 'living culture' of the community, ICH is culture practiced in people's daily

lives, which clarifies the inseparable and interdependent relationship between ICH and the bearer. From this perspective, ICH safeguarding is focused on enhancing its visibility, maintaining the culture and natural ecology in the community, and supporting the rights of communities and inheritors. In response to these goals, following the principle of 'rescue first, protect first', and under the chairmanship of Wang Wenzhang, the then-deputy minister of culture, China's early work on safeguarding includes the completion of the first national census work and the establishment of the four-level directory system of the country, province, city, and county, and the approval of the *Law of the People's Republic of China on Intangible Cultural Heritage* in 2011. These measures have promoted the standardization and legalization in ICH safeguarding.

The practice of ICH in this stage is intricately connected with the original production methods and social environment. For example, local weavers use traditional looms to weave Dong brocade. The progress of production technology or the change of the practical environment has reduced the vitality of broad public participation, as the practice of ICH, in this case, is dependent on now-unpopular technology. The emphasis on the 'authenticity' of ICH keeps people quite alert to 'over-exploitation'. In this case, the involvement of design in ICH is quite limited. At this stage, the greatest degree that design can achieve is to have breakthroughs in scenarios and functions by micro-innovation while maintaining the original productivity, relation of producing, and mode of production. For example, to protect Dong Brocade in Tongdao Dong Autonomous County of Hunan Province, while ensuring that the creation process is still guided by the local opinion leader Su Tianmei who is the national inheritor of Dong Brocade weaving skills, and adhering to traditional craftsmanship, the designers in the *New Channel* team can only propose opinions on new materials, user needs, and functions, and gradually create new products and revive traditional craftsmanship. This is the designer's best efforts under the original cultural ecology and technical conditions.



(a)



(b)

Figure 1. (a)The new product of manual Dong brocade co-created by local weaver and designer from the New Channel project; (b) animation of the weaving craft process made by New Channel project

3.2 ICH 2.0: Industrial production stage driven by output value and popularization

In the West, as early as the 19th century, the Industrial Revolution brought about fundamental changes to the overall 'making' system and human lifestyle. There have been multiple confrontations and separations between traditional art and machine production. The most typical historical event includes *The Great Exhibition* in 1851 and *The Arts and Crafts Movement* led by Morris and others. Modern production tries to imitate and replace tradition, whereas traditional handicrafts strongly oppose mechanized production; however, gradually, we have seen the possible fusion of the two, such as the design works done by Memphis Group, which represents Postmodernism. Although the rise of the ICH concept has come after this, the interweaving relationship with industrialization can be traced from the history.

Part of ICH inevitably flows and merges within the modern and industrial culture, which people intentionally keep distant from under the manual production stage. For example, considering craft, there exist two types now—the industrial crafts and the handicrafts (Chartrand, 1989). The industrial crafts are mass-produced and for the broad masses, whereas handicrafts still maintain individual and hand-made characteristics. UNESCO counselor Federico Lenzerini proposed the need for a dual protection strategy that states that ICH should not be viewed as a monumental heritage in a glass box, instead, it should be promoted and kept adapted to the needs of its creators and inheritors (Lenzerini, 2011). Facing the requirements of 'sustainability', the question of how to integrate the rich and diverse heritage into modern life so as to realize the activation and utilization of the heritage while respecting the will of people and not misunderstanding the cultural connotations of ICH is the focus of safeguarding ICH in the industrial production stage.

In China, since former Deputy Culture Minister Xiang Zhaolun was put in charge of the ICH safeguarding work, safeguarding has further shifted to the direction of 'creative transformation and innovative development', exploring ways to combine ICH with design and daily life, and starting a series of revitalization measures, such as launching the *Inheritance Group Study and Training Program*, establishing inheritance bases in universities, and releasing *The Plan on Revitalizing China's Traditional Crafts*, etc. These measures encourage ICH to step out of the local community and discuss and cooperate across regions and organizations in a way that cultivates the inheritors to continuously enhance their innovative ability in the exchanges with designers, artists, and the general public. Besides the educational part, China also devoted a great deal of effort in developing cultural industries on ICH. Industrial Parks were built in Chengdu, Lijiang and other places, which imported inheritors and shops to promote 'Inheritance +' by integrating ICH with film and TV, fashion, entertainment, tourism, and other industries. The top-down force at the government level has driven the rapid development of China's ICH safeguarding. Since the promulgation of the Law, China has spent more than 7 billion on it (XINHUASHE, 2019). This

led to a fever of ICH among the people, and the public's cultural self-confidence and cultural awareness have continued to rise.

Most approaches in this stage break down the concept of ICH and keep two aspects of it—pattern and technique. For example, design extracts the pattern and applies it into a new cultural and creative product; directors use figures and stories to make up new performances; engineers mechanize the traditional technique and make software to enhance the production efficiency (Figure 2). Through these processes, ICH gains wider dissemination and higher output through a certain degree of mass production, becoming a 'cultural intermediary' (Dennington, 2017), gaining recognized value in interculturality.



(a) (b)

Figure 2. (a) The new industrialized product based on Wu Long craft; (b) the computer-aided textile design software

As it drastically progressed, cultural appropriation occurred during this period, which made experts and scholars concerned about the authenticity value of ICH. Walker mentioned that it is the polar opposites of the values in traditional societies, which leads to unemployment, decreasing the local identity, and less connections between people (Walker, 2017). The consumer can quickly get a first impression of ICH through the final product; however, the experience is not complete. People gain a broader, more comprehensive perspective through traditional 'thinking-doing' (Walker, 2017). Thus, when the goal is directed to goods and businesses, ICH is relatively easy to be imitated, but it is difficult to implement and inherit cultural models and lifestyles on a larger scale. Nonetheless, reviewing the history of cultural practice, it is impossible to avoid the hybridity and impurity of culture, because culture is a constantly changing network of relationships (Rogers, 2006). Thus, to answer the question of how to protect ICH and keep the local people's cultural rights as much as possible, we investigated the essence of 'authentic' for the answer. Paul Philippot, former director of The International Centre for the Study of the Preservation and Restoration of Cultural Property, explained: "the authenticity of a work of art is in the internal unity of the mental process and of the material realization of the work" (Jokilehto, 2006). Xiang Zhaolun

also pointed out in his speech that 'materials and tools' are not the core of ICH, and 'the intervention of the exquisite skills representing craftsman's wisdom, talent, and experience into the production process' is the essence. Drawing on this view, the subject of authenticity has shifted from the static result of the work to the creative process of the work. The authenticity of the process emphasizes that in the process of product development in the industrial production stage, the social relations and history of ICH should be respected, the local context of culture should be emphasized, and the participation of inheritor's wisdom in the creative process should be noted, and a deep understanding of ICH itself should be maintained.

3.3 ICH 3.0: Digital intelligence stage targeting personality and technology integration

Walsh et al. (2014) pointed out that 'the historical separation rooted in art and technology has caused the wrong binary opposition between 'culture' and 'digital'.' Faced with the new generation of 'digital natives' and digital society, what will happen to the core value of ICH as a traditional culture? As more and more social interactions occur in digital experiences, the innovation of ICH will also digitally appear. Zhan investigated the Yangtze River Delta and concluded that trans-sector collaboration between traditional crafts and digital and material technologies might be good for crafts' sustainable future (Zhan, Walker, Hernandez-Pardo, et al., 2017). Although the evolutionary impasse is happening, where automation replaces traditional art and design, digital technology is showing the possibility of integrating rich and personal design capabilities into the new production process through digital design (Zoran, Valjakka, Chan, et al., 2015). Instead of using technology to expand the output, it is becoming the tool and 'palate' that people can play with. In the digital cultural interaction, the masses co-produce the digital culture of ICH, switching people from the consumption of 'cultural content' to the participation and creation of 'cultural experience'. People acquire the value of ICH on 'body memory' in a shifted way through a new hybrid medium, blending traditional and contemporary, digital and non-digital. In this transformation, the value of ICH is reflected in the happiness and participation in producing and sharing processes, virtual community construction, people's reflection on identity and society, and cultural shaping of digital public spaces. In the 3.0 era, ICH changed not only with the mode of production, but the focus is on revealing its spontaneous creativity as a 'living entity'. ICH will demonstrate its ability to continuously adapt to the social evolution of creators and holders (Lenzerini, 2011)and become the inherent creativity of the cultural generation system of society; therefore, the involvement of digital technology is no longer product-oriented but process-oriented, such as the use of artificial intelligence, collective intelligence, generative design, parametric design, etc., to enable each individual to participate in cultural creation. The main body of production is no longer a few professional designers and centralized enterprises, but a series of more diverse and flexible 'human–machine–biology' organic networks supported by brain-computer fusion technology and interactive collaboration platforms. The use of materials will become smarter and with more biological properties.

Along with the application of distributed technology and under the influence of technology democratization thinking, ICH production will realize the advanced decentralization, create a technological path that serves society and culture, and enable ICH to obtain continuous participation and creation of local groups and the public to reshapes the significance of ICH in social relations and local wisdom, so that it can be reconstructed and reborn in the ecological sense.



Figure 3. The artwork "The Shape of Time-Peking Opera", which is made by Fei Jun with four other artists. The team captured the dynamic data of the performances of four Peking Opera actors and transformed a dynamic time and texture co-existing posture time sculpture.

Stage 1.0, 2.0, and 3.0 of ICH represent the evolutionary changing process of ICH safeguarding under different socio-technical systems. The three are not mutually exclusive, but together, they form the intangible cultural heritage ecosystem. More and more people find their roles and position in this ecosystem. The skills and wisdom of ICH are also continuously democratized in this process. The ability of ICH to adapt and evolve as the excellence of world culture is fully reflected (Figure 4).

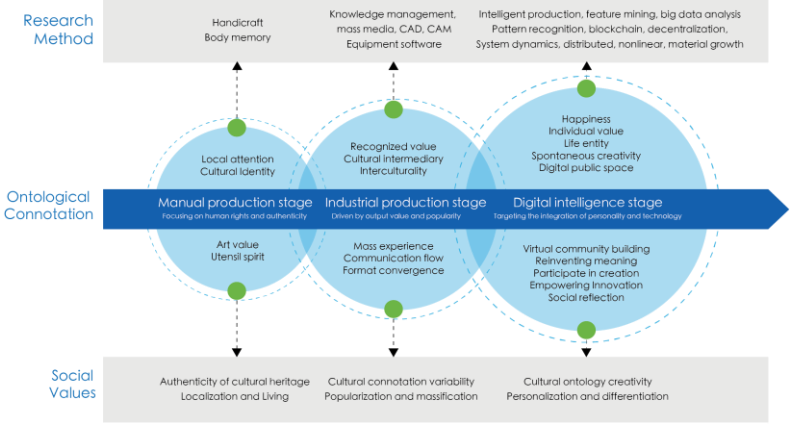


Figure 4. The changing connotation of Intangible Cultural Heritage (ICH) under the evolution of the socio-technical system

4. The Digital Platform of ICH under the Diversified Orientation

Digital means are the technical condition for the development of ICH 3.0; however, many of the current ICH digital platforms belong to different stages in terms of the core value of the practice. By searching through major databases and search engines, the data of ninety platforms were collected. ICH digital platforms can be divided into five categories:

- Archive Platform: it digitally collects and shows ICH's physical materials, making processes, and practical situations and tools;
- Trading Platform: it supports the display and sale of ICH related products;
- Learning Platform: it provides interactive ways for users to experience ICH content;
- Social Platform: it promotes users to share and communicate ICH topics;
- Creation Platform: it provides technologies, tools, and resources that support the creative development of digital ICH.

Table 1. Comparison of the different digital platform of ICH.

	Archive Platform	Trading Platform	Learning Platform	Social Platform	Creation Platform
Representative examples	Europeana Memory of the World	JD.com (ICH) Etsy	i-Treasures Google Arts and Culture	Promoter REACH	Europeana Labs Culture Moves
Stages	ICH 1.0	ICH 2.0	ICH 2.0	ICH 3.0	ICH 3.0
Object user interacts with	Cultural data	Final product	Participatory process	Inheritor, amateur	Creative tools
Experience user gets	Passive, imported	Joyous, impulsive	Active, immersing	Interpersonal, involving	Exploratory, embodied
Technology applied	Data storage, semantic analysis, knowledge Graph…	Blockchain, recommendations algorithm…	Machine learning, computer vision, AR/VR…	Intelligent editing, face recognition, beauty algorithm, recommendations algorithm…	Computational creativity, AI, 3D printing, motion capture…

Firstly, the 'Archive Platform' has promoted the work of ICH 1.0. For example, the European Union's first digital resource integration system, Europeana, which integrates the artworks of different European institutions; the Asian Cultural Centre for UNESCO (ACCU) has

established the Asia-Pacific ICH Database, etc. They all emphasize the recording and preservation of the original state of the ICH. Secondly, both the 'Trading Platform' and the 'Learning Platform' have promoted the work of the ICH 2.0 stage, aiming to facilitate a wider range of inheritance and productive development. Thirdly, for the ICH 3.0 stage, 'social platforms' and 'creation platforms' are gradually emerging. With the democratization of technology, simply operated design tools such as Shapr3D and uMake have been born in the field of 3D modeling, and this creative platform will realize the transformation from professionals to the collective creation of the public. Current social platforms are usually embedded inside other platforms, but as ICH practitioners and enthusiasts increasingly gather online, more niche online communities will gain more space for sustainable development.

The role of design in the three phases of ICH 1.0, 2.0, and 3.0 will also change accordingly, and it will gradually play an increasingly important role. In the 1.0 stage, the design mainly participated in the visual, interaction, and experience of the digital interface, and did not have any involvement in the ICH itself. In the 2.0 stage, design mainly participates in product development, brand building, and storytelling. This has a great impact on the skills and processes of the ICH and will promote some new forms of intangible cultural heritage. In the 3.0 stage, on the one hand, design will play a role of imagination and association with innovative thinking, on the other hand, design will guide more public participation in a wider range of cultural innovations as the role of 'facilitator'.

5. New Trends in ICH Innovation with Design Participation in the Digital Age

Since the design's participation in ICH innovation is getting deeper, the classification of traditional ICH will present a new trend. The Convention for the Safeguarding of the Intangible Cultural Heritage identifies five categories of ICH: (a) oral traditions and expressions; (b) performing arts; (c) social practices, rituals, and festive events; (d) knowledge and practices concerning nature and the universe; (e) traditional craftsmanship. The basis of this convention is the protection and rescue of cultural diversity, and its classification is based on the manual production brought by ICH and relatively isolated social systems; therefore, in the new industrialized and digital society, the fate and situation of most of the ICH has been very different. The art form that was popularized in the past has now become a rare resource of 'collection'. What will intelligent technology and tools do to change this classification? In what form will the 'New ICH' become a cultural pattern with publicity and vitality in the process of globalization? Based on the digital representation of ICH, machine learning, artificial intelligence, and other future cultural production methods, we tried to explore the 'New ICH' intelligent creative direction from three directions (see Figure 5).

5.1 Digital artisan and machine participation based on traditional craftsmanship experience

The artisanal skills in ICH are strongly dependent on factors such as traditional experience, physical memory and materials, and digital technology that will facilitate the 'artificial' process to become more convenient, intelligent, and hybrid. The traditional handicraft production process will incorporate more digital processes, such as industrial production, machine production, and robot participation (Masterton, 2007). Using Mocap, Armines, Forth, and other motion capture tools, digital humanities and semantic technology can generate new linked data, international digital book search standards, and even data for machine production. The process of combining digital content and crafts will produce different results from the original craftsmanship, thus more theoretical research and practical deduction are required to adhere to the core concept of process value on the dual track of 'protection' and 'innovation', shaping the post-industrial pluralism digital craft culture. Unlike the 'dual-track system' often mentioned in the foregone process of productive protection, the involvement of digital technology will gradually blur the boundaries between craftsmanship, art and design, and digitization may lead to the disappearance of irregularities and subtle changes in the crafts; therefore, to find a way of 'designing through making' and 'designer way of knowing', to carefully adapt and deal with technology, would enable the preservation of ICH creativity during the period of production (Nimkulrat, Walton & Kane, 2016). When crafts are understood as 'a way of thinking through various practices' (Adamson, 2007) and as 'a dynamic process of learning and understanding through material experience' (Gray & Burnett, 2009), digital tools can be seen as part of the crafts. Based on the above, a new artificial process is created, gradually forming a global communication, collaboration, and market mechanism, thus achieving a new 'digital artisan' and 'cultural maker'.

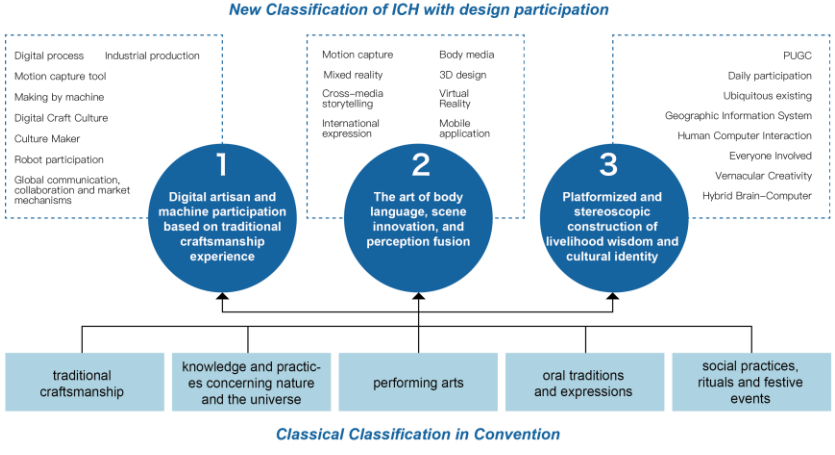


Figure 5. New trends in ICH innovation

5.2 The art of body language, scene innovation, and perception fusion

The expressions and performances of verbal and limbs in ICH are based on human perception, especially in some performing arts. The expressions and artistic rituals presented by performers using their own bodies as a medium (Carlson, 2013) can often span the barriers of language and culture. With the development of digital technology, humans have gradually entered the 'technical simulation of consciousness' stage, and the senses and nerves have been extended by various media (McLuhan, 1964). The application of a series of digital technologies, such as graphics, 3D design, dynamic capture, virtual and mixed reality, mobile applications, and cross-media storytelling, can extend and expand people's perception paths, creating more novel, physical immersive, and transformative performing art production processes and works. In the creation process, the relationship between digital technology and the performing art's creators should be more a partner than a tool (Bulut, 2018). Across the dichotomy between numbers and art, design creates an ecological environment that can promote cooperation, and thus allows the traditional performing arts to continue the history. Besides that, design can also enhance the aesthetic effect and scene sense of visual art, create the deep impact of emotion and sense, build the connection between meaning and symbol, and deepen inner wisdom (Dixon, 2007), transforming traditional performances into international expressions with empathy.

At the *Asian Digital Art Exhibition* held during the *Conference on Dialogue of Asian Civilizations*, the works of *Shape of Time · Peking Opera* created by Fei Jun and others captured the performances of Peking Opera masters, they then conducted a dynamic and materialized solidification of posture data generated by the performers in two dimensions—time and space. Using 3D printing to form sculptures, they integrated 'people' and 'fields', while also translating the culture of Peking Opera, which also changed the way of artistic production. Moreover, there are various kinds of digital and cultural performances, such as the 'Original Changsha' media art show and the light and fireworks art performance at SCO Summit *Friends Come from afar*. They all use elements from a variety of traditional cultures (such as fireworks, folk music, etc.) as the theme throughout, and use rich new media technology methods (such as large-scale drone fireworks matrix, holographic projection, numerical control technology, etc.) to construct an artistic perception and cultural innovation cognition that transcends language both visually and audibly.

5.3 Platformized and stereoscopic construction of livelihood wisdom and cultural identity

Social practices, rituals, festivals, and other activities of ICH, as well as local knowledge and practices, are important parts that run through the life of the non-heritage community, and deeply affect the establishment of community interpersonal relationships and the shaping of community identity. Driven by advanced technologies such as advanced manufacturing, the Internet, artificial intelligence and 3D printing, the production and consumption of ICH is a new mechanism and system for production, organization, sharing, and dissemination.

Everyone can be a part of creating new things more easily, and also be an important part to assist, guide and share the creation of others. The ubiquitous survival, everyone's participation, PUGC (Professional User Generated Content), and the enabling design of brain–computer integration co-exist, thus building a three-dimensional 'ICH community or platform' with different values.

The EU's cultural work plan suggested that new technologies offer huge potential for marginalized groups to integrate into society (EU, 2017). In the interactive network of 'human–community–nature', through the development of key technologies such as human–computer interaction, mixed reality and geographic information systems, it is possible to realize the reconstruction of resources and relationships, generate new art and cultural projects, and renew the vitality of cultural activities. In accordance with the concept of 'vernacular creativity' (Edensor, Leslie, Millington, et al., 2009), transforming traditional cultural activities into expressions that can be associated with the interests of 'everyday participation', creating the value of 'sharing', 'participation' and 'perception' in an immersive and inclusive atmosphere, can strengthen the sense of local belonging, thus making digital cultural activities a 'catalyst' for cross-border resonance and understanding, and promote community building. In 2014, the Milan Makers Association (MIMA) organized the exhibition *When 3D Meets the 10D World*, emphasizing the diversified 'dimensions' and 'social needs' in the social structure, which inspired a group of designers and artists to think deeply about the responsibilities and mechanisms of cultural, technological, and social innovation. In the process of using digitalization to promote the construction from culture to community, Coventry, as the experimental site of the 2021 'UK City of Culture' plan, stimulated the revival and regeneration of the region by developing programming concepts, including the immersive creative application of technology and exploring how to capture data more effectively. At the *Asian Digital Art Exhibition*, artists focused on the theme of 'Asian civilization exchange, mutual learning, and community of destiny'. Xu Bing 's 'Chinese Characters', Qiu Zhijie and He Xiaodong's *Jingdong AI Generation Map*, Wu Junyong's *Thousand Moons*, *PomPom Mirror* by Israeli artist Danny Rockin, *Calligraphy Movement Vision* by German artist Tobias Glemir, etc., these works use digital art to creatively explain and interpret traditional Chinese culture, showing the inclusiveness of Asia in the local and global context, and reflecting the impact of the Chinese civilization gene on Asia and even the world's art trends.

6. Conclusion, Limitation and Future Research

In order to maintain social sustainability, society is paying more and more attention to inheritance of minority cultures in globalization. Discussion on the protection of ICH has become a matter of general participation in the academic community, and the public can experience and understand ICH through various channels. But in this process, as to how to maintain a balance and sustainable development between cultural protection and social participation, different disciplines put forward different opinions on the participation and

role of design from their own disciplines. The interpretation of this issue is of great significance for clarifying the direction of participation in future ICH safeguarding. From the perspective of Cultural Ecology, this article describes three ICH safeguarding ecology under different socio—technological systems, and explains the role and work of design in them through design practice and case analysis. The three ecology are named as ICH 1.0 (manual production stage), ICH 2.0 (industrial production stage) and ICH 3.0 (digital intelligence stage). These three parts constitute the current intangible cultural heritage ecosystem. In the future-oriented ICH safeguarding, we can see that digital intelligence provides a new way to enable the design and participation of ICH safeguarding to go beyond the industrial stage, which is focused on objects and commerce, but return to the focus on the demands of ICH as a kind of culture, which is public creation and group interaction. Combined with smart technology, design can provide new ways for the public to participate. Therefore, this article also collects and analyzes data on the current digital platforms in this field. Through the clustering of the functional characteristics of 90 platforms, five platform types are obtained, namely Archive Platform, Trading Platform, Learning Platform, Social Platform and Creation Platform. Design also plays a different role in it. In the experience design for the interaction between users and ICH, the design object has also changed from the interaction between people and things to the interaction between people in the making process. Under this general trend, traditional intangible cultural heritage will be cross-integrated. This article proposes three new ICH categories: (1) digital artisan and machine participation based on traditional craftsmanship experience; (2) the art of body language, scene innovation, and perception fusion; (3) platformized and stereoscopic construction of livelihood wisdom and cultural identity. The values and concepts contained in ICH show the new era spirit under the integration of culture and technology, promoting the two-dimensional integration between ‘tradition’ and ‘contemporary’, and ‘regional’ and ‘global’.

The research is subject to two main limitations. First, we proposed the macroscopical views which provided the overview of design’s evolvement in ICH safeguarding; however, concrete and detailed working framework need to be deeply clarified. In the future, developing working framework of design process in the ecosystem and for developing new ICH will be useful. Second, since ICH and design intelligence is such polarized area, the question of how design can be the bridge to integrate each other is significant. In the future, it would be valuable to explore the mechanism of new technology as the driving force to foster ICH’s evolution.

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Acknowledgements: this research was funded by National Social Science Key Program of China (20AG011), Social Science Youth Program of Hunan Province (19YBQ037), and National Key Research and Development Program of China (2019YFB1405702).

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Domesticity and digital eugenics: design cultures of Silicon Valley

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Abstract | The paper attempts to make sense of the two more recent areas of interest of Silicon Valley's 'gang of four': Amazon, Alphabet, Apple, Facebook. The last few years have seen this group of four turning their attention to the development of 'smart' ecologies with a focus on automation and the development of a 'house of tomorrow'. More recently, reports have emerged of increasing interest in biotechnologies and Synthetic Biology start-ups. Interest in these two areas are commonly interpreted as the logical consequence of the need to find new profitable markets. We suggest, instead, that modification of the human body is central to understanding these corporate actions. We use the notion of eugenics as an interpretative framework to understand these new areas of expansion, suggesting the creation of a hegemonic culture gestated by digital technologies.

KEYWORDS | INTERNET OF THINGS, SMART HOME, SILICON VALLEY, ARCHITECTURE, EUGENICS

1. Introduction

In September 2018, Plant Prefab issued a small press release announcing their new collaboration with Amazon. The company would receive resources from the Alexa's fund, created in 2015 by Amazon as a pot of capital fund investment designed to promote development of Artificial Intelligence research and application as well as Internet of Things and robotics. One use of the Alexa fund is in the form of small grants to groups of graduate students, often in applied sciences and engineering, who develop small applications or devices integrated to Amazon's vision of a 'connected' future. Plant Prefab was an unusual candidate for the Alexa fund. Paul Bernard, a spokesperson for the Alexa's Fund, announced that the partnership would be intended to develop prefabricated units which would leave the assembly line with Alexa-ready IoT devices — a seamless mesh of devices ready to be connected to Amazon's emerging line of Echo units (Gibson, 2018).

Echo was unveiled to the American market in November 2014 and released to the market in the summer of the following year. The device is a plastic cylinder featuring a small array of buttons on its top and a ring of LED lights at its upper rim which make up one of the main interaction strategies with a human user: feedback is represented by the light ring changing colours and dimming patterns in a way that looks suspiciously similar to the interaction of HAL-9000 in *2001 Space Odyssey*. The outer appearance of Echo is the pinnacle of minimal design — there are little cues in its exterior to tell us what it can do. It is also the result of the design culture of Silicon Valley — the product is never finished, it is constantly upgraded. Echo was initially marketed primarily as a speaker, with other functionalities added in through software updates and newer generations of hardware. The one outer feature suggesting its function is the grilled pattern that allows the soundwaves to travel outwards from its speaker arrangement. It also allows the array of seven directional microphones to pick up sounds happening around Echo (Crawford and Joler, 2018).

In the English language, speaker has a few meanings. In the context of Alexa and similar devices, speaker means a piece of equipment used to reproduce sound through the vibration of an acoustic material. An older meaning of the word, however, describes an entity, often human, who is capable of speech. After its initial release, Amazon integrated Echo to Alexa, the Artificial Intelligence (AI) agent responsible for making Echo not only a device that reproduced sound but one that speaks with its human owner. A smart speaker. Shortly after its announcement of collaboration with *Plant Prefab*, Amazon started rolling out its *Experience Centers*, prototype homes installed across the United States to showcase the potential of a truly smart living. The architecture and interior design of these centres are unremarkable beyond the technological cornucopia of sensors and actuators. At the centre of this deep mesh of electronic convenience stands Echo, intended to become the operative system of domestic life.

The digital domesticity of Amazon and other members of the '*Gang of Four*' — Alphabet, Apple, Facebook — is interwoven with tactics to subtly modify the human body to make it more adept at interfacing with machines (Hernan & Ramirez-Figueroa, n.d.). The *Amazon Experience Centers* produced by Plant Prefab are often presented with a series of placards, placed at strategic points of the tour and providing customers with instructions of how to interface with Echo. One of the cards reads '*Just ask "Alexa, movie time'.* Instructions continue further down in a smaller font: '*With this command, Alexa will … turn off the living room lights, turn off the music*'. The cards can be seen as an atmospheric 'user manual': it instructs would-be users on the 'right' way to interface with the AI agent. There is a pragmatic dimension to this — at this point of development, Echo is capable of understanding *these* queries, so users are asked to shape their speech when operating their device.

A more sinister reading detects the emergence of an *Alexa-speech*, a whole new form of simplified English in which vocabulary and grammar are shaped to the capabilities and current constrains of the technology. Taken to its logical consequence, the Amazon-censored language would change with every new software and firmware upgrade, with new words coming in and out of use depending on the ability of AI agents to detect their patterns and transcribe them to text queries. While this 1984-esque vision can be dismissed as a critical conceit, studies on the effect of AI assistants on human speech invites a different interpretation. A survey by Science Centre Newcastle suggests the majority of users change their speech patterns, specially to 'soften' regional accents (Life, 2018). As argued by Erin Carrie (2018), personal assistants replicate the human biases of the people who design and programme them. The automated speech of these devices is '*without culture, disembodied, hegemonic, and, in a word, white*' (Marino, 2006).

In this paper, we attempt to make sense of the two more recent areas of interest of Silicon Valley's '*gang of four':* Amazon, Alphabet, Apple, Facebook. Having dominated the development of digital technologies in the late twentieth century, the last two decades has seen them turning their attention to the development of 'smart' ecologies towards the '*house of the future*' and, more recently, to biotechnologies start-ups (Chang, 2018; Gibson, 2018; Simonite, 2017; Strengers & Nicholls, 2018). Understood through a financial framework, these recent engagements can be read as a way of diversifying income streams from corporations under increasing pressure to grow. We believe, however, that there is a unifying logic that concerns directly with the human body at actual and metaphorical levels, an ethos to generate a better humankind.

We employ a methodology influenced by feminist studies to analyse the entanglements of these corporations and their development projects and financial interests in smart speakers, personal assistants and biotechnologies. We perform a close reading of promotional material and press releases of smart speakers and personal assistants, confronting it with recent interests in biotechnology start-ups such as Jeff Bezo's engagement with Unity Biotechnology (Terry, 2018); Alphabet's branch in the California Life Company (Tate, 2013);

and Facebook's with AncestryDNA (Schwartz, 2019). We draw inspiration on the work of Christina Cogdell (2010; 2000) linking eugenic ideology with streamline design in twentieth century America. We write this paper within a critical tradition — we believe that the design cultures of Silicon Valley should be analysed beyond prevalent discourses of technocentrism and progress. But we do so as a cartographic exercise (Braidotti, 2011) — we propose instead that reading the tactics of the gang of four through the interpretative framework of the ethos to create a better humankind allows the design community to device their own tactics of resistance and destabilisation of a digital hegemony.

2. Digital Eugenics

Christina Cogdell has linked eugenic ideology with streamline design in twentieth century America, arguing a broad cultural pattern in which ideas and practices of modern design are inextricably linked to those about race and evolution. She performs a historical overview to detect the way that notions about efficiency, hygiene and progress shaped not only the views of scientists and medical professionals who self-identified with the ethos and principles of eugenics, but also in a group of industrial designers and architects loosely grouped around the aesthetics of streamlining: the development of form that follows principles or rationality, efficiency and progress. Eugenic thinking, she argues, operates as a '*a guiding framework within a certain cultural psyche without which the streamlined style in industrial and architectural design would not have resonated with such force'* (Cogdell, 2000, p.194). These designers '*approached products the same way that eugenicists approached bodies*' (Cogdell, 2004, p.4): both could be managed and manipulated to create a better form of humankind.

Although there are visible figures in Silicon Valley that can be somehow linked to eugenic ideals and discourses, such as Paypal founder Peter Thiel, we can also detect a broader design culture that favours ideals of efficiency and progress actualised in the human body. Claudia Dutson has argued that the architecture of Silicon Valley typifies the management practices of its corporations. Through a detailed study that draws on drawing and situated practices, Dutson has created a detailed documentation of the ways that technology companies have used tactics to colonise the geographies they are located in. trying to shape their immediate environment in their own image. The analysis extends to the architecture of campus themselves. Dutson argues that the way that activities are arranged, and the buildings laid out within a complex, respond not only to functional requirements but to a strategy to embody the corporate ethos and elicit affective states in their workers. Elsewhere Dutson analyses the *entrepreneurial subjectivity* of Sillicon Valley, a form of management that arose after the Second World War within West Coast technology companies that shifted an emphasis on top-down hierarchies to self-management (Dutson, 2016). The new emphasis on individuality allowed corporations to stealthy align their objectives to those of their employees, phasing out traditional objectives explicitly formulated around making a profit towards hyperbolic statements of *'"making a difference"*

and "changing the world"' which, Dutson goes on to conclude, incorporate '*an employer's need for personal growth and desire to do meaningful work with a bigger shared goal*'.

Dutson has argued how the architecture of building complexes from Apple, Amazon, Google and other incorporate strategies that enable them to surreptitiously influence the experiences, thoughts and feelings of their employees. The repertoire of spatial strategies of power include the use of open plan offices and extend to the more 'innovative' strategies that seem to invert the work/play: lavish interiors, free gourmet meals and 'playful' environments with arcades, bean bags and table football. The expectation is that by creating an environment in which all possible needs and desires are catered for, all distractions will disappear and liberate employees' cognitive capacity to actualise their full potential. By constructing the architecture, Silicon Valley corporations hope to generate a better, more productive version of employee, one that has learnt to assert their personal values at work; to derive positive identification that produces an unlimited revenue to the company (Dutson, 2019).

Although Dutson doesn't explicitly frame her discussion of Silicon Valley architecture through the notion of Eugenics, it is easy to detect the ethos in the will to produce a better sort of human-kind. More explicit evidence of this form of 'digital eugenics' can be found in Silicon Valley's more recent entanglements with biotechnologies. Early in 2017 it was announced that Amazon's CEO, Jeff Bezos, would be investing a significant amount into Unity Biotechnology, a biotechnology start-up poised on reducing the debilitating consequences of aging (Terry, 2018). The company concentrates on removing '*senescents cells'* from the body: a specialised form of cell charged with preventing multiplication of cells into tumorous tissue. The cells have been linked to the development of age-related conditions, including arthritis and kidney diseases. Following some successful trials in rodents, the company hopes to develop products that target and eliminate senescent cells which, it is hoped, might slow down some conditions associated with ageing.

Association with the ideals and principles of eugenics is more overt in DNA services. AncestryDNA, one of Calico's partners, which provides direct-to-costumer genetic testing: a service in which costumers send a tube with their spit to get information about their 'ethnic origins' and 'DNA' tribe. In early 2019 *23andMe* announced a partnership with AirBnB to allow its customers to put together holidays based on their 'ethnic' origin and ancestry. Mahdawi (2019) describes the phenomenon as a form of *DNAdvertising* reflecting on the way Silicon Valley companies seem to increasingly use genetic information, based on DNA, for gratuitous reasons. Spotify has also partnered with Ancestry to offer costumers personalised music playlist based on their genetic makeup. Despite the overtly racial discourse behind this use of DNA to speculate on racial origin, Mahdawi reflects, the companies are careful to phrase their products in terms of genetic populations, DNA tribes, heritage and ancestry. This banalisation, Caulfield (2018) argues, legitimises race and the idea that biological differences are constitutive of personal identity.

3. Accelerationism

In addition of their material entanglements and design tactics, it could be argued that the foundational myth and ethos of Silicon Valley is deeply woven and explicitly informed by eugenics. The giant corporations making up the so-called gang of four have made their fortune by creating and optimising products based on the internet. Their ethos and cultures could be said to be the result of the financial, material and ideological conditions of the 1990s — a decade characterised by the collapse of the Soviet Union, the emergence of the American economic and political model as hegemony, the 'end of history' and a financial boom in the US and UK linked to the strengthening of neoliberal policies. The corporations often identified as the 'gang of four' are of the decade or closely related to its conditions: Google's parent company Alphabet and Amazon, were founded in the 1990 and although the foundation of Apple predates the decade, it found one of its more financially profitable years in the same years. Facebook would only emerge in the market later but based on the conditions created by the technological revolution and mass internet culture that emerged in the same date.

The political and economic conditions of the 1990s not only created the possibility for the gang of four to emerge and flourish, they also gave way to *accelerationism*, a philosophical school of thought that has derived in contemporary aesthetic, political and ideological movements in the far right and left. Although the term means different things to the manifold of groups embracing it, Steven Shaviro (2015) proposes that the best way of defining accelerationism is through science fiction. In *Pop Apocalypse*, Lee Konstantinou (2009) describes a fictional movement of '*Creative Destruction*' inspired by Maxism-Leninism. The followers consider Marx's writers literally, considering its mission to *accelerate* the reach of capitalist markets '*because that's the necessary precondition for a truly socialist revolution*' (Konstantinou quoted by Shaviro, 2015, section 1). Shaviro points out the paradox of the creative destructionst ethos: in practice, its adherents are indistinguishable from the most ardent of capitalists, creating good value for investors and enviable business opportunities. A more succinct summary of the argument is that '*the only way out is the way through*' (Idem) — accelerationists believe that Western governments, and more generally the capitalism is inherently corrupt. The solution is to accelerate the expansion of the economic system and taking it to its extreme, often through shock tactics of creating chaos and confusion.

The origins of accelerationism can be traced to Nick Land and the work of the Cybernetic Culture Research Unit (CCRU) at the University of Warwick in the United Kingdom (Beauchamp, 2019). Their work can be understood as a reinterpretation of the old analogy of technology as a prosthetic extension of the human body first proposed by philosopher Ernest Kapp (1877) and later popularised and extended by Buckminster Fuller (1938, 1971)— suggesting a merging of technology and the human. Land believed that the prevalence of capitalism and networking cultures were intertwined strands which, when combined, produced a profound change of everyday life and the human. Drawing on the writings of

Deleuze and Guattari and Jean-François Lyotard, Land (2018) proposed that as the speed of modern life inevitably accelerated, the individual dissolved and became a new entity merged to its technological limbs.

Although not explicitly related, the argument behind accelerationism can be equated by that of transhumanism, the belief that the advancement of digital technologies inevitably leads to a future beyond the human where consciousness can be uploaded into a machine to achieve eternal life. Although often associated with the work of Raymond Kurzweil, the notion of transhumanism has expanded to different aspects of Silicon Valley thinking and products, animating its entanglements with Amazon's Unity Biotechnology and Google's California Life Company among others.

4. [Atonic] Smart Living

Our use of eugenics in this paper doesn't claim specific links between the people behind the big four and eugenics as a guiding ideology. We believe however that reading their tactics through the interpretative framework of the ethos to create a better humankind allows the design community to device their own tactics of resistance and destabilisation of a digital hegemony.

In his *Being and Event* and *Logic of Worlds* (2007, 2019), Alain Badiou proposes the term of atonic worlds: worlds homogeneous and simple which, in their *sameness,* make it difficult for new conditions to appear and any significant change to take place. Perhaps the best way to visualise atonic worlds and their damaging effect on those who inhabit them is the analogy that Ian Graham Ronald Shaw (2010) draws to the animated film Wall-E. The film reaches its climax when Wall-E, a robot designed to collect and compress rubbish, enters the Axiom, a spaceship designed to provide an artificial living environment to the human population that escaped earth. Shaw proposes that the Axiom is a perfect example of an atonic world: a bland place designed to keep humans entertained and sedate, growing to impossibly obese dimensions in flying chairs which cater to their needs. Wall-E however, *tenses* the world of the Axiom, bringing onboard a small plant that has grown on earth and that should change the directive of the Axiom to head back to Earth and repopulate. Despite the opposition of Auto, the computer controlling the Axiom, the tension generated by Wall-E ensues a series of events that end up with radical change coming about.

The eugenic tactics of the 'gang of four' can be said to generate an atonic world, a 'smart' future of automation and sedate happiness where little happens. Design has, however, the potential to 'tense' this world by interrogating the need and convenience of technologies and generate alternative narratives and visions of the future. Thinking in these terms suggest a new social role of design, central to the debate of how these technologies develop and the way corporations can be brought to account for their actions. Doing so, however, requires work of critical theory to examine the unifying themes and tactics. Understanding the design cultures of this influential group of corporations as digital eugenics provides a way forward

in creating the conditions to challenge and counteract — to tense a world where we speak to Alexa, one in which we are bodies are attuned to the vertiginous speed of capitalism.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Exploring Asian Philosophies and Service Culture: the Notion of Dignity

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Abstract | This paper studies Asian service culture with a focus on the notion of dignity in three major philosophies. In Confucianism, dignity is encapsulated in the social value of Ren, which has been influential in the Chinese service culture concepts of Miànzi and Guanxi, emphasizing private network. Buddhist dignity is centred in compassion, the attitude of serving everyone as a Buddha. This tradition is especially evident in the Japanese service culture of Omotenashi, or hospitality as moral obligation. The dignity of Taoism originates from spontaneity, an autonomous action unaffected by external forces. Spontaneity is related to the Korean culture of Jeong, referring to a broad body of emotional attachment over time. These philosophies are highly relational and community-oriented. Ethics in service is considered important, as service is bound by social relationships; however, its focus on community and blurred boundaries in relational dynamics can sometimes place moral pressure on service workers.

KEYWORDS | SERVICE DESIGN, SERVICE CULTURE, DIGNITY, ASIAN PHILOSOPHY

1. Introduction

Humans have designed the artificial world to elevate dignity in everyday life. Dignity is an especially important principle when designing services, as it has a direct influence on individuals who participate in a service system. Moreover, service is co-created by diverse stakeholders. Today, service refers to a commercial transaction involving labour goods; historically, however, service as a broader system of collective participation has been infused with sophisticated cultural connotations, such as political, moral or communal relationships. Therefore, it is important to focus on dignity in service, including that of customers, employees, managers and community members who are indirectly involved and affected.

One issue in the study of dignity is the cultural difference between service indignity incidents—service controversies that concern dignity—in the West and the East. In Western cultures, many service indignity incidents involve customer humiliation. For example, in the United Airlines Flight 3411 incident, a bleeding passenger was dragged off the plane because he refused to give up his seat. Other cases include passengers being expelled from flights for similarly controversial reasons, such as storing a baby carrier, wearing leggings or speaking Arabic. On the contrary, cases in Asia tend to concern the humiliation of service employees. For example, on Korean Air Flight 480, a customer assaulted several flight attendants and spit on their faces. Other incidents include passengers throwing a hot cup of ramen on a flight attendant, sexually harassing them, or attacking them for refusing to serve more alcohol.

Why is there such a difference in the way these service controversies manifest? The patterns of well-known service indignity incidents—or at least the rhetoric used to report these incidents—reveal certain cultural assumptions about service. In this paper, I review three major philosophies in Asia to better understand the characteristic of service culture in three Northeast Asian countries: Confucianism and the Chinese service culture of Miànzi (面子, ‘honour’), Taoism and the Korean service culture of Jeong (정, ‘intimacy’), and Buddhism and the Japanese service culture of Omotenashi (おもてなし, ‘care’).

2. Confucianism: Ren and Guanxi

Confucianism is considered the dominant philosophy influencing Northeast Asia. It is fundamentally humanistic in that it seeks the foundation of an ideal society by cultivating oneself to form a balanced relationship with others, instead of salvation via divinity. The central concept of Confucianism is Ren (仁), which is referred to as the substance of humanness. Ren, in a broader sense, includes a holistic virtue that includes intellect, kindness, justice and generosity. More simply, Ren means respecting and serving others, as explained by Confucius: ‘[h]aving others stand first and fulfilling others’ wish before self.’ Ren also indicates that fulfilling one’s role in society—such as a king properly behaving as a

ruler—leads to social harmony. Ren is practised through Li (禮, 'ritual'), a canon that guides religious rite, moral rules, custom and courtesy (Confucius, trans. 1999).

If we view dignity as the worth of a human being (Rosen, 2012; Debes, 2017), we can also see that Confucianism features dignity at its core. There are no deities in Confucianism; instead, Ren, a human value, is considered the highest good in everyday life and political interactions. As shown in the origin of the character 仁 (Ren)—made of two components (人 二, 'two people')—humans can prove their dignity only by continuously practising the benevolent virtue of Ren in relationship with others. The Saint, or the ideal practitioner of Ren, is described as serving others by fulfilling the responsibilities of their social position. The great Ren of a society is the collective outcome of many individuals practising Ren together (Confucius, trans. 1999).

If we focus on the notion of dignity in Confucianism, a characteristic connection can be found in the culture of Miànzi (面子, 'face') and Guanxi (關係, 'relationship') in China. Miànzi is an official and social image of a person as perceived by other people. Miànzi accompanies a sophisticated emotion of pride, honour, humiliation, morality and vanity altogether. For example, making a mistake in public leads to the unbearable loss of Miànzi. According to Hu (1944), if a person loses honour, they can no longer live in their community; however, if they lose their Miànzi, they also forfeit the meaning of life. Miànzi usually goes beyond the individual, influencing those who belong to the same group. For example, if someone regales another person for the sake of a third person whom they both are acquainted with, the Miànzi of all three people is saved. In other words, Miànzi is the public confirmation of dignity, especially in organizational settings.

Miànzi is inseparable from Guanxi, an essential private human network characterized by mutual interest. Guanxi, in a narrow sense, means utilizing private networks to achieve one's practical benefit. In a broader sense, Guanxi can include any trustworthy human connections for mutual aid, including friends, colleagues or acquaintances. Miànzi plays an important role in this process, as Guanxi exists on the assumption that people will respect one another's Miànzi and provide useful aid for anyone in their network. The exchange of social debt strengthens the bond of a private network (Buckley, Clegg, & Tan, 2010).

Guanxi itself is a social service. Researchers propose that Guanxi is a safety net originating in agricultural society, where people live their whole lives in connection to the land while protecting each other from large-scale political dynamics of Chinese regimes (Hsiung, 2013). Today, it is said that without Guanxi, no business can be done in China, and Guanxi still plays an essential role in every aspect of life, including commercial, public or even digital services. For example, Guanxi is explained as the main reason behind the rapid success of the WeChat service (Lin et al, 2019). WeChat started as a messenger but soon evolved into a social networking platform; now, it has become a vast system for all kinds of services in China. Service providers rely on WeChat to gain new customers through existing customers' network, exchange credit currency as gifts, and individually manage customer relationships in 1:1 or group settings, all of which reflects the offline tradition of Guanxi.

3. Taoism: Spontaneity and Jeong

Another influential philosophy is Taoism, emerging during the Spring and Autumn period in China, amidst continued warring between 7 countries for over 550 years. Laozi founded a philosophy to bring peace to the world, proposing that oppositions such as possession and non-possession, difficulty and ease, and beauty and ugliness all originate from humanity's artificial divisions. Tao (道, 'the way') describes the holistic relationship that brings these oppositions into a harmonious whole. This emphasis on relationship aligns with Confucianism, but Laozi argued that Tao is a path that cannot be described, named or walked on, meaning that Tao is different from the code of conduct which characterizes Confucianism. He criticized Ren as the artificial, exaggerated and calculated alternative to the Tao of the natural world (Lao, trans. 2011).

Instead, Laozi suggested that dignity is found in living spontaneously, such as through Wuwei (無爲, 'non-action') of nature. He proposed that action without intention—that which comes naturally from inner Tao—does not feel like an action, and is thus of higher moral value than the artificial value proposed by Confucian rituals and codes. What Laozi meant by 'nature' does not necessarily refer to the natural environment, but the principle of nature (自然) as autonomous (自發) being (然). In other words, dignity in Taoism is the autonomy of following one's free will, aligned with nature, instead of the external functions and regulations posed by society. The Sage, or the ideal human, serves other people autonomously without considering it to be a good deed, because they live in harmony with the natural world of Tao.

Laozi believed that spontaneous non-action and service to other people cannot be separated. He favoured water as a symbol of dignified service, stating: 'The highest goodness resembles water; Water greatly benefits myriad things without contention; It stays in low places that people dislike.' Water serves the world by changing its shape depending on different vessels and states, nurturing all beings and embracing all by filling any gaps. Serving others happens naturally, as there is no more distinction between self and other when desire and virtue becomes one in the wholeness of Tao (Lao, trans. 2011).

Taoism's influence is especially evident in Korean service culture. For example, scholars voted on 'spontaneity' as the most prominent characteristic of Korean culture (Shin et al, 2014). Spontaneity is the driving principle behind another pillar of Korean culture, Jeong (정). Jeong is a sentiment that permeates Korean society as a bond of intimate community. Jean-Marie Gustave Le Clézio (2017), a Nobel laureate, described it as the feeling of 'sharing the same destiny.' Jeong is a broad body of emotional attachment, including love, hate, care, jealousy, vengefulness and forgiveness. Over time, these mixed emotions sublimate into an overarching affection. As an emotional totality of positive and negative feelings that naturally grow through long acquaintance and experience—just like the fermentation processes that characterize Korean food culture—Jeong is considered the substance of humanness. Koreans feel dignified as humans by sharing this sentiment, which makes each individual a special and meaningful being.

Another characteristic of Jeong is spontaneous expression. Action without words naturally emerge from true sincerity, which resonates the non-action of Taoism. In Korean culture, the genuineness of an act of service is suspect if the person or organization delivering the service boasts about the favour. In contrast, non-expression is believed to prove itself as genuine by breaking away from artificial words or courtesies. For example, one of the representative characters of Korean service is the 'grandma with a potty mouth'. This character, the owner of a small local business, speaks to her customers using impolite words; however, her contrary actions, such as giving extra meat in a dish, spontaneously reveal her true Jeong. Understanding the sincerity of an action beyond words makes customers feel as though they have a special relationship with service providers, thus contributing to the dignity of those who are bound together in Jeong.

4. Buddhism: Compassion and Omotenashi

Another body of thought that has influenced everyday life in Northeast Asian culture is Buddhism. Originating from India, Buddhism was subsequently divided into the Mahāyāna and Hīnayāna branches. Its major flow into Northeast Asia was through Mahāyāna, meaning 'the great vehicle', an analogy of Buddha's teaching with the aim of saving not only oneself but every human in this world through the practices of self-cultivation and compassion (Shizutani & Suguro, 2013). For example, Zen Buddhism in Japan is representative of the Mahāyāna branch, emphasizing enlightenment through meditation and community relations instead of studying scriptures.

The fundamental principle of Buddhism is 'Śūnyatā (emptiness, शून्यता).' Śūnyatā is the belief that there is no fixed substance in the world. It does not literally mean 'emptiness'; rather, it proposes that there is no intrinsic, independent or unchanging nature in things. Substance is just a composition of our perception. Substance is only defined by one's relations to other things and people via infinite cause and effect. Therefore, one can be divine or enslaved according to their relationships with others. Obsession with non-existing substances, especially the self, in this ever-changing world is considered the cause of all pain. The self is not the absolute origin of thought or action: it is just an empty space filled with the outcomes of conditional relationships surrounding the self (Lee, 2016).

Buddhism emphasizes the importance of breaking the barriers of the self to continuously overcome attachments. One has to constantly put effort into emptying the self in order to accept the ephemerality of matter, instead focusing on relationships. Emptying the self can be achieved through service to others with *compassion* (maitri, मैत्री). Compassion is different from sympathy: it is expressing emotion for others who are equal and treating all people as having the potential of becoming a Buddha—the enlightened human. Dignity is found in respecting everyone as a Buddha and serving them to become the ideal being. Compassion is expressed as dāna (दान, 'charity'), or service to the community. Compared to Guanxi as a system of reciprocal aid, dāna refers to contributions without the expectation of recognition

or return (Lee, 2016). Service itself is a cultivation of both giver and receiver by emptying the self and appreciating relationships.

Buddhist influence is especially evident in Omotenashi, which is known as the spirit of Japanese service culture. Originating from traditional tea ceremony (Hisamatsu, 2015), Omotenashi originated from the word motenasu (持て成す), meaning entertaining, offering and treating well (Iwata & Okada, 2018). Mote (持て) indicates intentional action and Nasu (成す) suggests completeness (Ohnishi & Nakamura, 2018). Omotenashi is an attitude that refines a service into 'the ultimate spirit of hospitality' with formality, personal touch and careful attention that exceeds customer expectations (Ikeda, 2013). Not only one's actions but also state of mind should be cultivated to the degree of becoming art, with an active sensitiveness to other people's needs. For example, offering a pre-heated dish and a warm hand towel before serving winter food—in a dish decorated with a season-appropriate theme—is an example of Omotenashi.

Omotenashi operates as a service philosophy that enhances the dignity of both the host and the guest. Masaru Watanabe, General Manager of the Palace Hotel Tokyo, states that good service requires emotional devotion, describing Omotenashi as service refined to 'the utmost sincerity, grace and respect' without expectation of reward (Strand, 2014). Because service is seen as the art of character building, hospitality to others also enhances the dignity of the host. For example, Chikaraishi (2001) argued that service represents the dignity of the giver; therefore, service workers must refine themselves into polite and distinguished hosts who serve polite and distinguished guests. In sum, Omotenashi refers to the dignified devotion of an individual to another person who are in equal relationship, which resonates with the Buddhist concept of compassion.

5. Discussion

Asian philosophies serve as moral principles that influence people's thoughts, everyday lives and participation in services. At the core of these humanistic philosophies is dignity, which is manifested through serving other people in one's community. The central idea of Confucianism is the dignity of Ren, a human virtue that is manifested by an individual fulfilling their function in society. Taoism focuses on the dignity of spontaneous non-action in harmony with the holistic principles of nature. Buddhist dignity involves emptying the self and recognizing the substance of relationships via compassionate service to others.

Confucianism, Taoism and Buddhism are characterized by the *humanistic approach*. They do not suppose a God or pure reason as the highest good, instead focusing on how to live harmoniously with other humans. Even the Buddha is just an enlightened human. Everybody has the potential of becoming an ideal being—such as the Saint of Confucianism, the Sage of Taoism, or the Buddha of Buddhism—through continuous self-cultivation. The humanism of acknowledging the highest good in humans positions dignity as the key principle of Asian philosophy.

These philosophies commonly interpret *relationships as the substance* of the world. Each philosophy features social connection, holistic principle or interpersonal approach as a focal point. In this sense, Asian philosophy implies a service-dominant logic (Vargo & Lusch, 2014), which brings attention to the value of relational assets and the intangible substance of products. The harmony of a community as a collective of relationships is proposed to represent the ultimate good. Therefore, serving others is often seen as the most meaningful connection.

Emphasis on self-cultivation through serving others creates a *moral obligation to one's community*. Services in Asia have been historically delivered informally by a community, family or king, which represented the building of moral character among service providers as much as the benefit of recipients. This tradition remains today, which blurs the boundary between commercial service, public service, community service and informal care. Therefore, Asian views on service tend to emphasize ethical responsibility as a part of everyday life and community.

In the twentieth century, however, Asia has gone through rapid modernization, accompanied by countless revolutions, wars and regime changes. The transition is still in progress, leading to old cultures colliding with the new influences of industrialization and globalization. While the principle of dignity has been diluted, the methodological custom of community remains. The tradition of service as relational, moral and communal provision has been mixed up with the commercial notion of service as a labour good. Yet the boundary between public and private spheres remain indistinct, and cultural connotations remain informal. These contradicting views of service without a unifying principle often results in the abuse of weaknesses within a service system, as well as a double standard.

For example, a cultural assumption that views service as the provider's moral obligation can lead to emotional labour (Hochschild, 1979). From a traditional perspective, monetary motivation is seen as a base desire; therefore, service organizations often attempt to cover it in the façade of moral entity. Pressure falls on individual workers operating in the frontline—who must provide additional communal care without compensation—in the name of educational opportunities or character building. Customer dissatisfaction is regarded as a service worker's moral flaw. For example, a commonly observed problem in Korean service culture is that people misappropriate the sincerity of Jeong in business relationships. Lack of distance and a 'family-like' culture can cause unreasonable requests for the sake of Jeong, and when employees voice their concerns, they are seen as breaking the code.

This emphasis on relationships also creates a high-context society in which members must know implied meanings and conventions to be included. For example, Omotenashi is respect between equals; therefore, people are expected to know the proper etiquette and cultural conventions to fully participate in the art of service. The negative side, however, is that sometimes hospitality is given only to those who are considered deserving. Customers or workers who may not truly appreciate the service can be unwelcome, discriminated against or even expelled from the service. If a person with power determines that an

unconventional population (i.e. foreigners, women or children) is not qualified for a state-of-the-art service, they may be refused or even mocked in a way that only insiders would be aware of.

Another downside is that the community of service has the danger of deteriorating into a small, closed society. Outsiders are excluded from this union, and some members sacrifice for the community by providing free, informal services. Moreover, these outsiders or free labourers tend to be minorities who are at the bottom of the social hierarchy. For example, closedness is often pointed out as the problem of Guanxi; there is no buffer provided by the public sphere, and Guanxi supposes that social relationships are either 'we' or nothing. It is difficult to refuse requests from members who belong to the same group, because that leads to expulsion from the network. This private network also negatively affects the transparency of society when it becomes an expected reality that invisible personal connections influence key decisions.

Gapjil (갑질, 'power tripping') is a newly coined term that captures the service indignity problems in Asia. The word itself comes from the tradition of contract documentation: Gap (甲) is the employer or customer-king with the backing of a service organization. Eul (乙) is the employee who provides the service. Conflicts arise when Gap asks for more than what is explicitly agreed upon and even bullies Eul. The media has reported on several harassment cases of this nature, such as when a Korean Air customer asked a flight attendant to re-cook ramen three times before hitting her (Noori, 2013), when Japanese convenience store customers forced an employee to prostrate on the floor to apologize (Kyodo, 2014), or when a Chinese company punished its workers by having them crawl around on their hands and knees on the street (Paton, 2019). Gapjil is more than misplaced emotional labour—it is an issue of dignity.

I propose that this problematic phenomenon is the outcome of method without principle. Customs without philosophy lead to the misinterpretation of dignity as a hierarchical and comparative merit-status. Service companies have designed policies and cultures that lower the status of service workers to enhance the dignity of customers. However, Asian philosophies would regard this principle differently. Generally speaking, Asian philosophies emphasize the mutual relationships that bind people together in service of one another; therefore, insulting the dignity of workers only degrades the dignity of the customers and the company as a collective whole. There is a need to discuss and restore the principles of dignity to re-establish the service culture of Asia. This does not necessarily mean returning to the old, but finding a new direction that dialectically merges the strength of communal dignity with new meanings of individual dignity in modern democratic societies.

Dignity in service is also a problem in the West, although several cultural differences exist. Typical service controversies in Western countries reveal that the root of the problem lies in economic value being prioritized over moral value. This reveals a need for principles that can support service participants in making autonomous humanistic decisions on the basis that service is not a separate entity but is situated in the broader context of a society. In this

respect, Asian views on dignity and service can serve as inspiration for connecting services back to the relationships and moral values of a community.

I conclude this paper with the following discussion points for future research:

- How do we go beyond Western-centric principles, paradigms and perspectives in the study of service and its design to include voices from diverse cultures?
- How do we systematically study, apply and teach the principle of dignity in service and its design?
- How do we learn and adopt culture-specific meanings of dignity, and harmonize it with meanings from other cultures?
- How do we expand the notion of service as an economical entity and design a framework that foregrounds the humanism of participation?
- How do we move beyond a customer-centric approach to service design in order to cultivate community-oriented cultures that privilege the dignity of diverse stakeholders, especially the dignity of service workers?

6. Conclusion

In this paper, I provide an overview of the three major philosophies in Northeast Asia that have influenced the region's service culture. These humanistic philosophies—with dignity as a key principle—commonly reveal highly relational, community-centric and moral perspectives regarding service. Service is considered inseparable from everyday life, featuring community ethics as an essential piece. The downside is that customs without principle can lead to blurred boundaries and a totalitarian culture which places a burden on service workers and social minorities. There is a need to redefine the principle of dignity that has been lost. A new approach is needed that would celebrate traditional Asian cultures while still harmonizing with modern, democratic understandings.

This study contributes to service design and the broader field of design by exploring Asian philosophies, service culture and the meaning of dignity. The burgeoning field of service design in Asia represents a direct application of the Western framework; thus, a deeper understanding of diverse cultural voices will help designers develop design principles and methods that are better suited to individual countries. This approach will also bring new perspectives to Western service culture and its problems as well as helping designers to better reflect the diverse needs and voices of a global society. This inquiry reveals that service is not only a separate economical ecosystem but also a system of human relationships situated in community. By emphasizing dignity, we can refocus the social context of service and the direction of service design against the technological and political changes of our time.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Fantasia and analogical thinking: a specific reflection on teaching the essence of the Creative Leap

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Abstract | Many professional designers believe that creativity cannot be taught; tools, methods and methodologies can be learnt, but intuition, intended as that moment of illumination that occurs during the creative phase of the design process, is a personal matter. Within the proliferation of design methods recently developed in the past decades and that have successfully allowed designers and non-designers to build a common ground for project development and communication, the so-called creative leap has somehow not been directly addressed. This paper intends to examine one specific contribution to better enlighten the topic by reflecting on the Italian designer Bruno Munari and his book Fantasia, written in 1977, positioning it within the larger international discourse on design methods. The aim is to understand how basic thinking exercises, at the core of product and graphic design, can be revisited and applied within the domain of product service system design teaching.

KEYWORDS | DESIGN METHODS, CREATIVE LEAP, PRODUCT SERVICE SYSTEM DESIGN

1. Describing the context

Since its birth in 2005, the Design Methods course within the Master Program in Product Service System Design in the Design School of the Politecnico di Milano has evolved. It has modified means and purpose by constantly adapting both to the evolutions of the discipline and the different skills, backgrounds and knowledge of the international students enrolled every year. In this course, students come from different bachelors around the world (architecture, engineering, product design, interior design, communication design, interaction design and fashion) bringing their own project cultures pertinent to their hometown and design institutions. Therefore, the course aims to give the class a common understanding of the world history of design methods and the professional skills to build their own design process and methods in the future. Alongside the theory of the history of design methods students experiment a full design process working in groups.

Within the course we explain the different ways one can illustrate the design process starting from the more recent version proposed by the British Design Council (British Design Council 2019) described through the well-known Double Diamond model (British Design Council 2005) which defines four sequential design phases: discover, define, develop and deliver. In the latest version of this model, these phases are supported by two other elements which are defined as the Design Principles and the Design Methods Bank. The students learn that ever since the beginning of the debate around defining a scientific model and its methods, the design process has been illustrated in many ways by several scholars and practitioners starting from the first developed in the 60's by the Design Methods Movement that has consequently given birth to the Design Research Society (Jones 1963, Booker 1964, Gregory 1966, Alexander 1964) to more recent interpretations by fellow scholars and design agencies: from the Stanford d.school - Design Thinking process (2009) where the process is described in five blocks (empathise, define, ideate, prototype and test) to IDEO's Human Centered Design process and toolkit (2009) in which the phases are three, following again a smoother version of the double diamond model, alternating moments of divergence and convergence thinking, and giving form to the phases of inspiration, ideation and implementation.

Within the past 15 years of teaching this course there has been a constant reflection on how it was best to teach this subject, with which references, and, most importantly, how to encourage future practitioners to continually reflect on their method, adapting it to the different project complexities they might face in the future.

This paper intends to highlight one of these reflections and proposes the identification of a specific research gap in this field. In fact, in all the above-mentioned design processes there is a phase that is very rarely addressed and that lacks reflection and development of specific methods and tools. It is the phase that some scholars call the Aha! experience, when suddenly you see the problem clearly from a new perspective (Kolko 2017) and that other scholars in the past defined as the incubation phase (Osborn 1953). In any case, what we are referring to here is that unexpected moment in which a designer has an intuition.

Many methods and tools have been developed to brainstorm and allow these intuitions to arise, but very few are focused on really understanding how the intuitions occur and how we can exercise our thinking and our mindsets in order to create that right fertile ground for it to happen.

For this reason, in recent years, the teaching material developed for the Design Methods course has been integrated with a series of exercises to allow students to acquire a stronger awareness of self, one's personal project culture background, and to reinforce the designer's mindset, attitude (Michlewski 2015) and design heuristic abilities (Martin 2009). For the first learning objective the students are asked to write a professional diary: a daily reflective exercise on their previous design method, what they are learning in class and how this will affect their design thinking, process and methods in the future. For the second learning objective a more profound reflection needed to be made on understanding what are heuristic abilities, and consequently, how these skills could be taught.

This paper aims to highlight one of the methods and exercises that have arisen from this reflection and that has been shown to be effective in teaching the essence of the creative leap to students.

How do you prepare for the creative leap? Are there any specific methods? How do we "exercise our brain" (Munari, 1977) to create a fertile ground for the so called out of the box thinking? How do we teach these methods to future designers?

These are the questions that this paper is addressing, taking inspiration from Bruno Munari's desire to teach the art of imagination (or fantasy if there is a real distinction between these two terms today) to children and citizens and identifying a more contemporary interpretation and use of such methods. By contemporary interpretation we intend the extension and application of methods developed in the realm of product and communication design to the more recent fields of product service system design and service design, contextualizing Munari's writings within the international discourse around design methods.

Much has been said and studied around design methods and design processes (Osborn 1953, Simon 1988, Jones 1970, Cross 2011, Huppatz 2015, Kolko 2017), but this contribution will focus on a specific phase within the process: the intuition phase (or illumination). Over more, the paper will build on a first hypothesis that intuition can be taught (or better exercised), rather than leaving it merely to the individual's personal ability (or capability).

This hypothesis has already been verified within the above-mentioned Design Methods course in the past three years of teaching giving some interesting results, but it will need further verification in a second research phase as also a confrontation with a wider international group of scholars.

1.1 The creative jump, leap, and the meta-skill of intuition

When design professionals are asked to explain how they achieve their ideas they usually start by explaining the process that took them to the final solution. This process can be more or less structured; it can be conscious or unconscious; however, for sure it is always different, from project to project, from designer to designer, as has also emerged from the conclusions aroused by scholars that have approached this research field in the past. To mention one of them, in the attempt to develop general guidelines for design thinking through interviewing architects at work, Peter Rowe concluded that: "[…] there is no such thing as the design process in the restricted sense of an ideal step-by-step technique. Rather there are many different styles of decision making, each with individual quirks as well as manifestations of common characteristics." (Rowe, 1987, p. 2)

A common characteristic that we could take into consideration within the many design processes, however structured they may be, is a recurrent moment in which design professionals are unable to give a rational explanation to their thinking - common also to creative professionals in other sectors (for e.g. music, art, poetry, but also business) that deal with intuitions that appear (come to them) apparently without any explanation in their daily activities.

Jones called these episodes jumps in perception, moments in which he says: "One should expect confusion, loss of confidence, and procedural chaos to arise out of one's original strategy and be ready to jump to what feels better" (Jones, 1980). Broadbent called them creative leaps when he described the phenomenon as: "[…] a jump, a leap whose validity can never be absolutely guaranteed in advance" and added to this that: "[…] the creative leap can be as wild as possible as long as the following steps of the design process are done with analytic rigor" (Broadbent, 1966).

If we look back to Graham Wallas's stages of control of a creative process (preparation, incubation, illumination and verification), we can go deeper into the understanding of this phenomenon which is common to any creative activity: in the first phases "the thinker is preparing himself for the solution", in the illumination phase "a solution may present itself" while in the last phase we verify our idea (Wallas, 1926, p.41).

But how do we teach or exercise our intuition? Are there ways to do it, or is it only by practicing over and over again the same process that we learn to create a fertile ground for intuition to occur and grasp?

In his introduction to the second edition of his book, while attempting to better describe how to use his design methods (and trying to explain the meaning of his work to those that had misinterpreted it), Jones talks about the importance of having an intuitive meta-skill and the need to re-program one's mind:

> "I realise now that it is much more difficult to use these methods successfully than I thought while writing the book. Some of them take a lot more time than those

> unused to them see as worth spending on 're-programming one's mind' and similar secondary aims; it is very easy, once started, to lose sight of what one is doing, and to get drowned in data which one cannot use; the initial steps of some methods are difficult to carry out, at first attempt, partly because they involve the intuitive meta-skill of identifying what's going to be important; and most people find difficulty in branching out, without experience, into a way of designing that is unfamiliar, and much more collaborative than what they are used to." (Jones, 1980, xxiii)

In his text, Jones suggests using design methods in a mechanical manner at the beginning until one understands their functioning in order to act intuitively once one becomes an expert. This implies that intuition is a skill that should constantly be part of all the phases of the design process and not merely arise in a specific phase and it somehow also implies that intuition emerges spontaneously once you are familiar with the tools. In this reasoning, it is however unclear if intuition is a synonymous of creativity or if it is part of it or vice versa, and if imagination is an entirely different skill or not. It would be impossible to explore these definitions within this paper, however, it is important to question them since they are still unclear within the design discipline.

Going back to the design professionals and the explanation of how ideas are born, research in the past has demonstrated that often thinkers are unaware (or better unconscious) of how this happens and where ideas come from; Wallas talks about dissociation of consciousness and its usefulness for creative thought allowing the thinker to "escape from some of the habits and inhibitions which hinder the free association of his ideas" (Wallas, 1926, p. 118). In the Bauhaus, the propaedeutic course led by Johannes Itten worked in this direction, trying to free the minds of the students from prejudice, previous learning and bias in order to allow free thinking, although a deeper understanding of the Bauhaus methods should be addressed with this lens to integrate them within a broader design methods history (Maldondado 2019, Weber, 2009).

Nonetheless, probably due to the unconscious character of intuition, many professional designers believe that this specific skill cannot be taught. This belief hence leads us to say that tools, methods and methodologies can be learnt, while the meta-skill of intuition (as defined previously by Jones), when intended as that moment of illumination that occurs during the design process, is a personal matter and could be included in what has been previously identified as an 'individual quirk' by Rowe.

This might be the reason why within the proliferation of design methods that have recently developed in the past two decades, successfully allowing designers and non-designers to build a common ground for project development and communication, this area of the design process has been somehow neglected.

However, Jones did talk about the meta-skill of intuition, and since it is a skill we should be able to teach it, exercise it, and become experts in it. In the following paragraph we will build on the work developed by the Italian designer Bruno Munari to see if it is possible to identify some tools of methods to practice our creative thought.

2. Bruno Munari: fantasy, invention, creativity and imagination

The Italian designer and artist Bruno Munari, in describing his design process in his book Da Cosa Nasce Cosa (1981), has also omitted the description of how the creative leap (in his scheme it is called creativity) works, because he had already published his book Fantasia (1977) in which he faced the ambitious task of explaining how ideas emerge by exploring the possibility to define the main characteristics of fantasy, invention and creativity. To explain his intent, Bruno Munari writes:

> "The artistic world, the world of creativity and fantasy, has always been kept secret; how an idea is born or how a work of art is built (supposing that one knows it) must never be revealed. […] I think instead that people want to understand and therefore I am going to try to explain it hoping that others - more competent than me - continue this modest beginning of knowledge of this phenomenon that affects everyone, for a greater development of creativity and therefore of personality." (Munari, 1977, p.18 – authors translation from Italian)

In Fantasia Munari tried to first understand the difference between the terms fantasy, invention, creativity and imagination and then he described the different rules or characteristics (he called them *constants*) that determine a creative act by extracting them from real professional work. The constants of the creative act developed by Munari can be inspirational to see the world through a new lens; each time one tries to apply a constant to a problem one creates a new relationship between terms and activates analogical thinking.

Table 1. Scheme of the definitions and constants developed by Bruno Munari with a description of their meaning and use. (Munari 1977)

DEFINITIONS	
Fantasy	Everything that does not exist even if unfeasible
Invention	Everything that does not exist but is practical and without aesthetic implications
Creativity	Everything that does not exist but is possible to make in an essential and global way
Imagination	Fantasy, invention and creativity think; imagination sees
CONSTANTS OF THE CREATIVE ACT	
The world upside down	Think of the opposite, flip the situation around, think of the complementary

Repetition	Think of multiples of the same element or of variations of the same
Visual or functional affinities	Analogy making between two different worlds, for eg. “the leg of a table = the leg of an animal”
Changing of a single element	Change a colour, change a material, put it out of place – displacement, change function, change time, change dimension, change weight, etc.
Monster making	Put different elements together like making a monster
A multiple combination of the above	Relations of relations: something that is the opposite of something else, but it is in another place and has changed colour, etc.

The constants of creativity suggested by Munari, and in particular the third constant on visual or functional affinities, find a direct link to theories gathered also by Geoffrey H. Broadbent in his chapter entitled “Creativity” published in 1966 by the Design Method Movement in the book The Design Method edited by Gregory.

In this chapter Broadbent focused on the different phases of the design process inspired also by John Dewey’s scientific research process. Referring to heuristics as the backbone of the study of design methods, Broadbent sustained that its week point was that it was more fascinated by the means rather than by the ends. His text was a critic to the design methods that were emerging at the time, defining them less efficient than they could be since they were ignoring the contribution of the unreliability of the human operator. In particular, his contribution focused on the importance of applying synectics (Gordon, 1968) and analogical thinking - based on psychological studies - within the design process (Broadbent, 1966, in the Italian edition p. 141).

Table 2. Scheme of the typology if analogy making described by Broadbent. (Broadbent, 1966)

TYPOLOGIES OF ANALOGY MAKING	
Personal analogy	The designer identifies with the object in question. If I were it, how would I feel? What would I do? How would I work? Etc.

Direct analogy	The problem is confronted with known facts in another branches of art, science or technology. Learning from other contexts that have similar issues.
Symbolic analogy	The designer tries to penetrate into the essence of the particular meaning that he attributes to the problem by means of some personal symbol. Finding an abstract principle that allows you to see the essence of the problem.
Fantasy analogy (not present in Broadbent's text but added to the typologies of analogy making by scholars after him)	Working on desires, hopes, and utopia.

The work developed by Munari was based on his experience as an artist: each constant emerges from a reflection on art and how the rules can be extended to the development of ideas in the field of product and graphic design. But what if we apply the same constants and analogy making to product service system design? Would it be possible to apply these same thinking methods to service-oriented solutions?

In the following paragraph we will describe a first attempt to address these questions and the results that they have generated within the context of teaching.

3. An exercise for a creative mind in product service system design teaching

By evolving the studies around analogy making within a product service system design context, the typologies identified by Munari could be enriched with new meanings. The effectiveness of this exercise can be grasped in a first phase by analyzing existing case studies, and identifying service design projects that have been, consciously or unconsciously, ideated thanks to these thinking models or constants (as defined by Munari).

The following graph shows how the constants identified by Munari are still relevant and how, if exercised deliberately also within product service system design and service design projects, they can enhance the possibilities to develop more significant ideas and become a powerful tool for generating intuitions and creative leaps.

Table 3. Revisited scheme of the definitions and constants developed by Bruno Munari applied in service design. An exercise to verify the applicability of the model.

CONSTANTS of the creative act and case study examples		
CONSTANT	APPLICATION	SERVICE
The world upside down	Think of the opposite, flip the situation around, think of the complementary Public vs private Open vs closed Negative vs positive Passive vs active Etc.	A couch at home, which is considered 'private' becomes 'public' offering a hosting service. (Couchsurfing) The meaning of risk management services changes from being 'negative' to being 'positive'. (Deloitte risk culture - Verganti, 2016)
Repetition	Think of multiples of the same element or of variations of the same	Sharing cars, sharing bikes, sharing homes, etc. (Sharing economy)
Visual or functional affinities	Analogy making between two different worlds, for e.g. "the leg of a table = the leg of an animal" Completing the sentence: "As if it were…"	A pillow can be ordered in a hotel as if it were a dish. (The pillow menu)
Changing of a single element	Change a colour, change a material, put it out of place – displacement, change function, change time, change dimension, change weight, etc. Change actors or change their role in the system, change the flow of information, change behaviour, change rhythm, etc.	A restaurant becomes a space where you can order from any other restaurant nearby. (Food Factory by Martì Guixé) People can exchange time as if time were a currency. (The Time Bank)
Monster making	Putting different elements together like making a monster	A glamorous hosting solution allows you to experience wildlife. (Glamping)

	Bring together and merge different offerings, services, products, behaviours, etc.	
A multiple combination of the above	Relations of relations: something that is the opposite of something else, but it is in another place and has changed colour, etc.	An office which is usually 'closed' becomes 'open' and shared with others in a public space in the city (Co-working in parks)

The above exercise has allowed the students of the Design Methods course to be more conscious of our creative thinking, empowering intuition. When using this exercise in a real project context, students felt more at ease with the creative leap; they were more aware of their thinking and insight generation was no longer considered as being a mysterious black whole.

The first experimentations led with students in this specific course, but also in design thinking courses within other majors, suggests that there could be space for further development of thinking tools that can be exercised in the ideation phase. An intuition also tells us that there could be more constants that might emerge by studying today's professionals, but we will leave this to a future development.

4. Conclusion

This paper has been the result of many years of reflection and teaching design methods to a class of international students in the field of product service system design. It is based on the emerging need to teach how to think and ideate while also teaching design processes, tools and methods. Service designers can learn from the previous theories developed on creative thinking, but they should also develop specific theories that adapt previous experiences to new contexts and complex problems.

This paper is a starting point for further reflections on this topic. Its aim is to bring Bruno Munari's work within the international debate and use his reflections to elaborate a first framework for further evaluation and testing. The following steps for this research will be to deepen the understanding of the topics described and to enlarge the debate at an international level to include other perspectives and contributions. The final aim of the research in this domain is to verify if there is a research gap that needs further attention and if the assumptions stated at the beginning of this paper, the idea that creative thinking can be consciously taught and exercised, can be validated also by on field experimentation both within the academia and through interviews to design practitioners.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

How to teach design thinking to non-design students: enablers and barriers to transfer design research practices.

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Abstract | The scientific debate on how and why teach design thinking to non-design students is strongly evolving. However, literature shows a significant gap in defining which are the key elements to train and teach a specific aspect of the design thinking process: how to deal with design-based research. Which kind of pedagogical framework can be adopted to teach design research to non-design students? Which are the main enablers and barriers that students encounter while conducting a design-based research process?
An exploratory inquiry on 70 students involved in a design studio placed in a Management Engineering Master Degree has been run to find answers to those questions. Results derived through the use of descriptive statistics show that students encounter a lot of difficulties in abstracting ideas from real situations. On the other side, what acts as an enabler is the possibility to work on a real project that provides the experience of learning by doing in a team.

KEYWORDS | DESIGN TEACHING, DESIGN THINKING, DESIGN RESEARCH, DESIGN STUDIO

1. Introduction

In the last 20 years, a considerable literature is increasingly animating the debate on how to teach and transfer design knowledge, both in design as for management and innovation areas.

A significant relevance is acquiring the design teaching related to non-design educational contexts, in particular those ones related to new engineering fields. Following the milestone experience of D.school at Stanford, where students enrolled in all the various degrees and Masters can attend a selection of courses to increase their "designerly way of knowing" (Cross, 2001; 2006), diverse Management Schools (as INSEAD, MIP-Politecnico di Milano, Antwerp, Saint Gallen, Harvard Business School) are integrating in MBAs programs design-related entire streams, labs or single courses (Author, 2019).

The form of pedagogies to teach creativity in literature are varied and manifested in different ways; recently design thinking is considered one of the new paradigms to teach design embedding new principles and practice to drive innovation (Cross, 2011; Elsbach and Stigliani, 2018).

Different authors (Glen et al., 2015) in a recent theoretical contribution emphasize the benefits of DT for management students, recognizing how it fosters the ability to face the complexity of the innovation process, the capability to be engaged in real-world situations and active learning through a hands-on approach with specific tools, and the improvement of interpersonal and soft skills.

Despite a consolidated debate related to design and management in business practice, it still emerges a poor understanding on how to transfer design thinking and design processes, through learning and educational activities, to both management and engineering disciples. In particular, literature shows a significant gap in defining which are the key elements - enablers and barriers - to train and teach a specific aspect of the design thinking process: how to deal with the Design Research process.

The research phase is the core and the crucial start of each design process; in design thinking, research is conducted with specific and peculiar methods that act as key-factors in discovering insights from data and information collected from real situations. The activity of identification of insights and then transforming them into innovative opportunities implies the capability of framing and reframing (Dorst, 2011) the problem observed in the data collection phase. This part of the design thinking process is the most important in order to obtain meaningful and innovative solutions, and it is even the most difficult topic to teach in a non-design educational context.

So, which kind of design (thinking) pedagogy principles can serve the learning of design research for non-design students? Which design research activities non-design students consider more difficult in approaching a design project? And finally, what are the main enablers and barriers that they face in experiencing a design research process?

To address these questions, an exploratory on field research has been conducted. Basic questions have been submitted to 70 students in a Design studio placed within the Management Engineering Master Degree at Politecnico di Milano. The inquiry is focused on

the key-activities that made the students confident in the process and the most difficult aspects faced in each step of the design research.
Descriptive statistics have been used to generate results and discuss insights. The paper shows the main difficulties faced and the key-points in the learning process that enabled creative leaps in the design research process.

The article is articulated into five main sections. As a starting point, the theoretical background expresses how design thinking is becoming an effective paradigm in teaching design with a particular focus on the importance of conducting a valuable design research process. The methodology follows, describing how the research has been structured. Later, results analysis shows the areas of inquiry and the main derived data. A discussion follows where the main aspects to consider on teaching design-based research to management students are explained. The conclusion at the end shows the main remarks for future avenues in research about design teaching and the article limits.

2. Theoretical background

Consolidated literature identifies “project-based learning” (PBL) as one of the most used and effective approaches to transfer the design knowledge within a given educational framework.

PBL is defined as a comprehensive approach to classroom teaching and learning that is conceived to engage students in an investigation of authentic and novel problems (Blumenfeld et al., 1991; Barron et al., 1998). In PBL, the project is the focus of the teaching strategy where students learn and grasp the central concepts of the discipline (Thomas, 2000).

A considerable literature - placed in 80ies and 90ies - saw in Project-Based Learning (PBL) a first source to enrich engineering culture (Blumenfeld et al., 1991; Thomas, 2000; Stepien and Gallagher, 1993) in order to improve the proposition and creative attitude, at the same time the project management abilities.

The recent growth of requests on training in methods and techniques of creativity by more consolidated disciplines has increased, particularly in management engineering, based on the fact that managers must confront each other with increasingly complex problems (Glen et al., 2015). In this scenario, design thinking (DT) has emerged as one of the most promising approaches to creative problem solving and innovation, also acquiring increasing recognition in Innovation Studies (Elsbach & Stigliani, 2018).

Despite its consolidated nature, however, DT is also a controversial topic both in the design discipline and in Management and Innovation Studies, which has generated a proliferation of perspectives and opinions (Carlgren et al., 2016).

In this paper, design thinking is considered from a teaching perspective as one of the classified ways to represent creative processes. Both among practitioners and scholars, DT is taught through codified theoretical models. These models were developed in the last ten years in order to provide structure and to ease the implementation of the process of human-centered design (Norman, 2005). The most acknowledged ones are British Design Council's Double Diamond (2005), IDEO's human centred design ideology and the D.school's Design Thinking process.

Despite the abundant presence of literature in this area - there are still few contributions related to the methods and practices useful for transferring design research techniques to non-designer. Since the purpose of the paper is to understand which knowledge and techniques related to design research are useful to be transferred to non-design students for introducing the creative problem-solving techniques of DT, several important scholars' studies investigating designers' knowledge contribution process have been reviewed.

Cross (1982, 1999, 2001) has identified "a designerly way of knowing", which has its own way to build very pragmatic knowledge for innovation based on reflective practices; and it is a way of constructing and validating knowledge with specific and original approaches, tools and purposes. This way of doing aims at producing novel results either by changing existing situations into preferred ones (Simon, 1969) or by creating new practices from scratch (Romme, 2004). Both of these two approaches start with understanding what the real situation is and what problems or challenges to deal with.

DT, same as a design innovation process, starts with research, a process of discovering insights from data and information from the real world (Kumar, 2004). However, not all the necessary information is, or ever can be, available to problem-solver, and there can never be a guarantee that 'correct' solutions can be found for them (Cross, 1982). It is a process of exercising through discovery and being driven to understand, to find explanations for phenomena not well understood (Owen, 2007).

Besides, designers' minds also have an essential ability to understand the worlds of others through empathy (Premack & Woodruff, 1978; Shamay-Tsoory, Aharon-Peretz, & Perry, 2009), which allows them to look into the meanings held by others (Dunne, 2011).

Rittel and Webber (1973) have characterized the problems that design deals with as "wicked" problems, fundamentally unamenable compared to well-framed problems in science and engineering. A similar statement could also be found from Schön (1983), saying that professional practice throughout design has to face and deal with "messy, problematic situations". As mentioned by Dorst (2011), framing is the most difficult task in an innovation process because it requires taking in a lot of data, and making sense of that. Designers need to have the ability to see hidden patterns, to parse the important information from the less important information to form a new "focus". This activity in a design process was identified by Lawson (1979) as "synthesis", different from the analysis in science.

On the basis of the analyzed literature, five (original) phases have been identified in order to describe and observe how a research is typically carried out by designers. The table below presents the parameters to describe each phase and related references that have been used for this synthesis.

Table 1. Five phases of design-based research in design thinking.

Phases	Characteristic	Reference
Brief interpretation	Design professionals rely on hunches and presuppositions, **not just facts.**	Rowe, 1987
	Play with **ambiguity**	Boland and Collopy, 2004 Liedtka, Martin & Dew, 2007
On-field data gathering	**Ethnographic research** methods are used extensively by designers, also become popular in business	Mariampolski, 2006
	Empathy with users and stakeholders	Brown 2008; Dunne and Martin 2006; Michlewski 2008
	The researcher's task is to **look for meanings** held by participants	Dunne, 2011
	Data from ethnographic research can be integrated for analysis and synthesis	Kumar and Whitney, 2003
Frame opportunities and problems	Reflection-in-action; making "moves to **reframe** problems	Schön, 1983
	Ill-defined problems	Cross, 2006
	"Wicked problems" were seen: to be unique and context-specific; to offer a host of courses for action	Rittel and Webber, 1973
	Idealized design is to **define the problems and challenges** the organization is facing	Romme, 2003
	Framing is, perhaps, the most difficult tasks; requires making sense of the data; Requires to see hidden **patterns**, to create **insights** that could be shared	Dorst, 2011
	Indeterminate; design problems are wicked problems	Buchanan, 1992

Reframing opportunities	Design requires **expanding concepts** that are partly unknown	Hatchuel and Weil, 2009
	Designer is able to adopt **a new mind-set** in order to develop a different perception	Lawson & Dorst, 2009; Nelson & Stolterman, 2003
	Selecting and identifying constraints and applying guidelines	Lawson 2006
	Working at high levels of abstraction as well as detailed level	Kumar, 2009
Direction identification	Designing **new possibilities** rather than selecting between alternatives	Boland and Collopy, 2004
	Needfinding & Synthesis - differ between obvious and hidden needs	Brenner, Uebernickel & Abrell, 2016
	Abductive	Cross, 2006; Dunne and Martin, 2006
	Co-evolution of problem and solution	Dorst and Cross, 2001

3. Methodology

This paper is based on the results of a survey conducted on students enrolled in the Management Engineering Master Degree at Politecnico di Milano, specifically related to "Design management, entrepreneurship and innovation" stream. The sample refers to students who attended a 15 ECTS credits course called "Design Management Lab", representing their final design studio. Inside the course, students need to develop an innovative solution, starting from a brief provided by a company, using both managerial and design theories and tools. The aim is to create novel solutions of product-services.

The didactic objective of the Design Management Lab is to enable students to develop capabilities and skills to handle design-driven innovation, to manage design-related tradeoffs, to mold scenarios of innovation and configure new product-service systems and business models.

The described learning outcomes are obtained through lectures on themes from both Managerial and Design fields. Moreover, the most important design tools to deal with the project are presented during the course. The assessment of students' achievement is

verified through a project conducted in teams, presented at different times during the course, where students have to apply the previously presented contents.

A questionnaire characterized by 5 main areas of inquiry has been submitted at the end of the entire course to 70 students composed of 37 males and 33 females.

Given the aim of the study, the investigated areas were addressing both enablers and barriers for students encountered during the course journey. The analyzed areas reflect the five phases of the design-based research framed within the theoretical background:

- Brief interpretation;
- On-field data gathering;
- Frame opportunities and problems;
- Reframing opportunities;
- Directions identification.

Each area was structured with two closed questions, for a total amount of ten questions. Closed questions were provided with multiple parameters to be analysed, ranging from 4 to 6 possible, depending on the investigated area. Each parameter needed to be evaluated on a likert scale from 1 to 5.

All the answers were collected in a .xls file in order to create descriptive statistics graph for each area of inquiry (Hays, 1973). The entire survey is available and provided in the appendix.

All the results were collected through histograms and were discussed by a team of three researchers and two Professors. After a first-hand discussion, the research team invited two external researchers in order to freeze insights and provide further comments to the statistics results.

4. Results analysis

The approach used for posing and then scaling the responses is the *likert* scale approach; the scale is articulated in a range from 1 to 5 as parameters of evaluation, where the lowest represents the poor impact of the investigated aspect and the highest stands for the high presence of it. For each area of inquiry analysed through one dedicated question, only the results of those answers/graphs which present a valuable variance are commented. The percentages that will be reported take into consideration the answers from students who evaluated equal or higher than 4 the related parameter (4-5). The full script of the questionnaire is attached in Annex to this paper.

Regarding the first area of inquiry, that relates to the "brief interpretation" the biggest trouble was represented by a *lack of information between the company's brief and the final expected outcome* (figure 1). It was highly evaluated by 66% (46) of students. Another trouble was the issue of *facing an ambiguous design opportunity/problem* (figure 1), highly evaluated by 73% (51) of students.

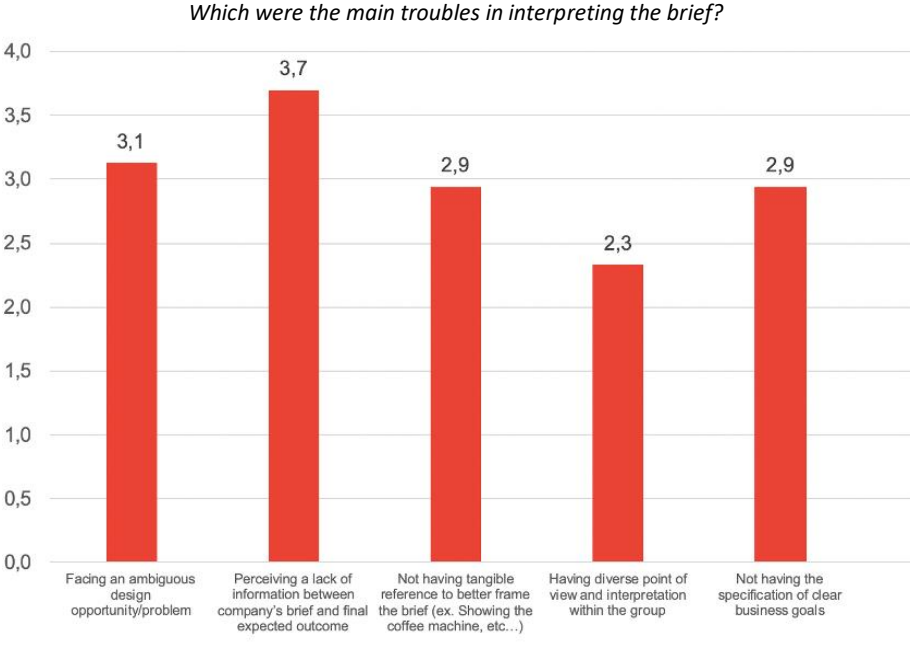

Figure 1. Main troubles in interpreting the brief

In the brief interpretation, there were different aspects that enabled students in data collections. One of the most important enablers was the possibility to *work within a team, sharing ideas and perspectives with other people* (figure 2), highly appreciated by 70% (49) of students. Other factors that worked as enablers were *searching for new technology trends* (figure 2), highly evaluated by 60% (42) of students; *the presence inside the course of a "real" client* that was providing a real project (figure 2), highly evaluated by 56% (39) of students; and *looking at the possible context of use* (figure 2), highly evaluated by 53% (37) of students.

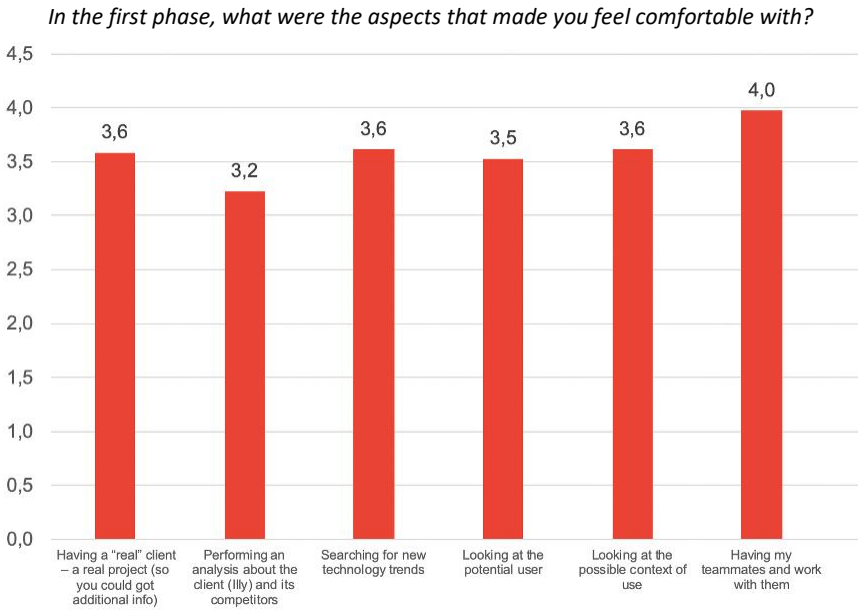

Figure 2. Main aspects that enabled the brief interpretation

Concerning the second area of inquiry that relates to the "on field data gathering" the most useful method was the *adoption of contextual cases study* (figure 3), highly evaluated by 70% (49) of students. Also, *blue-sky cases study* (figure 3) was highly useful, highly evaluated by 56% (39) of students.

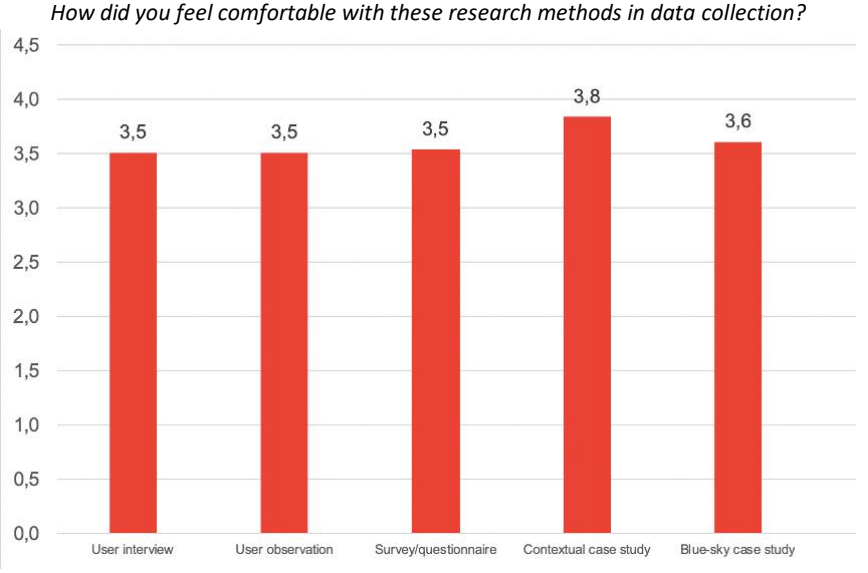

Figure 3. Research methods that enabled the data collection

Along the data collection process, two were the two most difficult activities experienced by students. *Finding the right questions to ask* (figure 4) was highly evaluated as a barrier by 66% (46) of students. Moreover, 61% (43) of students found highly difficult to *identify the right "people" with whom to conduct research activities* (figure 4).

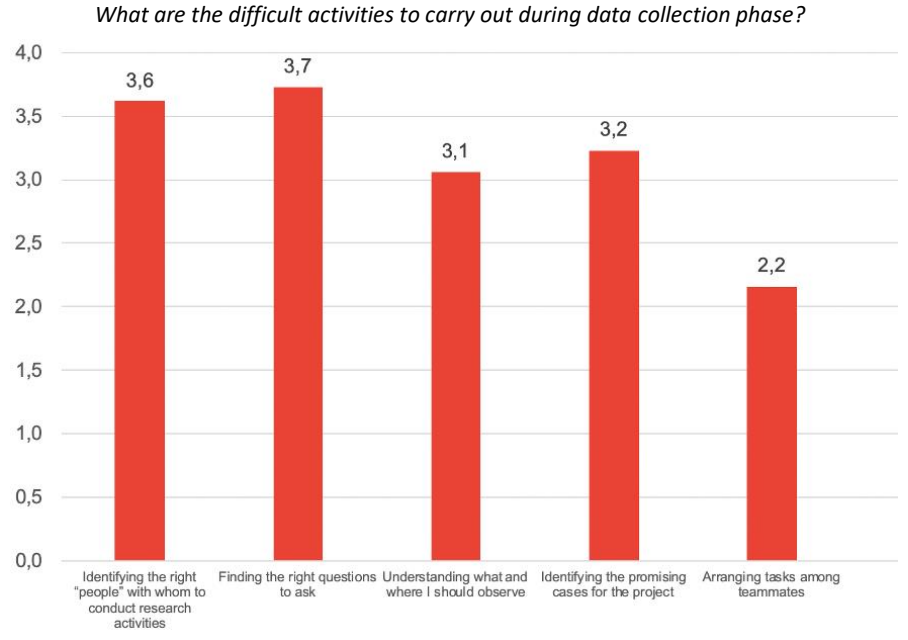

Figure 4. Difficult activities to carry out during data collection phase

Concerning the third area of inquiry, that relates to the "framing of both opportunities and problems in the development of the project" the most needed useful abilities resulted to be to *understand what was a promising opportunity* (figure 5), highly evaluated by 70% (49) of students. Another important aspect in this phase, resulted in the ability to *select the "right" research data* (figure 5), highly evaluated the 69% (48) of students.

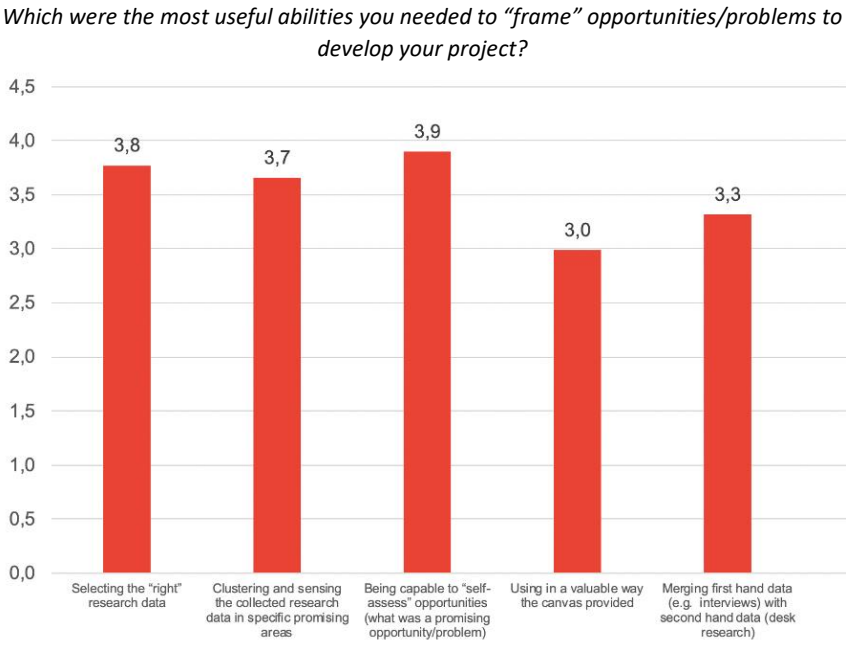

Figure 5. Abilities needed to frame both opportunities and problems.

The bigger difficulties inside this phase, were represented by two main factors. The first was *selecting a promising signal among the data collected* (figure 6), highly evaluated by 70% (49) of students. The second one was *thinking outside the dominant paradigm* (figure 6), highly evaluated by 63% (44) of students.

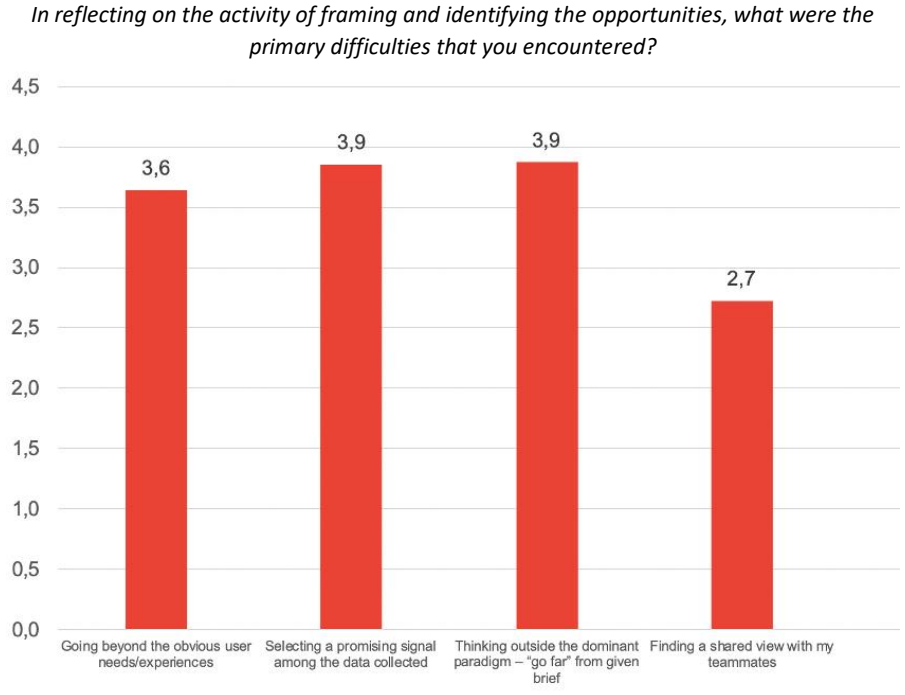

Figure 6. Difficulties encountered while framing both opportunities and problems.

The fourth area of inquiry relates to the "reframing of opportunities" phase, that inside the course happened within a co-design session with professors, tutors and students together. The most useful enabler was represented by the *received feedback from the faculty, about possible promising reframing directions* (figure 7). This aspect was highly evaluated by 89% (62) of students. Another enabler resulted in *the possibility to work together (both teams and faculty) through conversation and discussion* (figure 7), highly evaluated by 83% (58) of students.

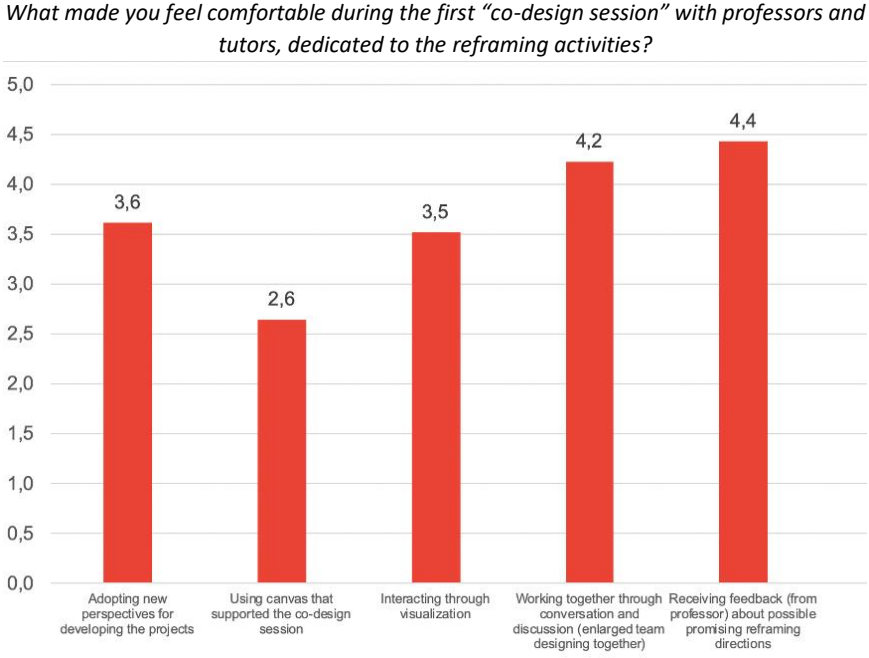

Figure 7. Main enablers during co-design sessions aimed to reframe opportunities.

The main troubles in this phase were encountered in *synthesizing the new opportunities developed* (figure 8), highly evaluated by 47% (33) of students. Moreover, another difficult task in co-design was represented in the moment of *visualizing the results* (figure 8), highly evaluated by 36% (25) of students.

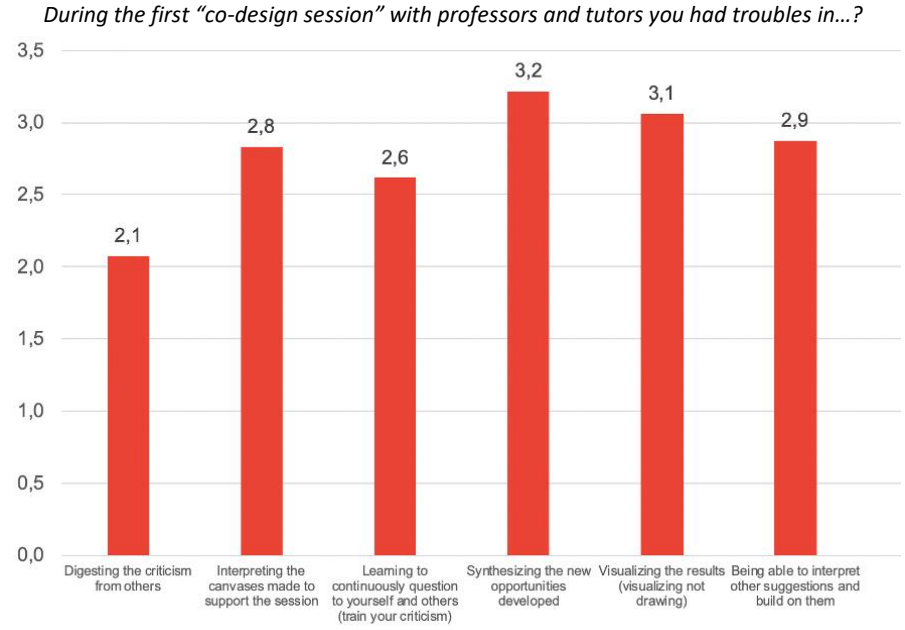

Figure 8. Main problems encountered during co-design sessions aimed to reframe opportunities.

Concerning the fifth area of inquiry that relates with the "direction identification for the project" the main enabler resulted to be the ability to *find a concrete and convincing "reason why" beyond the idea* (figure 9). It was highly evaluated by 86% (60) of students.

Which were the most useful abilities you needed to identify promising directions of your project?

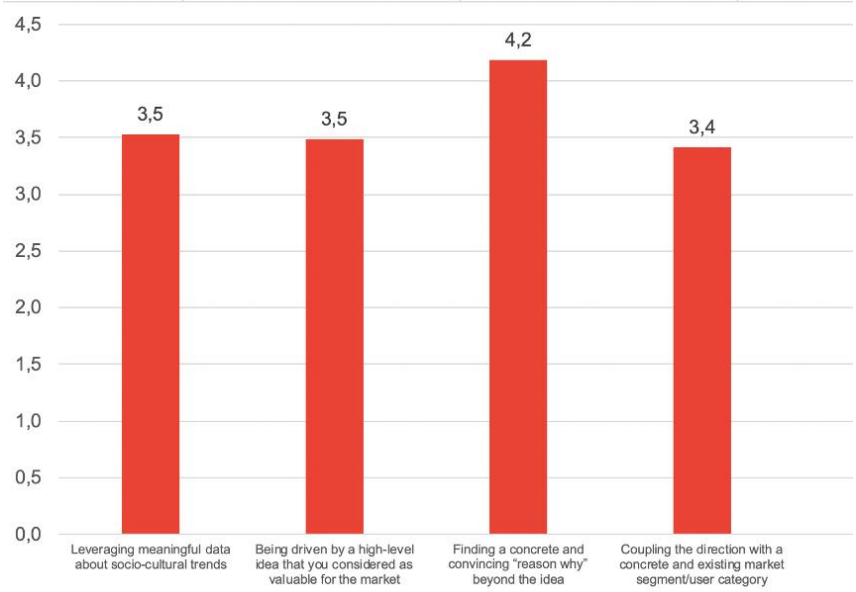

Figure 9. Main abilities in identifying promising directions.

What resulted most difficult in this phase was the moment of *understanding the level of detail that should have the direction* (figure 10). It was highly evaluated as a barrier by 79% (55) of students. Moreover, other difficulties were encountered while *selecting the "right" perspective on which leverage to identify promising directions* (figure 10), highly evaluated by 66% (46) of students.

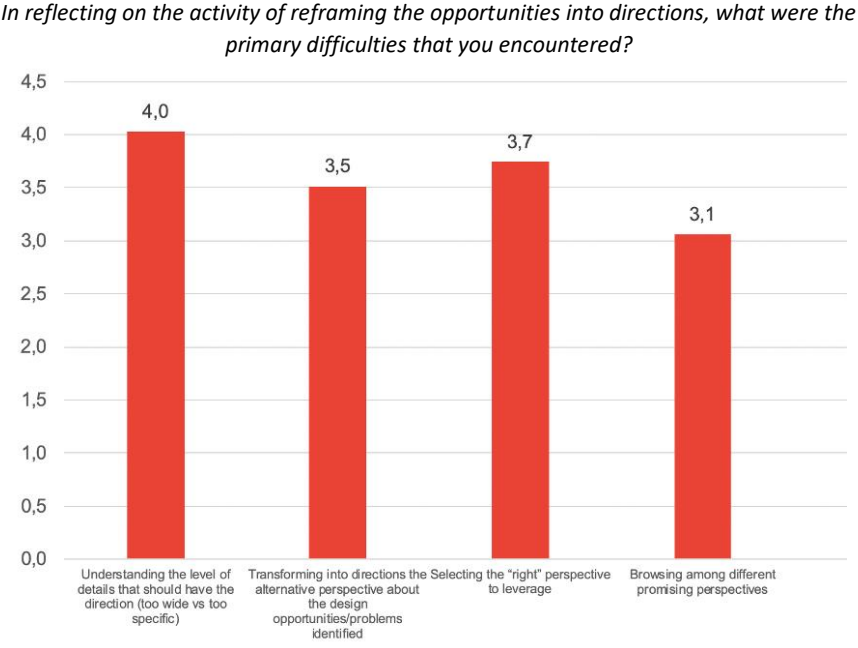

Figure 10. Main difficulties in identifying promising directions.

5. Discussion

Placing the peculiar traits of design research identified in the literature into a complete Design Innovation process (fig. 11), it is immediately clear how the different phases can be framed into a constant dialogue between inquiring in the real world and abstracting to develop novel ideas: just like in any creative process, the DT one also iterates between poles of Real vs Abstract and Understanding vs Making, while oscillating non-linearly between Research, Analysis, Synthesis, and Realization. The complete DT process runs through these phases several times until the final solution is implemented and tested, ready for production and commercialization.

Design research, as the first part in the process, runs through all four areas before completion: design practitioners need to go through the entire process before turning to concept generation and solution development. The same happens for non-design students in the context enquired in this study: because PBL essentially presents students with a real brief and asks them to run the process first-hand to learn its tools and methods, design research is the first (and therefore most challenging) cycle iteration that students face while trying to master abductive thinking skills they never experienced before. This is a contextual

element that raises highly the difficulties in teaching design research strategies and methods to non-designers.

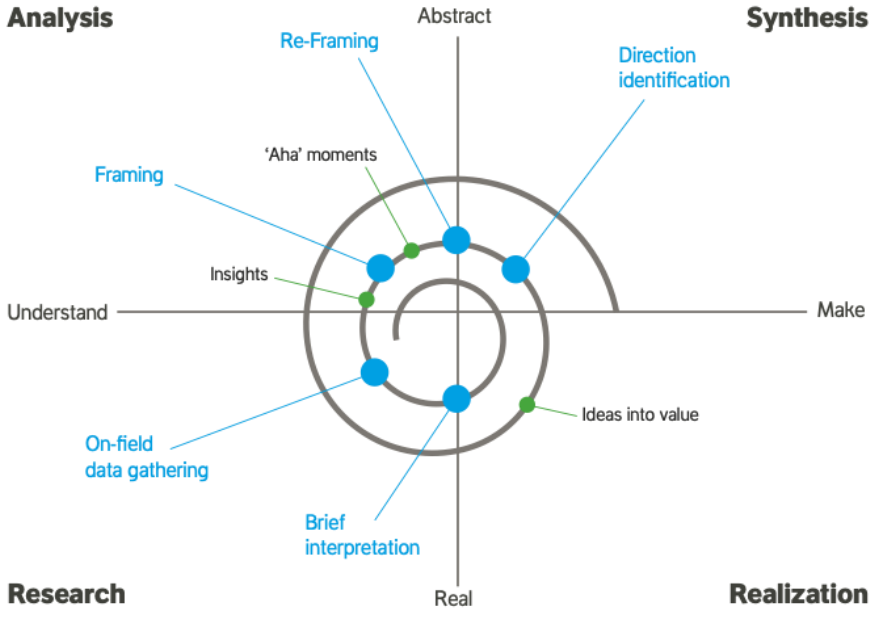

Figure. 11 The process of Design Innovation (Adapted from: Kumar, V. 2013)

Going more in-depth and positioning in the process the five phases identified through the literature analysis while reading against this the results of the survey, we can notice how the lower part of the diagram describes the phases in which students felt more comfortable, while the upper part identifies the areas in which students have encountered higher barriers.

In particular, students have expressed as enablers all the elements in the process that have helped them get in touch with (or get feedback from) the real world, from receiving a real brief from a real company, to conducting user interviews and observations, and analyzing case-studies for inspiration. To these positive aspects, the direct support of the teaching team can be associated, a result that should not be read only in terms of uncertainty but also as a direct link with the real as visualized in fig. 11. As opposite, the abstract reasoning required in the following phases encompasses the main barriers. Framing, reframing and direction identification all seat in this part of the process and include major difficulties linked to abstracting from the real. For example, identifying insights, selecting promising signals, going beyond obvious user needs, and synthesizing opportunities have all registered suffering and stress from the cohort. In this direction, one of the most important barriers

that appear in the research is the difficulty of posing the right questions. This emerges also in literature, for instance Legrenzi (2005) paraphrasing Oscar Wilde said that "*Genius is not in knowing the answers, but in posing the right questions*". This ability is one of the most important aspects that should be addressed in teaching design to non-design students. Another result that emerges from the analysis is that non-designers expect a brief with well-defined borders, as they have difficulty in understanding how to deal with blurred and complex problems. For this reason, the first part in teaching design research should be about what a brief is and what are the strategies to deal with its complexity.

To overcome the barriers outlined, it's clear how adaptation to the creative process would need further cycles of iteration especially in such contexts in which these principles are introduced for the first time. Adapting and mastering the rules of lateral thinking, as described by Edward De Bono (1970), requires more than the typical thinking outside of the box; it necessitates accepting failure as a natural part of the process, being open to provocations as a way of overcoming the obvious, breaking established/personal concepts and perceptions, proposing unexpected alternatives with value for a majority. All these principles require more than one experiment to be mastered.

The lack of prior knowledge and experience can be identified as the main general barrier in this type of context, while all the other barriers identified in the survey can be seen as sub-barriers: the lack of familiarity with DT brings students to struggle in identifying and interpreting weak signals and insights and go beyond obvious statements. At the same time, the main driver is to be found in the enthusiasm and commitment that students show in experiencing the process, which leads them to try out things and overcome failure, thus finally acquiring an appropriate DT attitude. In this sense, the results show how the teamwork has a central role: it is often seen as a way to reassure students about the goodness of their choice. This outlines how in teaching the design process it is necessary to stress self-consciousness more. Students should be aware in understanding the value of their ideas.

Looking at the existing literature on the topic, this is not counterintuitive and highlights how going through such a process for the first time remains highly intuitive. Furthermore, this substantiates that first-hand hands-on experience is the best method to get newbies acquainted with the nuances of DT. In terms of helping overcome the sub-barriers seen in the abstract reasoning, iterative development of experiences still remains the best strategy, while more effort could be put into matching management competencies (i.e., working with statistically valid data) into DT (i.e., leveraging weak signals coming from direct observation) to provide a progressive step-by-step process of learning with more anchors along the way.

6. Conclusions

The article tries to understand what the main difficulties are faced and the key-points supporting the learning process of design thinking for non-design students. Design thinking is becoming more and more important in different disciplines. This interest is producing new

conditions to teach design and related new areas to explore the design thinking process inside different kinds of courses, and new forms to teach design in non-design contexts are increasingly emerging. Moreover, this new role of design requires the understanding of some concepts that are peculiar to the world of design but that assumes great complexity in teaching non-design students. This paper has pointed out the main areas on which is necessary to focus on when teaching design thinking to non-designers. At the same time, it has emerged that certain activities of a design research process could facilitate the way non-design students approach to a project. However, the questionnaire elaborated, being made up of closed-answer questions, could be affected by a bias of students, who filter the multiple answers given in an uncontrolled way. Moreover, the results obtained could be influenced by the fact that the questionnaire was made with closed questions, excluding possible personal points of view not included in the provided answers. The sample should also be scaled to obtain a more precise result than the answers obtained. Next steps in the research will be to enlarge the amount of sample for analysis, in order to obtain wider and more accurate results. In addition, it will be necessary to go deepen on some micro activities related to design research that have not been extensively dealt in the course.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Not just Thinkers, Makers

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Abstract | Relying on the Admission Point Score (APS) introduced by universities, based on the student's final matriculation results, to see if an applicant qualify for a specific program is often not a good indicator for potential future achievement. To select students with an aptitude for practical application of knowledge and therefore the greatest potential to succeed in the program, the Industrial Design department has adopted a portfolio assessment system. Using the data from the first six years of the program's existence, the APS is compared to the Portfolio Assessment Score (PAS) score as well as the Achievement Level Score (ALS) of the student in the actual program. Comparing these datasets highlights the importance of the portfolio assessment. From this data, it can clearly be seen that the APS is not as good an indicator for potential achievement in a program that focus on both design thinking and making.

KEYWORDS | PORTFOLIO, ACHIEVEMENT, ASSESSMENT, HIERARCHICAL, DESIGN

1. Introduction

Most tertiary education programs, in South Africa, rely on the Department of Basic Education's standardised national assessments in order to select applicants for programs. The assessment of the candidate is expressed as an Admission Point Score (APS) introduced by universities, based on the candidate's final matriculation results. However, for many design disciplines, the typical secondary education subjects and assessment thereof do not always act as a good indicator for potential future achievement. In South Africa, as a result of high levels of inequality, the quality of schooling is not consistent. After 25 years of democracy in South Africa, matriculation failure rate is still highest in rural schooling with little improvement (du Plessis & Mestry, 2019). Therefore, relying on the APS, to see if an applicant qualifies for a specific program, is often not a good indicator of future achievement in that program. A student who might show great potential and aptitude for design, could have a low APS, because of the teaching received, and not their actual potential. Therefore, relying entirely on an APS for selection into a design program, might disadvantage those students who have potential and an aptitude for design. This paper aims to assess the selection system used by an Industrial Design program in South Africa, by investigating historical data of graduates. This then provides evidence for a process for selecting *not just thinkers but makers*, in other words, potential graduates who can engage and apply theoretical knowledge in practical applications.

2. Portfolio Submission

The Industrial Design program at a South African University of Technology deliberately made the decision in 2008 to reduce the APS requirement as part of their selection criteria. This decision gave applicants from previously disadvantaged communities a better chance for acceptance to the Industrial Design program despite various factors that negatively impacted their APS. However, in order to still select graduates who, have the best chance of achievement, applicants are expected to submit a portfolio (Tshwane University of Technology).

This portfolio submission as part of an application process for undergraduate programs, follow the precedent of many design disciplines across the globe. For example, Eindhoven University of Technology, Bachelor of Industrial Design, requires applicants to complete a homework assignment and to come for a personal interview (Eindhoven University of Technology, 2020). The Royal College of Art application process consist of a portfolio submission and a short self-introductory video (Royal College of Art, 2020). One of the portfolio requirements to study Industrial Design at Auckland University of Technology necessitates a short explanation of 12-24 pages of images or photos of the applicant's own work related to the field of Industrial Design (Auckland University of Technology, 2020). The Industrial Design portfolio requirements for Tshwane University of Technology have been contextually devised not to discriminate against applicants from previously disadvantaged communities but to identify those with potential and aptitude for design. For example,

“using a sheet of A4 paper, make a set of detailed sketches and written instructions on how to make a wall mounted candle holder from an empty aluminium soft drink can” (Tshwane University of Technology). This assignment is seen as contextually relevant. Not all South African households have consistent electricity and therefore the most accessible alternative is to light a candle. Furthermore, to accommodate applicants from poor households, no expensive materials are required for fulfilling the portfolio requirements.

The following portfolio requirements are a prerequisite to be considered for the Diploma Industrial Design at Tshwane University of Technology.

> “**Portfolio requirement 1** - Using typed or neatly hand-written responses do the following:
>
> Using 10 to 20 words, describe how you got to know about Industrial Design?
>
> Have a good look at the Toyota Quantum minibus taxi. Look at the overall design and the detail design. What is good about the design, what is not so good about the design? Write your comments in a paragraph (40 to 100 words).
>
> Write a paragraph (40 to 100 words) explaining why you have chosen to apply for studies in this field?
>
> Write a paragraph (40 to 100 words) explaining anything you have done as a statement of your maturity?
>
> **Portfolio requirement 2** - Produce freehand drawings showing a new product you have designed to solve a problem in your kitchen or bathroom. Include neatly written explanatory notes with your drawings.
>
> **Portfolio 3** - Provide a set of detailed sketches and written instructions on how to make a wall mounted candle holder from an empty aluminium soft drink can (coke, fanta, sprite etc.). Your candle holder design should safely support a standard white candle to be used as a night light in a bedroom.
>
> **Portfolio requirement 4** - Design and make an envelope from an A4 page. The design may not use glue or staples to hold the envelope together. The envelope design must be capable of securely holding a valuable photograph (140mm X 100mm in size) that you are planning to post to a friend using the South African mail service.
>
> **Portfolio requirement 5** - Two photos of something you made (not school projects).” (Tshwane University of Technology)

3. Portfolio Assessment

The assessment of portfolios relies on a panel of full-time employed Industrial Design lecturers at Tshwane University of Technology. Each portfolio assessment criteria are carefully considered to the realities of the great majority of the current student body with the aim to identify applicants with a potential and aptitude for design (Nyamupangedengu,

2017). Portfolios submitted are scored based on a list of criteria. Each criterion is either scored as a 'Yes' (2 points), 'Maybe' (1 point) or 'No' (zero points) which totals to a maximum score of 22. The total score for each portfolio is known as the portfolio assessment score (PAS). The criteria used to assess applicant portfolios are maturity; motivation; comprehension and language; design awareness from background; creative, visually active; problem identifier and solver; hand-skill (drawing); hand-skill (making). Following on, a justification for including each criterion as well as an explanation on how the panel establish whether the student full-fills each criterion.

- Maturity – is a measure of using good sense, understanding right and wrong, being able to amalgamate what you are doing now with the results of your actions later, and other thinking processes that go along with reasonable and acceptable behaviour. A study conducted with 5808 undergraduate students showed that emotional maturity influences self-regulated learning and motivation and these in turn affect academic performance (Kahu, Stephens, Leach, & Zepke, 2015). The statement of maturity that form part of portfolio requirement one is used to evaluate maturity by means of the following keywords: age, life experience, work, travel, independence, married, communicates at adult-to-adult level.
- Motivation – is an important factor to include in the selection process as student motivation uniquely contributes to levels of achievement. Steinmayr, Weidinger, Schwinger, & Spinath (2019) study revealed how different aspects (ability self-concepts, their task values, learning goals, and achievement motives) motivate students irrespective of intelligence and prior achievement. Portfolio requirement one's written component provides the assessment panel with the necessary evidence to establish whether the applicant show signs of motivation. The assessment panel is guided by the following phrases to assist them with their decision on potential applicant motivation: Adequate understanding of Industrial Design; Irresistibly attracted to activity of design, rather than imagined glamour of being a designer; Has made an effort to apply on time; prepare portfolio according to requirements; aptitude of self-belief.
- Comprehension and language - Research in South Africa showed that second language undergraduates usually attributes to limited language proficiency in English, and therefore affect student's academic performance (Duckhan, Cameron, & Brenner, 2016). Furthermore, in recent years the demographics of Tshwane University of Technology changed dramatically as opportunities were opened for black students (Duckhan, Cameron, & Brenner, 2016). Increasing numbers of students come from poor quality rural schools where in the past students came from good quality urban schools. This necessitated the Industrial Design program to provide additional training that focussed on reading proficiency skills and writing skills to promote critical thinking skills for second-language students. The comprehension and language selection criteria evaluate

portfolio requirement one to establish whether applicants understood and followed portfolio instructions correctly and whether applicants can write to an acceptable level.

- Design awareness from background – Prior exposure to design positively influence both the acquisition of knowledge related to design and the aptitude to apply problem-solving skills. (Hailikari, Katajavuori, & Lindblom-Ylanne, 2008). The assessment panel assess the portfolio to establish a sense of design awareness from background. Guiding words such as prior exposure to design at home, school, at work, shops, friends and big city are used to measure design awareness from background.
- Creative – Designers typically apply critical (analytical) and creative (lateral) thinking (Liikanen, 2009), seeking appropriate information and applying domain independent knowledge and specific knowledge from memory to solve design problems. Portfolio requirements two, three, four and five are used to assess creativity. Any evidence that suggest an experimental nature, curiousness about things, an ability to imagine things or to do things are used as guidance for creativity.
- Visually active – Designers' intentions due to typically ill-structured design problems require them to access and use external information afforded (presented) by primary physical objects and elements that they perceive (Haupt, 2015). Perceiving information from objects in the environment (including perceiving sketches made previously) plays a significant role during the early phases of the design process (Gibbs, 2005). Comments about what is good, not so good about the Toyota Quantum minibus taxi in portfolio requirement one is contextually relevant to many students, as a minibus taxi is their main mode of transport. Portfolio graphics and appearance; notice things in everyday life; comments on products, objects, people seen; is interested in style, fashion, visual trends are used as guiding criteria for measuring visually active.
- Problem identifier and solver - There are several ways of modelling the design process. Dorst (1997) proposed that design is a process that typically starts with an investigation into and a breakdown of the problem, followed by an intentional linking of the interconnections between the various components of the problem. Designers then solve sub-problems in isolation before combining partial solutions coherently into an overall problem solution (Goel & Pirolli, 1992). Portfolio requirements one, two, three, four and five are used to assess an applicant's aptitude as problem identifier and solver. Guiding criteria for problem identifier and solver are as follow, likes finding and solving problems; has imagined better ways of doing things; has made a device/solution or fixed something; logical thinking.
- Hand skill (drawing) - Sketches enables designers to think of different issues and aspects of the ill structured problem (Babapour, 2016). The drawings made for portfolio requirement two, three and four provides visual evidence of the

applicant's ability to make free-hand drawings using perspective, linework, proportion and layout to communicate ideas.

- **Hand skill (making)** - Making physical models are characterised as designers' process of constructing a physical and tangible format of their ideas (Babapour, 2016). Physical models are usually made during the early phases of the design process using cheap and manipulative materials, such as cardboard, wax, modelling clay, wood and foam (Kim & Lee, 2016). The two photos submitted for portfolio requirement five provides visual evidence of the applicant's ability to make things from scratch.

4. Thinking and Making

The three-year Diploma in Industrial Design at Tshwane University of Technology is an undergraduate qualification preparing graduates for a career in industrial design. Industrial design is an international profession that plays an important role in a country's economic growth. In the world we live today, numerous products are designed and developed to meet specific needs. Industrial design is part of the process of changing ideas into products that can be sold. The focus of the Industrial Design program is on developing both design thinking and making. The intentions of the program are to broaden the design experiences of students and equip them with skills to turn ideas into finished products that emphasise the look, feel, safety and convenience of a product. Formal and informal community engagement projects, social responsibility projects, innovation projects and projects with an entrepreneurial focus are given to students to become familiar with a well-considered design process to develop, communicate and specify product designs.

The Industrial Design program has an integration module, one for each year (Industrial Design I, II & III), to integrate thinking and making skills competence in increasingly complex real-world design project-based assessments. Other modules such as sketching, computer-aided design (CAD), industrial materials and processes, and manufacturing methods are included in the program to support the above realm of design projects with thinking and making skills. By the end of the program many of the linked subjects are completely integrated into the integration module to assist students in designing cognitively demanding tasks.

The design culture of thinking has been characterised as a complex higher order problem solving activity, which is due to the ill structured nature of design problems. During such problem-solving activities, designers' understanding of their design problems, typically co-evolve with their design solutions throughout the course of the design process. This is supported by a study that investigated expert designers' design cognition and found that the way that they think about their design solutions could be typified in a hierarchical structure (Haupt, 2016). Several scholars have acknowledged the importance of developing students'

design cognition to train novice designers to mirror expert designers with the intention to improve the levels of achievement at design programs (Allen & Starr, 2018; Stables, 2014).

5. Approach

In a program with a focus to develop students to integrate theoretical and practical skills to solve design problems using a hierarchical structure, this Industrial Design program followed the precedent of similar design programs by using a portfolio assessment method for selecting students. However, the authors wanted to measure the portfolio assessment score (PAS) compared to the admission point score (APS) as an indicator of student future achievement in the program. The study was conducted using a dataset spread over a period of six years. The dataset consisting of the APS the PAS as well as the achievement level scores (ALS) of students who completed their diploma in the Industrial Design program. The ALS for each student is based on the average for all subjects over the three-year diploma. The dataset for this study was limited to successful students who passed all subjects for each year over a three-year period. Failing students and students which did not complete the diploma were purposefully excluded, as various factors including financial problems, personal issues and other external factors can be cited as reasons which goes beyond the scope of this study. The study also eliminated any students where the data was not complete, for example, missing APS, with the dataset including a total of 52 students. Although this is a relatively low figure, it spans the lifetime (up to 2018) of the program at the Xxx University of Technology, being a young program.

6. Findings

The authors' suspicion was confirmed when the achievement level score (ALS) and portfolio assessment score (PAS) comparison was done, followed by the comparison between the ALS and admission point score (APS). To explain, the different values extracted from the data are each determined in different ways which does not only effect how nuanced the actual value is, but also the potential average of the score. The ALS and APS are both an aggregation of many different sores and have the potential for a larger range. The PAS is rated using 'Yes' (2 points), 'Maybe' (1 point) or 'No' (zero points) for each of the criteria. This is then totalled into a score out of 22. The 52 students who form part of the data set were also selected for the program based on this score, so the average expressed as a percentage for portfolio score is 89.7% which is far higher than the average for the APS of 69% and the achievement level average of 65.8%. In order to correct for these differences and thereby normalise the three datasets for better comparison all the values were divided by the mean of the respective datasets. The values are then expressed as a value ranging from 0 to 2 with 1 being the mean. A value of more than 1 implies higher than average achievement while below 1 implies below average. Then, the PAS was compared to ALS, as indicated in Figure 1.

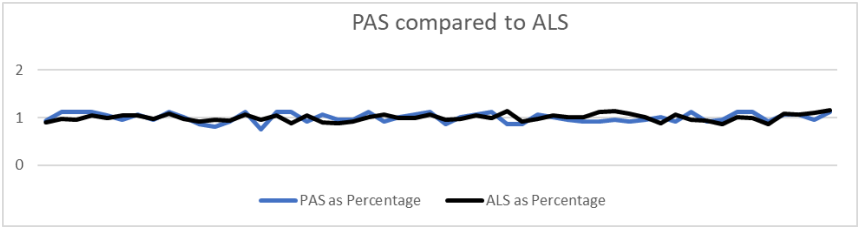

Figure 1. The deviation between the Portfolio Assessment score as a percentage and the Achievement level.

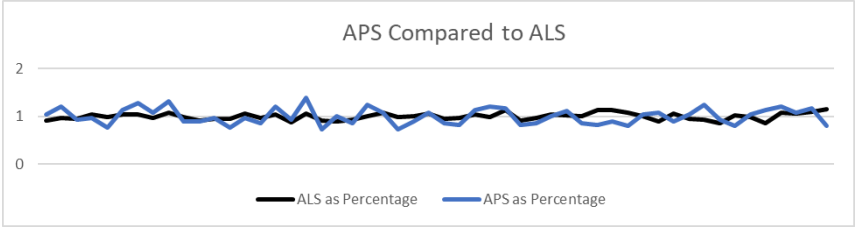

Figure 2. The deviation between the APS as a percentage and the Achievement level.

As evident in Figure 1, the deviation is not as pronounced when compared to the APS once again compared to the Achievement level (Figure 2). As can be observed in Figure 2, the APS is often quite different from the achievement level. The total deviation (above or below) compared to the achievement level for each was totalled together. The PAS had an average difference of 9% compared to the achievement level, while the APS had an average difference of 14%. Both values are low which indicates that both can be considered as indicators of potential future achievement. However, this also indicates that the PAS is a better indicator of future achievement than the APS for the Industrial Design program.

7. Discussion

The authors are of the opinion that the APS is not as good an indicator of future achievement for the following reasons: Firstly, as noted, the quality of teaching and learning is not consistent across rural and urban schools in South Africa. Secondly, the APS can at best only confirm that the student has a general understanding of the world. The portfolio requirements and resulting PAS, are more focussed on the skills set required for Industrial Design, whereas the APS is more generalised.

Is the difference between the PAS and APS significant enough to justify the effort involved in portfolio assessment? The authors believe it still is, firstly, because it can be argued as more fair for our specific context. Secondly, the number of students selected each year is low and

therefore must be very selective, in order to maximise the level of achievement. Thirdly, it helps to expose applicants that are more likely to succeed.

8. Conclusion

This paper revealed that a better correlation exists between portfolio assessment and achievement levels of Industrial Design students than the APS and achievement levels of students. With high levels of inequality in South Africa and inconsistent quality of schooling, made it difficult to select applicants with potential success. To improve student's design thinking potential to succeed in the program, the Industrial Design department created their own portfolio assessment system for selecting applicants. The Industrial Design department aimed in their portfolio requirements to make the assignments contextually relevant so as not to discriminate against applicants from previously disadvantaged communities, but also to best select applicants with potential and an aptitude for design, the thinkers and makers. The results showed a better correlation between portfolio assessment and students' level of achievement than the APS and students' level of achievement over 3 years. This indicates the preference of portfolio assessment over APS for a program that require students to integrate theoretical and practical skills to solve design problems using a hierarchical structure. Further study is recommended to refine and improve the portfolio assessment criteria and using the portfolio assessment system to better identify applicants who would not be successful for other reasons.

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Radical Interdependence: learning/doing with things

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Abstract | Design research can include a range of actions but has gradually become assimilated into the production of theory. The making of theory in design has been widely discussed (Redström, 2017), but the kinds of cognitive operations that it entails is still to be fully explored. I will argue that contemporary theory entails three different ways of relating to objects: objectivity, critique and affect (Daston & Galison 2010, Kosofsky Sedgwick 2003, Massumi 2002). These three ways of knowing, inherited from modernity, protect us from the material reality that surrounds us, from the power of objects over humans. They all contribute together to create a distance between humans and the world we live in. In the following paper exploring the power of erotics, I will propose forms of design research that don't distance us from the objects we are analysing, forms of knowing/doing that allow us to establish interdependent relationships with them.

KEYWORDS | THEORY, INTERDEPENDENCE, EROTICS, DESIGN, EPISTEMOLOGY

1. Introduction

Design research has now established itself as a discipline and a recognizable practice (Rodgers, 2018). It goes along with, interacts with and feeds into contemporary design practices, whether academic, creative or business-oriented. Ever since Christopher Frayling proposed a categorization to differentiate research into, for and through design in his pivotal article 'Research in Art and Design' (1994), the number of debates and academic discussions on the subject have grown continuously. A crucial moment in this debate occurred when Nigel Cross published the article 'Designerly ways of knowing' (2001), opening up the question of whether it is possible to make a design science. Hovering in the background of these debates was the role of theory, or more precisely critical theory. This specific way of engaging with practice has grown to occupy a central role in design research. Essays, dissertations, explanations, exegeses and accounts of how design practice takes place are not not only expected but almost a compulsory activity in any academic context. Design research can include many different actions – it can imply to, for example, prototype, diagram, draft, test or experiment – but gradually it has become assimilated into producing theory. What "making theory in design" is has been widely discussed (Redström, 2017), but what kinds of cognitive operations it entails, I will argue, is still to be fully explored.

It is paradoxical that we have come to expect theory to accompany any form of practice because it seems to function as its dialectical negative. As twins start gravitating towards each other, theory and practice engage into a choreography that materializes as design research. Historically, theory comes from observation. As the philosopher D. N. Rodowick explains, "one finds the noble origins of theory in the Greek sense of *theoria* as viewing, speculation, or the contemplative life" (Rodowick, 2015:7) – the division between viewing and doing is established at the very origin of the concept. Practice needs to be unpacked, exposed and explained in order to gain legitimacy. As Rodowick writes, "Theories seek to explain, usually by proposing concepts, but in this they are often distinguished from doing or practice. In this manner, (Raymond) Williams synthesizes 'a scheme of ideas which explains practice'" (Rodowick, 2015:18). Theory needs to be systematic, consistent and methodologically robust. In this sense it has become a practice in itself, with clear rules, tones, aesthetics, rituals and gestures. Theory is now central to design research, and practice needs to be theorized in order to be validated academically. Currently, the word "theory" has weight, gravity and solidity in the humanities. But, as Wittgenstein might have put it, like every overly familiar word, on closer examination it begins to dissolve into "a 'corona' of lightly indicated uses" (Rodowick, 2015:3). Despite its openness, art and design schools still rely on theory as a tool to unpack and make design a legitimate research practice.

Epistemically, theory can be problematic, as it inherits some of its cognitive modes from modern ways of understanding the relation between objects and subjects, persons and things (Esposito, 2015). In the midst of the nineteenth century, with the colonial projects, the scientific and the industrial revolution at their peaks, Europe was filled with a stream of objects at a magnitude that had never seen before. Extraordinary and mysterious things to

the eyes of the common European. Artefacts, tools, magical instruments, animals, plants, minerals and subjects were being forcefully imported to the European continent from the various colonial projects. At the same time, the industrial revolution was running on full steam, and factories were producing commodities at a rate never seen before. The growth of the scientific discipline was also accompanied by the creation of new and powerful instruments that allowed the human gaze to see a reality for the first time. Confronted by the power of these objects, the European enlightenment could merely try to (re)name, categorize, taxonomize, describe, measure, inscribe, dissect, collect and explain them (Foucault, 1994).

Powered by the belief in rationality, modern ways of engaging with things implied that no object could have or exert its power over a subject. Modern epistemologies were born to neutralize the magic, allure (Goffey, 2014), strength or power of a multitude of objects that now challenged the pretense of humanism that the human, and human agency, was at the center of the world (Braidotti, 2013). To confront the power of these objects and in order to contain them, three different cognitive modes started operating almost simultaneously. In the context of the natural sciences the idea of objectivity started gaining strength. Adopted in the 1850s, objectivity is a strategy to analyse natural objects that implies becoming detached from what one is examining (Daston & Galison, 2010). It limits the impact of human subjectivity on the object that is being analyzed. All traces of magic, animism or material power had to be erased from the human descriptions of natural objects. Only a few years later Karl Marx was finishing his *magnus opus*, Capital Volume I, in which he made us aware of the fetishist power of the commodity (Marx 1990). In order to escape from its attraction, he proposed critique as a way to unveil the underlying ideology that remains latent behind each commodity. Only through suspicion one can get to understand the truth that lies hidden under the surface of any commodity, so theory would imply an act of debunking its magic. The growth of aesthetics during the nineteenth century as a philosophy aimed at understanding how objects affect the body (Eagleton, 1990) shows us that, in order to understand the object one confronting, we have to look into ourselves to see how it affects our emotions and sensations. In front of a painting, a mountain or a poem that can overwhelm us, aesthetics gives us a way to name and contain the affects these elements have on our body/soul.

2. Three epistemic movements

In their exhaustive history of the notion of objectivity, Lorraine Daston and Peter Galison note that “to be objective is to aspire to knowledge that bears no trace of the knower-knowledge unmarked by prejudice or skill, fantasy or judgement, wishing or striving” (Daston & Galison, 2010: 17). In order to achieve this, the scientific community spent time and energy to develop methodologies, instruments and techniques that would allow them to view objects without any kind of interference of the subject. The object in this context is

equated to an accumulation of qualities, for example, weight, height, density, intensity. Reality becomes datafied in order to be comparable and easily archivable. To do this, animals, plants and minerals have to be decontextualized, reduced to parts and understood rationally, that is, as small logic rations. Matter is transformed into information, pure representation that can be dealt with (Latour, 1986). There must be a distance between object and subject; they cannot contaminate each other.

Objectivity has to do away with emotions, sensations or intuitions, which all stem from the subject and could end distorting the qualities of the object put under scrutiny. These objects need to be extracted from their context and introduced into the laboratory, a clean and open space in which matter can be transformed into facts (Latour, 1986). This idea of objectivity and its ambition to constitute a universal and unquestionable form of knowledge has been largely contested and challenged. Since Kuhn's now famous "The Structure of Scientific Revolutions", the challenges to objectivity have come from many fronts. Even in the mid-sixties, during the Berkeley student revolts, one could walk around a campus and see the slogan "objectivity is only another word for white male subjectivity" (Gitlin, 1995: 150) written all over the walls. In her now well-known work, "Situated Knowledges: The Science Question in Feminism and the Privilege of Partial Perspective", Donna Haraway also questioned the role of objectivity and its uses from a feminist perspective. She opens the paper with a defiant sentence "Academic and activist feminist inquiry has repeatedly tried to come to terms with the question of what we might mean by the curious and inescapable term 'objectivity.' We have used a lot of toxic ink and trees processed into paper decrying what they have meant and how it hurts us. The imagined 'they' constitute a kind of invisible conspiracy of masculinist scientists and philosophers replete with grants and laboratories" (Haraway, 1988: 755). Her answer, in order to escape the objective-subjective division, is to work on situated forms of knowledge, making the researcher accountable for the conditions in which knowledge is being produced but escaping the pursuit of universal forms of truth.

In the same decade as the notion of objectivity started being deployed, Karl Marx published "Capital vol I" with a chapter devoted to understand a new kind of object: the commodity. He writes "A commodity appears, at first sight, a very trivial thing, and easily understood. Its analysis shows that it is, in reality, a very queer thing, abounding in metaphysical subtleties and theological niceties" (Marx, 1990). These objects have a fetishistic character; they are able to hide the power relations that allow them to be produced, exercising their power of seduction over consumers. Objects become fetishes when their physical reality is a condensation of abstract productions forces. To suppress their power, to understand these objects, Marx proposes a very specific cognitive exercise: look behind the commodity. Find the production systems that allow it to exist. We must debunk the commodity to understand its real meaning. This cognitive exercise is what we refer to as critique. It implies learning to suspect what an object really is. A commodity is a proxy for a specific ideology that can be unveiled through a critical reflection. Understandably the traditions of cultural analysis influenced by Marxism will look at cultural objects as an envelope for ideology. Critique can unpack and expose the truth behind these objects.

The French philosopher Paul Ricouer coined the term “a hermeneutics of suspicion” to define a specific way of engaging with reality that runs through a genealogy that crosses the works of three of the most important analysts in the 19th century: Nietzsche, Marx and Freud. What they all share is a distrust for how things appear to us (Ricoeur, 1999). Confronted by the power, magic or seduction of the object, this school of thought promoted suspicion, distance and attention. That is why critical theory has normalized critical detachment as a way to engage with objects that could exercise their magic over us. Analyzing how critique has changed to adapt to contemporary academic needs, Rita Felski writes “a preferred idiom is that of ‘troubling’ or ‘problematizing’, of demonstrating the ungroundedness of beliefs rather that diagnosing false consciousness. And the prevailing tone is ironic and deliberative rather than angry and accusatory. The role of critique is no longer to castigate but to complicate” (Felski, 2015:130). In this sense, again, as in the case of objectivity, a distance is created between subject and object, knower and known. Objects are not trustworthy; theorists must always be alert; and this mental operation can push critique into a semi-paranoid state (Sedgwick, 2013). Everything must be put under suspicion, normalizing a detached and cautious way of understanding material reality that surrounds us. As the cultural analysts Eve Sedgwick sustains, “To apply a hermeneutics of suspicion is, I believe, widely understood as a mandatory injunction rather than a possibility among other possibilities” (Sedgwick, 2003:125). This sustained suspicion transforms the theorist into a cautious “paranoid” agent, always ready to debunk objects and expose their dirty tricks. “The first imperative of paranoia is there must be no bad surprises, and indeed, the aversion to surprise seems to be what cements the intimacy between paranoia and knowledge per se, including both epistemophilia and skepticism” (Sedgwick, 2003:130). This is the main reason why critique does not get along well with practice, with materialities, with the messiness of design projects that will always be contradictory. During the 1990s critical theory was challenged by scholars pertaining to the natural sciences, in the so called “science wars” (Latour, 2004). From the perspective of rationalist scientific disciplines critique lacked “objectivity”, it always managed to find what it set out to debunk, it was seen as a postmodern hoax (Sokal & Bricmont, 2003). But still, one of the most powerful challenges to this tradition came from Bruno Latour in his article “Why Has Critique Run out of Steam? From Matters of Fact to Matters of Concern”, in which he signalled some of the main shortcomings of this cognitive mode engaging with reality. The distance between conspiracy theories and critical theory was to close.

As we have mentioned, alongside objectivity and critique, the third epistemic tradition that feeds into contemporary forms of doing theory is aesthetics. Aesthetics deals with sensations, feelings and affect. Ben Highmore writes that “Aesthetics, in its initial impetus, is primarily concerned with material experiences, with the way the sensual world greets the sensate body, and with the affective forces that are generated in such meetings” (Highmore, 2010: 185). This philosophy of affect, born against utilitarian and instrumental reason, has devoted much of its time analyzing and understanding how the arts act upon the human body. As Terry Eagleton explains, "Aesthetics is born as a discourse of the body. In its original

formulation by the German philosopher Alexander Baumgarten the term refers not in the first place to art, but, as the Greek aisthesis would suggest, to the whole region of human perception and sensation" (Eagleton, 1990:13). With the industrial revolution on the background, capitalism and utilitarianism gaining strength, philosophy wakes up to the fact that under the regime of ideas there is a sensual body waiting to be explored and understood. Aesthetics allows for the sensible life of humans to be explored; it follows affect, how objects impinge upon the body, how the body reacts to sensible stimuli.

Baumgarten was the first to work for a positioning of aesthetic in the system of philosophy. This new science of perception implied, "detaching and describing a special class of objects— in Baumgarten's terminology, 'perfect sensate representations' (*perfectio cognitionis sensitivae*) achieved through artistic means" (Rodowick, 2015:25). Once we are detached enough from the object, we can start to understand how it affects our senses, our inner being, how it impinges on our subjectivity. In this sense, it epistemically starts signalling towards a relation between subject and object. As "the experience of aesthetic pleasure was conceived both as an external perception of the intrinsic formal qualities of the presented object and as the stimulation of the subject's internal representational and emotional capacities, though in the form of intuitions, not concepts" (Rodowick, 2015:34), still the subject continues to be the active agent, the knower, of a world that needs to be known. Here is where we find the aesthetics' greatest problem, as when it looks at the object it cannot really see it; it instead is a discipline focused on understanding how the body reacts to it. Rather than engaging with the external reality, it folds into the subject, scrutinizing and explaining how a certain note, colour, image of phrase produces specific emotions and sensations. To engage with exteriority, aesthetics produces a complex sense of interiority, forgetting the material reality it is intended to address to instead engage with sensations, feelings and physical states. This is how aesthetics failed to understand the social and political realities of these objects it seeked out to understand. It became self-absorbed in itself as a cognitive exercise. By doing so it lost its status as a philosophical perspective and during the twentieth century and was demoted to being a specific way of doing art theory.

So what we see is that these three modes of interrogation, the three strands of modernist enquiry that converge in what we today call theory, share their discomfort with the power of objects: the hierarchical tension between subject and object; the belief that human rationality can rise above and control and neutralize the magic and force imbedded in materiality; and the perpetuation of a modernist obsession with controlling and dominating the material world in which humans live in. This has led to a crisis that Arturo Escobar describes as a "result of deeply entrenched ways of being, knowing, and doing. To reclaim design for other world-making purposes requires creating a new, effective awareness of design's embeddedness in this history. By examining the historical and cultural background from within which design practice enfolds" (Escobar, 2018:19). They presuppose a superiority of subjects over objects, humans over things. Rationality over sensuality. They incite us to see contemporary problems through a modern lens.

This pushes us to ask, following Escobar: “can design be extricated from its embeddedness in modernist unsustainable and defuturing practices and redirecting toward other ontological commitments, practices, narratives, and performances?” (Escobar, 2018:168). Can we find ways of thinking/doing, leaning/making, researching/producing that escapes the dualist modes of thinking we have inherited from modernity? Can we devise forms of theory that go beyond objectivity, critique or affect? And more importantly, can we develop forms of research that are able to accept the messiness, contradictions and openness of materiality? Can we research design without having to distance or protect ourselves from the power of objects but, instead, allow them to seduce, play and deploy their magic over us? Can theory be evicted from its epistemic sense of superiority, opening research to other ways of knowing/doing the world?

3. Final remarks: Epistemic erotics

Distance, suspicion, affect. Objectivity, critique and aesthetics. Contemporary theory has specialized in understanding the politics, ethics and aesthetics of the objects it analyses. It has tried to define a clear-cut subject in charge of controlling objects. This has contributed to a detached way of producing knowledge that is unable to give a strong account of our interdependence with things, human and non-human entities. To conclude, I will argue that the price we have paid for this epistemic privilege is losing a way to evidence links, attachments and forms of interdependence that make modernist dualists depictions of reality obsolete. It is in this context in which I will argue for the need to engage with an erotics understood as a specific epistemic exercise. As a way to get entangled by the links and bonds that ensemble humans and non-humans, subjects with objects, persons and things. We could define this erotics as the materialization of the bonds that make us part of the world. Erotics signals the subject that is fascinated by another subject, or by another object. It engages in the power of attraction. It casts light on the broken links that modern epistemic modes have enforced on our understanding of the material reality of which we are a part of. Erotics is fuelled by curiosity, attraction, allure, desire. Erotics is a transgressive cognitive exercise as it forces the subject to lose itself in the midst of the object. As opposed to objectivity and critique, it bridges the distance with the material reality it seeks to understand by allowing it to seduce and cast its magic on the subject.

Contemporary design research’s investment in theory perpetuates the division between subjects and objects, knowing and doing. It is in this context that we argue that we need other ways of engaging with design objects or projects. If theory seeks robust confirmation of facts, erotics opens up the possibilities of playfulness and curiosity. If objectivity requires distance, erotics opens the way for presence. If critique is based on suspicion, erotics allows us to explore complicities, attraction. If aesthetics is self-absorbed, erotics pushes us out of ourselves to explore the different forms of interdependence between us and the world in

which we live in. Erotics allows shininess, viscosity, symmetries or lengths to shape ways of knowing the world. If theory needs clear categories and taxonomies, erotics allow us to engage with messiness. Experimenting with materials, with uses, with shapes and functions will always be full of contradictions, openness and uncertainties. An erotics can help define an epistemology of mutual fascinations and unrequested entanglements.

The genealogy of erotics we are pursuing here should push us to engage, entangle and establish intimacies with objects, plants, minerals and animals. In this sense, we are not thinking of an erotics as a steps towards sexuality, but as an acknowledgment of those forces that push us into the world (Bataille, 2013), escaping the self to become part of a complex network of beings. This use of erotics should be understood as a way to develop those radical interdependencies that Arturo Escobar asks designers to engage with (Escobar 2018). A way to create a bond and kinship with non-human beings, as argued by Donna Haraway (2016). A way to build dense ensembles in a Latourian sense (2008). So erotics is not the prelude to sex, but to deep intimacies with human and non-human actors. It is a movement towards thinking/being/doing with others. Allowing ourselves to be attracted by things that do not need debunking or explaining. Allowing the power of materialities to invoke complex networks (Bennett, 2010).

Erotics is a form of knowing/doing that allows the power of others to be felt, to be experienced. Following the ideas of feminist scholar and poet Audrey Lorde, if objectivity, critique and aesthetics were defined in order to neutralize the power of objects over subjects, then she sees erotics as an exercise to gain repressed powers. In her own words, “There are many kinds of power, used and unused, acknowledged or otherwise. The erotic is a resource within each of us that lies in a deeply female and spiritual plane, firmly rooted in the power of our unexpressed or unrecognized feeling” (Lorde, 1984:87). Erotics in this sense helps us to regain confidence in intuition and non-rational ways of knowing, those forms of engaging with the world sanctioned by the modern epistemologies we have previously dissected. Erotics helps us acknowledge the contradictions inherent to material complex realities. As Lorde writes, “The erotic is a measure between the beginnings of our sense of self and the chaos of our strongest feelings” (Lorde, 1984:88). Learning to trust these feelings, inclinations, sensations and propensities, we can start allowing ourselves to escape from a false sense of self and embody interdependent based subjectivities. Without an erotics, we buy into this disaffectionate, distant and ironic mode of theory that inevitably doesn't allow us to fall in love with our practice. That, inevitably, will find evidence of material shortcomings and contradictions.

An erotics affords us to become entangled. It allows the imaginary barriers we have established between subjects and objects to be erased. Through an erotics, frontiers become fuzzy. An erotics opens ways of knowing based on touching, sucking, smelling, biting, measuring or tinkering with things. Erotics implies transgression of rules, disciplines and categories, opening the gates to *indisciplined* forms of research (Camps & Rowan, 2019), challenging limits and expectations. Objectivity, critique, aesthetics and erotic

epistemologies, a repertoire of modes of knowing/relating/caring for objects. Suspicion with complicity, distance with care, affect with responsibilities. This leads us to conclude that design research needs theory, with its objective distance, its critical suspicion and its affective aesthetics, but also needs to engage erotically with materiality, with the contradictions inherent to practice. It needs to open up to playfulness, to material alliances and weird entanglements. Pushing the human to one side, learning/doing with things, through unexpected alliances and erotic pleasure.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Rethinking & Appropriating Design Education for a VUCA World

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Abstract | Design education once again faces the challenge to cope with a world full of volatilities, uncertainties, complexities and ambiguities. For this paper, we – the head of a BA programme in Design Management, the head of a MA Design programme and the head of a design research group with a focus on public sector innovation – explore and discuss the opportunities and challenges we see this involves for design education as we seek to prepare design undergraduates and postgraduates for a VUCA world. In this paper, we share our experiences as design educators and researchers on different levels (BA, MA, PhD) to engage with questions discussed now in the design education community. We employ our different perspectives to provoke thinking about design education and understand their implications. We start with multiple and often conflicting objectives: 1) we seek to educate and prepare BA and MA students for successful careers in today's design jobs but also for those that are emerging (many of which we do not even know about yet); 2) we need to develop and appropriate methodological and theoretical foundations and ensure they find their way back into teaching and 3), we must adjust and adapt our curricula to relevant topics and themes that emerge through research and professional practices – even in other fields! Our multilevel conversation suggests that the task of design education is to provide a frame for the plurality of design principles and methods that grounds design as a field and discipline. This, we conclude, requires new integrative forms of research and education in design and speaks to a change in the design culture itself.

KEYWORDS | DESIGN EDUCATION, CULTURE OF CHANGE, DESIGN CONVERSATIONS

1. Let's Talk Design: Our respective experiences in design and design education

Over one hundred years ago, the Bauhaus sought to offer disciplined design education among the uncertainties of the Weimar Republic. In Post War Germany, the HfG Ulm School generated new possibilities for a new future after the end of the Nazi regime and amidst the backdrop of significant social and economic changes expressed through student unrests and radical movements. Whenever nothing seems to be what it was and whenever many things and situations can no longer remain as they are, the way we conceive of, plan, develop and deliver new paths forward into the unknown take on new significance (Junginger 2017a, p. 59). As we are writing this, the foundations for a New European Bauhaus are being laid out following the call by EU President Ursula von der Leyen for artists, designers, engineers and architects to address wicked problems in today's VUCA world.[1] From the *Sustainable Development Goals* to the *Green Deal*, from the *Just Recovery* to questions of *Equality and Equal Access*, design challenges abound.[2] Yet, the skills and qualifications needed to arrive at outcomes that enhance human living are very different from those where design meant to satisfy a single client's requirements. How do we experience this VUCA world in our role as design educators and researchers?

Response Head BA programme in Design Management (BA): Until recently, I was a design researcher in the Faculty of Medicine & Dentistry at the University of Alberta, Canada. When entering a team, my first contribution to a project, was asking different questions. How do you know what you know? The second contribution was to know how to engage with people. And the third contribution was implementation. We have a lot to offer as designers in implementation, in creating strategies so that people will know that the research exists. We know how to transfer that research. We bring that user-centeredness naturally, and we use it to engage with the diverse groups of users, and implement knowledge in real contexts (Frascara, Noël, and Ruecker, 2018).

When needing to enlarge my team, it was easy to find young graduates that were familiar with current computer programs. They were quick at finding things on-line, were relatively good at the graphic aspects of communication design, and curious to implement recent trends in design methods. It was, however, extremely difficult to find young designers with basic knowledge about behavioural and cognitive psychology, qualitative research, writing, and data analysis. Design graduates struggled to grasp the human part of complex problems, develop a research question or a research plan. They had a hard time to identify patterns of

[1] See https://www.starts.eu/article/detail/president-von-der-leyen-launches-the-new-european-bauhaus.
[2] See http://sustainabledevelopment.un.org; https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal_en.

information and interpret them to gain a more complete understanding of the design problem to articulate a design intervention. It would have been also desirable to find young design professionals with understanding of stakeholders and how to partner with them.

In my new role as the head of a BA program in Design Management, I am working toward remediating this reality. But the task is neither simple nor easy. Developing a curriculum that responds to the current demands of design practice requires careful examination of content, pedagogies, approaches, tools, teaching team and their capacity, as well as context and students' capacities. Above all it, requires careful consideration of what we are trying to achieve: Who are we forming, to do what, where.

Each school is situated in a particular context. This context inevitably conditions the answers to the above questions. Many schools are trying to educate and train professionals that have the ability to change existing realities into better ones. But which realities? Which form of knowledge these realities require? Which principles should inform the choices of the knowledge needed to address these realities? What level of complexity should these bachelor students be able to address? How much should they be able to change? Or is their task rather to support change processes rather than to lead change? With which other disciplines should they engage to achieve the desired change?

What design knowledge is and entails in much debated. It depends on the design subdiscipline, on the diverse understanding of design, and on a lot of unchallenged assumptions about what must be learned to be a good designer.

Response Head Competence Centre for Research in Design & Management (Research) Like Guillermina, I think it is helpful to provide context with my own journey. Before entering design education myself, I dabbled with radio broadcasting, pursued a career as journalist in print media, and somehow ended up working with Designworks/USA, a BMW company in California and Siemens Corporate Design in Germany. I had gathered extensive experience in marketing and market research, where I was introducing products into a new cultural market. Only after all this professional work did I enter the MA Communication Planning and Information Design at Carnegie Mellon University. I applied to join the newly minted PhD program under Richard Buchanan in my second year of the MA. My second supervisor, Denise Rousseau, is an expert in organizational change and public affairs as well as a former head of the Academy of Management. With Bruce Hanington, an expert in design research methods and Stephen Stadelmeier, an outstanding industrial designer, I had two additional committee members who would engage with me in questions of design research and design education across and beyond traditional boundaries.

My first teaching took place at Carnegie Mellon, initially as an assistant, then as a co-instructor before I developed and led my own courses. Research and teaching were deemed complementary and my courses were formed around my research. My role as instructor at Georgia Tech was very different, as I became a conduit for an already well-established and

well-prepared course, training incoming BA students across all disciplines in the School of Architecture in the basics of art and design. The last time I had a major role in teaching was at Lancaster university from 2007 to 2012, where I co-designed and co-ran the one-year Master of Design: Management and Policy and taught undergraduates in the management school. Working at a school of design in Denmark was the first time I was told I was a researcher whose topics and approaches would not benefit students and thus not suitable for teaching. But things seem to change. In my current position, also at a school of design, there is a significant and encouraging shift taking place. What troubles me most is that design education is central to design research – how else would we be able to open new areas for design research and design practice, if we did not find ways to reach out to people, inspire, demonstrate and make accessible these new domains, practices, processes and methods – i.e., educate – about these possibilities? I find myself regularly teaching – on conferences, at seminars, during guest lectures at other design schools and universities, yes and even through 'theoretical' papers. The historic foci and structure of design schools means that researchers struggle to share such insights with their own students. Being creative, researchers find ways to involve and engage students in research projects. We have been able to involve BA students in projects like the 'Future of Government' by the JRC EU Policy Lab. Our BA and MA students participated in the 'Creative Bureaucracy Festival Academy', and in the OECD OPSI conference 'Government After the Shock'.[3] To close the 'research gap', we have created a new position for a BA student intern in our Competence Centre Design and Management. We seek to support the development of future-oriented capabilities and capacities that enable students to carve out successful design careers in transdisciplinary teams. From a research perspective, this means addressing social, economic, and planetary challenges from a design perspective. I understand my educational role to provide examples of how design research works, what it can contribute, how it complements and how it differs from but complements other research practices.

Response MA Design Director (MA): Besides my own experiences as a student, also as an educator, I always experienced two different contexts with regards to design education: design being taught at universities or faculties of architecture and engineering or design being taught at schools of fine arts. Obviously, both come with fundamental differences when it comes to the background and history of these institutions as well with regards to the competences and skills being built up in their design programmes. While the latter emerge from the tradition of focusing a more artistic and expressive approach that used to aim at the aesthetic refinement of mostly physical artifacts as well as the critical or speculative examination of real-world matters, universities of architecture and engineering, instead, provide a more pragmatic, analytical and methodological approach towards complex problem-solving. Historically, these two perspectives relate a lot to the fundamental shift

[3] See https://states-of-change.org; http://www.nesta.org.uk; https://gov-after-shock.oecd-opsi.org/event/gov-after-shock; https://creativebureaucracy.org.

and argument that emerged at the Ulm School of Design—between former Bauhaus student Max Bill and the group of educators around Tomás Maldonado and Ottl Aicher (a historical moment that I will refer to later in this paper).

Just recently, this difference between different institutions providing design education has been pointed out by Michael W. Meyer and Donald Norman in their paper called "Changing Design Education for the 21st Century", where they critically examine the gap that emerged between schools of arts and design and such coming from an engineering background (Meyer & Norman, 2020). In their paper, they point out the increasing level of complexity that characterizes today's problems – problems that can't be exclusively addressed by an „arts & design approach" anymore. In fact, most of today's wicked problems cannot be exclusively approached by any single discipline. I agree with my colleague from the research department here: educating "single-trick" designers or any other professionals is not enough. A couple of years ago, I critically examined the widely known "T-shape" that combines disciplinary depth with the ability to collaborate across disciplines (Guest, 1991; Brown, 2010; Eckert, 2018). While laying out my critique, I cited Machine Learning Designer, Caroline Sinders who refers to the T-Shape as follows: "The future is less of a T-shaped designer, but a designer that's a Jill-of-all-trades. You should have an aesthetic eye, but you need to be a systems designer when dealing with AI, you need to be a designer that focuses on ethics or (as) an ethicist, you need to have a little bit of a technical understanding. And you need to be highly data-minded and data-questioning." (Sinders in Schwab, 2017). Both Meyer and Norman's such as Sinders' points of view clearly indicate a post-disciplinary future in design education – a future that, actually, relates a lot to Gropius' call to synergise the disciplines, more than hundred years ago.

2. How would you describe the current shift and challenges in design education?

BA: Current environmental, societal and urban changes present new demands to design practice, forcing the discipline to expand from traditional craftwork to problems that are difficult to define given their complexity (Friedman, 2016; Justice, 2019; Norman & Stappers, 2015). To keep on being relevant design education must adapt to current demands. But this change is neither easy nor new, design education has a long history of change. In 1972, Icographic dedicated the whole of issue Nº 4 to design education. Patrick Wallis Burke (1972), at that time Executive Editor, reported "[Experts] maintain that many educational practices are based on philosophical premises that are no longer self-evidently true and, as a result, are out of harmony with the needs of the individual and society as a whole" (p. 2). In 1968, Tomás Maldonado, alerted us toward the need to focus design education on what he called environmental design: sustainability, making us aware of its great complexity and diversity of variables, that needed to be understood as a system of subsystems with close interdependence. He wrote

> "I may have taken an effective if not decisive step towards a new philosophy of Design Education… A school of Environmental Design should include all the fields of activity which can give sense and structure to the human environment" (Maldonado, 1968, p. 53).

Although the United Nation Sustainable Development Goals (SDGs) present new challenges to design education, the need to incorporate sustainability issues across the design curriculum is not new. It is well-known that in most disciplines, it takes around 17 years for research to be adopted into practice (Westfall, Mold, & Fagnan, 2007). In the case of design education, it has taken a bit longer to incorporate new knowledge and adapt our teaching to current demands. While Antonio Guterres, UN Secretary general in the Climate Ambition Summit 2020 strongly advices countries to declare a state of climate emergency (United Nations Secretary General, 2020), most design school do not have yet fully incorporated sustainability in their curricula. One could speculate, that this is partly due that good instructors on the topic do not abound.

Addressing the current climate crisis certainly entails to rethink design and design education. To move our offering beyond understanding customers' needs & wants, adopt new notions of growth, and reconsider current metrics of economic performance (Stiglitz, 2019). "We must transform how we live if human society and the planetary ecosystem that we are both part of and rely on are to flourish" (Wilde, 2020, p. 171). The transformation necessary to attend to human needs are tremendous, but possible if wanted. They require a shift in mindsets, priorities and understanding. In 1990, Herman Daly made the difference between growth and development: "To grow means 'to increase naturally in size by the addition of material through assimilation or accretion'. To develop means 'to expand or realize the potentialities of; bring gradually to a fuller, greater, or better state'" (p. 1). Still, our understanding, adoption, and promotion of growth has not changed much. It is time for action. Read reports, policies, case studies, scientific articles, watch and listen to experts like Mariana Mazzucato, Kate Raworth, Robert Pollin and many others to re-think the rationale and message we are giving to our students, and how we are preparing them to face this challenge.

Research: Just like many other disciplines and fields, we experience a significant disruption that challenges us to reconsider what expertise is needed today to practice design. There is also the question where design practice and design research matter today. Beyond the production and consumption, design today plays a much bigger role in articulating and ensuring the common good (see Steinberg 2014; Bason 2017, Junginger 2017b and 2018). Rather than embracing this development and providing the much-needed theoretical and methodological design foundations, there are still some who are busy guarding territories. This has produced a kind of inertia within design. Outside design, these conversations are irrelevant and the focus is on action. New approaches to design have been set up in design thinking schools, in management schools, even those focusing on the public

sector. Generally, this is a great development as it points to the need and relevance of design across many different domains. But the recent panel discussions informed by the authors of the two volumes of She Ji edited by Guillermina, lead me to give two answers to this question.

My first answer is: there is not much of a shift. As Jan has pointed out above, there is a long tradition of reflecting on design education, its relationship to art and the respective roles of theory and practice. George Nelson, for example reports in his book *Problems of Design* published in 1957 on *Art X = The Georgia Experiment* and adds the following subtitle: 'The account of a tremendous personal involvement in a very large problem. The proposal – tooled education – was violently resisted by the educators exposed to it. But it is happening anyway.'

Nelson's approach was based on experiments and open problems and is in line with the efforts made by the Black Mountain College, an attempt to re-envision college education in the US that started in 1933 and sought to bring to life John Dewey's principles of progressive education: "The founders of the college believed that the study and practice of art were indispensable aspects of a student's general liberal arts education." It was deeply driven by Dewey's understanding of art and experience as well as based on his understanding of inquiry.

I find it curious that neither of these attempts seem to have had much traction, though more recently, there seems to be a willingness to re-engage. And yet, to me the conversations we are continuing to have make me feel that a) we are cycling in yoghurt which means we are not getting anywhere or b) that we are obsessed to reinvent the wheel while failing to recognize or work with what is already there. Both have the not-so-nice effect of activism without substantive or sustainable outcomes. Taking this into account, the answer to the question is not much is shifting or changing in design education. Perhaps this is because we continue to re-design design schools from the inside out instead of the other way around. As one of my colleagues stated recently: "I am so tired of design research to criticize developments in society without offering a real path forward." Indeed, it is easier to express discontent and dissatisfaction with the way 'others' are coping with design. It is much harder to leave one's own place of comfort and to engage in high level design conversation, as for example, Richard McKeon does in 'Communication, Truth and Society' (1957/1990). This paper encapsulates the essence of every design undertaking – regardless if by a trained designer like Dieter Rams, Charles and Ray Eames, or George Nelson or by one of the perhaps less trained silent designers brought to light by Peter Gorb and Angela Dumas (1987). For each, the three core design tasks include 1) the discovery of ambiguities 2) the invention of possibilities and 3) the expression of (new) values.

My second answer is: everything is changing as everyone designs (Manzini 2015). We see new design educators; we see new design education programmes and we see new design professions emerging. The development we witness as researchers underline what Richard Buchan's observation (1995, p.3): "The direction of design is not entirely in the hands of

designers, no matter how much we cling to the old mythic idea of the designer as a heroic cultural figure leading the avantgarde." The Danish Design Centre – not a design school! – for example, has just started a design education programme in collaboration with a Canadian university's School for Public Policy. NESTA UK (not a design school) has been offering design skilling for several years and its spin-off states-of-change (not a design school) draws heavily on the methods and processes of design thinking, service design, user-centred design and human-centred design. Much of my research involves working with policy-makers, policy implementers and students in policy studies who see a role for design in government. Today, most government agencies (and businesses) host some kind of innovation lab informed by if not based on human-centred design. A rarity even ten years ago it is now the norm. This indicates a significant shift in understanding of design beyond consumer goods, industrial production and the 'creative economy'. The shift for design education is that design education is happening more and more outside design schools.

It also means that design education has to come to terms with the need for different kinds of design experts. People, for example, for whom a product might be a policy, even an organization. People, who can link the human experience and human interaction on a product and service level and connect it with strategic, organizational or policy related questions. People who have the courage to dive into this complexity rather than be overwhelmed by it.

MA: In the past few years, I spent a lot of time trying to understand how design schools might take back the lead in design education (Eckert, 2020). Amongst many studies on the future of jobs (World Economic Forum, 2016, 2019), or the creative economies (Weckerle et al., 2016), I also came across two interesting statements from the industry. The first one is made by Kate Aronowitz, partner at Google Ventures, who states that designers, who get the opportunity to have "a seat at the table" (Aronowitz 2018), often are falling short when taking these leadership roles. According to Aronowitz these design leaders "are paying too much attention to the 'design' part of the role and not enough to 'leadership'" (ibid.). The second statement is an observation that was made by IBM's design director Karel Vredenburg's in his Keynote at Valencia Design Education Forum 2020: an internal study at IBM pointed out that 38% of their hired designers were missing formal education in multidisciplinary collaboration (Vredenburg, 2020).

Both examples show that there is a shortfall in design education when it comes to leadership and collaboration — and that's probably one reason why many other players are taking over when it comes to teach design from this point of view: a study at Lucerne University of Applied Sciences and Arts has shown that out of 123 listed programmes using keywords such as Design Management, Design Thinking, Design & Innovation or Strategic Design over 30% are being offered at non-design departments or schools. So, the question whether design schools really are about to lose the lead in design education is an obsolete one. The question that remains, instead, is whether and how to gain that lead back?

Personally, I see two scenarios with regards to this question: in the first rather dystopic one design schools fail at leaving their disciplinary and author-driven approach behind. At the same time, they keep on concentrating on first and second order design. Consequently, the design domain loses its relevance in the context of complex problem solving and what might remain of design in other sectors is part of its human-centred approach and (visual) way to translate observations into (design) opportunities by imagining the future. The great success of design schools in this first scenario might occur, once our society passes the zenith of work as an existential part of our lives—then, the return to arts and crafts might become part of an upcoming sense-making-quest amongst people.

In the second scenario instead, design schools really start taking change seriously and realise that complex problem solving requires a post-disciplinary shift towards issue-based or theme-oriented learning. This scenario requires a decided step back from author-driven design that is focusing exclusively on aesthetics and design language by creating a bubble of self-references. At the same time, design schools need to build up competences enabling learners to extend their vocabulary to a conversation beyond the design domain as well as competences in leadership to lead that conversation. This scenario scrutinises the way we keep teaching and learning design and requires the acquisition of a new mindset of the designer to adjust design education. The acquisition of such a new mindset will require a lot of un-learning.

Many of the MA students I got to know in Lucerne joined the programme after graduating from rather traditional BA programmes in design—some of them exclusively based upon studio work and nothing else. For them, being confronted with courses in methodology, leadership, ethics or research, came with a lot of pain. Mainly, this pain was caused by the discovery that they could not succeed anymore by just delivering beautiful designs. Instead, they needed to articulate their design process and argue their decisions. I believe, this conflict is emblematic for the design domain and for design education: the fact that we need to unlearn some of the things we still regard as core for design education. And un-learning really means to „step outside the mental model in order to choose a different one" (Bonchek 2016).

3. Is today's VUCA-world less VUCA than a century ago?

BA: A century ago we had two devastating wars in Europe. Wars are by nature volatile. Today we also have wars, but in other parts of the world, so perhaps some people are less aware of them. A new pressure today added to war times is the sustainability crisis: the burning of the Amazon, extreme heat waves, drought, floods and devastating hurricanes add pressure to the social, urban, and economic current demands.

The present situation is uncertain because the size, magnitude and demands of the sustainability crisis are not clear to define, and strategies to tackle the crisis require constant adaptation.

The sustainability crisis is complex because it affects all of us in different ways: from health, to access to resources such as food, drinkable water and clean air; the cities and spaces where we live; inequalities; access to affordable and clean energy; and other human needs.

Current reality is also ambiguous because things change rapidly. However, this was also present a century ago. The challenge for most designers leading without authority (Heifetz, Heifetz, Grashow, & Linsky, 2009) in the context of the sustainability crisis, is that technical knowledge is no longer sufficient, we must accept that our current knowledge is inadequate, and must relearn.

Perhaps, other than the speed of change, what is different is that *we know* we are not doing our best. As Otto Scharmer (2018) explained "In essence, we are collectively creating results that (almost) nobody wants. These results include the loss of nature, the loss of society, and the loss of Self" (p. 5). Once we know, we need to intervene. But this intervention must be imagined, conceived and thought from a diverse perspective and set of values. "Humans values can change; they are not natural laws. …The critical issue is not technology, but ethics and politics" (Capra & Luisi, 2014, p.389). Intention, attention, sensing, listening, relating and connecting will help us in this process. Regarding our connections and relations to others and the environment, Michaels (2011) explained "in the larger community, your relationships with people were based on values like respect, love, and a willingness to put others first – all of which kept your more self-oriented tendencies in check" (p. 35). Today, in the context of the VUCA world and because of the VUCA nature among other things, we work more and more, putting our relationship with colleagues, family, friends and ourselves in a secondary position. But also, the nature of our relationships at work needs to be reconsidered. Edgar and Peter Schein (2013) proposed four different types of relationship levels: Level Minus 1 is "domination" like a guard with a prisoner, level 1 is "transactions" like a bank customer and a teller, level 2 is "personization" like the one in connected groups and teams, and level 3 is "intimacy" like the ones in families and high-performing teams. VUCA times require level 2 relations, require us to connect, to share, to come together and put equity at the centre. Fostering "personization" relations in our teaching teams, in our schools and with our students should be a priority if we want to evolve design education.

MA: If we consider the situation Water Gropius found himself in when he founded the Bauhaus—just at the beginning of Germany's first parliamentary democracy, the Weimar Republic—or the Ulm School that started off in post-war Germany, I'd say that people were just as uncertain about the future, as we are now. Just recently, it happened to me, to re-read Gropius' Bauhaus Manifesto and compare it to the speech former director of the Ulm School, Tomás Maldonado, held in 2003 at the occasion of the 50th anniversary of the Ulm School. Besides all the arguments between former Bauhaus students and the group around Maldonado and Aicher at the Ulm School: I see some similarity between Gropius' Manifesto from 1919 and Maldonado's speech eighty-four years later. In his Bauhaus Manifesto Gropius criticises the barrier that has been risen between craftsmen and artists and argues

that all professions—"architects, sculptors, painters, (we all) must return to the crafts!" (Gropius, 1919) to pursue the "ultimate goal" (Gropius, 1919) of the art of building. In his Ulm speech, Tomás Maldonado makes a similar call: he lays out his observation that many designations for professions (e.g., architect, engineer, fashion-designer, …) are being used in a very inflationary way (something that hasn't changed since then). He, therefore, reminds us to use the terms "with more austerity and differentiation" (Maldonado, 2003) and proposes the term *Entwerfer*—a German alternative to the terms Designer and Gestalter.

While Designer mostly refers to the discipline of design and Gestalter still refers to theories and practices such as the Gestalttheorie or the Gute Form, *Entwerfer* is a term that leaves apart discipline and belief by shifting the focus towards the active change of something by the means of the (design) project. In the context of the VUCA world it appears remarkable to me that both Gropius and Maldonado recognise that certain situations do not require disciplinary or ideologically loaded approaches but, instead, a call for collaboration. And I believe we find ourselves, again, in such a historic moment that calls out for collaboration. Not for nothing the president of the European Commision, Ursula von der Leyen just came up with the proposal of creating a "New European Bauhaus" that is meant to tackle the challenges of the digital shift and the green transformation together as artists, designers, engineers and the society.

Research: I agree with MA's response here – and have written as much (Junginger 2017a). In my mind, both the Weimar Republic in the 1920's and later the social unrest in the 1960's represent moments in time where people collectively recognized opportunities and consequences of systemic level changes related to society, economy, technology and environment. Finding themselves in a VUCA world, i.e. in a world full of volatilities, uncertainties, complexities and ambiguities, they turned to experiments to break free from what was then established and traditional. We live in a time where we have to decide again how we – and our next generations – want to live. We are now called on reflecting what a world it is we want to live and how we want to go about making this desirable world a reality. This, in essence, is a design challenge. It is also a revealing testament to design: design never leaves society or exits human life. It simply goes unnoticed when things seem settled. In these settled times, design education concentrates on little things along the first, second, perhaps the third order of design in Buchanan' Four Orders. It appears that when we find ourselves collectively struggling in key areas, ranging from business to politics, from government to civil society that it is that we reflect on our own design approaches that have gotten us there in the first place and that we are searching for new approaches to get us out of this trouble. Right now, we are in such a time where it is clear that how we go about designing is either fostering change and transformation or manifesting increasingly questionable norms, values and beliefs. It is what we do in this paper: we are reflecting on how we go about designing curricula to arrive at responsible designers who are capable of engaging and addressing these challenges creatively and productively.

4. What could be a common goal for design education to strive for?

MA: For me the question here could be specified into: How might design education move from a disciplinary approach towards a post-disciplinary one—and should it? First: I am convinced, it should! Like my comment on our previous question, it is not the first time in history, that a fragmented and disciplinary design perspective is meeting problems of increasing complexity—and it's not the first time, design education needs to adopt to this change. When in 2016, I set out to re-think the MA curriculum in design at Lucerne University of Applied Sciences and Arts, one term became increasingly important to me and my team—undisciplinarity. We had just examined the Swiss Creative Economy Report published by Weckerle et al. (2016), whose one key finding was that more and more designers are starting to work in non-design contexts, Weckerle et al. called them "Embedded Designers" (ibid.). This phenomenon caught my attention and together with our team, we tried to verify, whether it was true, what the report was saying. While most interviews with practitioners or representants of the Swiss design community were confirming the fact, one group that we reached out to, kept stating just the opposite: our alumni. Consequently, we concluded that there is an ongoing shift in design practice that has been neglected by our educational programme(s) for some time—which might be the reason why most of our alumni would still stick to rather traditional occupations in design.

Three years before we started our own research on disciplinary vs. post-disciplinary approaches in design education, Craig Bremner and Paul Rodgers published their paper „Design without Disciplines" (Bremner & Rodgers, 2013) and examined "the rupturing ad blurring of the design Disciplines" (ibid.). In their paper, they also pick-up Marshall and Bleecker's concept of "Undisciplinarity" (Marshall & Bleecker, 2010; Bremner & Rodgers, 2013) where according to learning expert Stephen Heppell "design practice shifts from being 'discipline-based' to 'issue- or project-based'" (Heppell, 2006). Furthermore, they relate to Nicholas Bourriaud's „Altermodernity Manifesto" (Bourriaud, 2009) by arguing for an "Alterplinarity" (Rodgers & Bremner, 2011) or "Alterdisciplinarity" (Bremner & Rodgers, 2013), which in a globalising context requires "an ability to make connections that generate new methods to identify 'other' dimensions of design activity and thought" (Bremner & Rodgers, 2013, p. 12). These studies and concepts gave a fundamental input to the development of our MA curriculum, at the time, and resulted in an increasing number of students that would approach MA projects from an undisciplinary point of view by combining their own discipline with knowledge from social sciences, economy, computer sciences or ethics. But most importantly our students started changing their mental model from the rather traditional image of designers as problem-solvers towards problem-identifiers (Frascara, 2002; Eckert & Mason, 2010). And what seems like an "easy thing to do" really came with a lot of challenges that we tried to support by offering new courses in "Issue Mapping", problem-framing, or conversation and negotiation training. So, to answer the question of which could be a common goal for design education, I believe it mainly is to

train young people to being able to understand and analyse complex problems from different angles and acquire a vocabulary to reach out to other people they need to work with to rearticulate the problems in a systemic way.

Research: To me, enhancing human living as John Dewey (1948) envisioned it provides a common goal to strive for. On the way, we have to figure out how to weave social, economic, governmental and research needs and responsibilities together. This is underlined by the OECD Quadruple Helix for Social Innovation.[1] The Quadruple Helix points to the need for design generalists – people who can grasp the overall design issues and approaches to bring in these different areas of expertise into a coherent and consistent design effort. In his recent book *Range*: *Why Generalists triumph in a specialized world*, David Epstein (2019) makes a similar argument. We have focused for a long time on creating design specialists who are either product designers or graphic designers, or the like. We have not been very good at establishing the common, general contribution of design by way of identifying and communicating the very aspects, skills and knowledge. We shy away from engaging with the characteristics of design across different domains and problems. Yet, being able to do so appears to me as one of the key strengths of design and is – in my own experience – highly relevant to today's world and its problems.

This is not to say that we should do away with design specialists. Design specialists are really good at minute details important for a specific design task. We need them. But long before we can focus on the minutia of a specific design task, we need to grasp the meta level of that design and for that we need people with different design skills, experiences and insights. The SDGs are a perfect example for how specialist knowledge and skills fail us when we are looking to systemic changes. For every one of the 17 boxes of the SDGs, we can point to stellar scholars and experts in the field. But on their own these experts have not been able to effect the systemic changes, the shifts in mindsets, the changes in rules and regulations needed to achieve the kind of transformation and change needed for climate action, poverty reduction, equal access or strong institutions and peace. For that, we need a systemic design approach. Every single box of the SDG is a desperate call for new approaches to design thinking, new methods for design, new processes for design, all of which challenge us to revisit our current design principles and approaches across all domains (not only the design schools!). In my view, design education has a role in clarifying distinct design approaches, assess their strengths and weaknesses especially in a specific context, exploit their possibilities and grasp their limitations. To get there, we have to challenge our own design thinking culture. We must be capable of providing a solid foundation and a solid understanding of design per se, or we will only send out one-trick designers. In a VUCA world, this is a disservice to the students, to the field and to society.

BA: The common goal of design education should be to achieve high-quality, understood as excellence. Quality means different things in diverse contexts, and it also requires diverse thing to be achieved. An editorial of a special issue on design education published by *She Ji:*

The Journal of Design, Economics, and Innovation (Noël, 2020) outlines 10 suggestions design instructors could adopt to ensure high quality design education. Below you find a summary of five of these suggestions:

1. *Train & Educate: Moving beyond Know-How*. Help students not only to find jobs, but to thrive as designers. Foster in students the need to engage in a constant learning path.
2. *Create a Context for Inquiry: From Objects to Problems.* Use problems to exercise inquiry, exploration, and the seeking of understanding. For example, how to help agricultural communities in Argentina shift from chemical to organic farming?
3. *Change the Conceptual Network: Identifying the Problems' Components*. Let students research and define problems. Let them identify the problem ecosystem and its connections.
4. *Broaden the Scope: From Designing Solutions to Implementing Change.* Include implementation as part of the learning exercise. Implementation is a complex process with multiple stakeholders, goals, interests and many other variables coming into play.
5. *Figure out the Subdisciplines: What Are We Educating for?* Identify what kind of problems students graduating from your school will be dealing with. Which are the different skills and competencies necessary to deal with these problems?

Achieving quality requires however, more than the good disposition of a teacher, and the adoption of the above suggestions. It requires the adoption of new models, both educational and financial. It requires to re-examine our beliefs and assumptions: why to design, how to design, for whom to design, with whom to design, what to design. Why is design or relevance to society today? Why should young people engage in studying design? What value do we bring to society, organizations, and our natural ecosystem? Perhaps being more humble could help us to move forward and achieve high-quality design education. Perhaps the first assumption to question is that we help to tackle complex sociotechnical problems: Are we really doing it? And if so then, why do we struggle so much when trying to change design education?

5. What is a "successful" design career, today?

MA: When I think of current design graduates, I hope they will look for jobs in some other field than design. And I don't mean this for economic reasons (even if still many jobs in design are underpaid), but if we compare Maldonado's above observations to the latest „Jobs of the Future report" (World Economic Forum, 2019) it becomes clear that there is no such thing as a design career—or at least there shouldn't. First: some of today's problems have been supported or even created by designers for the past decades of industrial design

dedicated to mass-production or visual communication to marketing—and here I'm referring to Papanek's critique on the design profession, back in the 70ies (Papanek, 1971).

Second: in my eyes the shift from designers focusing on the design domain towards „Embedded Designers" (Weckerle et al., 2016) who engage in other fields than design, supports both Gropius' and Maldonado's vision of pursuing common goals instead of raising arrogant barriers between disciplines (comp. Gropius, 1919, Maldonado, 2003). A development that I consider as highly positive with regards to the complexity of the problems humanity needs to tackle (e.g. the United Nations SDGs).

And third: design as we know it is going to disappear! It might be the last decade that—let's say—a graphic designer will get along without knowing to code or dealing with systems fuelled by artificial intelligence; or the last one that a product service system designer gets away without some skills in data science to gather and evaluate the right data for his or her design decisions. And even more importantly: the last one in which all designers get along without embracing social and environmental sciences to really understand the people and their environment that we are dealing with. In other words: our current way of thinking and educating design will and needs to change drastically. And first and foremost, we need to identify the right allies (such as e.g. other disciplines) to team up with.

BA: I understand the context that originated this question, as instructors and heads of programs we are asked to prepare students for a successful design career. However, what makes a successful design career might have different answers. Today, design and design education practices can vary widely. Not all designers understand design in the same way, and practices that are out of date are still implemented. What is a successful design career might also depend on individual aims. What makes a design career useful, valuable, pleasant, rewarding and liveable depends on each of us. Arthur, Hall and Lawrence (1989), defined career "as the evolving sequence of a person's work experiences over time" (p. 8).

Despite the different understanding of design and its subdisciplines, hopefully all designers agree that a successful career is achieved when we create possibilities to foster better realities. But which realities are we educating students to address? What does "better" mean? What level of complexity students should be able to address? And how much understanding of other disciplines should they have to engage with multidisciplinary teams to achieve the desired change?

Design education's final goal is to provide society with responsible, knowledgeable, skilled, experienced, informed and ethical professionals that can help people achieve goals. Lifelong learners that are also prepared to update relevant knowledge to their daily practice.

Seibert and Kraimer (as cited in Ng, Sorensen, and Feldman, 2015) defined career success "as the accumulated positive work and psychological outcomes resulting from one's work experiences" (p. 368). Hopefully a successful design career is one where designers not only get the work done in a productive and thoughtful manner, but also have the commitment to push beyond the familiar. Designers that can shift paradigms. Trailblazers.

Careers are also affected by organizations, and employees affect organizational success. We must make organizations aware, and validate the need for designers with degrees to evolve current organizational practices. We must advocate to change the perceive value of design, so that organizations will create new employment possibilities for the future Trailblazers.

Research: A successful design career today can take many forms and this insight should drive any curriculum design. Again, I find it helpful to lean on the Four Orders of Design by Buchanan in this question. There are still career opportunities within every order and in any of the variations of the individual fields of the matrix. I personally believe that the design professions in the first and second orders (i.e. graphic design and product design) are prone to being taken over by artificial intelligence at some point in the future. The principles underlying these foci involve many elements that can be fed into a logarithm: experimentation with material forms, tactile and cognitive aspects, colour, etc. Some of this may lead to inferior products, some of these may lead to superior results. Humans may experience satisfaction and joy in creating these outputs and feel good about creating them. Increasingly, this might become a luxurious self-indulgent activity. I would not be surprised if artificial intelligence might achieve similar or even better outcomes. Already, tools that used to be available only to design experts in the first and second order are now readily available to nearly every child in primary school. It is still useful and relevant to know about the core principles of design and any design education worth its name will include basic education on these. The question is: where should we put our brain power – or perhaps, what is our brain power? In a VUCA world and in a world struggling with matters of sustainability, design careers that focus on just one aspect of design may seem out of date sooner than later. Currently, new areas of practice and research are opening up in the public sector – from opportunities in design education to service design, positions are opening for design facilitators on policy design, for example on the EU level in the context of the New Green Deal and the New European Bauhaus. Just recently, another colleague of mine wondered if we should not focus more on future design careers and less on design education when we work with our students. I think there is something to it.

A conversation that needs to be continued?

We engage in this conversation to learn from each other and to see where we are in the shifting tectonics of design education. We are aware that design is shifting, and similar discussion are being held by diverse schools, groups and associations. There are several topics that have emerged in the process: the need to shift from crafts to an evidence-based discipline; the need to re-examine contents, contexts and methods in the teaching of design; the need to focus more on human interactions; and the need for interdisciplinarity in the context of post-disciplinary and problem-based Design Education. We have raised more questions than we found answers for. We would therefore like to engage with the Cumulus and other design education communities to reflect about these questions. Underlying our quest is the provocation, if design schools still are the places where design education

happens for the VUCA world and for the SDGs. Should they even be? Again, we explicitly pose this as a provocation to stimulate debate and to engage with the pluralism that marks the Cumulus community.

Despite our different entries into design that include experiences in the medical field, the public sector, and crossing from universities to schools of fine arts, the three of us find common ground on some issues.

We seem to agree that today's world is not any less VUCA than at the times of the Bauhaus or the Ulm School. In fact, the European Commision's "New European Bauhaus Initiative" proves that, once again in history places of collective complex problem solving are needed to engage with this world. One similarity is that in uncertain times design's capacity of dealing with the unknown becomes more important for both society and the economy. At the same time, we observe a shortfall in design education when it comes to build up competences to address complex realities. This also means that each one of us finds it necessary to re-engage in the developments and directions of design education.

We detect in the current shift in design education different scenarios that concern all of us: Traditional schools of design and art risk to become obsolete, if they don't adapt and expand the knowledge repertoire needed today. At the same time, multiple players in design education have emerged to fill these voids. These include non-design schools but also new design schools that explicitly focus on methods and issues not covered in traditional design schools. This has led to a certain pluralism in design education, but also to confusion, misunderstandings and even conflict. Dealing with these aspects is one of the tasks design education must tackle. Design research here has a role but for this voice to be heard, we need to strengthen design education in such a way as to promote such design research.

We also consider Theme-based Education and lifelong learning as topics with increasing demand—not only in design education but with regards to the entire educational system. At this point, design education must search for ways to engage with these topics. Mainly this means that as schools of art and design we must engage even more with other disciplines, as well as with other players in education. Design as a discipline and profession remains one of the few who do not regularly offer executive level courses to update design professionals in skills and trends in the field. Design simply assumes that practitioners are able to learn on the job. But beginning with the rise of service design, it became clear that training on the job and in the field fails many professionals.

The gap between the different educational levels has to be closed through new forms of teaching that involve research and big picture design seminars in BA and MA education. Furthermore, the confusing isolation of research from teaching needs to be overcome. Students ought to be introduced to as many possible design careers as possible. Research is one of them.

We have to engage with a variety of new fields, both from a theoretical point to be able to involve education around human behaviour, ecological matters and technological

developments – but also from a practical perspective, to grasp the realities of design contexts we are still less familiar with, such as organizations.

In the context of the design culture (of) thinking, we find that each of these points offers and needs space for further discussion in the CUMULUS community and beyond. Therefore, we would welcome the opportunity to widen our small 'in-house' discussion and reflect whether and which contribution the CUMULUS working groups could/should elaborate on with regards to these pressing questions of design education.

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Rethinking Design through Literature

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Abstract | Where design projects possibilities, literature activates their potential. This is evident in an unstudied genre of novels, poems, and essays, which give voice to objects and spaces and the force fields that bind and break them. These narratives offer a way of thinking about design that doesn't segregate the instrumental and the theoretical. Instead, such works synthesize the quotidian and the poetic yielding a wider tributary in the thought of things and places. In this paper, the spheres of design's multifarious entanglements will be examined within the temporalities of design itself. The effects of design and designing will be considered within three broad understandings of time: as deep, as immediate, as yet-to-be. Needless to say, these temporalities are as artificial the systems we have contrived to measure time. Moreover, these three frameworks are porous. This paper offers a new methodological contribution to design studies drawing on semiotic and textual analysis. It is meant to be viewed as much as a literary exercise as the source material that informs it.

KEYWORDS | DESIGN, LITERATURE, EFFECTS, MAKING, THINKING, PROPOSITIONS

1. The Value of Literature to Design

Design, in its ubiquity, invites taxonomies. This paper presumes to offer another. It considers design through the lens of time. It doesn't discount other factors such as culture, politics, and technology. Rather it offers a different methodology through which to approach the multivalent nature of design. For example, a phone can be understood as a technological extension of the senses, and it can also be understood to have the properties and values of temporal immediacy. Literature is especially useful in amplifying one or more of these characteristics. Here I deploy it as a relatively unexplored method of design research, drawing on excerpts from novels, essays, and poems whose protagonists are things and places. In keeping with design studies pursuit of theory (here, literature) *through* practice, the paper will be punctuated with works of contemporary design as a double reading of the matter at hand.

My overarching ambition is to open up an understanding of design, not as a professional endeavour, but as the configuration of things and places that set up conditions for alternate plot lines in daily life. Literature offers a rich compendium of scenarios in which those things and places act. The fact that those things (objects, systems, communications) and places (streets, rooms, cities, buildings) are rarely, if ever, described as 'design' in literature is especially germane to the ambition of this project. Namely, to locate design in between the particular characteristics of objects, places, and spaces and the larger ideas they enact.

This synthesis of the specific and the poetic is evident Ivo Andrić's novel *The Bridge on the Drina*, when he describes both the physical and the social character of the bridge of the book's title:

> "A man was then as if in a magic swing; he swung over the earth and the waters and flew in the skies, yet was firmly and surely linked with the town and his own white house there on the bank with its plum orchard about it." (Andrić, 1977, p.14-5)

Yet it is always only *this* historic bridge[1] that encourages cultural cosmopolitanism with its *kapia* – the swelling in the middle of its span with a *sofa* where people of different persuasions have met and talked for centuries. The bridge exists both in time and out of time. We see the same dynamic at work in the contemporary bridge, (below) in Sarajevo. Its vertical '*kapia',* with a bench inside its loop, invites both a pause in an otherwise linear span and an interruption of linear time.

[1] The plot of Andric's novel The Bridge on the Drina centers on an actual bridge in Bosnia designed by the Turkish architect Mimar Sinan, perhaps best known as the designer of the Süleymaniye Mosque in Istanbul.

Andric and authors like him thus amplify design by repositioning it in the space-time of language. In short, they show us the nature and ramifications of things and places that we've lost sight of simply because we see them all the time (-, 2019, p.107).



Figure 1. Festina Lente, Adnan Alagić, Bojan Kanlić, and Amila Hrustić, 2007–2012.

Drawing on literature for such insights demands what literary critic George Steiner calls "a politics of the primary" (Steiner, 1989, p.30). It requires openness to an author's way of presenting a work (and implicitly a world view), and abstention from critique until the work is fully ingested, not merely digested. Steiner argues for a performative criticism, which, in this context, entails focusing intently on an author's words for their own qualities instead relying on secondary and tertiary exegeses.

Steiner's commitment to a close reading of an author's words, however criticized in literary circles as deaf to divergent readings, is striking for its parallels with that of close observation. One of the challenges of design education is creating conditions in which students can lift the veil of preconception. (As happens, when, for example, a presumption about the needs of refugees, or other populations, occludes more appropriate design responses.) Of course, close reading and close observation do not eliminate bias on the part of designers, nor is it a guarantee of how design will be received and changed by choice or accident. But close reading and close observation do offer opportunities to think design differently. This, in and of itself, takes time – something the economies that support design rarely permit.

2. Three temporalities of design

Design's relation to time has been discussed in terms of patina and the social value it confers (Appadurai, 1997); as a matter of durability and environmental sustainability (Verbeek, 2005); and in terms of the simultaneous realms of the digital as it affects spatial design (Barbara, 2014). What this paper seeks to add to this highly abbreviated list of perspectives is a study of how the perception and experience of time is designed in and by artifactual narratives made visceral by literature.

The texts and projects that I will discuss deal with the dialectic between subjective and objective time. With the selection of excerpts that follows, I hope to draw out insights into how design alters temporality in different circumstances, provoking reevaluations of our relationships to human and non-human actors. By creating ruptures in the present – either by animating aspects of the past or projecting futures – design and literature lift us out of the everyday, and, if only momentarily, shift our positions in time and space, enabling us to question the world as we find it.

2.1 Deep time

How is it possible that design can make the past present? Self-conscious attempts like official memorials, grave markers, and commemorative plaques tend to have the opposite effect. In explaining what happened and when, they frame the past and pre-determine our relationship to it. Arguably, it is those unadulterated things and places - once designed – that transmit the deepest sense of time-in-the-past. Admittedly, designers cannot fashion a temporal experience because they can't access the states of mind of everyone who might come across their work. Nonetheless, associative triggers lie dormant in the configurations, contexts, and materiality of the myriad things and places we encounter – some more than others, depending on their notoriety.

W.G. Sebald explores this phenomenological dimension of design in his 2001 novel *Austerlitz*. In it, he takes his reader on a journey in which temporalities collide in train stations, villages, and fortresses. The protagonist, the eponymous Jacques Austerlitz, is an architectural historian, who sets off in 1967 to discover the fate of his Jewish parents and in doing so to understand his own history and recurring sensations he's never fully understood. Sebald's is an essay in the uncanny, which appropriately in German means *das Unheimliche*: unhomely or unsettled (Vidler, 1992, p.7). In fact, the protagonist's origin story begins with his removal from his home in Prague: at the age of four he had boarded one of the *kindertransport* that rescued Jewish children from Nazi German-controlled territories. As the story proceeds, Austerlitz discovers that his mother was taken to a concentration camp in the Czech town of Terezn, formerly and infamously Theresienstadt in German. Even and perhaps especially now, he finds it disquieting.

> "He notes there are only two shops, one of which, strangely enough, given the town's history, is an antique store… In the muteness of the shuttered village that

> turns a blind eye to his gaze, we sense, with Austerlitz, the politics of denial, a perceptible aesthetic of denial." (Sebald, 2001, p.12).

Austerlitz muses that his mother and the other 60,000 prisoners "had never been taken away after all but were still living crammed into those buildings and basements and attics" (Sebald, 2001, p.189). In some sense they are; after all, the world is composed of matter in various stages of decay and traces of human DNA might still be found there. But with Sebald, this is less about the bio-chemical than it is about the psychological character of the town. It projects an aura of the uncanny that is classically associated with temporalities of loss and transition (-, 2019, p.107).

For Austerlitz, the cumulative effects of encountering the now deserted town, its Ghetto Museum, and photographs of the charade of bucolic camp life is profoundly disorienting. With regard to the latter - in fact and in Sebald's fiction - a particularly insidious distortion of reality took place at Theresienstadt in 1944, when the Nazis converted it into a picturesque Potemkin village to deceive Red Cross inspectors. Through Austerlitz's confrontations with jarring evidence of evil's effects – effects which are embalmed in the physical fabric of present-day Terezin – Sebald gives us to understand that space is designed as much by time and narrative as it is by its material presence.

This fusion of past and present also happens outside the pages of the novel, as when an ordinary street sign morphs into memorial, as it does with Stih and Schnock's project in Berlin (below) in which constructs of past and present coincide. Dispersed and sporadically encountered throughout the city, the signs echo the way the Nazis used time to dilute the impact of the Jewish laws, staging them over months and years to obscure the extent of their program of dehumanization.



Figure 2. "Jews in Berlin may only buy food between four and five o'clock in the afternoon," Places of Remembrance, Renata Stih, Frieder Schnock, 1993.

Likewise, James Fenton's poem "A German Requiem," positions objects meant for one temporality into another. In the midst of chaos and destruction in postwar Berlin, care is still taken to design a response to death. As the poet writes:

> "But when so many had died, so many and at such speed, there were no cities waiting for the victims. They unscrewed the name-plates from the shattered doorways And carried them away with the coffins. So the squares and parks were filled with the eloquence of young cemeteries: The smell of fresh earth, the improvised crosses And all the impossible directions in brass and enamel." (Fenton, 2009, p.15)

The brass and enamel name-plates meant to welcome the dead home in some near or distant future now mark their permanent dislocation. "One imagines that it would take small acts of patience to unscrew them from their 'shattered doors' and affix them to coffins. Here, the expedience of wartime burial is tempered by improvised displays of tenderness" (Yelavich, 2019, p. 15). Informally but no less profoundly, design offers a modest bridge between two states of being. The most radical temporal split is momentarily assuaged by inert pieces of metal, synonymous with life in death.

*

Unnerving distortions of time and space are not confined to the heterotopic spaces of criminality or war. They can also infiltrate normative situations, as they do in Raymond Carver's short story "Why Don't You Dance?" In it, a man stages a yard sale of the contents of his home. The bedroom's furnishings are laid out on the front lawn exactly as they were in the bedroom.

> "The mattress was stripped and the candy-striped sheets lay beside two pillows on the chiffonier. Except for that, things looked much the way they had in the bedroom – nightstand and reading lamp on his side of the bed, nightstand and reading lamp on her side. His side, her side." (Carver, 1989, p.3)

What didn't fit on the lawn was staged in the driveway. Even the appliances were hooked up.

> "Except for the three cartons in the living room, all the stuff was out of the house. He had run an extension cord on out there and everything was connected. Things worked, no different from how it was when they were inside." (Carver, 1989, p.9)

We are never told if the sale was prompted by divorce or death, but it's clear that it is the man of the house who's arranged the tableaus. There is no girlfriend or wife in sight, though a couple shows up and meanders through this strange domestic simulation. The man invites the couple to drink with him; the boy passes out and the girl agrees to dance to one of the man's records. Before they leave, he tells her that he hopes she'll like the bed.

> "Later, the she talks about it with anyone who will listen, trying to understand what she felt surrounded by things that felt depleted yet still emanating something of their past. Something was transferred in the dance that cannot be dismissed." (Yelavich, 2019, p.216)

In Carver's prose we hear another echo of the uncanny: "the inhospitable context of [being in] the here-and-now at the same time as imagining a there-and-then" (Vidler, 1992, p.5). What else is a yard sale but the transference of goods and their pasts to someone else's future? Here the innocence of the transaction is compromised by time: the time to which the bed continues to bear witness, the time before it had to be sold.

2.2 Immediate Time

The second temporal perspective I want to discuss derives from the present-tense processes of thinking, making, and perceiving. While the work of design often includes long phases of research, the synthesis of that research into an outcome generally happens in a compressed time, one that often feels immediate. The psychologist Mihly Cskszentmihlyi describes this state of absorption (be it designing, writing, or conducting surgery) as one of "flow" (Csikszentmihalyi, 2014, p.67). The term is particularly useful here as it doesn't reduce time to a point but rather to the time-space we otherwise call "now." The precondition for entering that space is practice. Until then, time is choppy. Even the most experienced of hands can find that the process of mastering a new technique proceeds in fits and starts.

*

These are the circumstances in which we meet a potter named Cipriano Algor in Jose Saramago's 2002 novel *The Cave.* Algor has been making earthenware dishes his entire life and suddenly his wares are no longer in demand. The modern 'Center' - his main source of income - only wants wares made of plastic. Rather than give up his life's work, he decides to make a new ceramic product: figurines. However, making the miniature nurses, clowns, and other costumed characters proves exasperating. The clay doesn't cooperate. Saramago's omniscient narrator offers an explanation – one that demystifies what is otherwise called the design process – observing that:

> "Very few people are aware that in each of our fingers… there is a tiny brain. The fact is that the other organ which we call the brain, the one with which we came into the world…has only ever had very general, vague, diffuse and, above all, unimaginative ideas about what the hands and fingers should do.[…] The brain has never been curious enough to ask itself why the end result… bears so little resemblance to its instructions to the hands. Anything in the brain-in-our-head that appears to have an instinctive, magical, or supernatural quality – whatever that may mean – is taught to it by the small brains in our fingers. In order for the brain-in-our- head to know what a stone is, the fingers first have to touch it." (Saramago, 2002, p.67)

Like all designers, Saramago's potter draws on knowledge gleaned in two different time frames. His process involves both his past experience with kilns and clay and the unpredictable behavior of the medium in the present: he has to master slip casting. Algor gradually achieves proficiency he needs and production proceeds apace. The deep pleasure of mastery is his, until he must break the rhythm of the studio and present his work for sale. Once again, he is out of step with the market's tempo. The Center's buyers tell him the figurines are too precious and outdated. Mass production militates against the pleasures of 'flow,' raising the value of speed over the sensual temporality of intensely concentrated work.

*

Just as designing opens up a 'state of exception'[2] from time, so does love. In Orhan Pamuk's 2009 novel *The Museum of Innocence*, a young man's infatuation thrives in an atemporal oasis: the family home of Füsun, the woman he adores. Having missed the opportunity to marry her when she was free, the protagonist Kemal contents himself with visiting her at her parent's apartment in Istanbul under the guise of a distant cousin, which he does for eight long years. Every evening that he sits with Füsun and her parents the Keskins, he enters a romantic purgatory. In the process, he becomes closely attuned to the ways in which time is designed.

The most conventional mechanism, the wall clock, serves both a "reminder to the whole family of time's continuity, and to bear witness to the 'official' world outside" (Pamuk, 2009, p.283). Public and personal time also co-exist in other domestic technologies: wristwatches, radios, and televisions, the latter still a novelty in 1970s Turkey. To wit, every night at seven o'clock, when the news comes on, the Keskins synchronize their watches with the start of the national broadcast. As they do this, Kemal muses that they "felt the presence of the millions of other families, all doing likewise, and the throng that was the nation, and the power of what we called the state, and our own insignificance"(Pamuk, 2009, p.286). (Note the novel is set when Turkey was governed by Mustafa Kemal Atatürk, whose secular government set out to create a homogenized nation.) Here, Pamuk's protagonist is describing time-keeping as both a collective pledge of allegiance and an acknowledgement that:

> "It was not Time we remembered but other families, other people, and the clocks that regulated our business with them. It was for this reason that Füsun studied the clock on the television screen to check if she'd adjusted her watch "perfectly," and perhaps it was because I was looking at her with love that she

[2] The term 'state of exception' is a term associated with the philosopher Giorgio Agamben and usually refers to extreme political actions that dispense with the rule of law. Here it is used to refer to a condition that dispenses with the laws of the marketplace.

> smiled so happily – and not because she'd remembered Time." (Pamuk, 2009, p.287-8)

Love and the informal social bonds forged in daily life have nothing to with official "Time" – what Pamuk calls the "evil line" that reminds us of death. This is the line (and lines) to which design seems most partial in its visualizations. That said, Pamuk offers an exception to the rule in an anecdote about a watch owned by Füsun's father that "had two faces, one in Arabic numerals, and the other in Roman" (Pamuk, 2009, p.288). "Time" doesn't disappear here; it is still measured. But the Eastern and Western watch faces speak to the variable ways it is marked. (Pamuk also explores the power of objects to transcend time in his museum project in Istanbul.[3])

Perhaps the best that design can do is to complicate time, offering cues that our awareness of it is conditioned as much by emotion as its diurnal rhythms. That time is fungible is also apparent in Tibor Kalman's Askew clock, below. Like Pamuk's protagonist, Kalman recognizes that time is fungible, told by durations of pain and pleasure, of boredom and curiosity.



Figure 3. Askew Clock, Tibor Kalman, 1989.

2.3 Time as Yet-to-be

The temporality of the 'yet-to-be,' once thought of as an empty void, has become particularly congested today with the advent of speculative design and its offshoots. Such work is undertaken in large part in response to global warming and its attending social and environmental consequences that threaten to poison, if not entirely preclude, the future.

There is, however, another sense in which design can signal the future. It acts as the embodiment of hope in the face of everyday uncertainties. A poignant example is to be found in Wisława Szymborska's poem "Clothes." A woman has just seen her doctor, who tells her to check in with him again later, and that for now "it's not too bad" (Szymborska, 1997, p.137). The exam over:

> "it's time to tie, to fasten with shaking hands shoelaces, buckles, velcro, zippers, snaps, belts, buttons, cuff links, collars, neckties, clasps and to pull out of handbags, pockets, sleeves a crumpled, dotted, flowered, checkered scarf whose usefulness has suddenly been prolonged." (Szymborska, 1997, p.137)

Of all the objects and attending gestures involved in getting dressed, it is the scarf that matters most here. Unlike the mechanical and structural "zippers" and "sleeves," the explicitly "dotted, flowered, checkered" textile is clearly decorative. Was she looking to a future of hospital gowns, it is unlikely the poet would take such care in dressing or, more to the point, add the ornament of the scarf?

Where Szymborska uses cloth to signal that there will be a future worth dressing for, Bruno Schulz uses it to fabricate an alternative future – a counter-scenario to the one being pursued by Germany at the time. *The Street of Crocodiles*, published in 1934, is set in the small Polish town of Drogobych, now part of western Ukraine. In it, the narrator's father offers a "Treatise on Tailors' Dummies, Or, The Second Book of Genesis," claiming:

> "The Demiurge… has had no monopoly of creation, for creation is the privilege of all spirits. Matter has been given infinite fertility, in exhaustible vitality, and, at the same time, a seductive power of temptation which invites us to create as well." (Schulz, 1977, p.59)

To break that monopoly, he proposes to create a species of beings with deliberately limited capacities. There will be a different creature - each with only one limb - for every gesture. Moreover, the creatures won't be precious.

> "We shall give priority to trash. We are simply entranced and enchanted by the cheapness, shabbiness, and inferiority of material… We wish to create man a second time – in the shape and semblance of a tailor's dummy." (Schulz, 1977, p.62)

The tailor's dummy is an argument for an imperfect future – the opposite of a future uniformly populated by Aryans. The dummy is neither golem, nor superhero; it is not envisioned as a savior. Instead it is a rejection of all utopias. Schulz could have made his argument against purity without resorting to materiality (the stuff of design) or referencing the figure of the Demiurge (the designer). That he chose to do so suggests an understanding that the future is not abstract, that it is made. More than that, it is tailored.

Though he would have been no stranger to history of pogroms, it is unlikely that that Schulz could have anticipated the scope of Hitler's Final Solution. Nonetheless, there is prescience to the tale of the tailor's dummy. This is true not just in his affection for ungainly creatures (surrogates for the poor and disenfranchised) but also in his attention to the liveliness of the materials they are made of, writing:

> "Matter never makes jokes: it is always full of the tragically serious… Can you imagine the pain, the dull imprisoned suffering, hewn into the matter of that dummy which does not know why it must be what it is, why it must remain in that forcibly imposed form which is no more than a parody?" (Schulz, 1977, p.64)



Figure 4. Biodegradable bottles, Ari Jónsson, 2016.

In this Schulz anticipates the new materialism[4] almost a century before it entered the consciousness of design, an example of which we see below in biodegradable bottles designed by Ari Jónsson. Made from oceanic algae, they exhibit the kind of imperfection that Schulz's tailor wants to bring into being. Where Schulz was tacitly addressing the future of the Jewish people, Jónsson is speaking to the survival of all sentient beings whose futures are already compromised.

3. Conclusion

With Sebald, Carver, and Fenton, this paper has looked at time as latent in things. It has considered time experienced as an elastic present embedded in the act of designing with Saramago and in response to the design of time with Pamuk. With Szymborska and Schulz, it has also looked at design as aspirational and prefigurative. The careful reader will by now have concluded that these distinctions are a matter of perspective. However, even if it is the case that design is inherently multi-temporal, *experiencing* design as simultaneously retrospective, present, and propositional involves practice and risk. As Vladimir Nabokov warns:

> "A thin veneer of immediate reality is spread over natural and artificial matter, and whoever wishes to remain in the now, on the now, should please not break its tension film. Otherwise the inexperienced miracle-worker will find himself no longer walking on water but descending upright among the staring fish." (Nabokov, 1989 p.2)

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DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The chain reaction. How to design a process for transforming museums by rethinking the role of personnel

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Abstract | The museum system is changing. The change affects the approaches, methodologies and practices involved in all the museum's established functions: research, acquisition, conservation, communication and exhibition of man's cultural heritage and environment. In this renovation process, to which the adoption of digital technologies has made a significant contribution, the design practice becomes more central every day. The involvement of different types of audiences led to a significant disconnection between the museum and its operators. When not involved in the transformation process, the museum personnel remain estranged, isolated by a use of languages unfamiliar to them. In this context, can the activation of co-design processes lead operators to be triggers in the management of the museum renovation process? Based on the preceding assumptions, is it possible to design an adaptive process to enhance the contemporary museum?

KEYWORDS | MUSEUM TRANSFORMATION, INVOLVEMENT OF PERSONNEL, CO-DESIGN, DESIGN PROCESS, ADAPTIVE SYSTEM

1. Introduction

In their tangible and intangible heritage, museums preserve traces of history, collective memories, elements of material culture that contribute to defining cultural identity, locally, nationally and internationally. With education, study and enjoyment as their primary purposes, museums play an important role in promoting knowledge by sharing their documentation and collections; furthermore, they also encourage civic pride.

As a "Non-profit, permanent institution in the service of society and its development" (ICOM, 2017) the museum is strongly related to the historical geographical social and political context (Mairesse, 2018). For this reason, the significant socio-economic changes that occurred in the last twenty years led to important transformations in museum practices. Changes affect approaches, methodologies and practices in all the established functions of the museum: research, acquisition, conservation, communication and exhibition of man's cultural heritage and environment (Sandahl, 2019). In this process of renewal, design practices are becoming increasingly central (ICOFOM/UNESCO, 2018; Irace, Ciagà, Wolf & Trocchianesi, 2014; Maroević, 1998).

The exhibition project originally intended to study and define the relationship between architecture and museum collections by designing the environment to display the heritage taking into account both the layout of the objects and the configuration of the exposition. In this situation the architect received the description about the museum collections from the curator, who was responsible for the research on the subject.

The focus of the exhibition project, cantered on the relationship between space and collection, was later extended to the relationships between man, collection and space. The project – tailored to specific categories of visitors – involved curators and educators who worked together to define different profiled paths, based for example on the selection of languages, ages or on a particular disciplinary area of interest. Furthermore, the wish to allow the visitor more freedom, led the designer to provide a set of points of interest among which the visitor can move independently and modify his path in real time. The interaction between the visitors and the museum's collections becomes more direct: visitors can independently choose the objects to explore and how much time to spend on each artifact.

The visitor's involvement depends, of course, on her individual sensitivity and culture, but it also varies according to the way in which the objects are displayed and communicated. By interpreting the aims of the curators and by gathering all the information about the collection, the designer can emphasize one or more aspects of each piece, and define how visitors can interact with it, considering both the scientific and the emotional spheres. Each object on display represents in and of itself many different aspects: historical evidence, an example of a production process, a scientific discovery, a piece of memory and much more.

The use of digital technologies has made it possible to develop a multiple and simultaneous experience that can intrigue an extended audience with different needs and expectations. The visitor experience, led by personal devices, or mediated by the use of

proximity systems, offers the visitor an immersive and synesthetic experience (Bowers et al. 2007; Dal Falco & Vassos, 2017; Sayre & Wetterlund 2008; Villeneuve, 2013). A subsequent phase that expands the boundaries of the design process is the use of coding. The IoT and the use of interaction design shift the focus towards the study of the interaction between the visitor and the cultural heritage collected in the museum. The use of augmented objects defines new opportunities of experience between the physical and the multimedia fields. These tools make it possible to enjoy an interactive environment in which the visitor is directly and physically involved in an experience of knowledge and discovery that can enhance the cultural heritage through a historical contextualization or a futuristic simulation (Claisse, Ciolfi & Petrelli, 2017; Hornecker & Stifter, 2006; Not et al. 2019; Zancaro et al., 2015).

2. Participatory strategies as practical ways to enhance traditional cultural institutions

The researches on interaction design and visitor experience bring museum studies to propose a possible transformation of this context. This research path began in the '90s with a new phase of awareness for museums. A decrease in the audience, due to the lack of correspondence between the multicultural/digital world of people at large and the perception of a traditional institution frozen in the past, led curators to reflect. Their own programs were focused on a well-established segment of visitors, with specific cultural interests and civic values. They were generally older people with a high cultural level and little diversity, while increasing segments of the population were turning to other sources of entertainment, learning and communication (OECD/ICOM, 2019).

Though they also worked on reviewing information and theoretical content, museums identified participatory strategies as practical ways to enhance traditional cultural institutions to attract a wider audience. Visitors had to be actively engaged as cultural participants and not be considered as merely passive consumers (Moura et al., 2011).

For this reason, visitor-centered museums focused on promoting participation by diversifying and enhancing the visitor experience. This goal, which supported both the educational and recreational role of museums at the same time, was promoted in different ways by involving a plural audience – young school children, advanced students, general visitors to the locality, international or national tourists, or specialist researchers – in different practices and processes (Giaccardi, Palen, 2008; Anderson, 2004).

Below is a description of some of the most common practices used by museums to involve, broaden and diversify the audience, illustrated by some significant examples.

Exploring the sciences through wonder and surprise

These experiences, designed and developed within science centers and children's museums, since the Sixties and Seventies, seek to educate a greater range of people, focusing on entertainment and on the direct involvement of the visitors, in particular children. In this type of museum – of which the San Francisco Exploratorium, founded in 1969, is considered a paradigm – the exhibition project relies on interactive engagement, leveraging wonder and surprise to convey learning to the visitor through a recreational approach to the exploration of natural science phenomena and technology, making science visible, touchable, and accessible to a wide variety of people.

Extending Human Rights by improving accessibility and inclusion

The "museum for all" focuses its research on the exploitation of the visitor experience for an expanded audience, placing keywords such as accessibility, inclusion and usability at the center. Of significant importance in this field is the project coordinated by Corey Timpson for the Canadian Museum for Human Rights in Winnipeg. On this occasion he wrote the Canadian Museum for Human Right's inclusive design and accessibility guidelines. They can be consulted, updated and implemented online by the community.

Offering opportunities of meeting by rethinking guided museum services

The project Multaka: Museum as Meeting Point – Refugees as Guides in Berlin Museums works on widening the public and on a different experience of the heritage. Involving refugees in the museum experience, the project trains Syrian and Iraqi refugees to be museum guides, so that they can provide guided museum tours for other Syrian and Iraqi refugees in their native language. Facilitating refugee access, the Multaka project, which in Arabic means "meeting point", helped refugees to find social and cultural points of encounter and to increase their participation in the public sphere. Started in December 2015 with the involvement of four Berlin museums, the project very successfully became an international programme with a huge public.

Collecting testimonies by redefining exhibition paradigms

Museums established with the aim of commemorating and passing down an event or a socially relevant local phenomenon also focus on the participation of visitors. In this case the contribution can come through the donation of an object/personal effect or through the sharing of a direct or indirect testimony on the topic. In the latter case, the testimony contributes both to the definition of the exhibition and the creation of a local or global community. Examples of this type are war museums, such as the Italian War History Museum in Rovereto which since 1921 has been dedicated to the experience of the Great War, the "Museo Audiovisivo della Resistenza" in Fosdinovo, inaugurated in June 2000, about the experience of resistance on the Gothic Line, or the most recent one in Sarajevo, the "War Childhood Museum" founded in 2017, which tells the experience of war from the point of view of a child.

All the practices of involvement described here are processes that aim for greater visitor engagement in the transformation and renovation of the traditional museum.

The interpretation of the new needs of an ever-widening audience together with the adoption of digital tools and technologies encourages museum curators to open up to a multidisciplinary community of experts. On the one hand, the definition of the exhibition cannot prescind from the multi-transdisciplinarity of its contents, on the other, the experience requires the input of experts in the social sciences such as ethnographers and anthropologists as well as the contribution of legal and administrative offices, and many other professionals.

Although the actors in the process are growing in number and range, the design process of the exposition still proposes the five most common stages: Planning, Research/Interpretation, Design, Production and Installation.

The process is shared with other experts only in the planning, research and interpretation phases, which can be summarized with the term “definition phase”. But “museums, should add a new exhibition paradigm that does not resolve issues into a pre-determined message, is proactively multidisciplinary, and has embedded multiple worldviews without editorial judgement”. (Macleod et al, 2018, pp. 34-44).

This format, which involves all the stakeholders – museum curators, visitors, personnel, designer facilitator, or other experts –, could lead to collaborative solutions that can reflect personal ideas and lead museums to act as agents of change in their socio-geographic context.

This process, generally known as co-design, finds its references in a much wider practice used both in public administrations and in business contexts.

3. The involvement of different stakeholders in co-design processes with citizens and companies

The involvement of different stakeholders in a project is a common practice in the field of design. Methodologies that relate the designer to other stakeholders are usually linked to the Scandinavian tradition of Participatory Design (Kleinsmann & Yalkenburg, 2008), although it is possible to trace some foundations in authors such as William Morris and Gregor Paulsson (Holmlid, 2009).

This field is rich in approaches identified by different shades of meanings, such as: participatory design, co-creation, co-design, etc… One of the most widely-shared definitions in academic literature is the one by Sanders and Stappers (2008, p. 2): “Co-creation is a very broad term with applications ranging from the physical to the metaphysical and from the material to the spiritual, as can be seen by the output of search engines. By co-design we indicate collective creativity as it is applied across the whole span of a design process […]”.

In Urban Planning, the first experiments and theories were shared in the Sixties. According to Kamacı (2014): “While it is commonly accepted that citizen participation is not a tool but the main goal of the urban planning, there is almost universal uncertainty as to the best way of citizens’ involvement in urban planning.”

Though the real effectiveness of the process is questioned by some (Wallin, 2013), there are many different tools that can be adapted to different situations and goals in urban planning. Some areas of intervention for participatory processes in urban planning could be, for example: the redevelopment of abandoned buildings, the conversion of a district, the revitalization of a green area. Whereas the tools are divided, more specifically, into three different types: exploratory, conceptual and deliberative.

The first group includes, for example, established formats such as focus groups or world cafes. In the second group there are tools such as design laboratories or open space technology. The third group includes methods for collective decisions, such as informed surveys or public debates.

The documented examples of urban regeneration processes through participatory design are numerous and it is not always possible to define their importance. To name just a few we might mention: “Coltivando”, the university community garden of the Politecnico-Bovisa campus (Meroni, 2013), “the MIL project”, focused on the physical and social regeneration of buildings from the 1970s in the city of Malmö, or “La Kumpania” an intercultural project designed to connect Roma and Italian women through food and cooking traditions, to resolve problems of conflict in the complex area of Scampia (Naples).

The involvement of different stakeholders is not a prerogative of urban planning alone. More recently, this approach has also been used by companies with the intent of boosting innovation processes, strategically reorganizing the company or imagining new solutions and services, especially through the methodological tool of design thinking (Beckman & Barry, 2007; Leavy, 2010; Martin, 2009; Ward, Runcie, & Morris, 2009).

Design thinking is a methodology that has been developed by many authors with different points of view (Cross et al., 1996; Badke-Schaub et al., 2010) and has the merit of extending the practice of design beyond its traditional sphere (Brown, 2008).

One of the fundamental assumptions of design thinking is precisely the collaboration between people, bearers of different knowledge who cooperate to achieve a result that must have economic and technical feasibility and desirability for the user.

There are many examples of the use of design thinking by companies in different sectors. They include the case of PepsiCo (Adi, 2015) in the packaging sector, for example, or Deutsche Bank in the field of financial services (Vetterli et al., 2016) and IBM as a company with high technological content (Lohr, 2015).

The sequence and the development of a participatory process changes according to the fields of intervention and the tools used.

Although it is not possible to find a single key of representation, since each case is characterized by many different variables – from the goals, to the tools that are used, to the different personalities and areas of expertise involved – we can try to trace some models that schematically synthesize the main phases (Fig. 1).

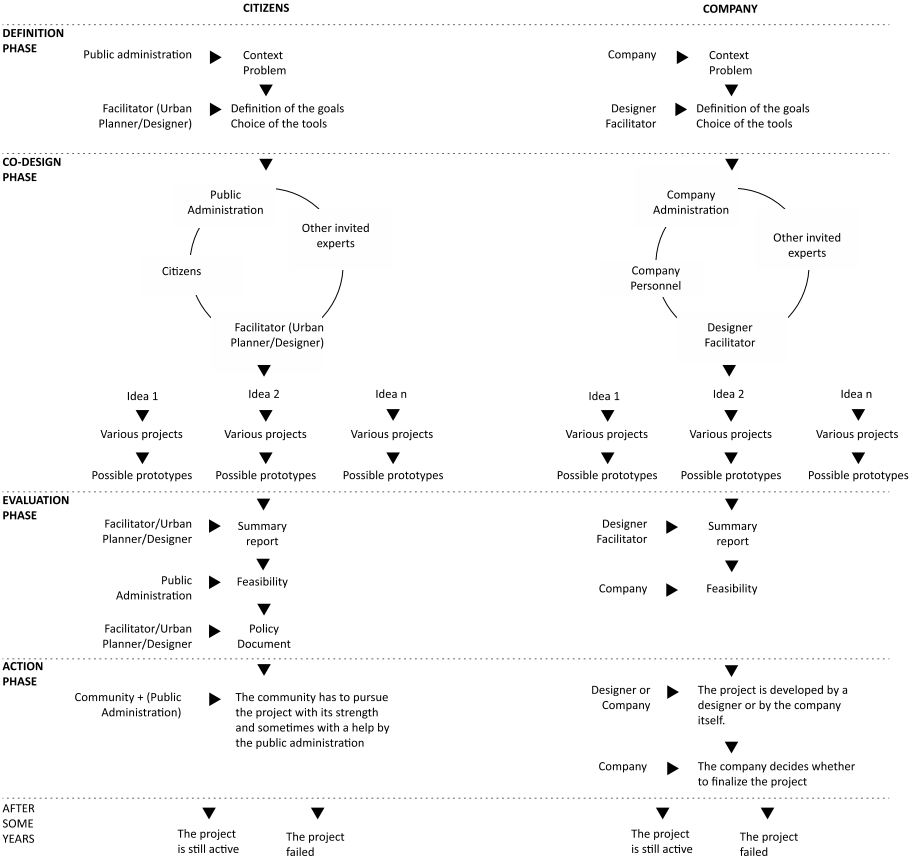

Figure 1. Co-design processes referred to citizens and companies.

As Shown in Fig. 1, excluding stakeholders and tools, the two processes are quite similar in the first two stages (Definition and co-design phase). The diagram intentionally omits timing information because they can vary according to the type and the complexity of the problems to be faced. The co-design phase, for example, can be unique, but it can also be repeated several times with the same or with different stakeholders.

In the evaluation phase of the first process – the one referred to citizens – the facilitator usually prepares a summary of all presented projects, then the public administration can make an assessment of the submitted proposals and define their feasibility and their technical requirements according to the regulations. Finally, the facilitator delivers to the community a policy paper that defines the guidelines. At the end of the process, often supported by the public administration, it is usually the citizens who carry out the approved projects.

In the second process – the one referring to companies –, after the designer-facilitator delivers a summary document that collects the best ideas, the company itself decides whether and how to carry them forward. In this case, a project assignment could be entrusted to the designer, or the development and realization of the idea could be handled by the company itself.

4. Co-design processes in museums

The cultural heritage and museums in particular may also be considered as stimulating fields where we can find experiences of participation of different stakeholders. These kinds of interventions usually aim to create a network of people to improve the museum experience and to expand the audience with which to share the material and immaterial culture preserved by the museum.

There are many people that can be involved in these kinds of activities: organizers, designers, museum personnel (both the scientific and technical staff), visitors and an extended network of people involved in the museum's activities.

An interesting co-project based on a three-year research study was developed by the Planetarium and Science Museum of Rio de Janeiro City and the Pontifical Catholic University of Rio de Janeiro (Moura et al., 2011). The project originated with the aim of renewing some of its spaces, services and installations to offer a visiting experience suitable for many types of users. It began with an ethnographic study, a co-design workshop and a Blank Model prototyping session. "Together with children, teenagers, teachers, designers, computer scientists, and astronomers, amongst others" the experience aimed to "explore collaborative exhibits; interact multimodally; immerse in collective play; co-construct knowledge and share ideas about astronomy and other related sciences; and participate in mentorship networks together with other visitors and museum staff" (Moura et al., 2011, p. 152). During the co-design workshop, participants generated a great number of ideas. The most frequent insights were: "Create an immersive experience" and "Provide interactivity". At the end of the experience, the most interesting ideas were prototyped.

Another case study based on co-design processes in museums is Museomix (Rey, 2017). The format, invented in 2011 by Stéphanie Bacquère, Samuel Bausson, Julien Dorra, Diane Dubray, Yves-Armel Martin, Christophe Monnet and Marie-Noéline Viguier, and repeated

every year, consists in a three-day immersive co-design workshop that aims to reinvent the way in which the museum's contents can be presented to the public, by connecting with the museum staff and interacting effectively with other professionals. Museomix has involved more than 1000 participants for each year of activity and many museums around the world. This format has several goals: exploring new possibilities for the museum, imagining new ways to welcome visitors and interact with the collections, integrating the maker and digital cultures into the museum institution, opening the museum to the community through a new type of collaboration (companies, schools, artists), connecting the local culture with the global network of Museomix, training the staff to develop new skills and combine their know-how with that of other professionals. The basic team is composed of communicators, developers, designers, content experts, makers and facilitators. Museum personnel and visitors can interact with the working group in every moment. After the three days of intensive co-design activity, the teams share their prototypes with the other teams, as well as with visitors. Feedback is provided through an evaluation document. Finally, the projects can be shown in the museum exhibition as simple prototypes, or they can be developed, become stable, or simply be abandoned.

From further investigation of this case study, in interviews with some of the curators directly involved in the Museomix experience, we discovered that many of the projects would involve the visitors in an interactive experience. Furthermore, in most cases, the projects were abandoned immediately after the co-design experience or several years later. A restricted number of prototypes have been developed and are currently shown in the exhibition. Some of them need maintenance or a renewal.

A simplified model of the co-design process in a museum can be represented by the diagram in Fig.2. The process itself is very similar to the one referred to the citizens and the one related to the company, but in this case, there are some changes in the final stage of the process. Projects, in fact, can be proposed by many different stakeholders (co-design phase) and developed by a restricted number of people (curators, designers, technical staff). This leads to a great initial effort to have rough prototypes at the end.

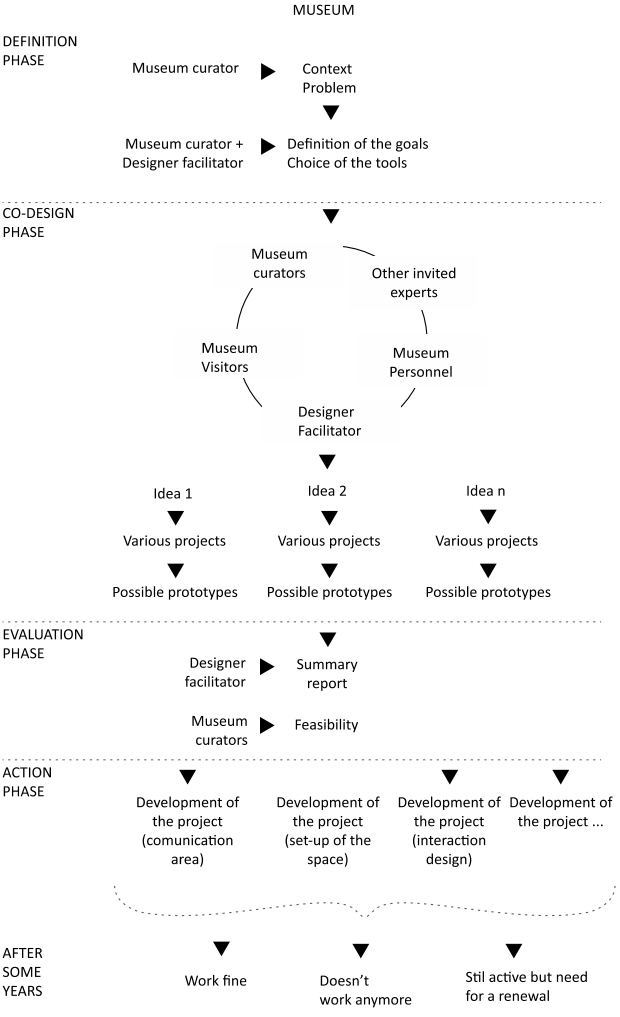

Figure 2. Co-design processes in museums.

Although there are many positive aspects to a co-design process, there are also some limitations. For example, at the end of the process, though many ideas are considered, only a few of them will be developed and displayed in the museum. Furthermore, these projects, usually related to the involvement of the visitor in an interactive experience, often have to be updated. Furthermore, the maintenance or the renewal of the technology used in these kinds of installations must be carry out by professionals with specific expertise. So, during

the last few years, many design studios have developed more and more specific device apps, multimedia tables or augmented reality objects for experiencing the heritage.

On the one hand, this has led to the involvement of different types of audiences, but on the other, it has caused a significant disconnection between the museum and its operators (Not, Petrelli, 2019; OECD/ICOM, 2019; Wolf et al., 2015).

If not completely involved, the museum personnel remain estranged, isolated, due to the use of languages they are unfamiliar with. To ensure that the museum personnel becomes aware and engaged, it is important that they be more involved. Participating in the co-design process can be a starting point but is not enough.

5. Transforming museums by rethinking the roles of the personnel

Museums, strongly linked to their historical, geographical, social and political context, represent possible fields for enhancing local identities. They preserve heritage traces of history, collective memories and elements of material culture in which citizens can recognize traces of their origins. Places for dissemination and sharing of knowledge, oriented towards education and leisure, museums could be configured as new hubs of a possible cultural network, strategic points that recognize the potential inherent in updating the museum experience to connect to a wider network on the territory. The museum opens up to the local community and considers new public and private actors with which to collaborate on virtuous projects, it opens towards new audiences in integration projects aimed at defining a wider community. But if the opening process does not include the network of professionals and the personnel working within it, the museum risks missing a great opportunity.

The involvement of the personnel in co-design processes in museums would give solidity and durability to the entire process of transforming the museum. The personnel, always present, can contribute to the process starting from the first phase (Fig. 3) by contributing to the definition of the state of the art. Participating in sharing the tools and objectives that will be used in the co-design process creates awareness of the problems identified as a priority by management and curators, and of all the information that constitutes the context of the project.

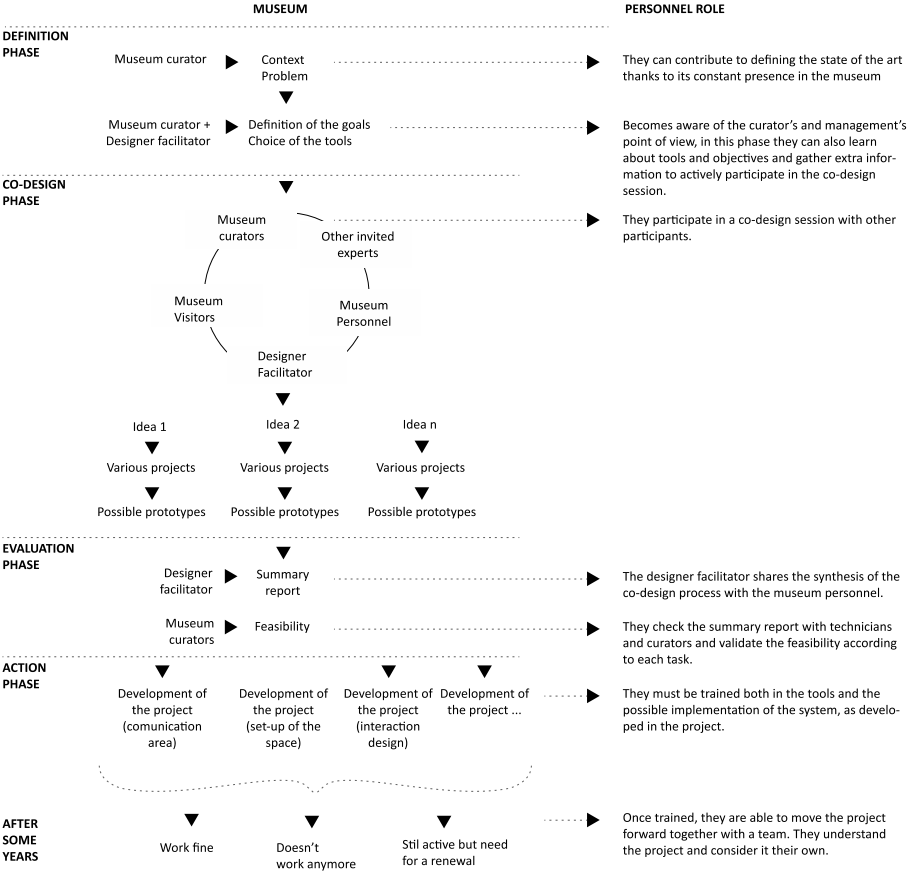

Figure 3. The role of personnel in a co-design process.

Awareness of the system makes the personnel feel they are an active part of the co-design process by sharing possible solutions. Following the definition of the summary report, the museum personnel will participate actively, together with the technicians and curators, in verifying the feasibility of the project. The personnel will be then trained to contribute to the realization of the solution, to its updates and its possible implementation. If staff members feel comfortable supporting or leading participatory activities, the project could go far.

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Acknowledgements The paper was conceived, written and reviewed jointly by the authors. The introduction was developed together by the two authors. Alessandra Bosco produced paragraph 2 and Silvia Gasparotto produced paragraph 3. Together they design the frameworks and wrote paragraph 4 and 5.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The concept of Interaction Design under review: literature review and interviews with qualified informants

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Abstract | The article mentions a parallel about the conceptual strands for the Interaction Design theme. It relates what had already been addressed in the literature with in-depth interviews with professionals and educators, providing a unique record of this field in the city of Rio de Janeiro. Thus, it can be postulated that the material is related to the descriptive analysis of the concept of interaction, recognizing a multifaceted and human prism in its conception. This proposition is relevantly because of the Interaction omnipresent character permeating the entire process of production and consumption of information in the present times. By the conceptual relationship between information and interaction emerge a new literacy. Therefore, the matter of this research may be review of the design interaction concept and how it's iterative intrinsic with humans- interfaces with technology, into continuous cycle of redesigning our perspective of living.

KEYWORDS | INTERACTION DESIGN, USER EXPERIENCE, EMOTIONAL DESIGN

1. Introduction

The article analysis the concept of interaction, recognizing a multifaceted and human prism in its conception (Lévy, 1999). This proposition also related to Card, Mackinlay & Shneiderman (1999) insight concept during interacting with visual information. Such dynamics can be related to interaction through accessible connectivity, as well as the way in which the construction of this dialogue between people, tasks, goals and aspirations is projected. It may rise to a point of interest and concern when thinking about more social developments for the interfaces developed by such professionals involving information and communication technologies.

2. The research prior definitions

The research is essentially theoretical in nature, including a descriptive section, and its main objective is to critically investigate both the concept of Interaction Design and its more contemporary understanding. The research seeks, initially and using a bibliographic review, to understand the concept of Interaction Design. In the second part, it takes a very empirical character, where interviews with professionals and educators stand out.

More specifically, the theme of the research is related to a descriptive analysis of the concept of Interaction as a key issue for building the concept of Interaction Design, in a dialogue with Information Science, Usability and Information Architecture.

3. Review of the literature references

3.1 Information and interaction

The objective here is presenting conceptual issues that are related to the theme, but from a perspective of Communication and Information Science, as a priority, since such theories will impact Interaction Design as an area of knowledge. As example of one of the key issues, Drucker (2002) should be remembered, as he emphasizes that, in a world where technology is not natural, but rather created by man, technological changes will always express a new worldview. And the artifacts of such new expression will always come from the creative vision of man. However, Information Science (IS) will be construed as the driving agent of this theoretical and conceptual journey. As Saracevic (1998 *apud* MIRANDA; BARRETO, 2002) indicated by highlighting that the IS's interdisciplinary nature is inexorably associated with Information Technology (IT). It is an activity that takes part in the evolution of the Information Society. Therefore, it refers to information boom as a social issue that began in science and has now spread to any and all human endeavors. According to Hobsbawm (1995 apud BARRETO, 2002), and Asimov (1988), based on the analysis of the last fifty years of the 20th century, mankind saw more innovations being inserted in its coexistence than in the

rest of human history. In addition, Tomaél, Alcará and Di Chiara (2005), related such achievements to two subsequent components: availability and exposure of information.

The reach of information meaning as proposed by Barreto (2002) refers to the individual as a cyclical procedural flow for life, which usually provides a starting point for discussing the transformations that arise from ICTs (Information and Communication Technologies), from the emergence of new knowledge-related demands. For Tomaél, Alcará and Di Chiara (2005), where human beings are leading players, sharing information and knowledge will only bring results if this implies a learning process, as simple access to information and knowledge without such a process will not change reality, and will therefore lose sense.

Thus, one should keep in mind Dixon's statement (2000) when he says that, if people begin to share ideas and realize the importance of this process, sharing itself will create the culture of learning. Meaning arises from exchange, and especially from interaction.

3.2 Interaction Design, beyond user experience

In the quest for understanding the concept of interaction, one may realize that Design, as a project activity centered on human beings, consists, in its way of seeing, in interpreting, in coexisting with the social environment in a holistic and ethical way. Based on such Interfaces, it is suggested, according to Royo (2008), that definition reaches a broader context, so that Interaction Design can be characterized in a more evolved stage of this conception, as follows: a space that sets the boundaries of interaction design with a view to its form, language and actions that fully anticipate interaction with information, respecting users' native skills in order to facilitate its use to fulfill a specific need. In this case, it may be synonymous with user's experience, but it certainly goes beyond a handling-based quality.

Another similar view found during this review proposes, recalling Lima and Dias (2012), that Usability is linked to the system's ability to interact with the user. Therefore, it appears to be a property of the interaction between product, information, user, task and context. At this point, once again, interaction is seen as a key element and as a connecting agent for the others. That said, users' involvement can be revisited at three different levels: tasks, emotions, and qualities associated with the product.

In this case, now talking about affection, pleasure, enjoyment and fun, all these elements can be critical to stimulate both interaction and the discovery of new ways of interacting. In this regard, it makes sense to revisit Desmet's proposition (2004) when he describes emotions as a mechanism that signals when events are favorable or unfavorable for a particular interest. Certainly, they are not properties of technology, but they can be construed as feelings arising from the experience of use. Therefore, it is possible to recall another objective of Interaction Design by highlighting that it should stimulate interaction and exploration. And this will not happen by chance but is rather the result of a careful

interface design. However, one must not forget the role of equalizing competences and challenges as an equation to reach a stage of confidence and relaxation that can lead users

to a sense of Flow. This is the pleasure acquired by performing a task in itself and also as Williams and Dargel (2004) advocated.

In a slightly further elaborate proposition, Saffer (2007) said, when considering that Interaction Design is more related to human behavior than to the aspect of the screen. Together, Preece, Rogers and Sharp (2002) are referred to when they describe the same concept as the design of spaces for human communication and interaction. Now, after such substantiations, it can be highlighted that interaction design should aim to connect people through products and should be an informational space where communication can take place, as Krippendorff (2005) pointed out. In other words, the value is not in the things themselves, but rather in the knowledge contained therein and in the new knowledge generated by using it. To this end, Information Architecture (IA) will always bring very effective contributions, because, as a concept, it must be regarded from a perspective that involves the content, the business strategy and the user. Additionally, information must be seen as something that has to be designed and structured to be found, accessed and used. It is noted that, in a transversal way, interaction design is present, but it is also true that without information, such interaction cannot be sustained. Garrett (2003), on the other hand, broadens this understanding by believing that IA is about content design and user experience.

In turn, both IA and Interaction Design are part of a highly complex ecosystem of behaviors, being a part of the interactive human-information-technology dialog.

4. Interviews with educators and professionals

The interviews with professionals and educators in the areas of Design and Communication sought to map out their understanding of such issues related to the subject of the research. In order to have a representative sample of different profiles and cultures, professors from two nationally renowned specializations, located in Rio de Janeiro, were selected, either because of their pioneering spirit or because of their recognition in the market. Therefore, such collaborators can be regarded as opinion leaders, educators and representatives of major companies in the interactive media sector.

The interviews had a pre-defined logic, and included a structured procedure, in which the concepts were presented sequentially, always one at a time, exactly as below.

1. Information.
2. Interaction.
3. Interaction Design.

Table 1. Interviewee profile

Code	Training	Trainer	Specialist
1MMEBRGPU1212	Design	Yes	Yes
2MMLTPAPM1012	Design	Yes	Yes
3MMERFINPU0912	Design	Yes	Yes
4MFCHMGPU1212	Design	Yes	Yes
5DMLMACOP1112	Design	Yes	Yes
6MMFRFCOP1112	Communication	Yes	Yes
7NMLCAGPU1112	Design and Communication	Yes	Yes

4.1 Information

The first word, printed on the sheets handed out to participants, encouraged interviewees to make remarks regarding the plurality of understanding, human dominance over its nature, the vast amount of information in current times, and its ubiquitous nature in post-Internet society.

First interviewee, NMLCAGPU1112, when thinking about Information, contributes by recalling researcher Peter Morville. Then he talked about complexity, just like other collaborators, to the point of saying that such concept had not been properly defined. As a justification, he contextualized it as follows: "... it is a rather polysemic term from the point of view of Information Science. It can have different meanings and can be construed in different ways". Finally, he found a definition he prefers. So, he said: "I really like the view where information is seen for itself. In it, information is understood as an attribute of the universe, that is, of our world. And it has space, energy, mass, movement and information". Collaborator MMFRFCOP1112 said: "Information is, more than anything else, a function." Then he went on: "The function of any data is to become information". Interviewee MMLTPAPM1012 said: "Information is the medium in which we live". This collaborator justified his initial thinking by going beyond the context and postulating that one lives in the information medium whilst, at the same time, information frees the individual, giving them autonomy so that they (users) may do whatever they want. However, at the same time, Information would condition people in a variety of delimiting situations. Thus, the collaborator recalled Bill Viola, a New York born American video artist, when he said that the concept of information refers to its own access, as well as the waste of information due to overexposure.

4.2 Interaction

Interviewees shared different impressions, but with very similar guiding principles, particularly the way in which interaction has a broad human dimension and how it is both marked and shaped by the same existential plane.

Specifically, for educators and specialists (DMLMACOP1112), interaction has a temporal boundary. In this way, the current time, the way in which demand becomes evident, the inherent medium of use, the allowed density, the types of drives, the responses provided by the apparatus and the never-ending real time mutation must be contained in any definition related to such a concept. Due to the proliferation of interactive technologies, the interviewee believes we are living in the era of technological interaction ubiquity. Then he postulated that the types, density and depth of interaction may be different due to the characteristics of the devices. He also pointed out that the degree of depth and intensity is not always the same, as there are times when the user investigates deeper than others. With his own approach to the temporal issue of interaction, interviewee MMLTPAPM101 said after a brief pause: “Something that marks our passage through things”. At this point, it has to do with the human ability to interact with objects or people. He goes on in his reflection: “... is the relational. In other words, it is what we seek, desire and that fulfills us in a certain way”. Interviewee MMFRFCOP1112, in turn, said it is the systematization of a human relationship, especially for those who come from the areas of Communication and Design.

More specifically, NMLCAGPU1112 likes a concept of Interaction that comes from the investigations made by researcher Alex Primo (professor at UFRGS). This professor and researcher fail to understand interaction through a reductionist perspective. He sees interaction as a reaction and explains: “When interacting with a machine or software, a person will get a pre-programmed response within a selection of alternatives existing in the algorithm of that technology. In turn, the user will respond reactively - just like the artifact, but in another dimension. So, when it comes to Human-Computer Interaction (HCI), we are, in general, dealing with this type of interaction”. However, there is still another level of interaction, seen as mutual. In such an interaction, a human can interact with another human or even with several users, but always mediated by a machine. Above all, within the same proposition, the interviewee highlighted that several people could interact with each other, all participating at the same time, although abiding by the same mediation dynamics performed by technology. Thus, the interlocutor could enable changes, certainly modifications, during the course of their own experience. To him, this means a level up in terms of interaction. Sometimes, aspects of the so-called reactive interaction can be found in mutual interaction, but this is not a rule.

4.3 Interaction Design

Here, questions related to dialog experience design arise in a specific context, using technological tools as a means, guided by the skills of those individuals who operate the interface.

Interviewer MMERFINPU0912 comments on experience as a more contemporary concept, namely: “It is a way to design dialogues. As a designer, I believe that all interactive products come to solve an interaction problem”. In this regard, the interviewee advocates Interaction Design as a means to get to the solution of such a problem. According to collaborator MMLTPAPM1012, Interaction Design has the following meaning: “It's how I design interaction. Even if it is idealized”. Then, the interviewee tried to synthesize his thoughts, as follows: “It is when I design the experience the user will have in terms of interaction”. For interviewee MMEBRGPU1212, it is when the specialist will act in the way of designing how people will interact with the system. At this point, the collaborator made a reference to the sense of materialization of product’s key concepts. Interviewee MFCHMGPU1212 commented on how the designer should design the interaction of a product, advocating a very close relationship with Information Architecture. In the same way, collaborator NMLCAGPU1112 highlights that Interaction Design should have to do with the act of designing a certain product that will play the role of mediation between the different types of possible interactions, namely, either reactive or mutual. He continues linking the concept to design, research and a relative search anticipating how interactions will take place. On the other hand, participant DMLMACOP1112 said: “Design using all the multimodal capabilities of the tools”. For this to happen, he refers to Design, in the sense of a project, making people use technologies in a natural way, without looking like they need a lot of effort and, above all, technologies that make sense, especially at the time of using. Thus, he states: “Do something that makes sense at that moment rather than through the free means of technology. Making sense is the greatest thing”. To better explain his thinking, the interviewee goes on: “... not the free means of technology. One sees when something is forced and when something is natural. So, it closes, fits and there is real involvement”. In conclusion, he says: “... how much people take ownership, take advantage of and enjoy their integration with information through the interface”.

4. Conclusions

This final section is not intended to exhaust the issues raised, but rather to provide a parallel perspective on the central themes addressed herein.

Based on the bibliographic sources, it was possible to verify a relationship between Interaction Design concepts and the other concepts. The interaction, technology and information trinomial seem to have two modular transversal axes: design and users. Thus, the sense of design as an articulating field is reinforced, which interacts with technology,

making it unnecessary to legitimize a single immutable concept. However, certainly, information aims to change the way the receiver will perceive something and, because it is dynamic, it becomes complicated to define it in a deterministic way. Therefore, a first wording is created to characterize Interaction Design more fully, although other facets can still be addressed. These include the proposition of an intimate Information Architecture, almost internal to the individual, since, in order to design based on users' experience of use, it is necessary to have a better understanding of their habits, activities, mental work and feelings when dealing with the digital world of information. Additionally, based on Suri (2007) - an understanding that, as the interviewees have already pointed out, is not effective to train new information architects and interaction designers. At this point, a point of interest and concern arises when thinking about the more social developments for the interfaces developed by such specialists involving information and communication technologies.

In a slightly further proposition and based on what Saffer (2007) said when considering that Interaction Design is more related to human behavior than to the aspect of the screen.

Together, Preece, Rogers and Sharp (2002) are referred to when they describe the same concept as "the design of spaces for communication and human interaction." Now, after such substantiations, it can be highlighted that interaction design should aim to connect people through products and should be an informational space where communication can take place. In this way, it can also be assumed that ICTs are an interface to bring people together, since it is the means of this communication and not the end. This is justified when one accepts that the new logic is in the value of the information obtained from an interactive experience. In other words, the value is not in the things themselves, but rather in the knowledge contained therein and in the new knowledge generated by using it.

However, at this point in the discussion, consider that interaction begins long before the existence of a concrete product because, in theory, it is a productive and creative act of an individual who needs and longs for a tool capable to provide him with information - here a more internal space is considered for the external, that is, it speaks directly to the dream and ideal that will eliminate the bitter nature of such emptiness caused by the information gap to the potential user. At the same time, ICTs will intensify and enable end consumers to innovate interactive technological products and services. It is through this same interaction that people share meanings and senses digitally, since the Information Society operates based on information that is loaded with intention and feelings.

Therefore, the concept can be configured through the ubiquity of technological interaction, the first steps of direct manipulation and integration with users' studies tracing their informational needs, in addition to case studies covering a broader topic. Thus, ultimately, the Interaction Design seems to be, in this context, the design of plural experiences that will mark the passage through information structures that dignify human beings, thus enhancing their qualities, bringing meaning and improving their most intimate skills.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The Emergence of Modern Design Discourse in the Eastern Mediterranean Region (EMR)

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Abstract | This study will offer an overview of applied discourses of design in the Eastern Mediterranean Region (EMR), including Egypt, Palestine, Lebanon, Syria, Jordan, and Iraq. These countries have been known for their pioneering statues, creative engagements, and influence on shaping, resourcing, and sustaining the emergent project of modernity in the region since the 1940s. Studies of the contemporary discourse of design for these countries are acknowledged as underdeveloped, with extremely limited studies addressing its context and practices. This study will survey identical phases throughout the contemporary history of these countries, observing major stages that transformed the societies within them into sovereign territories and national states after World War II. The study will explore and critically review key historical themes in the regional socio-political rhetoric since the 1950s, specifically those associated with and involved in shaping the emergence of design as a modern discourse in the region.

KEYWORDS | DESIGN IN THE EASTERN MEDITERRANEAN, EMERGING DESIGN, MODERNITY, DEVELOPMENT, INDUSTRIALISATION.

1. Introduction

Studies in the socio-politics of development culminated in design discourse as a process at the micro-level to enhance technology transformation and industrialisation to achieve economic growth. This context emerged in the Eastern Mediterranean region after World War II, when development was promoted as a process targeted at fulfilling basic human needs. The United States clearly articulated these principles through a program President Harry S. Truman presented in his inaugural speech on the 20th of January, 1949:

> "Fourth, we must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas."[1]

Based on the United States' extensive engagement with industrialisation, this program attempted to promote society's economic growth over the previous European colonisation era (Dorrestijn, 2013). According to Mignolo (2011), this era was shaped "*not by appropriating land, but by managing finances and natural resources through the project of development and modernization"* (Mignolo, 2011, p. 32).

The politics of modernity and development directed the political rhetoric of developing countries such as the EMR during the vibrant era of the 1960s-80s, and was reflected in the design context progressing and linking with development strategies. It endorsed the vital need for developing countries to apply design knowledge and practices in their strategic development plans. This is presented as a unique attempt in the design history of the developing countries, and the region, which was acknowledged at the end of the 1970s when the Ahmedabad Declaration was articulated as a framework of interlinked design discourses and socio-political practices for the benefit of developing countries (Saad, 2013). The postcolonial regimes in the region embedded 'modernity' and 'development' as synonymous terms in the political, economic and social rhetoric from the 1960s. A number of resolutions since then guided and demonstrated the context and pedagogy of design education applied models in the region. These can be classified into three different models:

1. Applied Arts Designers (AAD) sustains the Art and Craft and the Bauhaus methods and practices in design pedagogy. AAD dominates education programmes at the higher education institutions and the local professionally accredited institutions in Egypt specifically.[2]

2. Design as a discipline in the institutions of Fine Arts, seen predominantly in Iraq, Syria, Lebanon and Jordan. This model continues to amalgamate design knowledge

[1] http://avalon.law.yale.edu/20th_century/truman.asp (Retrieved 30th Nov. 2019)
[2] Applied Arts Designers Syndicate represent the professional organisation of graduated from applied arts higher institutions in Egypt http://www.eds.org.eg/portal/ (the website in Arabic)

based on aesthetics and local traditional context and practices. This context applied also on the design professional practices in these countries.

3. A model of design programs established within schools of architecture since the 2000s, responding to marketing demands to link design as a profession with the architecture. Such demands promoted by the private higher institutions spread rapidly in Jordan, Lebanon, and other regional countries. It is similar to model (2) concerning pedagogy and the practice of treating design as a fine arts discipline.

The dominant geopolitical instability and broader conflicts from external as well as internal powers, seen extensively in the current chaos overtaking regional societies such as Syria, Iraq, and Lebanon, can be seen in numerous cultural manifestations. Those conflicts holding design disciplines moving outside the dominant 'early modernity' emerged context and practices, as can be seen in other cultural creative practices such as literature, poetry, fiction, theatre, cinema, art, architecture, sport, media, and communication. This study will explore and critically review key historical themes associated with the emergence of design as a modern discourse in the region since the 1950s.

2. Design as a Manifestation of Modernity

A sense of hope was revived in the region to liberate people from the long-term Ottoman hegemony when, at the turn of 20th Century, Western modernity emerged in the region with the introduction of Western progressions in science, technology, art, and social systems. The slow emergence of direct and indirect communication channels between Arabs – the regional majority – and Europe extended the number of European books, periodicals, and newspapers available to Arabic readers. Moreover, new opportunities were available for regional students to continue their studies at European Institutions. As a result, many waves of migrants from Syria, Lebanon, and Palestine departed their lands and went to the 'new world.' The expansion of communication with Europe and America supported efforts by regional writers to engage in writing and to "*express in Arabic their consciousness of themselves and their place in the modern world*" (Hourani, 2005, p. 503). Despite this, religion continued to fuel reactions against practices rooted in Western modernity, and movements in Egypt, Syria, and Iraq "*acquire[d] the strength to confront Europe and become part of the modern world*" (Hourani, 2005, p. 503). A challenging debate developed between traditional Islamic thinkers and the newly-educated social leaders with regard to the alignment of modernity with Islamic principles in education, socio-cultural practices, and economics, based on the fact that "*modernity is Western, and imperial powers have imposed the Western ways of thought associated with it on the Middle East*" (Helfont, 2015).

Simultaneously, this era addressed the rise of nationalist political beliefs that guided civil leaders to seek European support in their attempts to detach from the hegemony of the Ottoman Empire. (Mackintosh-S, 2019) Moreover, geopolitical and economic factors led the European colonial powers that controlled parts of the regional territories after the end of

WWI to arbitrarily draw borders, dividing the region into new states. These borders represent the "*colonial power seeks to design a world that accords with its desire for power and control*." (Kiem 2017, p. 2) Also, those boarders have remained a major source of conflict and instability in the region in present times. European attitudes promoted the self-determination of national entities and created a new Arabic political identity that justified their mandate agreements with the local social groups. The colonial mandates were formally granted in 1922, when the League of Nations gave Britain sovereignty over Iraq and Palestine, and France sovereignty over Syria and Lebanon (Jackson, 2017) (Mackintosh-S, 2019). Support for the modernisation of these new territories and transforming their isolation into part of the new world was one of the major arguments justified and legalised Western domination in the region (Kingston, 2002).

European mandate powers supported the formation of states in the region, and shaped their socio-political order. Iraq, Jordan, Syria, and Lebanon then further provided consultation, finance, and technical expertise covering broader aspects relating to forming governments, managing the social system services, and planning for infrastructure projects targeting the major cities of Baghdad, Damascus, Beirut, and Amman. Urbanising projects based on modern architecture was introduced in those cities and first seen in government administration buildings and transportation networks and stations. These buildings were prioritised to support the creation and expansion of modern social system services relating to health, education, housing, and social security. The era culminated with the introduction of early modern material objects in parts of those regional capitals such as railway stations (Figure 1), hospitals, schools, higher education institutions. These buildings demonstrated early attempts to introduce modern architecture in addition to their furnishing and accessories. While many of these early examples were designed by European architects or imported from Europe, they were promoted as modern lifestyle objects to enhance people's interaction with them. Examples of other modern lifestyle objects introduced at this time include domestic furniture, home appliances, transportation vehicles, and electric appliances.

These buildings and objects served as inspirational elements for many handcraft practitioners to develop their products, style, materials, and production techniques. These modern material objects are reflected later in many socio-cultural manifestations and supported the regional transformation toward the modern European lifestyle. This was seen not only in private houses, but also a wave of modern social spaces such as cafés, social clubs, cinemas, public libraries, art galleries, museums, theatres, and public services offices. Access to these services gradually expanded outside the elite social groups and into the newly flourishing middle-class consisting primarily of public service workers. In fact, this vibrant social group supported the expansion of design and production processes to fulfil their demands for modern housing, domestic furniture, entertainment, publications, and many other modern lifestyle services.



Figure 1. Baghdad Central Station is the main train station in Baghdad which links the Iraqi domestic railway network. The station was designed by J M Wilson and built by the British in 1948. http://ruyafoundation.org

The relatively stable socio-political order in Egypt, Iraq, Lebanon, and Jordan at that time contributed to socio-cultural progression beyond the basic human necessities. For example, the Iraqi government created the Iraqi Development Board (IDB) in the late 1940s, aiming to utilise the expansion revenue from the oil export industry to finance extensive infrastructure and urban planning projects. This covered the entire country and presents a unique example of enhanced progression toward modernising the country. Baghdad also emerged as a modern capital city during the 1950s. The IDB commissioned elite European and American architecture, in addition to pioneering Iraqi architects to design modern architecture for

public buildings, university campuses, national theatres, sports stadiums, and many other buildings (figure-2).[3]



Figure 2. Louis McMillen, Umberto Varnini, Walter Gropius, and Hisham Munir (an Iraqi architecture) 1967, The University of Baghdad campus. Source: Harkness, John C. The Walter Gropius Archive…,P237) In http://postwarcampus.wordpress.ncsu.edu

Since World War II, the EMR has been considered a pioneer in the successful implementation of modernity through applied strategies and programs of development, considering that,

> *"post-colonial societies… are said to be strong, in that people rely on social networks rather than the state to meet their needs… they rely on tribes or villages notables. As a result, it has been difficult for these states to carry out their policies and they have often had to resort to violence* (Helfton, 2015).

That era of political stability ended dramatically, fuelled by military coups initiated in the early 1950s in Egypt and then Syria, and in the late 1950s in Iraq. These coups introduced political instability driven by age-old problems, both internal and external, leading to the

[3] The Iraqi Development Board (IDB) commissioned Le Corbusier to build a mammoth sports stadium, Walter Gropus from the Architects Collaborative to design Baghdad University, Alvar Aalto to design a civic center, and Frank Lloyd Wright to design an opera house. Additionally, the pioneer Iraqi architects Mohamed Makiya, Kahtan Awni, and Rifat Chadirji were offered the opportunity to design many public buildings.

dynamic and meta-complex problems seen in the region today. When the project of modernity was framed by these problems—empowered by a collective identity—the situation again fostered religious contradictions and political fundamentalism began to flourish. Intellectual modernity as a structure and concept progressed under complicated circumstances that were widespread in the region. According to Tagharobi (2016),

> *"there were three waves that demonstrated transformation toward modernity in the Middle Eastern region: Modern literary forms were primarily seen as a way of supporting social and political reform… Emphasis on domestic sources of thoughts and development under leftist influences, when the will to change was manifesting through nativism… The last wave of intellectuals see the path toward change in analysing their own societies through modern critical disciplines and by adopting historical perspectives towards their contemporary issues."* (Tagharobi, 2016).

Historically, design knowledge was applied to promote the production of handcrafts, which was treated as an important sector for its ability to support regional economic growth.[4] At the same time, design practices were applied as a secondary layer to the production of quality crafts ready for export to international markets, specifically in Europe. In this context, the design discourse promoted the "*organic relationship that the crafts-person had with his works, and with his culture*" (Author, 2005, p. 106). Overall, attempts to introduce modern design discourse in the region, as well as in many other developing countries, reflected the specific contexts and practices of design in these countries. Craft-oriented societies and social practices dominated the making process in countries like Egypt and Syria, for example, (Faroqhi, 2012) which exemplified the design context following art and craft movements. The stagnation and disempowerment of the modern design discourse in the region represents a resolution from the long-standing promotion of traditional contexts of design and its association with artistic and artesian practices. These practices dominated, and continue to be the guiding context and practices behind design education in the majority of design education institutions established in the region since 1950s.[5]

4 In Jordan, the US 'Point Four' program focused on technically and financially supporting local craftsmen through design consultation, grants, and services, with a local community development foundation established for this purpose. The Walter Dorwin Teague Association in America studied the Jordanian handicrafts industry in the 1950s, and the study later led to a strategic plan to develop a number of NGOs to support craft sector production, training, and marketing in Jordan. (Saad, 2006)

[5] For example, the Faculty of Applied Arts in Egypt, established as a vocational school in 1839. In 1909 the school initiated craft and art as a new discipline. In 1932, the School of Vocational Education changed its name to the School of Arts. In 1942 it was referred to as the Higher School of Applied Arts. In 1975 the school partnered with the University of Helwan (a state-funded university) to become the Faculty of Applied Arts. It is now known as the mother of all Applied Arts faculties in Egypt.

3. Politicisation Modernity

The socio-political order has undergone dramatic transformations since the 1950s, seen in the military coups over monarchies in Egypt in 1952 and in Iraq in1958, while Syria has faced many military coups since its liberation from the French in the late 1940s. The rhetoric of modernisation and development has been extensively promoted by the new regional post-colonial military regimes since the 1960s, using "*the military and their methods of discipline and indoctrination*" (Mitchell, 1988, p. XI). The socialist political discourse in Egypt, Syria, and Iraq utilised "*development… led by an alliance of the military and the working class*" (Kadri, 2016, p. 12) to achieve modernisation, which was defined by Mignolo (2011) as

> "*a want to have a comfortable, middle-class existence with all the amenities and attributes that go along with it—clean water, indoor plumbing, electricity, telecommunications, infrastructure, personal safety, rule of law, stable politics and a good education system*." (Mignolo, 2011, p. 52)

This was further inspired by political debate that the developing countries initiated against colonialism or neo-colonialism, articulated through the principles of the 'non-aligned' political movement established after the Bandung Conference in 1955 in Indonesia, where new independent Asian, African, and Latin American countries agreed to cooperate economically and culturally to oppose neo-colonialism. The movement's first meeting was later in 1961, where developing countries "*made visible the hidden face of modernity, that is, coloniality"* (Mignolo, 2011, p. 47). The instability of international political discourse during the 1960s, affected by Cold War tensions, empowered developing countries to search for alternative solutions to strengthen their development strategies (Trentin, 2009). Industrialisation was endorsed by many of those countries as the fundamental objective in their progression to achieve modernisation and development. Industrialisation was considered the path to transforming economic growth from agricultural-led into industrial-led, to fulfil the modern lifestyle of materialisation while at the same time responding to the politics of self-efficiency.

In this political context, design discourses were promoted in association with their social context,

> *"beginning with the arts and crafts movement in Britain in the 19th century… social engagement was a main driver of design theory from the time of the emergence of the profession of designer in the context of industrialization"* (Dorrestijn, 2013, p. 47),

and utilised as essential creative practices serving industrial manufacturing production. Furthermore, this aligned with previous local and international attempts seen in design theory, design education, and professional design practices during the 1960s–70s that stimulated design discourses' core function in social and economic growth through industrialisation (Gwendolyn, 2017) (Papanek, 2018). Debates concerning the modern role of design practices have continued in the political rhetoric in developing countries since the 1970s, responding to the expanding demands for materialisation and its signifying

characteristics in the empowerment of social groups. According to Bonsiepe (2006) "*the excluded, the discriminated, and economically less favoured groups as they are called in economist jargon… [amount] to the majority of the population of this planet.*" (Bonsiepe 2006, p. 30) This is applicable to the scale and types of technological knowledge transforming developing countries, supporting the need for design practices to engage and effectively utilise these new technologies. However, new technologies are divided into hardware and software; that is, "*technology implies hardware and software—and software implies the notion of design as a facet of technology that cannot be dispensed with*" (Bonsiepe, 2006, p. 32). This definition supports the role of design in industrialisation, as well as its role in socio-political capacities to create a path toward the democratisation of society and to "*provide for a broad sector of the population to have access to the world of products and services in the different areas of everyday life: health, housing, education, sports, transport, work, to mention only a few*" (Bonsiepe, 2006, p. 32).

Responding to late 1970s political debate, the '*Design for Development*' movement was introduced politically when the '*Ahmadabad Declaration*' was issued in India in 1979. The declaration resulted from joint efforts between the United Nation Industrial Development Organization (UNIDO), the International Council of Societies of Industrial Design (ICSID), and the Indian National Institute of Design (NID) (Figure 3). The document explicitly proposed the engagement of design with development as the right way to approach design in developing countries. Additionally, the document marked the "*first time that industrial design had been suggested as worthy of inclusion in national development plans*" (Coward, 2005, p. 545). The declaration's major principles presented the following points regarding design:

- Design is *"a powerful force capable of improving the quality of life of developing countries' populations.*
- *Designers should understand and recognize the values of their societies and reflect them in their designs.*
- *Designers should utilize both local, traditional resources and modern science and technology.*
- *Designers should collaborate with one another to ensure that collective identities are preserved and the priorities of these collective identities are met"*
  (Ahmedabad Declaration, 1979).



Figure 3. Signing the Ahmedabad Declaration at the NID, India.

India was characterised as one of the 'non-aligned' movement's founders and leadership countries, as was Egypt at that time, and this fact was addressed as the political ideology that supported the establishment of the '*Ahmedabad Declaration*.' As Margolin (2006) argued, "*it was in the spirit of an aggressive call by the developing countries to restructure the world economy that the Ahmedabad conference was held and the declaration was produced*" (Margolin, 2006). However, the '*Ahmedabad Declaration*' continues to maintain its position as the only official document at the international level that articulates the strategic role of design discourse and practices in supporting the development of developing countries. Additionally, the document articulates the spirit of modernity in the political context by shifting design from its local and traditional context toward enhancements in the modern context. Iraq was the only EMR country to sign this document, and embedded its principles throughout design education and professional design practices specifically in the discipline of industrial design. This addressed the Iraqi political demands toward industrialisation.[6] As Parsons (2016) writes:

> "*What the Modernists sought, therefore, was not to turn design into 'fine art' or tradition-based craft, but to blend the best elements of traditional craftsmanship,*

[6] Responding to the declaration principles the Iraqi government, with technical support from the United National Industrial Development Organization-UNIDO, established a centre to support local industrial manufacturing corporations through research and development. The Specialized Institute for Engineering Industries-SIEI was established in the late 1970s with objectives to utilise industrial design knowledge and practices in the process of developing Iraqi manufactured products

> *modem mass production and fine art into a new way of producing material goods that made sense in the social context of contemporary life*" (Parsons, 2016, p. 46).

This context enforced the nature of interdisciplinary knowledge and practice that culminated in the design process in terms of innovation, visualisation, production, promotion, and marketing. These practices identified design as a micro-element within industrialisation and production processes; however, the nature of design practices overwhelmingly shows that design plays a macro role in efforts to achieve human development goals, especially in developing countries. Such arguments support the value many governments placed on addressing and elevating design as a strategic factor in their development planning. New waves of policies—the 'design policy' or 'design and innovation policy'—utilised design discourse as a core for strategies toward implementing and promoting the country. Additionally, the power of design has been identified in relation to national economic growth. Accordingly, further new waves of design policies have been issued in countries such as Estonia, India, New Zealand, South Africa, and many more. The transformation of design discourse emergent in developing countries can be visualised as seen in Figure 4.

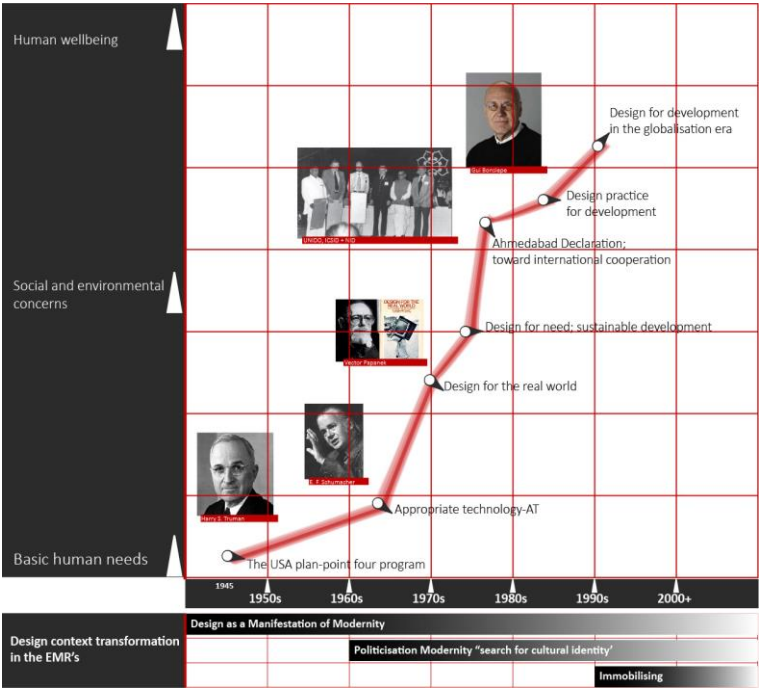

Figure 4. Mapping design discourse emergence and transformation in developing countries and the EMR's

4. Conclusion

Since the 1950s, revitalising capital and other major cities in the EMR has been demonstrated through modern infrastructure, urban planning, architecture, and broader expansion of available materialisations to provide a better quality of life for the region. Design practices and services have been creatively utilised to enhance regional societies' transformation and achieve development. This process was initially guided by the mandate system and later by the postcolonial national governments. The process influenced the emerging design context to enhance economic growth and development; as seen in strategic infrastructure planning by both the development board in Iraq (IDB) and later in Jordan (JDB) initiated during the 1950s-60s and also by sustained industrial manufacturing capabilities in Egypt and Syria, also promoted Lebanon as the regional destination for finance and tourism. The process benefited from the relatively stable socio-political systems until the 1950s. The state-supported postgraduate scholarships of that period must be strongly acknowledged for the ways they allowed local architects, artists, and applied artists to study abroad, who after graduation became the pioneering figures of foundation programs in architecture, art, and design at the higher education institutions. These programs then expanded to broader disciplines in architecture, communication, ornamentation, fine arts, etc. in Egypt, Lebanon, Syria, and Iraq and the establishment of associations to support and promote local handcrafts sectors in Jordan.

The principles of modernisation and development have been re-contextualised since the 1960s by developing countries and articulated through the political principles of the non-allied movement, which later promoted self-efficiency policies. These factors imposed new nationalisation military orders in Egypt, Syria, and Iraq, actioned to face the hegemony of neo-colonialism over the region's natural resources. The 1970s-80s experienced extensive promotion of economic growth based on industrialisation, which was represented as the core principle to achieve modernisation and development. The milieu offered the emerging design context and practices new scope, aimed at developing local visual aesthetics and reflecting creative adaptation between modern aesthetics and the regional heritage visual culture, articulated by Akkach (2014) "*The main preoccupation of this trend has been the idea of difference. The search for cultural identity in all spheres of thought and practice has been essentially a search for difference*" (Akkach 2014, p. 61). Creative application of this adaptation can be seen in architecture, communication media, and many other creative works (Figure 5). Moreover, the design studies progression toward utilising design practices to achieve innovation through strategic national policies[7] inspired the creation of the '*Ahmedabad Declaration*' of '*Design for Development*,' which transformed the role of design into a strategic core element of development planning. This was specifically enforced through design education in Iraq for example. (Saad, 2020).

[7] Examples of the historical discourse surrounding this development can be found in Britain, through events such as the conference of 'Design Policy' organised by the Department of Design Research-Royal College of Art, the Design Council, and the Design Research Society in 1982



Figure 5. Rifat Chadirji, Iraq; Regionalized International Architecture 1952-1978
http://alchetron.com/Rifat-Chadirji#-

Derived from international experiences around the significance of design knowledge and practices in branding, new events continue to emerge in the regional capital cities that target the strategic role of design to support local innovation and creativity. Examples include 'Design Weeks' in Beirut, Amman, and Cairo.[8] Unfortunately, outside these new events, the design discourses in the region continue to suffer from deep immobilisation since 1980s due to socio-political instability, and the dominant conflict limits expansion in the region.

[8] Amman Design Week http://ammandesignweek.com/about/overview Beirut Design Week http://www.beirutdesignweek.org/page/45/Home-Page

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JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

The engagement of visitors in faber's houses and studios. Empirical design research and experimental actions in Lombardy

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Abstract | Lombardy is characterised by industriousness and creativity, a crucial aspect of the region's identity that drifts from eminent artists, designers, and architects from the late XIX century to the beginning of the XXI century. This context is the action field of D.E.SY. (Designing Enhancement Strategies and Exhibit SYstems for the Italian House Museums and Studios), a research project carried out by the authors that aimed to improve and investigate theories, methodologies and design solutions in order to foster enhancement strategies for house-museums and studios of artists (*faber)*: eminent creative personalities connoted by a tangible output and whose studios and houses are influenced by their "creative action". The three meaningful examples of experimental actions developed within the research are: *Genius Loci*; *Atelier as living nature*; and *The art and its inhabitants: artistic imaginaries between houses and exhibitions*. In conclusion, the paper argues the interdisciplinarity between design and art through an empirical approach and three experimental actions focused on the enhancement of both tangible and intangible values of artists (*faber*) and their workplaces.

KEYWORDS | ART&DESIGN, HOUSE MUSEUMS, CREATIVE'S ATELIER, DESIGN FOR CULTURAL HERITAGE, CULTURAL NETWORK

1. Introduction

Lombardy is characterised by industriousness and creativity, a crucial aspect of the region's identity from the late 19th century to the early 21st century, including internationally renowned artists, designers and architects.

This context is the field of action of D.E.SY. (Designing Enhancement Strategies and Exhibit SYstems for the Italian House Museums and Studios), a research project carried out by the authors that aims to improve and deepen theories, methodologies and design solutions to foster strategies for the enhancement of house museums and the studios of artists and designers (faber): eminent creative personalities marked by tangible production and whose studios and houses are influenced by their "creative action".

The places involved include both real institutionalised house museums and spaces that represent just neglected potential future museums, but still reflect the narrative of their original function. Moreover, they can be spaces owned by public or private institutions. The focus of the research also includes houses and/or studios that have been partially modified over the years. The narrative of the original place is hidden but still traceable and could be virtually reconstructed thanks to the remaining visual documentation and other sources.

This essay aims to present some results of the research developed in the analysis of existing cases and addressed to some design-drivem proposals in order to enhance the experience of visiting such places.

The subject of this study is a group of representative house museums and studios from the late 19th and early 21st centuries. They are all significant examples of eclectic culture, the expression of artistic personalities, at the same time designers and compulsive collectors, a mise en scene of their taste and creative spirit. These "special" environments, paradigmatic "magician's laboratories", are therefore considered to be a well-recognised heritage even by museum protection and conservation institutions such as ICOM. Indeed, in addition to an immersive portrait of creative and unique personalities, they also include many aspects of everyday life and thus important historical traits that are recognisable as an outstanding part of territorial identity. Moreover, *faber* spaces, often animated by passionate heirs and curators, represent a countertrend to a diffuse and less sustainable hypermuseum. In this way, taking into account the projects developed by D.E.SY., these spaces generate educational processes for communities (Bosoni, Lecce 2019; Mazzanti 2019).

On the other hand, the analysis of the criticalities related to these places highlights the connection between different narrative levels: the historical background of the house-owners/creators' lives, their specific personalities, the lives lived in these houses, the relationship with their own creative expressions in their lives, the relationship between their collections and their creations, the relationship between the space of creation and the space created.

Three significant examples of experimental actions developed by the authors within the D.E.SY research are: *Genius Loci*, a cultural experience based on an interaction design approach; *Atelier as living nature*, a series of exhibitions located in ateliers; and *The art and its inhabitants: artistic imaginaries between houses and exhibitions*, an experimental action focused on the exhibition and meta-design approach.

Genius Loci was developed in collaboration with Museo Bagatti Valsecchi and proposes an innovative approach to enhancing heritage through non-invasive digital technologies.

Three photographic exhibitions entitled *The Atelier as Living Nature* were hosted at the Fondazione Albini, the Fondazione Castiglioni and the Studio Negri; they showed views of studios at the time when their creators were active, creating an intriguing dialogue with the current studio environments and the voices of the *faber's* heirs and museum curators. The exhibitions also fostered an eloquent new narrative, reawakening the connotation of these spaces as a true 'Living Nature'.

The art and its inhabitants: artistic imaginaries between houses and exhibitions is based on the interpretation of the "portrait" of the artist's home and studio and aims to answer two research questions: how does the physical workspace influence the artist's creation process? How do the creation processes and techniques combine to "shape" the creative space? Herein, the aim is to collect different design-driven interpretations within the same methodological context: from a field analysis to an interior design output.

In conclusion, the article supports the interdisciplinarity between design and art through an empirical approach and three experimental actions focused on enhancing the material and immaterial values of artists (*faber*) and their workplaces. Museum scholars define these as "talking spaces", places that with their furnishings become the "body of an intention" (Orsini, 2012). The D.E.SY. methodology has focused on them with non-invasive good practices and micro-interventions to decode them as environmental diaries (Mazzanti 2019).

2. Experimental actions

2.1 *Genius Loci*

The Bagatti Valsecchi House Museum is a special place, with a vibrant soul, worthy of exaltation. The house is the result of the creative minds of Fausto and Giuseppe Bagatti Valsecchi, two brothers of the Milanese upper middle class of the 19th century who dedicated their lives to it.

To create a real sixteenth century mansion, the brothers dedicated themselves to a detailed study of the most important palaces of the Italian Renaissance, not to reproduce a specific model of the past, but rather to take advantage of multiple sources of inspiration that they could elaborate in a completely personal key (Rolando, 1999), creating what was called the

Bagatti Valsecchi Renaissance (Pavoni, 1994). In so doing, the house became a mix of authentic and carefully selected pieces from the Renaissance period and details personally designed by Fausto and Giuseppe. The final result appears as a middle ground between the collection and the personal aspiration, but we must not forget that, primarily, it was a context of lived life. In fact, the house was inhabited by the Bagatti Valsecchi family until 1974. After that date, Fausto and Giuseppe's descendants opened the doors to the public, transforming it into a museum: they restored it to the original condition in which their creative ancestors left it.

This rich environment already provides detailed information about what is displayed but it is missing the valorisation of the most intangible heritage it can provide: the *Genius Loci*[1], the spirit of the house, including the figure of the *fabers* and the actual results of their work. Consequently, Interior and Interaction Design were selected as suitable means to create an engaging and situated experience, oriented by a human-centred approach. Moreover, the aim of the project was to take inspiration from the very specificity of the place, respecting and combining the will of all the parties involved: curators, visitors and designers, standing respectively for the place, the typology of experience and the means to meet all expectations. For this reason, for instance, nothing could be introduced or modified not to distort the frozen image of the time; while a temporary and replicable event format worked the best for a personal and engaging experience.

For a thorough knowledge of the location, preliminary on-field investigations had to be conducted to better understand the existing relationship between the place and its visitors, mixing traditional and bespoke research tools, aimed at involving users unaware of being guiding the generative phase of the design process (Hanington, 2010). Firstly, quantitative data about the visitors of the previous semester were collected through the statistic system of the museum. Secondly, to get a closer to the users of the institution and to comprehend its dynamics, an ethnographical enquiry based on unobtrusive shadowing has been undertaken. That seemed to be the better solution to get impartial information about the visitors' experience inside the museum, as their direct involvement in this exploratory phase could have vitiated the results.

This information helped in getting familiar with the place and its users, assessing the great appeal of the house that amazed and engaged visitors with its sense of familiarity. Though, the observed behaviors and emotions prompted the modalities for a direct confrontation with the possible users – aimed at identifying the meaning for the intervention – and ultimately the design itself.

At the end of the research, all the parties involved highlighted the desire to have the homely dimension prevailing on the museum identity, so that the welcoming and familiar sensation could be emphasized.

[1] A project by Martina Sciannamé (2017), supervisor: Davide Spallazzo.

In order to make the most intimate side of the house emerge, we returned to the original personification of the *Genius Loci*, whose symbols were painted on the walls. Even if this tradition acquired different meanings, it has never really disappeared, on the contrary, it has taken the form of noble families' coats of arms. That is why we translated the two main emblems of the Bagatti Valsecchi brothers in the materialization of Genius Familiaris (eagle) and Genius Rerum (lily). Each of them embodies a particular point of view of the Genius Loci and stands for a different visit path to discover the house's life on a symbolic reception day when the Bagatti Valsecchi brothers were still alive. The first one reflects the memories of the people who frequented the house, while the second gives voice to the objects' point of view.

To make Genius Loci come alive, an integrated and flexible technological system has been designed so that the space could become responsive in a natural human-environment interaction with pervasive and concealed devices, not to alter the perception of space. In particular, audio and projection modules had to be deployed across the rooms to convey contents when triggered by the interaction module, a beacon-powered amulet worn by each visitor or group of visitors. The entire system also responds to the requirements of flexibility and scalability, as the modules can be easily moved and reprogrammed to be adapted to different settings and narratives.

Strolling around the house is at the core of the interaction and in the different rooms, visitors may encounter three kinds of experience, according to the relevance of the place itself. Those where visitors just have to pass along are the sound passage rooms. Here, the immediate detection of the visitor wearing an amulet triggers environmental noises or distant voices. In the vision rooms, where evocative events could happen, the amulet activates a projection module, making shadows appear to visualize a significant scene. While, in the active narration rooms, visitors have to discover hidden details. The overall experience translates into an evening event, outside the museum opening hours, in which the visitor can experience an intimate and magical relationship with the house. The visit begins with the selection of the Genius that will guide the entire experience, and a brief tutorial for the interaction modalities. Then, across the rooms, different narrative strands are interwoven to show different aspects of everyday life and culminate in a banquet in the Grand Salon, the symbol of the social life of the period.

Designing solutions to exhibit the Genius Loci is a delicate process. First, one needs to stay in the place, to live it, willing to understand and listen to it, in order to recognize its essence (Crespi, 2013). Then, when the spirit is revealed to the designer, the challenge is to make it patent without being intrusive, to let it pervade the environment as if it was the most natural outcome. In this way, the resulting experience of the visitors appear more authentic, they establish a deep bond with the free-of-barriers institution, they feel privileged of being part of an environment that is revealing its true and most hidden self in an almost human manner, and, finally, they develop an unparalleled sense of belonging in such a place.

2.2 *The Atelier as Living Nature*: reflecting (on) Studio's heritage

Within the research framework - that supports both multidisciplinary systemic insights and field experimentation in museological and culturally oriented design areas – the D.E.SY. Research group promoted three photographic exhibitions entitled 'The Atelier as Living Nature'[2] . The exhibitions are part of the Milano MuseoCity 2019 event - promoted by the namesake Association and the Municipality of Milan, and by a network of private and public cultural institutions working to promote and enhance the dissemination of Milan's museum heritage. The three small exhibitions at Fondazione Franco Albini, Fondazione Achille Castiglioni, and Studio Mario Negri were dedicated to the image of the studio through the eye of the photographer who captured the panorama at the time of their creators. The archival images presented in the actual exhibits have become a stimulus to start a deeper reflection on the spaces and to show their original auras, as they are an eloquent narration of the present time, which can be enriched by reawakening the connotations of these spaces as true examples of 'Living Nature'[3].

In the context of the research, the 'Living Nature' theme was thus dialectically reflected in the particular environments of the studios and ateliers of creative people, designers, architects or artists. These are places full of hints and interpretative clues. It is an environmental and immersive 'nature' created from eloquent objects: works, tools, and inspirational subjects, more or less evident signs which outline the memory of the protagonists. "Whether it is the artist's atelier, an almost always solitary space, or the architect's or designer's studio, which is usually collective, we find ourselves faced with places that are always full of memory (where the archive area is the pulsating testimony of the creative heart), environments that preserve an atmosphere and are the mirror in which we can still see the reflections of those who have practiced and lived in them, when they are no longer active but are 'kept alive'" (Bosoni, Lecce 2019). These spaces, while constituting 'still lives' with respect to the time in which they were established, are, in fact, still vital and often dedicated to renewed and new activities (as in the case of the Fondazione Achille Castiglioni and Fondazione Franco Albini). In this sense, the 'Living Nature' theme has been recognized as an interpretative and meta-design metaphor useful both for observation and for the design of actions to enhance these spaces.

The three small exhibitions were therefore an opportunity to experiment with different curatorial and exhibition approaches to the same interpretative metaphor. The studios of an architect (Albini), a designer (Castiglioni) and a sculptor (Negri) lent themselves to being reinterpreted through archival photographic images, often authored, that testify to the passage of time, the evolution of spaces and of private and professional life, the endurance of a particular 'creative aura' that, reread with the eyes of the present, acquires even more charm and strength. T This precious archival resource (the photos), which can almost always

[2] Exhibit project promoted and curated by Anna Mazzanti, Giampiero Bosoni, Rita Capurro, Chiara Lecce, and Alessandra Spagnoli.

[3] Nature, in all its forms, from the natural or anthropized landscape to the relationship between man and the environment, was the guiding theme chosen for Milano MuseoCity 2019.

be found in the *faber's* spaces, is therefore a primary resource for activating storytelling design strategies and represents the "hub for the enhancement of the *faber's* home and studios". (Bosoni, Mazzanti 2019). The three studios, which differ in the morphology of their spaces, their character and their distinctive features, still reflect the soul of their *forgers* and, at the same time, their heritage filtered through the eyes of their direct heirs. Therefore, since the three exhibitions were presented as parallel and coordinated through a single fil-rouge, the different curatorial and exhibition strategies adopted made it possible to highlight the peculiarities of these studios. The curatorial and design choices - such as the selection of the images, the design of framing system and spaces' layout - made it possible to translate the metaphor into three different design interpretations: the frame as a focusing tool for Fondazione Franco Albini, the unexpected glimpse for Fondazione Achille Castiglioni, and the intimate retrospective for Studio Mario Negri.

As for the exhibition at the Fondazione Franco Albini, the selection of shots aimed to show the three temporal and physical movements of the studio: from via Panizza 4 to via XX Settembre 21 and, finally, to via Telesio 13. Among the selected images, the iconic portrait of Franco Albini taken by the American photographer Irvin Penn in 1948 is the only evidence of the studio in Via Panizza. Franco Albini and Franca Helg are portrayed side by side in the Via XX Settembre studio in the 1960s. The shots from the 1970s, set in the current studio in Via Telesio, bear witness to the transition to the "Studio Architettonico of Franco Albini, Franca Helg, Antonio Piva and Marco Albini". Strict light wood frames soberly highlighted the pictures. The photographs were integrated into the spaces according to a principle of cleanliness and spatial rigour: the images of the various Albini studios have been superimposed on the layout of the current Foundation's headquarter and have been arranged on parallel levels - almost never overlapping - unravelling a clear, almost linear narrative of the evolution of the studio over time.

A different approach was adopted in the exhibition presented at Fondazione Achille Castiglioni: from the photos' selection to the display setting, the aim was to give a "concentric" interpretation of the Castiglioni brothers' professional history. A limited selection of archival shots recounted the first studio of the brothers Livio, Pier Giacomo, and Achille Castiglioni in Corso di Porta Nuova preparing the viewer for a reinterpretation - through images - of the current studio in Piazza Castello. The shots by Luciano Ferri and Ugo Mulas, among others, cover a period from the mid-1940s to the mid-1960s. Through the images, integrated in simple white passe-partouts (a legacy of the last great monograph dedicated to Achille and promoted by the Triennale di Milano in 2018/2019) it was possible to recognize objects that have become iconic, the three brothers involved in the various design phases, and illustrious visitors who testify to the cultural dynamism that characterized the studio's life. The glimpses, details and moments captured by the shots were directly compared with the current layout of the studio, preferring, whenever possible, oblique and unexpected set-ups: a direct homage to Achille's amusing and shrewd personality.

Finally, at Studio Mario Negri, it was decided to set up images which, as in previous cases, would retrace the evolution of the sculptor's studios (from Via Pisacane, to Via Stoppani 6 and, finally, to Via Stoppani 7), emphasizing the intimate and introverted aspect of his creative activity. Through the shots it is possible to recognize the artist as he gives form to his works, the objects and tools that characterize his private corners, the sculptures he made and those in progress: testimonies that reveal years of hard work and creation, from the 1950s to 1987. Frames of different shapes, sizes and finishes, which were previously an integral part of the studio, have amplified the aura of an already intimate and private place. Views, perspectives and instances of intense creative fervor have brought the space back to life, allowing the viewer to perceive the sculptor's strong presence, and "act as memory consolidators" (Trocchianesi, 2014). In all of these studios, the photographic archives show themselves to be 'active folders' capable of underlining the constant presence of *fabers* as "spatialized biographies" (Bosoni, Mazzanti 2020).

2.3 The art and its inhabitants: artistic imaginaries between houses and exhibitions

The art and its inhabitants: artistic imaginaries between houses and exhibitions is the title of an experimental action aimed at involving young designers and researchers in the exhibition design field[4].

This research is based on the interpretation of the "portrait" of the artist's home and studio and aims to answer three research questions: how does the physical workspace influence the artist's creation process? How do the creation process and techniques work together to "shape" the creative space? How can this content be synthesised in an exhibition?

The aim of this action is to collect different design-driven interpretations expressed through exhibit solutions within the same methodological framework and spatial context: from a field analysis to an interior design output.

In this way we can have a collection of several interpretations developed according to a process that starts from the field analysis towards an interior design output embracing the following methodology divided into three stages:

Immersing&Reading

- Studying the artist's personality, his works of art and his productive process.
- Visiting the actual space (the artist's house and studio).

  Method and tools: desk research, on-field research, interviews, camera, sketches pads.

[4] Project curated by Raffaella Trocchianesi and Anna Mazzanti, 2018-2019.

Output: map of topics and suggestions, sketches and notes.

Interpreting&Abstracting

- Graphically synthesizing the "essence" of the artist and his workplace (spatial and mental) through a critical approach.
- Focusing on a specific topic starting from the artist's production.

  Method and tools: metaphor, abacus of chromatic, material and iconographical codes.

  Output: moodboards, diagrams and collages.

Translating&Representing

- Translating the artist's studio identity into a design exhibition that hosts both the artist's works of art and a spatial (archetypal) interpretation of their own house and studio.

  Method and tools: exhibit score/partitura allestitiva, narrative model, exhibit model, design attitude.

  Output: diagrams, sketches, technical drawings, render.

This approach allows to "extract" some crucial elements that represent the pillars of the relationship between the artists and their workspace through metaphorical communication registers.

This research action produced twenty-four design exhibitions, hypothetically placed in PAC – Padiglione di Arte Contemporanea in Milan, as "indirect portraits" of artists and their house-studios. For each of them, *narrative models* and *exhibit models* have been defined. The *narrative model* is the way in which the narration of the exhibition is organized, while the *exhibit model* is the design attitude with which the space is treated in order to stage the contents of the exhibition.

The *metaphor* is also an important tool able to synthesize the core of the idea using evocative images belonging to other contexts. But the essence of this process is the spatial interpretation and translation of the house studio into an exhibit model: how do interior designers locate and interpret the studio's synthesis of the identity in a place out of the studio itself? What metaphors, spatial models and design attitudes do they choose in order to express the relationship between the artists and their creative space?

If we read and compare all the design results of this research action, we can find some recurrences. Following some design attitudes which interpret the identity of the studios:

- *Scenography:* in the exhibition the studio is represented by a scenographic setting through different ways and systems: i. e. *layered wings* able to stratify multiple images and perspectives of the workplace; *stage setting* as a reproduction of a

meaningful part of the workplace in a style which is not realistic but totally white and out of scale.

- *Synecdoche*: in this case the identity of the studio is present in the form of a synecdoche (the part for the whole) using a specific piece of furniture present in the workplace: i. e. the *wardrobe of memories* (Leonilde Carabba) is reinterpreted in different ways within the exhibitions, as a big video wall where visitors can discover her stratified memories and art suggestions or multiplied as an actual furniture system with which visitor can physically interact (opening doors and drawers) and find objects and information; the *freestanding tripartite screen* (present in the Fornasetti's house/studio and collection) becomes the main display system here; in the exhibition the *red room* – which in the Fornasetti's house/studio is a "secret" and totally red one, where all pieces of furniture and textile, objects, and books are red (even in the titles of the books there is the word "red") – becomes an immersive room where visitors can discover thoughts, private objects and special pieces of information; the *colours and materials* as architectonic references to the actual place (Mario Negri).

- *Domestic paradigm*: the exhibition is interpreted as a cross section of the house/studio. In this way visitors are immersed in the private space of the artist: i. e. the *wall as a linear unrolled space* in which rooms and corridors are photographically reproduced in the same vertical surface, the bi-dimensionality is interrupted by niches with actual objects or interactive screens (Fornasetti); the diverse rooms of the house/studio are "spread" in the whole exhibition in a sort of multi articulated and *"diffused home".*

- *Abstract spaces*: the exhibition "undresses" the space all figurative references to the actual artist house/studio: i. e. in a "neutral" context parts of *walls and surfaces are malleable* in terms of materials and settings in order to make the place performative and dynamic (Pomodoro's creative process); some parts of the house/studio is reinterpreted by *archetypal spaces* like tunnels and caves in order to underline some crucial meanings of artworks and their symbolic context; the *white box* as a "neutral" place where pictures of the actual workplace are shown as a documentation.

This research project demonstrates the interdisciplinarity between design and art through an empirical approach and an experimental action able to extrapolate the interpretative logics of both the tangible and intangible values of the artists and their workplaces. The latter influence the creation process and, symmetrically, the creation process shapes the workplace: indeed in Fornasetti's case – for instance – part of the space is a repository of sources of inspiration (see the room with the archive of iconographical units) and part of it is a show of countless objects. Pomodoro's studio includes an archive of works, documents and – at the same time – a workshop "shaped" by materials. All of these artists and places tell something about the creation process, the inspiration path, the physical and/or mental approach to the art. All of

these spaces can be expressed by metaphors like: the introspective journey, the retreat, the labyrinth, the wonderland, the Wunderkammer, the silent island, the grammar of signs and so on, in a continuous dance of evocative images and physical installations (fig. 1).



Figure 1. The chart illustrates the correspondences between the artists involved in the research and the design attitudes and metaphors assumed in the exhibition systems related to them and their studios (Trocchianesi 2019).

3. Conclusions

The three actions previously described, demonstrate three different ways of enhancing the topic and object of the research:

- In *Genius Loci* the object of the research – Casa Bagatti Valsecchi and its tangible and intangible heritage – is the actual context in which visitors explore the narrative related to the house itself.
- In *Atelier as living nature* the object of the research – the ateliers and their tools and works – is the actual context of the exhibition and, at the same time, the subject shown through the mediation of pictures.
- In *The art and its inhabitants: artistic imaginaries between houses and exhibitions* the object of the research – the essence of the studios, the artist's personality and their works – is not shown in the studios themselves but in another place (PAC-Padiglione d'Arte Contemporanea).

Sharing attitudes and skills, the researchers involved in D.E.SY., therefore, have set up experimental laboratories where the different narrative processes adopted underline the immersive portrait of the *faber* and his work, his poetics and his interpretative ideas of spaces. In doing so, they found ways to make submerged and hidden meanings eloquent and evident. In conclusion, therefore, it is a matter of display techniques, or immersive narratives through digital technologies or exhibit re-constructions and interpretations. The common intent has been to bring back to life what Valery (2008) called the "poetic state" of the *faber*.

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Acknowledgements: The paper is the result of common research and findings undertaken by the authors within the research D.E.SY. (Designing Enhancement Strategies and Exhibit SYstems for the Italian House Museums and Studios). Nevertheless, the paragraph 1 was edited by Anna Mazzanti, the paragraph 2.1 was edited by Davide Spallazzo, the paragraph 2.2 by Alessandra Spagnoli and paragraphs 2.3 and 3 by Raffaella Trocchianesi.

We would like to thank Marco Albini, Paola Albini, Elena Albricci, Leonilde Carabba, Giovanna Castiglioni, Barnaba Fornasetti, Laura e Luciano Fiume, Antonella Gornati, Marina, Chiara and Lalla Negri, Casa Museo Lodovico Pogliaghi and Museo Bagatti Valsecchi.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Theory under suspicion: criticality and material meaning in practice based research.

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Abstract | Practice based research projects in design constitute a relatively young practice and despite the recent growth of books and articles dealing with the subject (Camps & Rowan, 2019; Vaughan ed. 2017; Redström, 2017; Muratovski, 2015), the articulation of practice and theory in these kinds of projects still remains problematic. The following paper explores alternative forms of practice-based research in design capable of engaging with criticality whilst avoiding its tendency towards signalling shortcomes and contradictions without providing ways for reparation. It also deals with how to avoid the shortfalls of objectivity or demonstration but nonetheless not falling into subjectivist practices (Verwoert, 2007). We will be looking into ways to embed design practices in a complex and heterogeneous present, working with pluriverses (Escobar, 2018) and situating practices in more than discursive material worlds.

KEYWORDS | PRACTICE BASED RESEARCH, CRITICAL THEORY, MATERIALIST AESTHETICS, ENTANGLEMENT

1. Introduction

Theory and practice have not always found it easy to fit in together in academic curricula and in studio or practice based education. Even if we acknowledge that the notion of theory itself is problematic and doesn't constitute a neatly defined practice or stem from a single continuous history (Rodowick, 2015), in some contexts theory and practice can be perceived as competing or even antagonistic practices. The cultural theorist Raymond Williams in his work Keywords, "identifies four primary senses of the word "theory" emerging by the seventeenth century: spectacle; a contemplated sight; a scheme of ideas; and an explanatory scheme" (Rodowick, 2015: 18). In this sense theory has come to be a set of conceptual operations that "seek to explain, usually by proposing concepts, but in this they are often distinguished from doing or practice. In this manner, Williams synthesizes 'a scheme of ideas which explains practice'" (Rodowick, 2015: 18). But as we will see, theory seeks to do more than mainly explaining practice.

In one of the fundamental texts that came out of the Frankfurt School, Max Horkheimer sets out to establish a more active role for theory. In his work Traditional and Critical Theory, he challenges the notions of objectivity and impartial universal knowledge that characterises modern science. He argues that the dualist Cartesian split that separates mind from body, subject from object has contributed to create a form of instrumental rationality that runs through modern epistemologies. He argues that "traditional theory" is a result of this paradigm in which the rational subject thinks he can understand external reality. Traditional theory is a detached cognitive operation that explains how things are. He opposes this traditional theory to what he brands as critical theory. For this new way of doing theory, reality is not waiting to be understood, but it is actively enacted through social practices. Subject and object are both social formations. This is why critical theory does not only contemplate reality from a distance and unpacks its mysteries, it needs to give a robust account of the social, economic and material conditions that shape reality. Critical theory does not only aspire to describe how things are, its main aim is to contribute to social change social, deal with inequalities and make power relations evident. If traditional theory is happy to describe how things are, critical theory aims at contributing to change reality in order to create a more equal and just society.

Critical theory has found an interesting space to inhabit design research projects, in the form of discussions and works on design and feminism (Rothschild, 2011), decolonizing design[1], design gender and discrimination (Costanza-Chock, 2018), design and diversity, design and surveillance (Weizman, 2017) or the politics of material objects (Winner, 1986). But despite the growth of interesting projects and critical practice, we have experienced how in many cases critical theory reproduces some of the epistemic mistakes and errors its seeks to

[1] See https://www.decolonisingdesign.com/

eradicate: it privileges words over things, theory over practice, discourse over material meanings (Boscagli, 2014), suspicion over affect (Kosofsky, 2003), concepts over actions.

Theory has grown in design studies programs and arts and designs universities and its is now central to design research schemes, but we will argue that new ways of engaging with theory/practice must be explored. Ways in which material meanings are taken into account (Barad 2007). In which the knowledge/action split is undone. This implies the pursuit of ways in which to enrol and work with non-discursive meanings and addressing semio-technic entanglements (Puig de la Bellacasa, 2017) and the need to investigate and integrate non-western epistemologies (Sousa Santos, 2017; Viveiros de Castro, 2009), giving space to explore materialist aesthetics (Gregg & Seigworth, 2010) and playful ways of performing knowledge.

2. Theory Under Suspicion

Our aim is to explore and showcase some of the strategies/devices/prototypes we have devised in order to bridge the theory/practice gap. In order to promote "knowledge in action" (Camps, 2019), and more experiential forms of learning. Forms of learning that matter. Meaningful engagements with art and design research projects. These are pedagogical experiments aimed at finding new ways to integrate theoretical concerns and practice based forms of researching. We are aware that practice based research projects in design constitute a relatively young practice, despite the recent growth of books and articles dealing with the subject (Camps & Rowan, 2019; Vaughan ed. 2017; Redström, 2017; Muratovski, 2015). Still, most of these proposals and discussions end up producing more theory. Separating matter from meaning, as if theory provides meaning for a matter that waits to be understood. This is why we aim to work through pedagogical practices that can promote and help to establish these forms of "knowledge in action", in which concepts, examples, experiences, and intuitions can be invoked. In this sense, this does not constitute a research method per se, these are not closed ways of doing research, but open strategies/devices/prototypes that can be redone, contested and continually reworked. The following pedagogical experiments consciously aim at going beyond the modern epistemic framework we have inherited in which science and art occupy different academic spaces. Going beyond binarisms, bridging the knowledge practice divide, reworking through modern taxonomic categories, and challenging hetero-patriarchal and colonial epistemic regimes, our aim is not to put theory aside, but to allow it to inhabit and become entangled with material practices avoiding epistemic privileges. The following pedagogical experiments try to circumvent the knowledge-truth paradigm, to link learning with affect, theory with joyfulness, material with meaning, ideas with care.

These proposals stem from the certainty that sustaining uncertainties is one of the hardest problems for design students and researchers. Our previous research has proved agents that engage in design research projects usually feel more comfortable with closed assignments,

conceptual certainties and methodological boundaries (Camps, 2019). Tinkering with learning processes, experimenting with inventive methods (Lury & Wakeford, 2012), or deploying theory strategically, enables messiness and confusion to become part of a creative research process. In this sense we consider that it is important to design strategies to sustain "knowledge in action", a practice inspired by the political and aesthetic work carried out by the artist and philosopher Erin Manning and the philosopher Brian Massumi (2014). In an attempt to see how affective theory could be put into practice they devise forms of engaging with theory that transcend the mind/body, thinking/doing categories. In that sense we aim for research practices that give place to forms of knowledge woven into the body, through practice and repetition. Involving the senses and going beyond ocular-centric ways of producing theory, by touching (Puig de la Bellacasa, 2017), licking (Morton, 2013), sweating (Pérez Galí, 2013) or sensing rhythms (Ikoniadou, 2014) as forms of learning and understanding the world.

The following strategies/devices/prototypes, or as Isabelle Stengers smartly has put it, the creation, invention and use of artifacts (facts or art) (Stengers, 2000:50), allow our students to become engaged in the research process and forget the inherited frameworks of research from natural sciences or social sciences, which aim to obtain objective outputs or get closer to some kind of truth. For these artifacts to work, we must rework traditional ways of assessing research outputs and deploy new indicators under which these projects are going to be measured. Research in design should not aim at establishing universal truths, neither should they be a material representation of how theoretical discourses operate. The experiments that follow aim at engaging in a sensorial dialogue, in which different knowledge genealogies, theories, materialities and located forms of knowledge can take place.

In our experience as teachers and researchers, we have often found that the power of critical theory and its great capacity to debunk the material reality it confronts ends up blocking forms of creativity and material intuition. We must find meaningful ways of engaging with theory without aiming at becoming theorists, but design researchers with a deep understanding of the contemporary world in which we inhabit. The strategies/devices/prototypes we have developed stem from the awareness as teachers and researchers that in too many occasions the deployment of sophisticated theoretical apparatuses can overpower practice based design research projects. Despite theory's desire to change uneven power relations, to provide a coherent framework in which to understand contemporary issues, can become an obstacle for the development of projects by students and researchers.

During these last five years in our work we have experienced that, the more students/researchers advance in their engagement with theoretical issues, the more responsibility they feel regarding their role as designers. They become aware of the implications of trying to function as active agents of change in contemporary social issues. A much needed step if one confronts complex challenges and socio-technical controversies.

Nevertheless, this responsibility does not always transform into creativity, on the contrary, their practice often suffers either from a material paralysis, or they feel the need to translate and represent the concepts put forward by certain theoretical discourses. The concepts they work on are so powerful, the epistemic consciousness of their shortcomings can be so violent, that it is common to end in a creative impact that can turn the proposals for research action or projects more rigid and troubled, concerned exclusively with fulfilling the requirements of the premises of critical theory. This can lead to believing that for a project to have meaning, for it to be meaningful, it must be justified and accompanied by a dense theoretical analysis. We would like to argue that practice matters, and because of that, it can produce its own meanings.

Our aim with the following strategies is to move beyond this feeling that theory operates as a judge of material actions and rather establish a joyful conversation with verbal, material and sensitive discourses. We propose that design research projects should not be obsessed with debunking, seeking revenge, judging or saving the world, but, as Arturo Escobar reminds us, they should be concerned with the idea of opening up possible worlds. Or as he puts it, they should engage in designing for the pluriverse (Escobar, 2018).

3. Entanglements of material meaning: some attempts

Once we have identified the risk that theory tends to contribute to the production of more theory, and that in occasions it is struggles when it has to relate, engage or become entangled with practice, we propose a repertoire of possibilities for handling this reality. We need to clarify that In the following paper we will not focus on the development of design research projects and their relationship with theory[2], but on how can we start exploring meaningful material entanglements by encouraging the establishment of live relationships that place the practice in specific networks of practice, systems of ideas, aesthetic repertoires. To do so we have been inspired and we have worked with the idea of intra-action developed by the feminist physicist Karen Barad (2007). This notion helps us to explore and articulate encounters between critical theory, the politics of matter and the sensibility of aesthetics. It is in fact an invitation to take part and be able to contribute to the creation of a mutually constitutive entangled agencies, in which matter, discourse and bodies occupy unexpected positions. What we have called “entanglements of material meaning” are areas of potential engagements with theory/practice that can lead and end in

[2] For deeper insight to this subject we recommend reading “Building Theory Through Design”(Markussen, 2017) in which the author shows how design projects can lead to new theory distinguishing between three basic forms of theory construction: *guiding philosophies, conceptual frameworks* and *ideas borrowed from other disciplines, manifestos, annotated portfolios and design implications*, all exemplified by PhD theses.

the shape of performances, drawings, paintings, constellations of objects, sound based projects, movement and body languages, interactive outputs, etc. In this sense they are not defined methods, recipes or closed procedures, they function as ways of generating engagement. Ways in which to explore more evocative ways of mattering meaning. Ways to envisage and define sensorially genealogies of thought and action. Following Donna Haraway's assertion that we are constituted by relational ontologies, that who or what we are is defined by a dense and complex set relations with and into the world, our aim is to detect and shape these relations. Promoting ways in which to embed one's own practice into social, political, material and aesthetic concerns. Shaping the meaning of a specific practice by locating it alongside other meaningful practices.

These meaningful matter entanglements also draw inspiration from the idea of "community of practice" developed by Richard Blythe and Marcelo Stamm in the context of Practice-based Design Research in doctoral studies (Blythe and Stamm, 2017). As they put it, "a community of practice can be understood as the choir of voices that operate as self-talk during the creative process. This self-talk, although an individual phenomenon, is an internal conversation with peers and collaborators (and sometimes challengers) extending the social aspects of community also to individual thinking"(Blythe and Stamm, 2017:59). This leads us to open our field of action and focus on contextualizing the proposals in a more effective and conscious way. This idea of "communities of practice" was initially developed as a way to identify those forms of knowledge production that take place beyond academic or institutional learning environments (Lave & Wenger 1989). In any given formal or informal context, people devise ways of sharing ideas, producing specific arrangements and forms of knowledge that help these communities to deal with practical issues that affect their life. Following this idea, rooted in the pragmatism of Pierce or Dewey, defining a community of practice helps the researcher to become aware of the subjects, spaces and practices that inform and contribute to expand their own practice. Drawing a community of practice implies becoming aware of who else is working on the same issues you are dealing with, who is sustaining similar concerns. Who is affected by your practice and what practices affect your own work.

The challenge we face is to articulate forms of theory and practice that belong to different fields, disciplines and genealogies. To open conversations and links with other researchers/practitioners whose work resonates with our own. Establishing non-hierarchical topologies of instruments, technologies, debates, concerns and matters. Becoming open to being affected by other projects, seeking to affect the work of others. In this sense, these entanglements can be more poetic than logical, more evocative than descriptive. Learning to identify other instances of meaning, other ways of mattering theory, contributes to defining our own practices. Research is about establishing non-liner and extraordinary links, coherence is what provides a framework for this exercise of material entanglements and actualization. By identifying and establishing entanglements we can intra-act in a new system of meaning, the aim should escape from casual linking in order to seek deep and strong intra-actions, to intertwine a particular practice with other practices and theories. Locating our practice in one or other community of practice, linking it to a specific set of theories, a defined set of aesthetic inclinations or other, makes our practice perform in completely different ways. Making oneself accountable for these entanglements,

acknowledging how you affect a certain context or affects your practice implies a deep understanding on how your practice operates.

The following examples come from the PhD. thesis “Knowledge in action: undisciplined teaching practices” (Camps, 2019), and they explore some of the issues developed above.

> Pencil quotes: Pencil quotes constitute a specific way to do a literary review, in this case, working on visual summaries and handmade drawings and diagrams. Instead of engaging linguistically with concepts, these pencil quotes acknowledge other ways in which meaning can be attained and knowledge created. Diagrams, colours and visualizations can be created allowing non-linear ways of ideas to emerge. These images open-up new meanings and relate in weird and open ways to the ideas and discourses which have previously been developed semantically. This contributes to the creation of new relationships and hierarchies of information and other ways of presenting concepts. Pencil quotes are spaces of assimilation of the theory that help to deepen its meaning. Still these pencil quotes are still too flat to allow intra-actions, to give place to entanglements with other ideas or practices. Their limitations become apparent when our aim is to define a new system of relationships. However, this is a first step towards mattering theory, towards working in a more visual and personal way. This contributes to attain a better understanding and developing new meanings of theoretical and discursive practices.
>
> We have selected three pencil quotes that unpack and work through some key concepts and ideas put forward by different authors, in this case Damasio (1994, 2018), Federici (2010) and Braidotti (2013) that serve specifically to the research and practice of the thesis:



Figure 1. Pencil Quote: Damasio (1994, 2018). Camps (2019).



Figure 2. Pencil Quote: Federici (2010). Camps (2019).



Figure 3. Pencil Quote: Bridotti (2013). Camps (2019).

Interactive genealogy

Bruno Latour, inspired by a concept put forward by John Tresch (2005) developes the notion of the *cosmogram* in order to provide ways in which to display and allow for the interaction of human and non-human agents in the design and transformation of natural and social reality. A cosmogram is a device with which we learn to describe the associations of convenience, coexistence, opposition and exclusion between human and non-human beings. As Latour himself points out: «Mapping cosmograms means becoming sensitive to these lists of associations and logical duels without resorting to the distinction between the rational and the irrational, the modern and the archaic, the systematic and the asystematic» (Latour, 2000:115). We have explored ways in which to develop these entanglements of humans and non-humans, tools and ideas, techniques and practices.

The following example was an attempt at making pencil quotes to intra-act with other quotes and materials. To generate a more complex set of relations and genealogies that would help to shape a specific cosmogram. Once some of these links were drawn on paper, there was a need to look for another tool that would allow these relationships to move, grow or change.



Figure 4. Drawn on paper genealogy. Camps (2019).

This cosmogram was digitized and uploaded on an online server[3], that allow interactions between discrete objects and movement among them. Each element, mostly pencil quotes, specific theorists or projects, was tagged with information such country of origin, date of birth or when it was published, keywords, etc. The tool allows these elements to be recombined, generating different relations among them. Their sizes can be altered, which also allows to give more or less importance to specific elements in a genealogy or another. These temporal arrangements help to envisage how cosmograms can change, can grow or give place to new genealogies. The combination of elements, the possible links and entanglements among them, define specific cosmograms that later can be redone. In this sense, heterogeneous elements can come into conversation, can be linked giving place to new meanings and cosmologies.

[3] In this case the free-software activist server https://hotglue.me/

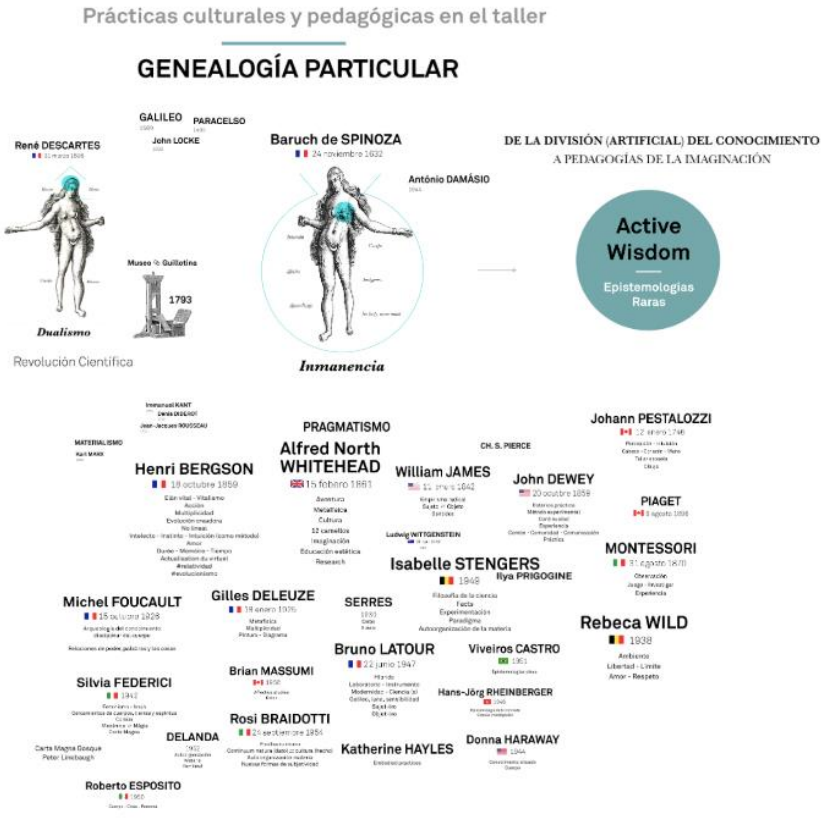

Figure 5. Interactive genealogy[4]. *Camps* (2019).

Performative genealogy: a litany

This artifact is inspired by the interdisciplinary research project "Choreo–Graphic Figures. Deviations from the Line", led by artist Nikolaus Gansterer in collaboration with choreographer-dancer Mariella Greil and artist-writer Emma Cocker, in dialogue with a team of international critical interlocutors[5]. The proposal stages an eccentric encounter between drawing, choreography and writing that aims to

[4] https://practicasculturalesypedagogicas.hotglue.me/
[5] http://www.gansterer.org/choreo-graphic-figures/

investigate those forms of 'thinking-feeling-knowing' produced through collaborative and interdisciplinary reciprocities. At the same time it explores the performativity of notation (figures of thought, speech and movement) in order to materialize research. What we find particularly useful and inspiring from this kind of proposals is that they explore the nature of thinking-in-action where different practices enter into dialogue. It allows different semiotic meanings, practices and bodies to become entangled and to collide. This opens-up the opportunity for new layers of knowledge and affection to become embodied, encouraging «the need to invent and define research methods that explore results and formats capable of challenging the hegemony of the written word» (Rowan y Camps, 2018, p. 55).

In the following strategy/device/prototype, we have worked through this sense diagram proposed by Gansterer and tried to transform it into another machine to allow this meaningful material entanglement. In this case, it is a sound base device that operates on a purely sensorial dimension: a litany. Originally litanies have their origins in Christian songs or prayers, from the 5th century, which constituted long and monotonous enumerations of frequently repeated prayers, with a standardized cadence. In this case we take up the litany as a possible practice to help to entangle matter and meaning. To do so the researcher needs to work on an open list of references, ideas, theories, practices, objects, materials, needs, aspirations or fears. Through an exercise of free association of concepts, ideas and experiences, the litany provides a context for them to be located in different proximities and rhythms. It creates a (dis)order, in which intuitive associations become weave through sound. This is an evocative way generating relations between elements that can seem apparently disconnected. It helps overcome the practice/theory divide, and works against the idea that knowledge operates following rigid disciplines. In this way, the voices of artists, thinkers, designers, sociologists and scientists as well as different materialities (colours, textures, sounds…) can be brought together through a sensorial entanglement of meanings and traditions.

Litanies contribute to synesthetic experiences. The performativity of sound here affects the bodies of those listening, where concepts, words and images become entangled in their minds. Sensorial entanglements take place. The litany presented in Marta Camps' thesis was entitled "The (Artificial) Division of Knowledge"[6] In this case, the litany, originally handwritten in a slow and monotonous rhythm, chains together ideas and images and builds up this prayer through a series of enumerations. It is both a written and an audio-performatic piece that provides an opening to an imaginary of arbitrary hierarchies.

[6] https://archive.org/details/letanialadivisionconocimiento



Figure 6. Performative genealogy. Camps (2019).

4. Conclusions

In the following paper we have discussed some of the problems derived from trying to entangle two different material practices: producing theory and design research projects. We have looked into ways to embed design practices in a complex and heterogeneous present, situating practices in more than discursive material worlds, and trying to find new ways of producing material meaning. Along this paper have argued that practice based design projects need to work on the creation of strategies to situate these practices in the world, allowing material and political interdependencies, discursive continuities and material entanglements to become apparent.

We have shown evidence of research projects in which rich entanglements of semiotic and material elements are present, in which aesthetic, political and social considerations are taken into account, contributing to go beyond the epistemic affordances of criticality or discursive based practices. We have tapped into a history of practice-based forms of research in design, showing how notions such as “community of practice” can help us to define more complex ways of situating and materializing links between heterogeneous practices, complex discourses, theoretical approaches and socio-aesthetic concerns. We have explored ways of engaging with criticality whilst avoiding its tendency towards signalling shortcomes and contradictions without providing ways for reparation.

In this sense we have explored the consequences of embedding the notion of relational ontologies into design research, showing how semiotic/material entanglements, situated practices and aesthetic concerns matter. This paper is a small contribution to a long debate on how to make design research projects meaningful, in this case, by working and providing evidence of how practice not only is embedded in the world, but by establishing new links and robust entanglements, helps to produce new worlds. Design is an ontological practice, material/meaning entanglements contribute to the production of these new worlds, or pluriverses using Escobar’s terms (Escobar 2018). In this sense, helping to find, understand, establish and become accountable of these entanglements, is a way of making design matter in a world that needs healing and repairing. It's a meaningful way to make design matter.

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DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Tokyo 2020: globalisation and self-orientalism in the communication of the next Asian Olympic Games

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Abstract | The paper aims to review of the communication strategy of Tokyo 2020 Games, starting from a historical analysis of the previous Japanese Olympics: the critical stances are supported by bringing together the theories of the main Olympic design reviewers and by using the Decolonising Design critical method. The discussion focuses on the underlying ideology of Olympic designs, highlighting the bond between local culture and global branding. The research has been carried out by consulting original documents concerning Olympic design from the Historical Archives of Olympic World Library (Lausanne) and the Musashino Art University Museum and Library (Tokyo).

KEYWORDS | OLYMPICS, NATIONALISM, GLOBALISATION, JAPAN, BRANDING

1. Decolonising design critical framework on ‘a cultural performance of global proportion’

Since their birth in the late 19th century, the Olympic Games were strongly influenced by consumerism, as the host cities implemented a vast number of strategies to cover the organisational costs: from the sale of tickets and gadgets to the long-lasting sponsorships with worldwide partners (Chappelet, Ferrand & Séguin, 2012).

Another distinctive trait of the Olympic Games is the political involvement. Indeed, despite the Olympic Movement’s claims to be an apolitical association, the Games have often mirrored the dynamics of international conflicts: the many boycotts during the Cold War or the struggle for the recognition of China’s and Taiwan’s National Committees are just a few examples (Guttmann, 2002).

The link between Olympics, politics and consumerism, allows tracing a critical analysis which involves design as a fundamental means to convey values and identities and to support the mass production of consumers’ goods. The visual design projects for the Games, as well as the design of the symbolic venues and objects related to the event (torch, cauldron, podium, medals, stadiums, etc.), are in fact the touchpoints which are meant to create a link between the audience and the values spread by the Olympic Movement. The importance of these aesthetic experiences is well expressed by Kang and Traganou:

> “The key features of the reception of the Olympics are grounded upon the aesthetic experiences of the spectacles created and disseminated by the global media and entertainment industry complex.” (Kang & Traganou, 2009)

From the point of view of communication design, if we consider the Olympic Movement as a brand and a brand as “the entire organisation from the stakeholders’ point of view” (Davis, 2010) the vast number of stakeholders which revolves around the Games enriches the brand with many facets, giving life to “a cultural performance of global proportion” (MacAloon, 1984). This “global proportion” is rooted in the DNA of the Olympic Movement, since the Olympic Charter claims to promote “universal fundamental ethical principles” which aim at enhancing the “harmonious development of humankind” (International Olympic Committee, 2019, p. 12).

Despite the aspiration to universality, the Games are, from its inspiration (ancient Greece) to its modern references (British sports), a cultural expression of the European elite class of late 19th Century (Chatziefstathiou, 2005, p. 367). The organization of the Games, which classify athletes according to their nationality, is a direct consequence of the Internationalist ideals of that time. It is then possible to identify the birth and spread of the Olympic Movement as a part of a bigger process, which is deeply rooted in the colonialist/internationalist mindset of Western cultures: imposing local (western) cultures on a global scale with the claim to be universally valid or correct.

Decolonising Design approach traces a suitable framework to analyse the contradictions between local and global culture in such a complex event as the Olympic Games. Khandwala provides a concise explanation of the ideas that lie under the concept of decolonisation:

> "It's an acknowledgement that in the West, society has been built upon the colonization of other nations, that we exist within a system of privilege and oppression, and that a lot of the culture we've come to see as ours has actually been appropriated or stolen". (Khandwala, 2019)

From a design point of view, colonization lies in the principles and methods of what is considered 'good design': a canon, often regarded as universalist, which is in fact deeply rooted in Euro-American culture.

2. Japanese westernisation and the problematising of national identity

Japan was the first Asian country to host the Games: a chance for western countries to come into contact with a radically different culture. When it comes to Olympic design in Japan, we can witness the multifaceted intertwining of different cultural influences, both local and western/global.

In order to analyse these design projects according to the decolonial privilege/oppression dichotomy, it is fundamental to understand the unique configurations of Japan's international affairs through history and the key moments in which it faced colonialism:

- after more than 250 years of political and commercial isolation, Japan underwent a lightning-fast process of modernisation during the so-called Meiji Era (1868–1912) in order not to succumb to Western colonialism;
- in the pre-WWII period, Japan has carried out an aggressive military strategy aimed at colonising neighbouring countries. This Pan-Asianist militarism was rooted in Japan's national feudal culture and influenced by Western model of colonialism:
  "[…] when the premises of the national hierarchy were transferred horizontally into the international sphere, international problems were reduced to a single alternative: conquer or be conquered" (Maruyama, 1963, p. 138);
- after the Axis' defeat in WWII, Japan has been occupied by the Allied Powers for six years (1945–1952): the Japanese constitution was rewritten under the American influence and the Emperor's powers became strictly limited by law.

The two-sided role of Japan as a coloniser and a colonised country originates a unique mixture of local and foreign culture, which results in a rich and multifaceted expression of its national Identity. Along with the introduction of Western culture, the Empire began to question its own traditions, problematizing the issue of national identity in order to relate to

foreigners. From a decolonising design point of view, the notion of problem-solving itself is markedly linked to the Western approach to design:

> "the work of design, even when practiced with a supposedly 'socially-conscious' mindset, ultimately follows 'the guidelines of the oppressor,' teaching designers to assume the world as a well-defined set of problems to be solved" (Oliveira, 2018, p. 94).

Design is a solid example of a Western discipline which has been assimilated by the Japanese culture and reinterpreted in original ways. At the same time, the visual outputs of Communication Design provide a touchpoint to critically examine the expression of national identity in Japan.

3. Tokyo 1940: self-orientalism and reinterpretation of western models

Japan was in charge of hosting the first Asian Olympic Games in 1940. However, after the Marco Polo Bridge Incident, the Government decided to cancel the Games.

The cultural relevance of an Asian country hosting the Games was underlined by Pierre de Coubertin in person:

> "The task of celebrating the XIIth Olympic Games will be the greatest ever given to a country, for it does not mean merely to pursue the Olympic Torch through the universe and to unite the whole of Asia with the Modern Olympism in a most cordial manner, but also to combine Hellenism, the most precious civilization of ancient Europe, with the refined culture and art of Asia" (The Organizing Committee of the XIIth Olympiad Tokyo, 1938, p. 13).

The communication artefacts designed for the 1940 Tokyo Olympics are characterised by the lack of any kind of visual coordination. The Organising Committee couldn't set up a communication team on time, and the competitions for the poster and the seal have been carried out without the supervision of a design director. The finalist posters show a blend of Western references and Japanese traditional culture: some of them remind Art Deco sophisticated simplicity, other ones recall propaganda images of contemporary dictatorships and their classicist inspirations. The winning poster represents the first Emperor Jimmu Tenno as 1940 was also the 2.600th anniversary of the foundation of the country (Traganou, 2016). The use of stereotypical Japanese images (cherry blossoms, Mount Fuji, geisha) is regarded by the critics as a self-orientalist attitude (Traganou, 2016): the way that Asian countries use to depict themselves according to Western-Orientalist narrations. This alignment to the Orientalist point of view could be regarded both as a sign of "perceived-inferiority" compared to Western countries and as a way of injecting the native culture in a different framework in order not to lose it and to better communicate to a new audience.


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It is crucial to highlight that, in the above-mentioned cases, European art and design were used as a void visual reference without taking account of their historical and political implications, since classicist mannerism in the Olympic posters and modernist visuals in *Nippon* and *FRONT* magazines were both used as neutral languages to convey nationalist messages.

4. Tokyo 1964: traditional references in a modernist universalist corporate identity

After its defeat in World War II and the Allied occupation, Japan wished to regain independence and international credibility: both Olympics and design have proved to be fundamental tools to convey a renewed and peaceful national identity to the world. One of the key moments in this process was the World Design Conference held in Tokyo in 1960, where designers from all over the world were provided with a common ground to discuss about contemporary issues. A relevant speech on the balance between tradition and innovation was given by Yusaku Kamekura. As he asserted:

> "Tradition is a burden for the designer, but one which he cannot reject. We have the duty to take our tradition apart, and then put it together in a new way" (Kamekura, 1960, p. 33).

He then enumerates some examples of Japanese art: the family crests (*mon*), the rigorous body movements of No and Kabuki, the tea ceremony. All of these traditions are strategically selected to be formally related to modernism: they are all characterized by geometrical purity and a focus on the function. Traganou (2016) claims that the continuity between tradition and modernity is only apparent: modernity was, in fact, imposed forcefully as a Western cultural standard. However, instead of just passively assimilating the design method, Japanese designers actively contributed to the development of the discipline with crucial innovations, some of which were initially triggered by the Olympic Games.

The international discipline of Corporate Identity and the Olympics met in Tokyo. The design guide sheet, a proto-branding manual, became a blueprint for the Olympic design management of the following Games. The universalist ideals were also embodied in one of the most important visual elements of the Tokyo 1964 Olympics: the pictograms. With Otto Neurath's work and the above-mentioned *mon* as main inspirations, Tokyo 1964 pictograms were conceived as a universal language to overcome linguistic barriers (Katsumi, 1964). According with the denial of pre-war nationalism, the 1964 Olympics has also been a way to re-establish a new meaning for *hinomaru* (Japanese flag) after the WWII. Even though the logo designer Yusaku Kamekura (1960) stated that the main idea behind the design was to represent the sun, the similarity with the Japanese flag was highlighted by both other designers and the official report of the Tokyo Games.



Figure 3. Anzai, A., Awazu, K., Katsui, M., Yamashita, Y., Sugiura, K., Tanaka, I., Tokyo 1964 design guide sheet. Logo design by Yusaku Kamekura, pictogram design by Yoshiro Yamashita.

Far from being a revolutionary break with the past or an example of mere continuity, the Tokyo 1964 Olympics could be more appropriately thought of as a hub where various influences converged and from which other trends took off. Corporate identity and modernist visuals, regarded as a sort of universally understandable *lingua franca*, were used to convey a renewed Japanese national identity.

5. Sapporo 1972 and Nagano 1998: from the crisis of universalism to the rise of branding in the globalised-neoliberal world

The universalist ideals behind the pictograms and corporate identity started to collapse (Traganou, 2016) with Sapporo 1972 Winter Olympics.

The stillness of the Tokyo 1964 red circle was broken by the modular approach adopted by Kazumasa Nagai for the Sapporo 1972 logo, which allowed to combine three square elements in different ways. The typographic poster by Gan Hosoya shows a dynamic and bright effect applied on the letters, which clearly moves away from modernist style. The illustrated poster by Kenichi Kuriyagawa depicts an archer wearing traditional clothes and the city of Sapporo in the background. This output is similar to a proposal made for Sapporo 1940 Olympics and restores tradition without significant reinterpretation (Comité International Olympique, 1983).



Figure 4. Nagai, K., logo design of Sapporo 1972. Hosoya, G., Sapporo 1972 poster. Kuriyagawa, K., Sapporo 1972 poster.

The eclecticism of the Sapporo Olympics denotes a change in the approach to the project, as modernism was not a principle nor a design method anymore, but just a set of stylistic elements. The alleged universalism of modernist artifacts like pictograms turned out to be not so universally valid: for instance, Japanese rural population couldn't understand them at Expo Osaka 1970 (Komatsu, 1970). From then on, modernism and corporate identity took separate paths.

With the advent of globalisation in the following years, the role of the nation in the international context has dramatically changed:

> "In the one hand, the trade liberalisation brought to worldwide deregulation of capital. In the other hand, single nations, free from controlling the economy, still have sovereignty over their territory in an increasingly connected world. 'We now recognize that the local, regional, national and global operate in dynamic simultaneity'" (Fallan & Lees-Maffei, 2016, p. 14).

At the same time, in the globalized world:

> "The culture of mainstream commercial design has developed […] to support and promote neoliberalism" (Julier, 2012, p. 345).

As a consequence, corporate identity evolved into branding, according to which the communication of the product relies on marketing techniques applied to design: brands are systematically built on values which are chosen to match the consumers' aspirations and are not necessarily related to the actual qualities of the product/service itself. Design direction became significantly weaker with the speed of neoliberal market demands and the rise of new media: in order to satisfy these increasingly complex needs, the projects started to be entrusted to several different agencies, resulting in a lack of overall vision (Burns, 1993).

1980's Japan was radically different from the past: a rich and strong country which aimed at increasing tourism thanks to the promotion of *nihonjinron* (Japaneseness) (Collins, 2008). However, the values chosen to build the Nagano 1998 brand were not specifically Japanese, but they were meant to be universally understandable: participation of children, homage to nature, festival of peace and friendship (The Organizing Committee for the XVIII Olympic Winter Games, 1998). The visual identity designed by Landor does not stem from Japanese culture: the logo is a snowflower (snowflake+flower) in which each petal represents a moving athlete (The Organizing Committee for the XVIII Olympic Winter Games, 1994). The pictograms, not conceived as a universal language, were designed to trigger an immediate recognition of the brand thanks to their similarity with the logo. Despite the rich and detailed brand manual, the huge amount of material produced to promote the Olympics lack a univocal approach to follow. The numerous posters do not share a common layout: both them and the website were not included in the guidelines.



Figure 5. Shinozuka, M. (Landor Associates), Nagano 1998 logo. Landor Associates, Nagano 1998 pictograms. Nagano 1998 poster with painting by Sesshu.

Even if not explicitly included in the brand values, the tradition was recalled in many forms: the torch design, the poster with the artwork from Sesshu, the podium, the sumo wrestlers at the opening ceremony. This form of neo-traditionalism was not managed in a consistent way, and the overall result is far from the stricter visual coordination of Tokyo 1964.

6. Modern hybridity and criticalities in Tokyo 2020 design project

The analysis of Japanese Olympics from the 1930's to the end of the Century exposes both the development of the Country's design and the multifaceted approach to the representation of national identity.

The centrality of values that already emerged in Nagano 1998 brand, has been pursued in Tokyo 2020 project as well, despite the crisis that overwhelmed the neoliberal market in which this design framework has been born. As Julier stated:

> "The flexibility of neoliberalism and design culture ensures their predominance" (Julier, 2012, p. 348).

The main concept behind Tokyo 2020 Brand Book is the tradition/innovation binomial, visually represented by two colours (blue for innovation and red for tradition) and the display of contrasting images: contemporary architecture and temples, VR gaming and traditional board game Shogi, industry and agriculture, city and countryside, kawaii-style girls and geisha. The modern hybridity is also put into words by emphasising the contrast between the city of Tokyo (innovation) and the rest of Japan (tradition):

> "At the Olympic Games of Tokyo 2020, innovation prospers when contrasts between Tokyo and Japan become united and harmonised" (Tokyo Organising Committee of the Olympic and Paralympic Games, p. 22).

The brand essence is based on four pillars: celebration, diversity, harmony and innovation. Their interaction gives birth to what is defined as the promise of the Games: "Innovation from harmony". In order to identify these contrasting and complementary aspects of Japan, a survey was submitted to non-Japanese people: they were asked to link a series of adjectives to the city of Tokyo or to Japan as a country. The choice to rely on a foreign audience to define Japanese national identity can be regarded as a renewed form of self-orientalism: the elements of Japanese tradition are selected and re-organised as an easily understandable narration for a Western/global audience, which can easily fit into Western/global models of neoliberal marketing and branding.

The idea of highlighting both traditional and innovative aspects of Japan, can be related to the concept of modern hybridity:

> "Asian host cities distinguish themselves in their deliberate evocation of their modern hybridity: the co-existence of modern development with ancient cultural traditions" (Collins, 2008, p. 187).

Beyond the Brand Book, the re-interpretation of tradition was systematically pursued in many of the artefacts designed for Tokyo 2020: the Olympic Torch, as well as the bid logo for the Tokyo 2020 Candidate City, recall the sakura flower, a worldwide renown symbol of Japan.



Figure 6. Shimamine, A., Tokyo 2020 Candidate City logo. Tokujin Yoshioka Inc., Tokyo 2020 Olympic Torch.

The official logo by Kenjiro Sano (which was later discarded due to alleged plagiarism) contained a red circle as a reference to Tokyo 1964's *hinomaru*. The colours red, gold and black are drawn from the tradition, and inspiration from Ikko Tanaka's work is blended with Bauhaus-style modernism (Howarth, 2015). After the reject of this first logo a new international competition was launched in late 2015: among the shortlisted proposals, we can observe references to Asagao traditional flower and to Japanese deities (Mairs, 2016). The winning design by Asao Tokolo takes inspiration from a traditional pattern from the Edo period. As stated in the Brand Book:

> "It is a traditional Japanese colour, indigo, and I drew a stylish Japanese appearance. Three kinds of squares with different shapes represent differences in nationalities, culture, thought, etc, and even though there are differences, the message of 'diversity and harmony' is put in a design that connects beyond them" (Tokyo Organising Committee of the Olympic and Paralympic Games, p. 26).

In this case, a traditional pattern has been associated to a meaning which was not the root of its original design. This process reminds of the appropriation of western design during the pre-WWII years, but it is self-applied by Japanese designer to Japanese culture, demonstrating how colonization mindset has taken root in the Country itself.



Figure 7. Sano, K., Tokyo 2020 discarded logo. Tokolo, A., Tokyo 2020 logo.

The pictograms are not designed as a universal language, but as an explicit reference to the golden age of Japanese design. As the designer Masaaki Hiromura declared:

> "I have tried to express the dynamic beauty of the athletes through these pictograms, while respecting the legacy bequeathed by the pioneers of the Japanese design industry in their designs for the Tokyo 1964 Games" (Tokyo 2020 Unveils Olympic Games Sport Pictograms. Designs embody the artistry of athletes in action, 2019).

In this case, the imported discipline of design and the Western-inspired modernism switched from innovation to tradition, adding complexity to the multilayered perception of tradition in Japan.



Figure 8. Hiromura, M., Tokyo 2020 pictograms.

The fragility of globalised-neoliberal design direction was exposed by some criticalities and contradictions in Tokyo 2020 Olympic design, which are hard to conceal with the ideal of "harmony" promoted by the Games brand (for instance, the above-mentioned incident of the alleged plagiarism of Sano's logo). The two colours shown in the brand book are not consistently used for the applications: the tickets, for example, are designed in 5 different colours. Moreover, the colour combination method is inspired by traditional kimono craft, instead of representing the harmonisation of contradictions (Tokyo 2020 Olympic and Paralympic Ticket Designs Unveiled, 2020). The mascotte Miraitowa was selected in a process which involved elementary school kids. An initiative meant to engage the population in the design process, which could be however regarded as a sign of design direction weakness: looking at the diversity of each mascot candidate, it is possible to affirm that the visual coordination with the logo's blue pattern results in being totally fortuitous (The mascots were chosen by the elementary school children's voting, 2018).

7. Conclusions

The analysis of Olympic design pinpoints different phases within the representation of the Japanese national identity. According to the internationalist principles of the Olympic Games, Tokyo 1940 design could express its own militarist nationalism. The universalist ideals behind the Corporate Identity for Tokyo 1964 started collapsing with sparks of eclecticism in the Sapporo 1974 design. In a globalised-neoliberal world, the branding project for Nagano 1998 is characterised by a focus on values and the use of marketing techniques applied to design, revealing at the same time the fragility of design direction.

Tokyo 2020 has developed the branding and marketing strategies further to identify the founding values, but the values and the visual guidelines were not consistently used to manage the whole project. In this fragmented context, in which single designers worked on single outputs without a firm design direction, the reference to the tradition appears to be devoid of its original purpose and refilled with new meaning. It is possible to draw a parallel between these dynamics and Tlostanova's take on cultural appropriation processes:

> "It is crucial not to just give voice to or include the other in a certain prescribed and restricted way and then appropriate the devoid of meaning, but rather to change the whole logic in which anyone can be made into another to begin with." (Tlostanova, 2017, p. 59)

In the case of the Tokyo 2020 Olympic design, the above-mentioned "other" turns to be Japan itself: the Decolonial Design framework proved to be a useful tool to describe and analyse the reasons behind apparently universal design principles and methods. Japan turned on itself some colonial and neoliberal processes for what concerns national identity and tradition.

As Japan could be historically placed on both sides of the privilege/oppression dichotomy and the Country actively took part to the development of Western/global culture (as for the Olympic Movement and for design), the boundaries between what is Western and what is traditional has recently become more blurred: Olympic design itself is now regarded as a Japanese tradition, to the point which Tokyo 1964 pictograms became a traditional reference for Tokyo 2020 design. By acknowledging today's blend of tradition and innovation, is it still valid to perpetuate a colonial mindset in post-colonial design? In the case of neoliberal-global branding projects, wouldn't it be more upstanding to represent how tradition evolved into contemporary culture instead of replicating it in a fixed, never-changing way? The dualism between innovation and tradition is not so well-defined as shown in Tokyo 2020 Brand Book.

It is renown that globalised and neoliberal market demands for boutique multiculturalism (Tlostanova, 2017, p. 53) and neo traditionalism, however, it could be more interesting to represent contemporary culture, with its complex intertwining of tradition and innovation, than to use well-known, "safe for foreigners" symbols and attributing them new meanings that are not related to their origin. To avoid superficiality and misunderstandings it would be better to represent tradition in smaller and more manageable contexts like art exhibitions or theatrical performances, where it is possible to showcase tradition with a curatorial and historically accurate approach. This approach is also consistent with the celebration of Olympic Games, since the International Olympic Committee entrusts cultural events to the host city: a unique opportunity to give to tradition an appropriate place and time to be studied and appreciated.

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Acknowledgements: As this paper stems from my master's thesis, I would like to thank my reviewer Francesco Ermanno Guida for his advice and guidance. My gratitude also goes to the staff of the Olympic World Library (Lausanne) and the Musashino Art University (Tokyo) for their kindness, patience and expertise.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Towards borderless futures: How transcultural approaches changed the practice of graphic design

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Abstract | The purpose of this article is to discuss how transcultural approaches changed the praxis of graphic design, combining elements from different cultural contexts. Such a process, accentuated within the countercultural phenomenon of the 1960s, echoed the desire to build a borderless cultural identity, enhanced by the velocity of a world on the brink of the digital media revolution. This research intersects transculturality, counterculture, and graphic design according to the idea of change. The methodology reflects a qualitative approach conveyed through literature review, documentary research, and content analysis. Transcultural practices adapt to social, political, and artistic circumstances, fostering visual responses. The study suggests that this methodology outlived the countercultural movement as a resource for challenges to come, integrating and enriching design processes and thinking. Contemporary social design, such as that concerning climate change, can benefit from the coalescence of different cultural experiences and backgrounds to propose innovation.

KEYWORDS | TRANSCULTURAL GRAPHIC DESIGN, TRANSCULTURALITY, COUNTERCULTURE, SOCIAL DESIGN, DESIGN THINKING

1. Introduction

The evolution of graphic design practices into participatory processes intersected counterculture and transculturality during the 1960s. Transculturality, a still recent term in the field of cultural studies, grew and adapted within the countercultural phenomenon of that decade. That was in part due to the improvements in transports and means of communication at the time. With greater ease of movement, there was an increase in migrations that provided possibilities for cultural exchange. The other reason stems from the energic nature of counterculture and its will for disruption with obsolete social, political, and artistic paradigms. With both premises, it was easier for the participants to overcome geographical and even mental barriers. The world was about to become smaller.

Counterculture established a transcultural network by promoting change along with new connections and intersections. Epstein (2009) argues that such a structure demystifies and transcends cultural identities. Also, as the prefix 'trans' indicates, transculturality carries and stimulates transformation, transcendence, and transgression, concerning an idea of process and mobility (Gernalzick & Pisarz-Ramirez, 2013; Zhang, 2018).

For Patrickson & Young (2013), transcultural adaptation is a site of innovation. The field of design already works in this direction, operating transformations to adapt to the everchanging world. As a fluid territory, it prompts change through multidisciplinary actions that lead to new solutions and scenarios (Krucken, 2008).

This study aims to explore transculturality as a potential source of change in the process of thinking and doing design. The motivation derives from the traces of extensive use of this strategy within the countercultural scenario of the 1960s and the little attention still given to the subject. During that period, transculturality supported and integrated a challenging graphic language that, according to Auther & Lerner (2012), was capable of rethinking society at large. From this case scenario, this study also aims to outline opportunities for intervention in the contemporary design scene, reflecting on possible uses to promote innovation.

Transculturality is an evolution of the term transculturation developed by Fernando Ortiz in his 1940 study about the Cuban society (Mignolo & Schiwy, 2003; Côté, 2010; Cadman & Song, 2012; Marotta, 2014; König & Rakow, 2016). Ortiz wanted to find a replacing term for acculturation, to better express the interactive and transformative processes between groups of different cultural origins (Benessaieh, 2010; König & Rakow, 2016). From then on, authors from distinct areas started exploring the phenomenon and its adaptations (König & Rakow, 2016).

For Birringer (1989), transculturality is something beyond cultural narratives of identity, difference, and opposition. Epstein (2009) seems to agree with this perspective, describing transculturality as a model of cultural development and liberation. For authors such as Lull (2000) and Kraidy (2002), this notion is close to that of hybridity and the communicative

process it creates. For Côté (2010), both concepts imply an action "in which former cultural traits form new cultural practices in the course of its transformation" (p. 123).

Other authors, such as Pratt (1992) and Hutchinson (2001), study this process as an impact of colonialism on indigenous cultures. Concerning this subject, Patrickson & Young (2013) argue that the use of transcultural methods "may at first appear to be a potential source of inauthentic mimicry, or even exploitative appropriation" (p. 44). It is necessary to look at the relationship between transculturality and design to distinguish these situations.

Most studies intersecting transculturality with the 1960s counterculture seem to focus on the North Atlantic network. Subjects range from lists of countercultural events and participants to the 'transatlantic bridge' and the socioeconomic realities behind this network of ideas and knowledge. In general, these authors pay attention to the social sphere of counterculture while the field of design remains little explored. Transculturality often appears indirectly in this context with the identification of its traces occurring within the descriptions of counterculture itself.

McKay (2005), as well as Kosc, Juncker, Monteith, and Waldschmidt-Nelson (2013), describe the circular influence between the countercultures of the United States (US) and the United Kingdom (UK). For Marsh (2016), the improvements in commercial aviation eased this transatlantic bridge, responsible for the cultural exchange of ideas, sensibilities, sounds, and images. Salvatore (2016) extends this perspective by involving India in the transcultural network. Guarnaccia (2017) also includes India, arguing that the voyage of Allen Ginsberg (1926-1997) to that country in 1961 helped to bring the Indo-Himalayan spirituality into the United States. Both authors acknowledge the importance of the western tours of Indian sitar players and masters of meditation.

Massey (1998) approached transculturality when studying youth countercultural waves. For her, those phenomena form constellations within a social space resulting from cross-cultural relationships and interconnections, from the local sphere to that intercontinental. These interactions provide what Boudreau (2010) designates as the construction of identities in constant evolution.

2. Method

This study proposes an analysis of 100 posters and album covers from 1965-70, the most proficient period for countercultural graphic design. The goal is to identify possible formal or methodological transcultural traits, to assess how they may have contributed to a new graphic language capable of changing the practice of graphic design.

The first step is the literature review on countercultural graphic design. The aim is to search for traces of transculturality. This phase is followed by a visual analysis of posters and record covers, two of the most widespread objects, according to six parameters: 1) their geographical provenance; 2) the number of authors; 3) their purpose within counterculture;

4) their production context; 5) possible multi-origin influence; 6) identifiable transcultural traits.

The analysis criteria allow exploring the links between transcultural processes and features such as the number of authors, the aim of the graphic material within counterculture, the social context, and the place of production. The search focuses on illustration due to its prominence in countercultural layouts. Typography and photography often blended with the drawings or collages, thus taking part in the study. Color appears as a secondary element as it may represent specific cultural traits in association with the other features.

The third – and last – phase is an exploratory/relational analysis whose goal is to evaluate the transcultural ethos and its consequences for the practice of graphic design. The study covers materials from the United States and the United Kingdom, the epicenters of this kind of graphic design, but also from Brazil, a country with a substantial countercultural phenomenon during the 1960s.

The sample of graphic materials comes from 20 authors/collectives who worked within the countercultural phenomenon of one (or more) of the three countries either with music, protest, or both: Alton Kelley, Bob Fried, Bonnie MacLean, David Vaughan, Hapshash and the Coloured Coat, Joe Gomez, John H. Myers, John Van Hamersveld, Lee Conklin, Martin Sharp, Norman Orr, OM Tentacle, Peter Hugar with Suzanne Bevier and Su Negrin (as a group), Rick Griffin, Rogério Duarte, Ruth Garbell, Stanley Mouse, The Fool, Wes Wilson, and William Henry.

3. Countercultural graphic design

Countercultural graphic design marked a diversion on the direction of post-war modern design, then headed towards what Drucker & McVarish (2001) refer to as the universal language of visual communication, “based on the values of clarity, rational organization, and functional efficiency” (p. 259). Colored, organic, undulating, and often crypto-hypnotic, this new visual approach clashed with the universalist goals of modernism (Darricau, 2014). At the same time, as a design practice, it got deeply involved within the cultural and social scenarios, embedding societal features and symbols of each place.

To better understand the development of such a kind of graphic design, it is essential to keep in mind that the counterculture of the 1960s was a complex social and cultural phenomenon that produced multiple revolutions (Greenwood, 2016). The younger generation stood up for a variety of causes against the conservative and aggressive establishment, from the war in Vietnam to the use of nuclear weapons. Authority abuses, as well as social injustices related to race, sexual orientation, and gender, were also covered (Broackes & Marsh, 2016). Hebdige (1979) easily summed up this circumstance by saying that counterculture explored all the relevant speeches from that period. As a result, this

phenomenon became broader in both social and geographical compositions than precedent anti-establishment waves (Suri, 2009).

Counterculture is also deeply related to the concept of place and to what Barnes (2013) considers as its natural fluidity. By looking at San Francisco and London, 'focal points' of counterculture, one immediately sees their ongoing and relational character, decisive for the phenomenon's development and expansion into the western world (Criqui, 2005). Each city, despite their increasing contacts, developed its own countercultural identities, thus creating different design 'schools' (Grunenberg, 2005).

That is why the visual differences between the British and American approaches are so evident (Figure 1). While the British designers tended to create bucolic scenes with detailed illustrations, the Americans developed more aggressive layouts. The latter used acidic colors, highly distorted typography, and Art Nouveau women, along with Native American and Indian imagery or illusory patterns (Golding & Miles, 2018; Morley, 2018). Despite this contrast, transculturality seems to emerge as a graphic strategy in both contexts.



Figure 1. British (left) and American (right) countercultural graphic design. The British posters are generally built around a detailed illustration while the Americans transform the text into an element of the drawing. Both reveal transcultural traits: The left poster (Hapshash and the Coloured Coat, 1967) creates a dialogue between Europe and America with the castle, the flying saucers, and the reference to the CIA. At the right (Wes Wilson, 1966), the mystic sorceress is balanced and protected by the oriental yin-yang symbol.

4. Towards transculturality

Countercultural graphic design, in search of its own identity, absorbed and worked on references that varied according to the geographical origin of the author and the design typology itself. Such inputs, as the layouts indicate, came from different times and places – from the anti-academic movements of the late 19th century to Victorian mysticism, psychedelic substances, shaman rituals, and oriental religions (Grunenberg, 2005; Hathaway & Nadel, 2011; Darricau, 2014; Lowey & Prince, 2014).

A closer look at those materials, from distinct countries and years, allows exploring how transculturality permeated the process of design as a practice that, according to Robins (2008), creates new patterns of cultural diversity. The discussed examples summarize the analysis and reveal the extent of the use of this approach in both formal and methodological ways. In 1967, the English duo *Hapshash and the Coloured Coat* – Nigel Waymouth (1941-) and Michael English (1941-2009) – designed the poster *Are you Experienced* for a performance of Jimi Hendrix at the Fillmore Auditorium in San Francisco (Figure 2). The layout portrays Hendrix as a native North American healer, in an attempt to connect him to his home country and enhance his "magical" talents. There are flying saucers – remnants of the American UFO fever – a dragon, zodiac signs, and the eye of providence. The dialogue between those transcultural symbols aims at settling the first performance of Hendrix in the United States after his success in Britain, as well as to reinforce his Native American heritage.



Figure 2. Analysis sheet for the Jimi Hendrix Experience, Hapshash and the Coloured Coat, 1967.

Cooper & White (2005) argue that transculturality creates an interaction that exceeds the simple combining of cultural elements and the idea of fusion. When applied to graphic design, it potentially provides tools to propose change through multi-channel intersections. For instance, the undulating psychedelic typography and the recreation of light show/LSD visual effects are evident examples of this method, having evolved from experiences made on both sides of the North Atlantic.

Transculturality, in the case of the English and American countercultures, worked overall to capture the audience's attention to the social causes and the benefits of higher consciousness. As a result, the layouts exploded in color and shapes, drifting further away from the geometrical and functional paradigm of the International Style design. They contributed not only to fade geographical barriers but also those between the author and the public.

Hapshash's exploration of transculturality continues with *Hung on you* (1967), where they ventured on elements from far, near, and middle-eastern cultures (Figure 3). The mystic-oriented layout included Krishna figures, Chinese inscriptions, pseudo-Arabic lettering, and lotus blossoms, together with magic mushrooms. *OM Tentacle* – Mike McInnerney (1944-) and Dudley Edwards (1944-) – carried a similar approach in *Jazz at the Roundhouse* (1967), where the oriental features reflect a struggle between good and evil (Figure 4).



Figure 3. Analysis sheet for Hung on You, Hapshash and the Coloured Coat, 1967.



Figure 4. Analysis sheet for Jazz at the Roundhouse, OM Tentacle, 1967.

The appeal for transcendence carried by Eastern and pre-Columbian American imagery fascinated European and American designers because it emerged as an instrument for introspection and self-knowledge, similar to the effect of psychedelic drugs (Salvatore, 2016). Often close to mystical experiences, the symbology of those cultures was able to transform and empower countercultural messages. Its presence in the 1960s layouts strengthened the search for wisdom and provided new ways of transforming existence itself (Guarnaccia, 2017).

Several countercultural participants, from Allen Ginsberg to the *Beatles*, went eastward on meditative journeys during the 1960s. However, the popularity of the East, particularly India, grew also from the action of their inhabitants. Masters of mystical yoga and meditation like Maharishi Mahesh Yogi (1918-2008) or musicians like Ravi Shankar (1920-2012), came to Europe and North America to share their culture.

While in the countercultural turmoil, designers explored transcultural processes within the musical and social spheres. *Save Earth Now* (1967) is an example of a social cause that benefits from this approach (Figure 5). In this poster, the migratory birds evoke the beauty of coming and going, of creating something new by carrying a piece of different places. The intent is to celebrate the planet with all its elements, from fauna to flora, ethnicities, and religions. Waymouth's early life already reflects this ethos: he was born in India during WWII and spent most of his childhood in Argentina, before going to England.



Figure 5. Analysis sheet for Save Earth Now, Hapshash and the Coloured Coat, 1967.

The idea of transculturality in the work of this English duo stems from how they seem to be able to use distinct cultural inputs to create new significances, materializing the perspective of Guilherme & Dietz (2015) about disrupting universalist cultural assumptions.

Gay Liberation (1970), a combined effort of three authors, reveals that this method makes room for variations (Figure 6). The layout blends a photograph of young American protesters with a mandala, calling for higher consciousness through unity, eternity, and wholeness.

Each element – the mandala, the photograph, and the layout – was made by different people, making this poster an early example of a participatory process, where designers and non-designers work together to develop solutions (Sanders & Stappers 2008; Harder, Burford, & Hoover, 2013). The aim, according to Mouchrek (2018), is the "collective construction of knowledge, mutual learning, prototyping, and iteration" (p. 92).

As Friedman (2000) and Mouchreck (2018) remind us, design, as a dynamic process, includes thinking, planning, and directing actions under specific purposes. Such a mechanism, naturally, is not free from the background of the designers and their own experiences.

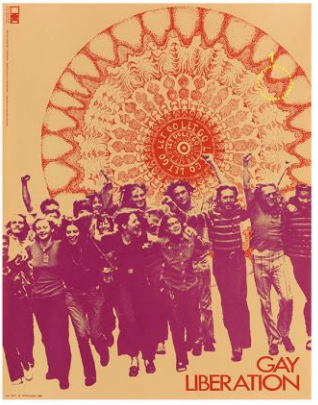
In the case of Martin Sharp (1942-2013), an Australian living in London between 1966-68, his overland journey through Asia shaped his vision on counterculture and provided him with new cultural experiences. *Legalise Cannabis: the putting together of heads* (1967) is perhaps one of his most evident signs of this kind of intersection (Figure 7). Here, Sharp got something all cultures searched at some point in their histories: a deeper state of mind with the aid of psychedelic substances. For that, he depicted a crowd of people from different ethnic groups.

Author: Peter Hujar/Suzanne Bevier/Su Negrin
Title: Gay Liberation
Year: 1970
Medium: Poster
Printing Process: Offset

Geographical Provenance
☐ Europe ☒ N. America ☐ Australia
☐ Asia ☐ S. America ☐ Mix

Number of Authors
☐ 1 ☒ 3-4 ☐ >6
☐ 2 ☐ 5-6

Purpose within counterculture
☐ Music ☒ Mysticism
☒ Protest ☐ Other_____
_____



Production context
Poster made in the United States,
Los Angeles countercultural scene
Picture, Mandala, and layout all made by different people
Published by Times Change Press Center

Possible multi-origin influence
☒ Yes ☐ No

Identifiable transcultural traits
1. Indian Mandala

Figure 6. Analysis sheet for Gay Liberation. Peter Hujar, Suzanne Bevier, Su Negrin, 1970.

Author: Martin Sharp
Title: Legalise Cannabis
Year: 1967
Medium: Poster
Printing Process: Silkscreen

Geographical Provenance
☒ Europe ☐ N. America ☐ Australia
☐ Asia ☐ S. America ☐ Mix

Number of Authors
☒ 1 ☐ 3-4 ☐ >6
☐ 2 ☐ 5-6

Purpose within counterculture
☐ Music ☒ Mysticism
☒ Protest ☒ Other Countercultural gathering



Production context
Poster made in England by an Australian designer (European heritage)
The designer worked regularly within counterculture

Possible multi-origin influence
☒ Yes ☐ No

Identifiable transcultural traits
1. Coalescence of people of diverse ethnic origins. Representation of Shamanistic rituals, dances, mystical experiences.
2. Bees symbolizing community
3. Magic mushrooms

Figure 7. Analysis sheet for Legalise Cannabis. The Putting together of heads. Martin Sharp, 1967.

Graphic design became one of the essential visual experiences of counterculture, acquiring more and more visibility (McKay, 2005). According to Rubin (2010), it became ubiquitous, surprising minds around the globe, together with music and LSD. The transcultural images

soon started to interact with the nations' political processes, representing "impulses for change" (Margolin, 1988, p. 59).

The presence of transcultural traits within artistic spheres is not a novelty *per se*. Migrations and diasporas have always contributed to cultural exchanges in the sense of connection and of going beyond (Monceri, 2019). As Patrickson & Young (2013) denoted, these visual representations can be mistaken for a form of cultural appropriation. Such a concept involves taking ideas, images, and art styles, subverting its meanings, and endangering its further use (Heyd, 2003).

However, cultures are fluid, able to absorb and provide inputs, thus promoting reciprocity (Imbert & Benessaieh, 2010). Accordingly, transculturality does not provide for closed, fixed, or immutable cultures (Epstein, 2009). It proposes fluidity, diversity, boundary-fading journeys, or a new level of liberation (Robins, 2008; Zhang, 2008; Epstein, 2009). In the end, it is about the aesthetic cosmopolitanism that grows from the increasing flow of technology and knowledge (Zhang, 2008).



Figure 8. Analysis sheet for Indian, John Van Hamersveld, 1968. This poster example of how transculturality can be, at first sight, dangerously close to the concept of cultural appropriation by adopting traits of another culture.

Therefore, no wonder transculturality blossomed outside the American and British countercultures. As the phenomenon expanded, so did the capacity for interactions and intersections. Brazil is an unambiguous example, with its anti-establishment movement, Tropicália, rising against the dictatorship installed in 1964.

Aesthetically, Tropicalists were keen on merging the popular with the avant-garde, as well as foreigner and Brazilian influences (Goffman & Joy, 2005). For them, the way to achieve a new Brazilian expression was to use a strategy of cultural production that 'cannibalized' local and foreign styles (Veloso & Dunn, 1996). That is, by creating their form of transculturality, with which Rogério Duarte (1939-2016), Tropicália's graphic designer, would play within his layouts.

The album cover for *Caetano Veloso* (1968) articulates this process with the 'digestion' of American and British psychedelic elements and Brazilian imagery, such as bananas and Amazonian snakes (Figure 9). In this cultural cannibalism, the members of the movement were 'eating' everything to produce something new (Veloso & Dunn, 1996).

Tropicália, supported by an active social front, was also a participatory phenomenon in which members from different artistic fields exchanged their views. The Brazilian movement reflected the perspective of Luck (2003) about how these participatory processes turn design into a method of interaction.

According to (Robertson & Simonsen, 2012), "many of the design tools and techniques generated to further this process have become standard practice for the design" (p. 3) from the 1960s onwards. Its importance is related to an uttermost need for transformation and improvements towards a different world.



Figure 9. Analysis sheet for the album cover of Caetano Veloso, Rogério Duarte, 1968.

4. Discussion

Graphic design, as a rising and ubiquitous visual manifestation during the 1960s, absorbed, contextualized, and transformed impulses coming from diverse cultures through its various fronts. In addition to the multiplicity of influences from different continents, sometimes getting mistaken for cultural appropriations, migrations drove counterculture towards a future with fewer boundaries.

The communication between participants became an essential feature for the upcoming challenges of graphic design by changing its *praxis* into a more dynamic process. The interactions between participants contributed to transform layouts into mystical and restless protest tools, creating strategies that eventually settled the beginnings of participatory design (Robertson & Simonsen, 2012).

That change had a visual impact, as posters, album covers, and alternative magazines became melting pots of cultural references conveying one message: transformation. The analysis suggests that the designers, regardless of their geographical locations, reconfigured cultural symbols from multiple provenances to strengthen their transcendence, protest, and social purposes. Transculturality, initially associated with religious or mystical practices, worked as a call for active synergy between cultures and their peoples.

When applied to graphic design, transculturality creates a hybrid territory, intertwining latitudes and longitudes, local and global elements, providing access to new cultural perspectives. It contributes to fade mental and geographical barriers by establishing exchanging networks of knowledge, ideas, and techniques. Within the field of design, the mediation between diverse actors is what opens the road towards innovation (Krucken, 2008).

In the contemporary scenario of global changes and uncertainty about the future of humanity and the planet, transculturality figures as a unifying element for the search of cooperative and sustainable design solutions. At the same time, the very scenarios of change encourage the expansion of the field as a process and as a strategic tool (Cassim, 2013).

In the case of the climate change crisis, the adoption of transcultural processes in both design research and practice aims at finding answers to ease the problem, sometimes despite controversial economic and political agendas. This kind of challenge gets stronger, especially when some of the stakeholders are from the most vulnerable areas. This circumstance is in agreement with the perspective of Madge (1993), in which concepts such as equity, participation, and future are all essential components of sustainability.

Consequently, the local and global efforts within this sphere of action integrate participatory dynamics that, according to Robertson & Simonsen (2012), promote investigation, understanding, and development, along with the support of mutual learning processes. Transcultural and transdisciplinary design programs are thus growing to raise awareness for these processes and preparing students to approach the various social challenges. They aim

to reveal the potentiality of design to both foster and develop creative and resilient innovations.

Interactive participatory exercises and games, such as *Cadavre Exquis* or Buckminster Fuller's *World Game*, may help to foster teamwork and to encourage critical thinking towards today's challenges. In our digital world, web tools may also play an important role in promoting the collaboration between designers so they can share the different strategies as well as their knowledge on their own communities.

The fights and daydreams of the 1960s not only engaged the *praxis* of graphic design into bursting layouts but also supported the roots of a transcultural strategy directed towards the future and us.

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Acknowledgements: I thank the support and guidance of my supervisor Emilio Vilar and co-supervisor António Nicolas, as well as my research centre CIEBA and the University of Lisbon, Faculty of Fine Arts. This work is financed by national funds through FCT – Fundação para a Ciência e Tecnologia, I.P., within the scope of my PhD project with the following fellowship SFRH/BD/131648/2017.

DC(S)
DESIGN CULTURE(S) | CUMULUS ROMA 2021
JUNE 08.09.10.11, SAPIENZA UNIVERSITY OF ROME

Which way to go? Some complicated crossroads facing design culture in Aspen

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Abstract | Born in 1951 thanks to the efforts of the businessman and philanthropist Walter Paepcke, the annual International Design Conference in Aspen (IDCA) proved to be a highly influential experience for the development of design culture during the second half of the 20th century. A closer look at its history allows for a better understanding of the ever-shifting directions of the design debate throughout the years, as well as of its connections with other fields of practice and knowledge production such as architecture, visual arts, sociology, and philosophy. This contribution will try to dig into the main issues at stake in the first two decades of the conference, and into the uses and implications of keywords such as technology, business, responsibility, environment. More broadly, the aim is to shed light upon some of the crossroads design culture was faced with in an epoch that proved to be crucial for its own development[1].

KEYWORDS | IDCA, DESIGN DEBATE, BUSINESS, RESPONSIBILITY, ENVIRONMENTALISM

[1] The present paper is the result of a close collaboration between the two authors. However, paragraphs 1 and 2 can be ascribed to Elena Dellapiana, and paragraphs 3 and 4 to Ramon Rispoli.

1. Introduction

In 1949, the Chicago-based industrialist Walter Paepcke (1896-1960) – who had already been involved in supporting and financing the New Bauhaus with the *émigré* László Moholy-Nagy (Malherek, 2018) – launched the proposal of a series of meetings involving architects, designers, artists, economists, industrialists and businessmen, gathered for a week in the montane environment of Aspen (Colorado) where he and his wife had properties: this is how the idea of the International Design Conference at Aspen (IDCA) came into being. Resembling – albeit in a distinctively non-urban fashion – the European examples of the Deutscher Werkbund conferences, the Darmstadt Artists' Colony or the CIAM, the initiative also contemplated the presence of the participants' family members: the intention was to establish an community-like venue where designers and intellectuals from various fields could get together and debate, in an idyllic place surrounded by nature.

2. The IDCA in the Fifties: the business first

Despite its charming and peaceful natural setting, however, the project of the IDCA proved to be rather turbulent from its very beginning. In the preparatory meetings – held in New York two years later, in 1951 – a first controversy emerged, one that would influence the conference at least for its first two decades. Answering to his own company's art director – Egbert Jacobson, who had proposed to invite as speakers prominent intellectuals and designers (such as Shahn, Burtin, Kepes, Charmayeff, Sert, Eames, Saarinen, Kaufmann) – Paepcke stated that "without the attendance of important businessmen there would be no point to the conference" (Allen, 1983, p. 277). The main purpose of the IDCA for Paepcke was, in fact, to address "once and for all the relation of design to business" in every field "from the graphic arts to industrial design, furniture, interiors, and architecture". His suggestion was, then, to have two conference chairs: one designer and one businessman; on this premise, the art historian Charles H. Sawyer suggested that the title of the first conference would be *Design as a function of management* (IDCA Records, 1951a).

After several invitation proposals, the definitive speakers' panel was mostly made up of businessmen – entrepreneurs and companies' art directors – along with several independent designers from either Europe (Bayer, Albers, Lionni) or the U.S. (Eames, Nelson, Kahn). Significantly, the list did not feature any member of the Industrial Design Society's management team (Dreyfuss, Bel Geddes, Teague, Loewy, to name just a few), who had discussed the new functions and directions of design only a few years before, at the MoMA 1946 conference *Industrial Design as a new Profession* (Poulos, 1988, p. 177).

The market-oriented approach was immediately clear in the introductory speech by Paepcke, the mastermind of the conference. Announcing the speakers' panel, he stated:

> "American business faces a new era and a new phase of competition. Because of the leveling or equalizing processes now generally practiced throughout industry (...) the opportunities for effective competition based on traditional factors of price and quality of product have been greatly diminished" (IDCA Records, 1951b).

The four days also included an exhibit on *integrated design* able – in the intentions of the organizers – "to illustrate the value of design in manufacture, sales distribution and public relation (…)". Along with several leading American companies, the show also included Olivetti: the graphic art, product design and architecture developed over the years for the Italian manufacturer of typewriters and business machines was already considered "an object lesson in management-designer collaboration for commercially sound and artistic expression" (IDCA Records, 1951c).

Just while the legendary exhibition *Olivetti: Art in Industry* – held at MoMA and financed by the company itself – was in preparation (Allen, 1983, pp. 279-280), the Italian firm was presented once again as a paradigm for the way it employed art, the work of excellent designers and the dialogue with tradition in order to improve both its products and its marketing tools: an enthusiastic judgement that was already becoming an axiom. It comes as no surprise, then, that during the following IDCA (which kept the same title of the first year) Walter Dorwin Teague – who was already familiar with the Italian design scene, having been involved in the organizing committee of the exhibition *Italy at Work: her Renaissance in Design today* (Dellapiana, 2018) – made a strong case for why Olivetti should have been a model for American companies too: "Olivetti in Italy has accomplished this identification superbly without any stereotype or repetitiousness whatever, with only an inexhaustible freshness that has become instantly recognizable. We are seeing this happen in a distinguished way with IBM. It is happening to Alcoa and to US Steel" (Teague, 1960).

Teague's pragmatic position was somehow counterbalanced by the only other designer invited as a speaker at the second IDCA, the already idolized Buckminster Fuller, whose paper *Design Today* (Banham Papers, 1952) had a completely different focus: the future. Providing that "American production genius was brought about, the ingredients of which were technique and financing", he made an optimistic forecast concerning technology and the possibility of extending its benefits to all mankind: 26% of the world's population was already enjoying them in 1952, a percentage that would rise, according to him, to 50% in 1970 and to 100% in 2000.

Apart from Fuller, however, those who made themselves most heard in the conference were the businessmen: Richard Gump, a luxury tycoon, who entrusted designers with the responsibility of making entrepreneurs aware of the need of "good design", or the printing company owner Alfred A. Knopf, whose argument went along those same lines. Such positions, implying the primacy of companies over designers, pushed the graphic designer and member of the organizing committee Leo Lionni – speaking on behalf of the latter – to

suggest that the presence of industrialists was not that essential for the real objectives of the IDCA.



Figure 1. Magazine page designed by Fernand Léger for Walter Paepcke's Container Corporation of America (source: Fortune, vol. 6, 1945). For Paepcke, visual arts and graphic design were crucial tools for improving business well before the inception of the IDCA.

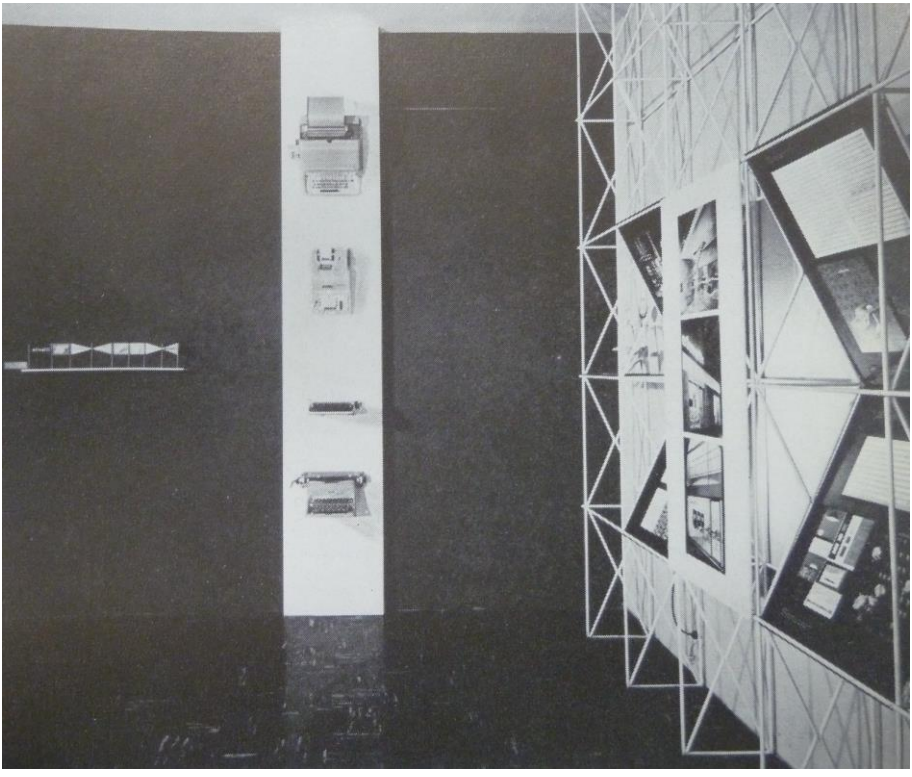

Figure 2. "Olivetti, Design in Industry" exhibition at MoMA, New York, 1952. Designed by Leo Lionni (source: Deborah Allen, "Olivetti of Ivrea", Interiors vol. CXII, n. 5, Dec. 1952, p. 111).

And in fact, the following conference – the last with the same title, chaired by Lionni himself – was entirely run by designers. This time, the European presence was strong: the architectural historian Nikolaus Pevsner was the main speaker; Max Bill, dean of the School of Ulm, and Enrico Peressutti – who was already in New York to supervise the construction of the Olivetti showroom – were the main international hosts; but also Xanty Schawinsky (Black Mountain College) and Gyorgy Kepes (Chicago Design Institute, former New Bauhaus) were also European-born, and perfectly in line with Moholy-Nagy's views. The only "authentic" American was in fact Dave Chapman, president of the U.S. Society of Industrial Design. The registered audience – which also included the panelists – was composed of 65 free-lance designers, 95 companies (represented by executives or art directors, e.g. Pei for Webb&Knapp, Nelson for Magic Chef), 10 journals or magazines, 9 museums, 37 educators, 34 students. New frictions soon emerged during the talks: Pevsner demolished each of the golden rules of American good design, which he saw as "fallacies". In his contribution – published years later by Banham (1974, pp. 15-18) – he made some ironic remarks about the

other guests, defining Fuller and his geodesic dome (built in a two-hour performance by two of his students) interesting but featuring an "obscure literary style"; Charlie Eames was for him a "youngish designer with a delightful boyish face" and the chairlift the most fashionable thing in Aspen. More seriously, he highlighted the fact that "on the whole the conference was happily free of politics". Pevsner concluded by shedding light upon what was for him a clear gap between the old and the new world, stating that those who worked in the US:

> "take their risks, defend their positions and at the end offer us, the public, a far higher volume of products for the house that are not the least bit hidebound in design. Our best design may be more refined than theirs, but we have less, and certainly too few designs that pronounce frankly what century they belong to" (ibid., p. 18).

Pevsner's diffidence towards the invited speakers was not isolated: evidently, the drafter of the minutes had not heard of the Ulm School before, nor could he understand the intellectualism of the BBPR monument in the Milan cemetery or Schawinsky's *Spectrodrama* performance, even though he was clearly "a good person" for him (Banham Papers, 1953). The 1954 edition limited itself to exclusively American speakers but focused on a wider spectrum of disciplines. *Planning: The Basis of Design* involved less designers (strictly speaking) but a larger number of architects, landscape planners, engineers, economists, art historians, biologists, psychologists, writers, specialists in public opinion, TV producers. The point, in brief, was to discuss the value of customers' needs and how to interpret and answer them through design. This was a recurrent topic in those years: something similar was promoted a few months after for the Ann Arbor Conference in Boston (*Design and the American Consumer*) and it was a replica, in turn, with a more "scientific" approach, of the call launched in Darmstadt during the 1951 *Darmstädter Gespräche*, devoted to *Mensch und Raum* (Man and Space) where the philosophers – among whom Martin Heidegger – tried to envision a solution to the crisis of design. While in Europe the disciplinary issues were tackled with the support of humanities, in the U.S. the same attempt was made with the help of science. 1954 was also the year of the First International Conference of Industrial Design held at the Milan Triennale (Molinari, 2001)[2], in which international designers such as Bill, Pevsner, Kepes, Wachsmann also took part; unlike in Aspen, though, the perspective in Milan was strictly disciplinary. The dialogue with the Milan Triennale went on. The following IDCA, chaired by the graphic designer Will Burtin, was titled *Crossroads. What are the directions of the arts?* The title evoked one of the X Triennale's main topics, *L'unità delle arti* (the Unity of Arts) (Bassi & Riccini, 2004, pp. 103-119); however, while the Milanese event insisted upon the *mixité* between architecture, design, and art – with the contribution of artists such as Lucio Fontana – the Americans focused mostly upon the crossroad between man and mechanization:

[2] Yet another factor contributing to the *annus mirabilis* of Italian design.

art was just the icing on the cake. On these premises, the board planned to invite Walter Gropius – whose seminal book *The Scope of Total Architecture* had just been published (Gropius, 1955) – who was unable to accept in the end (like Herman Wejl, Einstein's assistant, due to his master's death). In his introductory speech, Burtin – after paying tribute, once again, to those companies that had been capable of improving their business entrusting artists, such as the Italian Olivetti and Montecatini – presented a conference framed in various operational fields (Landscape and City, Education, Leisure, Communication) which would be addressed in a multidisciplinary way. Besides this new framework, one of the novelties of the edition was the presence of computer and cybernetic technicians (Bernard S. Benson, Arnold F. Arnold) who, following Fuller, insisted in their optimistic vision concerning the possibilities given by automation, despite being aware of their potential dystopian effects:

> "With the advent of automation it is not hard to imagine a system evolving as follows. The work of ten is done by one and the one works to support the other nine in questionable leisure. These other nine are attached to nine sensation-producing television sets and are allowed to 'wear out' by a natural process of living, at the end they are junked. (…) automation and the arts are natural marriage partners which can produce happy children, but the marriage will not happen by accident" (IDCA Records, 1955).

In general, the 1955 edition confirmed an increasing shift towards issues that were under the spotlight in the cultural debate in those years, leaving aside the industry and the market. It is worth remembering that some of the most famous dystopian novels – the ones by Burroughs, Asimov, Dick, to name just a few – were published between 1953 and 1956: this cultural mood influenced the following IDCA conferences and contributed to further stimulating the debate about the designer's moral responsibility. The following three editions, *Ideas on the future of man and design* (1856), *Design and Human values* (1957) and *Design and Human problem*s (1958), were consequences – as well as further triggers – of the debate concerning the so-called "human-centered design" (Scodeller, 2019). The designer's relationship with his own cultural roots was addressed both by European – Alberto Rosselli in 1956 and Ernesto N. Rogers in 1957 – and American speakers – John A. Kouwenhoven in 1957 and Harvey Wheeler in 1958 –, while the impact of design upon the society as a whole was the main issue at stake for the sociologist Charles Wright Mills (Trevino, 2014). In his famous 1958 talk *The man in the* middle, Wright Mills criticised designers for being submissive to the will of the market, one consequence of this being that they often lied to the public: the same accusation launched in those years by the social critic Vance Packard (1957, 1960), and the same that would later recur in Victor Papanek's seminal book *Design for the Real World* (1971). Wright Mills' radical attack to the capitalist market economy – something recurrent nowadays, but not at that time – recalled Gramsci's vision of the relationship between intellectuals and power (D'Orsi, 2001); from this perspective he urged

designers to take responsibility, that is, to be members of mankind and to fully understand what their "membership" meant: (…) what has been lost is the fact and the ethos of man as craftsman" (IDCA Records, 1958). Man and ethics were the new issues at the top of the design agenda; a similar mindset was spreading also on the other side of the ocean, where the debate started focusing more and more upon design's moral and political values, including in teaching (Stile Industria, 1959).



Figure 3. Poster of the IDCA 1959 (source: private archive).

3. The Sixties: from man to the environment

In the 1960s, in accordance with a cultural climate extending well beyond the specific field of design, the IDCA saw the sudden emergence of environmentally and socially conscious stances.

In 1961, the year following Paepcke's death, the title of the IDCA – perfectly consistent with its initial optimistic spirit – was *Man/Problem Solver*: the markedly positive stance emerged from the very first words of the chairman, the design educator Herbert Pinzke, who kept looking at design as an effective way to cope with human problems. But there was also room for divergent visions. In his speech *First things First* – which would be, quite interestingly, the title of the famous manifesto signed 3 years later by Ken Garland and other graphic designers (Garland et al., 1961) – Bernard Rudofsky provocatively stated that he had never seen man as a "problem-solving animal" inasmuch as humanity's most fundamental problems were still unsolved, in spite of any philanthropic aspiration:

> "Has man achieved the status of problem solver? asks the program committee. Are we able to recognize a problem when we meet one? I should like to ask. (...) Hypnotized as we are with extraneous problems, with conquering even less hospitable properties such as the moon and the stars, we are progressively losing track of our most pressing terrestrian problems" (IDCA Records, 1961a).

A similar disenchantment could be found in the first contribution to the IDCA by Tomás Maldonado, *The Problem of All Problems*, in which he claimed that the industrial designer might be in fact a problem-solver,

> "but seldom a problem-solver who is free to decide which problems should be set and how they should be solved. It is certain that the problems are frequently set for him from outside, and no less frequently the solutions as well. In most cases the designer wants to set and solve problems for human use, but in most cases he feels obliged to set and solve problems for human abuse. This is, without doubt, the problem of all problems" (IDCA Records, 1961a).

Critical stances of this kind gained further momentum in the following editions. In 1962 the IDCA focused upon the environment (particularly man-made) and upon the role played by design in altering and re-shaping it, either positively or negatively. Under attack was, most of all, modern city planning, whose negative social consequences had just come under fierce criticism (Jacobs, 1961): Herbert Bayer voted against the possible invitation of Le Corbusier and Niemeyer to the conference, as their cities were for him "monuments which start with designers rather than with people" (IDCA Records, 1961b). The current state of design was not exempt from criticism either. Arthur Drexler – who had just been appointed as director of the Department of architecture and design at MoMA – said that the world was not merely "a dump heap to be ruined by factories making things", and the only way to see architecture and design as tools for "perfecting the earth" was to consider the process by which a thing was made "at least as important as the thing itself" (IDCA Records, 1962a). Analogous was the stance of the industrial designer Neal Hathaway, according to whom designers were to

be held responsible for the shoddy artifacts which soon were “broken down, burned out, cracked, faded, rattled, bent, warped, slowed down or stopped” (ibid.).

Within this context, the IDCA 1963 – titled *Design and the American Image Abroad* – constituted a clear exception. At the height of the cold war – less than a year after the Cuban missile crisis – a conference whose explicit aim was to find new *designerly* ways of building international consensus for America was “too strong an invitation for political power plays” (Banham, 1974): any sort of critical stance was, therefore, out of the frame.
Already in 1964, however, critique made its way back into the IDCA. The premise of the conference - titled *Directions and Dilemmas* by the chairman Eliot Noyes – was once again the need for an “enlightened materialism”, able to improve the conditions in which human beings live. Particularly interesting, in that context, was the case made by the New York-based writer Ralph Caplan for the development of a more rigorous form of design criticism: “if the nation is to have public awareness of design, we need popular design critics and reviewers. (…)”, people whose voice would help to stop “the flood of superfluous appliances” (IDCA Records, 1964).



Figure 4. IDCA 1965 attendees gathered in front of the new tent designed by Herbert Bayer, replacing the former by Eero Saarinen (source: cover of the Visual Arts Bulletin vol. 6, n. 8, 1965).

By the mid-1960s the positions within the IDCA started polarizing and the tones escalating, also reflecting the state of a nation (and of an entire world) in turmoil for the Vietnam war and the emergence of the counterculture. The title of the 1965 conference, *The New World*, was chosen by the chairman George Nelson as an acknowledgement of the "tremendous pileup of changes" (IDCA Records, 1965) occurred on the planet in the preceding two decades, considered in all their socio-political and environmental dimensions (anticipating, somehow, what would be the premise for the foundation of the Club of Rome three years after): it was, therefore, the perfect stage for those arguments that put into question any form of 'technophilia'. The frightful repercussions of not tempering technology with human considerations – in other words, what Horkheimer referred to as "instrumental reason" – were the main focus of the keynote lecture by the British socio-economist Robert Theobold, whose words resonated with the ones pronounced a few years earlier by Rudofsky: "today we define the problem of going to the moon worth solving, but we do not define the problem of solving poverty as worthy of our attention" (ibid.).

A similarly critical vision of technology was the common ground also in 1966 (*Sources and Resources of Twentieth Century Design*) as well as in 1967, one of the most influential editions in the early history of the IDCA. Within the frame of the thought-provoking title *Order and Disorder*, nearly every participant - except for the artist Ben Shahn and his passionate defense of chaos - stood up for the need of a new form of order, to be re-established in the world also by means of design (IDCA Records, 1967a). The contribution that sparked the greatest interest – as it can be easily deduced from the extensive press coverage (IDCA Records, 1967b) – was the one by the architect Alfred Caldwell: his severe criticism of the lifestyle of modern man, who "through his disorder is poisoning the planet and making it unfit for all life – including his own" (IDCA 1967a), might well have had a significant impact upon Victor Papanek, who was in Aspen for the first time as one of the attendees (IDCA 1967c)[3]. Among the paladins of order also stood Max Bill, whose contribution was filled with philanthropic scientism and old-fashioned optimism: "as designers, we can produce examples showing how a problem could be solved" in order to "realize harmonious relations between the needs of the individual and the possibilities of society", something that "must be done honestly, with responsibility", the two bases of responsibility being "wisdom and morality" (IDCA Records, 1967).

In 1968 – within the framework of a dialogue between European and American architectural and design culture prompted by the chairman Reyner Banham – what came from the American side was something like a declaration of guilt. In contrast to Europe, where a designed object was conceived as an investment and should therefore be durable, in the U.S. design was seen – as the art historian David Gebhard pointed out – as "an experience, a well-placed maraschino cherry on a dessert to be consumed" (IDCA Records, 1968). Along

[3] He would return to Aspen as one of the invited speakers four years later, in 1971.

those same lines, the industrial designer Richard Latham admitted that American culture "concentrated too heavily on producing and marketing things" and if there was a way out of that, it should no longer be found in isolated things but in systems (ibid.).

The 1969 edition The *Rest of our Lives* was probably the one with the gloomiest mood in the whole decade, reflecting "the despair the participants felt at the crumbling of American ideals" (Michaels, 1980, p. 36). Henry Wolf, one of the two chairmen, claimed that the real problem at the end of the century was not "technology, organization, coping with obsolescence and other things", but "a problem of the fading of belief in something". From a similar point of view, George Nelson spoke of the necessity to escape from "the perverted offspring of the American dream" brought about – among other things – by the blind faith in technology: an escape that could be found by providing design and humankind in general with "new tasks, difficult tasks". From this perspective, he also borrowed the famous 1968 French students' slogan "let's be realistic, let's ask for the impossible" (IDCA Papers, 1969).

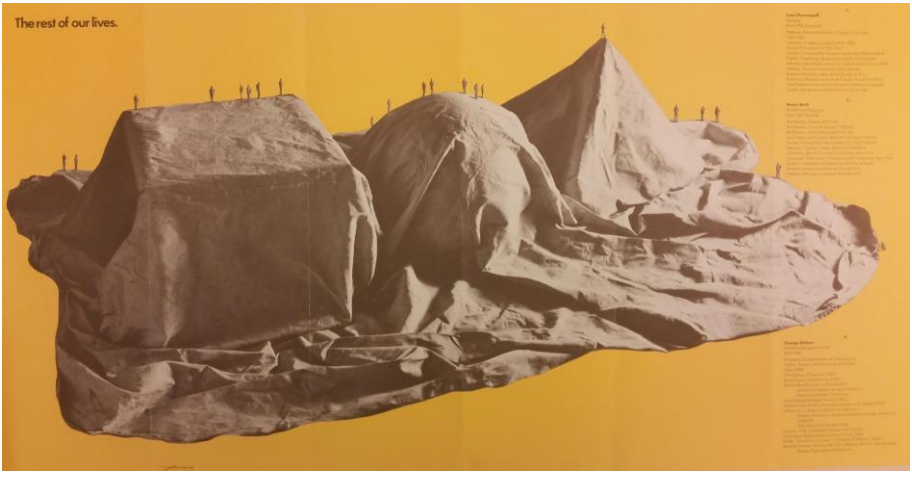

Figure 5. Poster of the IDCA 1969 (source: private archive).

4. The storm and its consequences

Quite ironically, the most powerful attack to the IDCA came, one year later, from the very people Nelson had taken inspiration from. In 1970 – as it has already been acknowledged (Scott, 2007; Twemlow, 2009, 2012) – an open protest against the *élite* of the organizers was launched by students, environmental activists and the so-called "French group" (a delegation of radical left-wing French intellectuals including Jean Baudrillard): which human being was really at the centre of design's concerns? The IDCA's already well-established

narrative of responsibility came under fierce criticism for being “too white, male, middle-class”; even the conference format was questioned for being too conservative, as the pre-established sequence of interventions left little room for open and collective discussions. Confronted with such an all-out attack, the philanthropic foundations upon which the conference had stood for two decades proved to be more fragile than expected: what fell under the notion of “designer’s responsibility” was not a common ground, but an outright political battlefield.

As Banham stated, “as a chairman of that stormy last session of the ’70 conference I could suddenly feel all these changes running together in a spasm of bad vibrations that shook the conference. We got ourselves together again, but an epoch had ended” (Banham, 1974, pp. 222). The IDCA took a different path from that moment on: no proceedings were published ever since - so as to do away with anything that could resemble the framework of an elitist academic venue; as for the topics of discussion, the socio-political and environmental agitation gradually faded away, paving the way for the re-emergence of issues and themes more specific to the design field. A crucial edition in this sense was *Shop Talk*, in 1977, the moment in which “design professionalism began to overpower politics: (...) a watershed year”, according to Jack Roberts, “because we were finally talking about design again” (Michaels, 1980, p. 38).

That said, the tensions and concerns of those first two decades were anything but solved: market-led, technicist, philanthropic, socio-politically engaged and environmentally conscious visions of design kept colliding head on in the IDCA up until its final editions, some 30 years after. In this respect, the main battleground was always roughly the same. Which issues and concerns fall within (or beyond) the scope of design? In a world increasingly flooded with an overwhelming amount of - often useless, sometimes even harmful - objects, how and to what extent are ecological and critical thinking allowed to have their say also in the field of design? The problematic crossroads of those early years at Aspen were yet another expression - a highly significant one indeed - of the most pressing dilemmas and challenges facing design culture during the second half of the 20th century; dilemmas and challenges that resemble, often quite vividly, those of our present time.

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DESIGN CULTURE(S)

POSTERS

ALL CONFERENCE TRACKS



A visual-analytical approach to phases of transition in people's life paths

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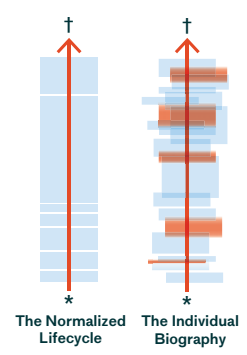
DESIGN CULTURE(OF) RESILIENCE
SOCIAL INNOVATION
CIRCULAR ECONOMY
SUSTAINABILITY

RiDeST - Persone in Cambiamento | Menschen im Übergang | People in Transition is an applied research project in the field of **service design**, mainly carried out from August 2019 to February 2021. The interdisciplinary team aimed to investigate whether and how social services for people in situations of personal change can be designed and established. — Society is changing: individual **non-consistent life paths** with frequent phases of reorientation are becoming the rule. However, Global North's welfare systems and social services are still based on clearly defined stages of life that seamlessly follow one another (Schröer et al. 2013). If one does not (want to) fit into the designated categories, difficulties emerge, the emotional burden increases and the uncertainty arises as to whom or to which institution one can turn to (Pfab 2018). — The project aimed at gaining a deeper understanding of the individual experiences and resulting social dynamics of life path transitions and, based on this, providing recommendations to social service operators. Besides conducting an ethnographic study in a social service department as well as a statistical investigation, design research methods were used and developed to investigate how public service providers can offer support to people in transition, to explore the **potential of visual-analytical tools** (see figures below), to conceptualize service concepts and to foster the exchange among the different stakeholders. Co-creative workshops and design interventions enable people to reflect on their situation (Sanders & Stappers 2014) and facilitate social service providers as well as municipalities to better understand their structural challenges (Junginger 2017). — The *Transition Sheet* was developed as a tool for workshop participants that helped them to **explore their transition challenge graphically** and to identify action approaches. The form was further used in the course of the project and is part of the final service concepts presented to the municipality and other stakeholders. The transition sheet is to be provided to social service operators as a tool to assess their clients' transitions and therefore will be further tested. The method presented here serves as an example of the visual-analytical approach to the phenomenon of life path transitions.

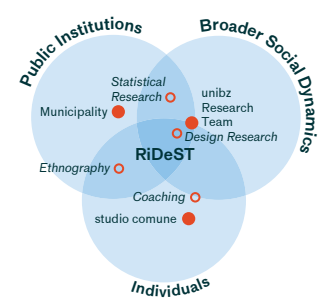
RiDeST
Menschen *im Umbruch*
Persone *in Cambiamento*

Research Topic

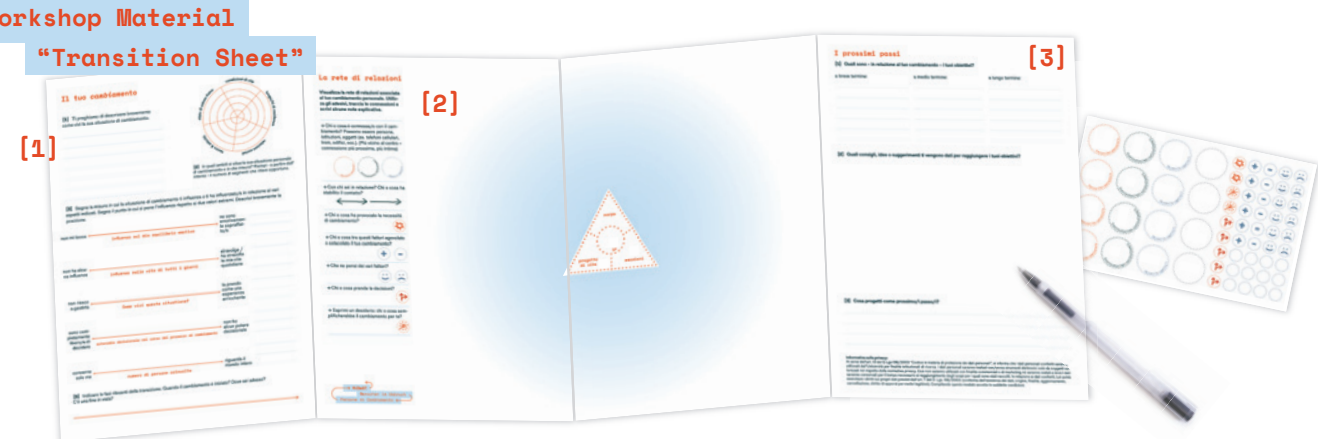
The **normalized lifecycle** as a smooth chain of traversed institutions is what most social service providers understand as the track where people have to be kept or brought back on (Weinhardt & Walther 2016). However, **individual biographies** often are characterised by phases of change that are not necessarily seen as failure by those affected. Yet, to manage these transitions successfully, administrative support is vital.



The project is located in the intersection between public institutions, individual people and the broader social dynamics. These are the spheres that define personal transition phases and potential corresponding service offers. The **different actors** (red dots) and activity fields (red rings) involved in the research project represent and target on specific areas of this field to facilitate a holistic understanding.



Workshop Material "Transition Sheet"



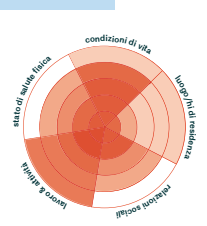
The Transition Sheet how it is presented here was part of a workshop in December 2019 conducted by the unibz researchers and studio comune. Among other tasks it served as a visual analysis tool for the personal transition. The participants completed it mostly independently while support was granted anytime. At first, the purpose of the sheet was mainly to gain an understanding of transitions in general, however, it became apparent that it can also be a beneficial tool for service providers.

1. The Individual: The first four tasks fostered a general reflection of the individual change: describing the transition, marking the fields the transition affects, locating the personal situation between poles and sketching a timeline of the transition path. The intention with these tasks was to acknowledge the importance of the transitions as a part of individual biographies. To unfold the learning potential, the transition has to be interpreted and biographically processed (Truschkat 2013).

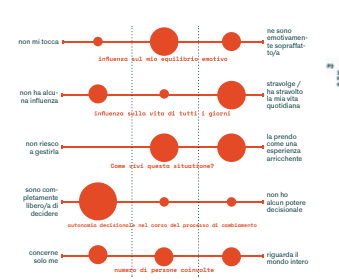
2. The Network: In this task tools were given to sketch the network that is connected to the transition phase. Participants located involved actors, drew connections, marked referring emotions, defined decision-makers and triggers and added a magic moment for a desirable turn. The analysis of the personal network crucially helps to assess the individual conflicts, changes and problem solving resources (Hill 2002; Rempel et al. 2007).

3. The Next Steps: The last part referred to a collaborative exercise moderated by the project team members of the social cooperative *studio comune* (inspired by Feedforwarding, see Goldsmith 2003). The participants defined their goals, asked for suggestions from the others and defined the next steps. This aimed at gaining personal agency through proactively shaping and creating alternative courses of action (compare Raitelhuber 2011).

Visual Workshop Evaluation



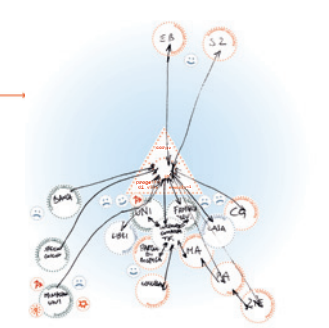
By overlapping the entries it is apparent that **each individual change shows a specific shape** but still certain main areas can be identified. Such a condensed visual format could possibly give a first understanding of the change situation's character and the areas where support might be needed.



This visual analysis is a synopsis of the individual scales ("semantic differential" (Osgood, Suci & Tannenbaum, 1957)) and **unveils emotional tendencies** among the people in transition. Some perceptions seem to be shared, some vary depending on the personal situation.



Putting the individual timelines in relation it becomes clear that every person and therefore every change situation refers to a **different time scale**. Also the degree of detail in the transition depiction varies.



This network example shows what was seen broadly: the personal change involves **many actors**. Some of the individuals, institutions and artifacts help the transition, some hinder it and others caused it in the first place. The "individual problem" therefore rather appears as a **systemic challenge**.

Conclusion & Next Steps

Even if the abstract graphical approach initially seemed to be inconvenient, sophisticated and not very natural for people who are unfamiliar with graphical expression (Venturini et al. 2015), the transition sheets turned out to be a helpful tool to find more clarity in the complexity of the participants' change situations. When the sheets were applied in the further course of the project, it became apparent that the completion was a challenging task, yet valuable as a trigger for the examination of intricate life constellations. The concept was brought to discussion in the project's steering committee and as they – from a practical perspective – also considered it as a useful addition to service portfolios, it was decided to further test the sheet with local NGOs that offer social support. The various tasks and the descriptions will be refined. Furthermore, it has to be investigated which settings – especially with or without assistance – enable the most effective completion of the form and therefore a helpful exploration of the personal transition. These investigations aim at understanding how this design approach could support social service employees to better comprehend the clients' life situations and to identify intervention points.

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Aeon, in his original meaning of "life", "vital force" or "being", "generation".

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DE SIGN CULT URE(OF) LANGUAGES AESTHETICS EXPRESSION VISUAL

ABSTRACT

The current professional, creative and commercial landscape has widened the scope of work of the Fashion Stylists and increased the competencies required (both technical and cultural). The personal and sometimes idiosyncratic vision is becoming increasingly relevant as the contemporary context is increasing pushing styling toward an independent yet connected art form. Generational and technological changes have disrupted traditional purchasing scenarios and buying patterns; mainstream fashion is increasingly accommodating new values and aesthetics. Consultants, commentators, provocateurs; stylists create and invite us to reflect on emerging issues, lifestyle as well as aesthetics and beauty.

The didactic methodology and project framework aimed at fostering a high-level conceptual approach that combines critical reflection on significant issues while working within a viable commercial domain. Aeon is a project developed by a team of students during a *Styling Workshop* in collaboration with Vogue Talents. The project leverages the aesthetic context of a fashion editorial, an editorial in which beauty weaves together with sociological issues and market needs.

The creative space of this proposal draws inspiration from the practice of Euthanasia (ending of a life to relieve pain and suffering). Conceptually the practice of Euthanasia is paired with plastic pollution as a metaphor for the pain and choking that the Earth is experiencing. The approach and this specific project create a direct dialogue between the aesthetics of a fashion editorial and social issues. This demonstrates a critical channel where is possible to communicate fashion and provoke human reaction on social issues. The project presents a think-forward approach, where fashion can also encourage and activate viewer reflection. The conceptual approach promoted critical reflection and commentary on large issues while working within the aesthetic and visual language (and modes of expression) typical of fashion and the commercial domain, often antithetical and contradictory territory.

AEON

Introduction

The protagonists have to decide where their lives are going. They find themselves facing two contrasting conditions or moods: freedom and suffering. Wherein plastic is the disease that leads to suffering and eventually causes choking and slow death; freedom is depicted as a path to a new dimension that relieves the person from all pain: the question remains whether this path is destruction or sustainability. The final output, in this case, was a meaningful fashion editorial depicting personal growth and pain relief while promoting a new way of thinking that rejects and refuses earth's pollution and nurtures freedom.

Methodology and tools / design process

The project aimed to investigate social issues that have a substantial impact on the current generation and to conceive, design and translate a fashion image that is also aesthetic and that responds to market needs. The project was conducted following the *Double Diamond Design Process*, a design process developed through in-house research at the *Design Council* in 2004. The process is divided into four distinct phases, discover, define, develop and deliver. It maps the divergent and convergent stages of the design process, showing the different modes of thinking that designers use.

During the discovery phase, the students explored current cultural, social and economic issues that have a strong impact on everyone's life. A central theme and direction of the projects were to promote environmental sustainability as an avenue to eternal freedom, hence *Aeon*. The students reflected on and discovered their personal feeling on the subject and how people from different fields can make a significant change in designing a better world. The second phase, the defining phase, was focused on generating insights, establishing the conceptual approach and the visual language. The third phase was focused on the development of a solution that could translate their concept into a visual communication project responding to the objective.

Figure 1

AEON: detail from the cover of the fashion editorial



During the last phase, delivery, the student created a photo shooting of the concept which reproduced the social issue visually while promoting the fashion outfits and a new solution of how to get rid of pain and pollution (Figure 2).

Conclusions

The approach and this specific project present excellent potential, since it creates a direct dialogue between the beauty of a fashion editorial and a social issue that are of high interest to this generation (and almost everyone on the planet). It includes a strong storytelling (plastic pollution and the chance we have to be free from it in a practical and metaphorical way) and creates a critical channel where is possible to communicate fashion and provoke human reaction on social issues. The project presents a think-forward approach, where fashion can also encourage and activate viewer reflection on the social issue. The process begins with an understanding of the problem (plastic pollution and what it causes to the planet: slow death, asphyxiation, sufferings) and then proceeds to generate a solution that communicates it (new dimension, freedom, sustainability) thus creating value for all stakeholders. The conceptual approach promoted critical reflection and commentary on large issues euthanasia-nature annihilation freedom-life while working within the aesthetic and visual language (and modes of expression) typical of fashion and the commercial domain, often antithetical and contradictory territory. The highly crafted visual language was fully developed through mood boards, model casting, selection of locations from dark suffocating spaces to open-air environments, styling proposals and final postproduction. The project also includes a social media strategy which aims to see how far it is possible to spread the awareness of the social issue and the idea of sustainability.
The use of hashtags on Instagram such as #SustainableSwitch #FashionForward #Future #Sustainability #SayNoToPlastic together with the production of a teaser campaign video showing parts of the concept are crucial elements in order to engage the viewer and to create expectancy. Moreover, in order to open a discussion on the subject and to have a feedback on the impact of work, students have introduced a challenge asking viewers to create their own expression of the hashtag #SUSTAINABLESWITCH with the subsequent reposting of the best ideas.

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Figure 2

AEON: images extracted from the fashion editorial that show how students have represented "suffering and freedom conditions".



SAPIENZA UNIVERSITÀ DI ROMA

cumulus creative fishing

DOMUS ACADEMY MILANO

Co-creating prothestics as fashion for assisting people with disability The case of hearing impairment

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DE SIGN CULT URE(OF) RESILIENCE
SOCIAL INNOVATION CIRCULAR ECONOMY SUSTAINABILITY

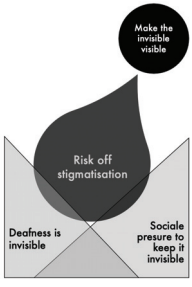
INTRODUCTION People with prosthetics must integrate these into their daily lives. Such integration requires an adaptation on the part of the person by modifying the relation of the body in its intimacy to the environment throughout their daily lives. This poses many challenges among them, the risk of stigmatizing the person as a result of a prosthesis that draws attention to itself. This qualitative study concerns the effects of co-creation on the modes of appropriation of these prostheses. We examine the case of a pedestrian with a hearing impairment who moves freely in city streets.

OBJECTIVE Using a co-creation process to develop a prosthesis that can be integrated into the person's fashion environment, in addition to supporting the realization of their life habits, and to observe the effects of this co-creation process on the long-term appropriation of the prosthesis.

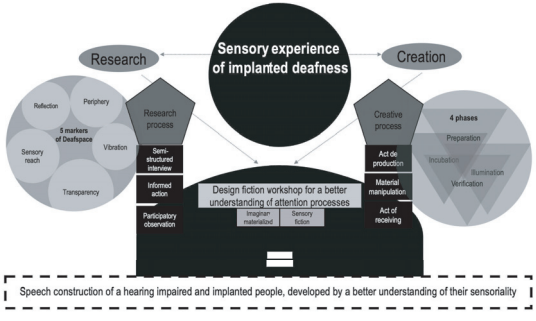
METHODOLOGY Our design methodology is based on the integration of a self-narrative using formal aesthetics. We hypothesize that the commitment and active participation of the person with a disability and his or her entourage in the co-creation process will enhance their appropriation of the resulting prosthesis. Integrating Design fiction to research allows us to activate the imagination without limits. The deaf person goes through the seven steps to create a self-narrative with the purpose to talk freely about his conditions.

7 Steps to create Selve-Narrative

1. Photograph important elements with the hearing impairment person.
2. Write a chronicle about these subjects photographed.
3. Extract those elements to make them visual component.
4. Make a synthesis of the visual component.
5. Evaluate the narrative possibilities of each component and make an inventory or catalogue.
6. Assemble these components to make motivational elements.
7. Juxtapose the motivational elements to make them meaningful in the context of a story.







CONCLUSION Through a process of artistic creation based on autobiographical narrative, a prosthesis for a deaf pedestrian that acts as a fashion accessory is developed. The results will lead to more inclusive and participatory development tools for citizens, creators and multi-disciplinary researchers whether or not they have a disability.

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Collaborative methods: design bridging academia and industry

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DE SIGN CULT URE(OF) MAKING
PROCESS MANUFACTURING POST-INDUSTRY

This poster shows the methodology used in the design studio "Product Design Project II" of the Master's in Engineering and Product Design taught at University of Aveiro and Design Factory Aveiro.
The collaboration between companies and academia is essential, on one hand, for the learning process to evolve in a real, yet controlled context, and on the other, for companies to adopt design and innovation practices.
This curricular unit (CU) is composed by 4 to 5 teachers, approximately 25 students and 3 companies. Students are organized in pairs previously defined by the teachers (according to their skills) and have to develop a project during the semester for each of the companies. Once the groups are organized by the teachers, students are given the opportunity to choose the company for which they will develop the project. There are 4 to 5 moments where the company's presence in the classroom is required and 4 to 5 moments where students must be present in the company. This commitment is fundamental for the successful development of the entire process since it enables a permanent dialogue between both sides.
After the company is paired with the students (normally each company will have 3 groups) the students start the 1st phase of the project. This phase consists of a research about the company, technologies and production processes, competition in the national and international market, market trends and specific users. The 2nd phase entails the re-definition of the brief launched by the company and the presentation of concepts; in the 3rd phase the technical development and layout process begins, and in the 4th phase the projects are implemented. The CU ends with a public exhibition of the projects where the companies select the products to be prototyped.
The prototyping and testing will be done later in the CU of "Product Design Project III" at Design Factory Aveiro. This iterative process allows the development of solutions adapted to the company and allows students to get in touch with the business reality, technical limitations and adversities of the normal design process.

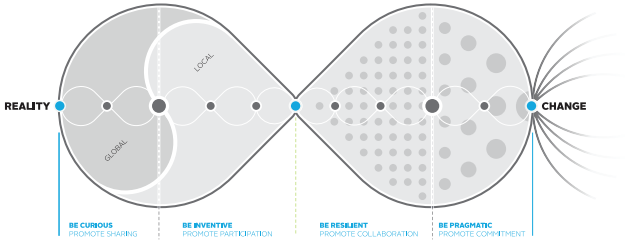
BE CURIOUS 1 2 3
PROMOTE SHARING



fig.1, 2 and 3. first visit of PDP students to the company's production units.

BE INVENTIVE 1 2 3
PROMOTE PARTICIPATION

fig.4 visual representation of the methodology used within the curriculum unit



BE RESILIENT 4 5 6
PROMOTE COLLABORATION



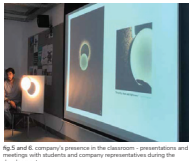


fig.5 and 6. company's presence in the classroom - presentations and meetings with students and company representatives during the development

fig.7 and 8 students prototyping process







fig.9. final exhibition with the students and companies representatives

BE PRAGMATIC 4 5 6
PROMOTE COMMITMENT

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Craft in Makerspaces: The Potential for Social Change for Sustainability

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PROCESS MANUFACTURING POST-INDUSTRY

Crafts ⟳ **Makerspace** → **Social Sustainability**

What is Craft?

A particular mode of making that involves creative skills in working with materials

Craft in the UK

149,5k people employed in the craft economy

11,62k businesses involved in craft industries across the UK

£3.4bn generated by the craft economy in 2014 (0.5% of UK GVA)

Source:
TBR for the Craft Council, "Measuring the Craft Economy", 2014

What is a Makerspace?

Spaces where people can gather to create, invent, and learn. They often have 3D printers, software, electronics, craft and hardware supplies, tools, and more.

Makerspaces in the UK

97 makerspaces in the UK

41% of 51 makerspaces are mostly used for socialising

73% of 87 makerspaces have digital fabrication tools

Source:
Nesta, "Open Dataset of UK Makerspaces", 2015

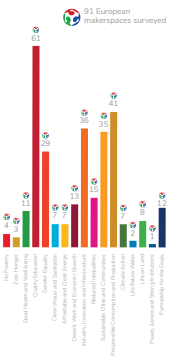
Sustainable Development

"Sustainable development aims to perpetually improve quality of life through reasoned and responsible uses of each community's tangible and intangible resources, protecting them against depletion, renewing them, as well as revealing new ones"

Marchand A. et al.(2018) Culture as a Resource for Sustainable Future. In Indigenous Communities. Walker, S. editor, Cassidy, T. editor, Bye, E. editor, Tonkinwise, C. editor, Laypeld [Eds.], Design roots: Culturally-significant designs, products, and practices. Bloomsbury Academic. [1st ed] p. 131-140]

Sustainable Development Goals and Makerspaces

https://sdgs.un.org/goals

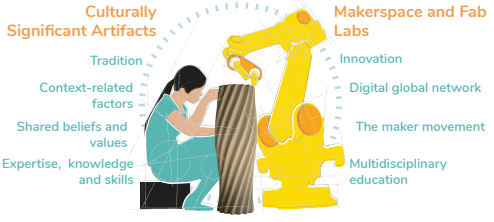


Data from the Working Group Fab Labs and SDGs:
SDG-profiles.mmap. (n.d.). Retrieved 20 November 2020, from https://share.mindmanager.com/#publish/W3daq7AYAp870EC9hYiDPkGL/Hdmd1V48y/YRIG

Abstract

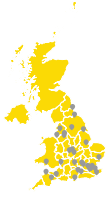
Building on prior work into the cultural role of makerspaces, this research focuses on the potential of craft practices in makerspaces as a driver for social change towards sustainability goals.
The project aims to understand emerging craft ecologies in the UK concerning sustainable behaviors, to establish how a maker literacy can be developed and integrated into specific social and cultural contexts. As such, particular attention is given to library makerspaces.
Initially, the project focuses on the existing craft and makerspace ecosystem in the Devon area, where the pilot library makerspace Fab Lab Devon was opened in 2014 and keeps running nowadays. Three other makerspace initiatives have been identified as suitable case studies. This study also aims to provide clarity on how those initiatives are coping with the COVID-19 pandemic, and how they are reorganizing themselves to pursue their mission.
It is expected that a preliminary understanding of the Devon makerspaces' social context will provide the first step towards developing a platform for work with and in makerspaces, implementing them, and evaluating program(s) for craft-led pro-sustainability change.

Maker Culture and the Cultural Role of Makerspaces



Makerspaces as Commons

UK Library Makerspaces



"Creating makerspaces in libraries to democratize access to the means of production, connecting inventors to knowledge and support, and providing educational programs that help people learn about digital making, is a natural extension to libraries' original goal in democratizing access to knowledge."

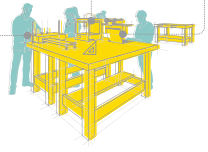
Libraries Deliver: Ambition for Public Libraries in England 2016 to 2021. (n.d.). GOV.UK. Retrieved 19 November 2020, from https://www.gov.uk/government/publications/libraries-deliver-ambition-for-public-libraries-in-england-2016-to-2021/libraries-deliver-ambition-for-public-libraries-in-england-2016-to-2021

Maker Culture for Sustainable Behaviour

Best Practices
- waste reduction
- reuse of old things
- recycle and upcycle

Behavioural Shift
- fixing instead of replacing
- custom product design
- responsible consumption
- awareness of fabrication processes' impact

Digital literacy
- better understanding of digital technologies
- awareness of digitalization and its implication



Current Craft and Makerspace Ecologies in Devon

Case studies - preliminary stage



Fab Lab Devon
Fab Lab Barnstaple (Barnstaple Library)
Fab Lab Exeter (Exeter Library)
- Opened in 2014, pilot project for the British Government's plan of public libraries' makerspaces.
- Digital making courses for the general public, schools and businesses.
- Operational during COVID-19 pandemic in accordance with relevant safety measures.

Fab Lab Totnes
- Part of the King Edward VI Community College.
- First college-based facility in the Southwest.
- Closed its open-access programme three years ago because of understaffing.
- Still operational for the college's students , "on-demand" service for the public.

The Craft Revolution
- Art and Crafts movement based at Dartington Hall Trust, North Totnes.
- Workshops and educational activities for the local community.
- Runs the Shippon Studios makerspace on Dartington Estate.
- Approach to making is strongly connected to politics and society.
- Most of activities moved online during COVID-19 pandemic.

Fab Lab Plymouth
- Based in the Plymouth College of Art
- Part of the Fab Foundation.
- Open-access space.
- Main mission: linking traditional crafts with advanced manufacturing technologies.
- Dissemination of digital technology skills through the Smart Citizen Programme.
- Sustainable agenda.

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Kingston University London
Kingston School of Art
Crafts Council

Kingston School of Art Supervisor
Dr Paul Micklethwaite
Prof. Daniel Charny
Craft Council Supervisor
Innovation Manager Alma Daskalaki

Creative design process for envisioning the future of emergency medical services in smart cities

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3. Health Research Institute, Limerick, Ireland E-mail Corresponding Author: vipul.vinzuda@gmail.com

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CRITICAL THINKING DISRUPTION CHANGE

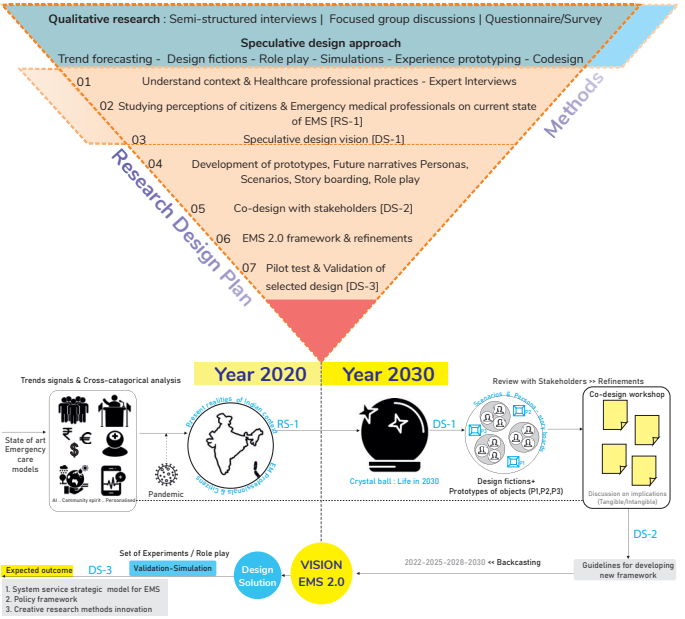
Background

The Government of India has launched its smart city mission for 100 cities (2015). To optimize the use of resources, promote sustainable living, facilitates energy saving with a budget of $30bn. India's context is filled with complex systemic challenges yet offers unique possibilities, especially due to its socio-cultural-geographical diversity amongst 1.37 billion people.

This research project focuses on developing key Emergency Medical Services (EMS) for one of the first smart cities of India. Creative design methods and speculative design approaches are considered for research plan to bring disruption while addressing the needs of vulnerable patients with equity and inclusiveness.

Methodology

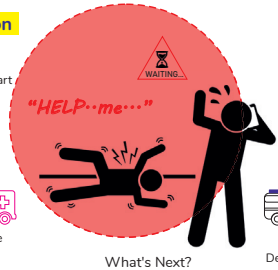
Creative design process >>



Key findings >>

Discussion & Conclusion

Potential impact of the project:
Contribution to evolving field of smart cities, Industry 4.0



Generating innovative health service strategies

Enhance digital health & wellbeing experiences

What's Next?

Towards SMART EMS

Design interventions for building smart, resilient, equitable, and inclusive pre-hospital emergency healthcare

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Design and Neuroscience for the UX
Possible tool for Designers

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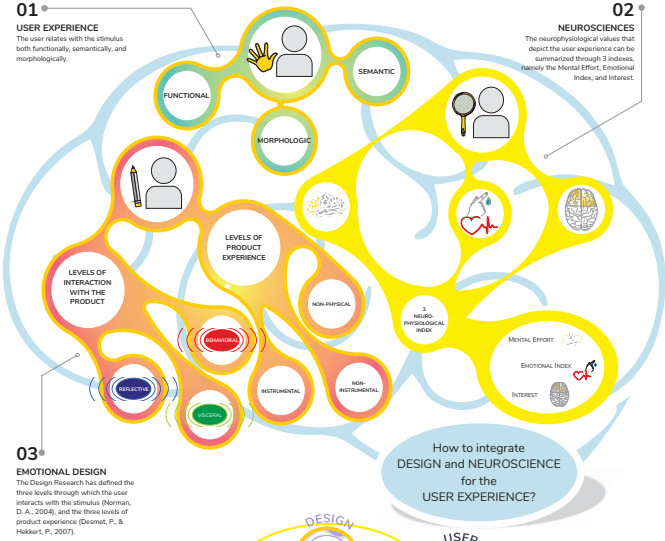
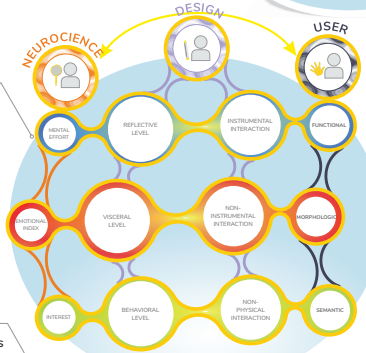
DE SIGN CULT URE(OF) LIFE
NATURE BIOLOGY HUMAN

01
USER EXPERIENCE
The user relates with the stimulus both functionally, semantically, and morphologically.

02
NEUROSCIENCES
The neurophysiological values that depict the user experience can be summarized through 3 indexes, namely the Mental Effort, Emotional Index, and Interest.



03
EMOTIONAL DESIGN
The Design Research has defined the three levels through which the user interacts with the stimulus (Norman, D. A., 2004), and the three levels of product experience (Desmet, P., & Hekkert, P., 2007).



04
CORRESPONDING MATRIX
By participating in a multidisciplinary research group composed of researchers in Neuroscience, Psychology, Biomedical Engineering, and Communication Experts, we, as designers, identified a certain integration of Cognitive Neuroscience with Emotional Design research. Once the potential has been identified, we have defined a correspondence matrix.
By combining the results in Emotional Design, we depicted the Alpha Matrix to interpret neurophysiological data from the Design perspective.
The goal of the matrix is to interpret neurophysiological data from the perspective of design to transform them into design indications. With a reasonable degree of approximation, it represents a possible bridge between Design and Neuroscience to define guidelines to interpret neurophysiological data. As the latest research about Neuro design found, what can be depicted are trends rather than precise results (Bridger, 2017.)

05
RESULTS-METHOD CARDS
One of the Research's results is the Cards tool's definition, which offers guidelines for interpreting the neurophysiologic data for those who have a background in design. The cards consist of three groups, one group for each of the three neurophysiological indexes.
They are recognizable by their color code: blue identifies the Functional sphere linked to the Mental Effort, red the Morphological sphere related to the Emotional Index, green the Semantic sphere associated with the Interest.
The front part of the Card contains an identifying letter of the sphere to which it belongs; it is followed by a heading that explains the sphere of belonging and a sub-header that describes the principle according to which to interpret the data. On the back, there is a short sentence in bold which explains the nature of the interpretative principle. This is followed by the questions that the designer can ask to interpret the data.



By conducting interviews with professional designers and researchers, they largely agreed on the following possible uses of Cards:
(1) interpreting the neurophysiological data elicited by a given product;
(2) designing a brand new design product with the goal to leverage on a specific neurophysiological index;
(3) to alter a design product, and by redesigning it, leveraging on emotional aspects not considered before in the original design.

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Design as a tool for participatory transformation of urban space

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CRITICAL THINKING DISRUPTION CHANGE



ABSTRACT

The art of walking is a practice that has been the object of several interpretations in its multiple artistic manifestations. Strolling conveys an aesthetic reverie that emanates a power of attraction towards the arts in general, but particularly in literature, as is the case of the essayist Henry David Thoreau, the Flâneur described by Walter Benjamin or Baudelaire, and the situations drifts and the subsequent artistic movements, such as Land Art. From this perspective, during the last years have been developed a series of manifestations that show this attitude in a certain way of rebellion, as it was announced at the end of the 60s by the French philosopher and sociologist Henri Lefebvre, which contributes to re -think the space around us and, therefore, our closest habitat; how it conditions our habits, customs and ways of relating.

In this regard, it is worth highlighting the work developed by Francesco Careri, Professor of Urban Planning in the Department of Architecture of the University of Rome III, who has been working with the Stalker group on the idea of walking as an aesthetic practice. He has made plenty of publications, conferences and walks in different parts of the world with the intention of recognizing the territory from different perspectives.

From this starting point we present below a work in progress on a project of intervention and transformation of urban space by designers and creatives.

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RESEARCH OBJECTIVES

The project aims to launch a series of methodologies by conducting courses and workshops that activate forms of critical thinking with the space we inhabit to highlight which are the necessities related with the design of urban (and non-urban) spaces of the 21st century beyond the "Smart Cities". These practices are intended to stimulate a utopian idea of shared space, where the inhabitants of a place can benefit from a functional design according to their real needs, instead of obeying marketing strategies imposed from the rulers that, in many cases, propose solutions away from the real needs of the people who inhabit it.

We propose a new way of understanding and addressing the urban (and non-urban) space, where walking and experimentation are part of new strategies to interpret a place, with the intention of implementing the design as a study and analysis tool, which serve to improve our

WE WOULD LIKE TO SYNTHESIZE THE OBJETIVES AS FOLLOWS

1. To develop our ability to detect what happens in the spaces generated by its surrounding architecture, from the smallest detail to the greatest architectural

r e p r e s e n t a t i o n

2. To explore the different contents generated by the architecture and how they transform the life and habits of

the people who inhabit it

3. To acquire conceptual tools that allow us to address real transformations aimed

at improving the citizens' lives

4. To understand the city as a space for human self-realization, and experiment with the possibilities offered by the urban space to generate moments of citizen

p a r t i c i p a t i o n

5. To stimulate our conceptual capacity to face empowerment projects and their particular possibilities of transformation through collaborative and participatory

practices

METHODOLOGY AND TOOLS

Our main methodological tool will be the realization of a series of participatory workshops where tours will be carried out in different neighborhoods of those different European cities that want to participate in the project.

The workshops-tours will consist of four topics to be addressed: urban waste, protected spaces, endangered actions and new uses, but more topics may be incorporated as the project develops. The routes will be uploaded by each participant to an APP where they will be registered, so their results can be consulted for further study and analysis.

RESEARCH PROCESS

The possible spaces and routes will be discussed to initiate the mapping of those places, where the different relationships with the proposed themes have been detected.

Once the places have been established, we select those that are sensitive to carry out some kind of action, allowing us to modify their environment in a sustainable way and thinking about the common good. The project may incorporate different methodologies as the research process develops, in order to establish links that provide knowledge and associative practices between different groups that are incorporated.

EXPECTED RESULTS

This project has already been implemented in collaboration with different universities and cultural entities, such as the University of Zaragoza, the European University of Valencia or Medialab Prado (within the international program "Open Cities" 2016) and its results are filed as a prototype for future practices, sincethe process is still fully alive.The aim is to

establish associative links

between different neighborhoods and cities encouraging critical thinking by the use of different disciplines to develop open, sustainable and participatory design processes. In addition, we also aim to place design as a methodology between new technologies and the world around us,

taking public space as an object of interaction

and development of proposals that provide solutions to the needs of its inhabitants. In short, we want the designers to

transforming agents of urban

(and non-urban) spaces attending to behaviors and values of each place, which avoid the objectification of the human being as a

tool of consumption.

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Digital visual tool for design project development in a multidisciplinary team

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DE SIGN CULT URE(OF) MULTIPLICITY GENDER PLURALISM DIVERSITY

ABSTRACT
The research aims to define a design-oriented model for the development of product/service systems starting from the study of collaborative design methodologies.
Nowadays multidisciplinary groups during the teamwork allow solving a common problem based on dialogues and shared solutions. The collaboration promotes the exchange of ideas between the community and different creative competence, developing project in participatory design ways.
The research is divided into three phases: exploratory, generative and practical research respectively Discover, Make, Define.
The first "discover" phase is oriented to the theoretical analysis of the main researches on the theme and is focused on the methodological approaches, on the application practices and the operative tools in the project phases. The second "make" phase elaborates a critical reading of the collaborative practices experiences and investigates the application fields, with particular regard to the healthcare and wellbeing. The third phase "define" is aimed to define an experimental model for leading the design in a specific sector.
The focus of this phase is to collect data about multiple experiences and ways to solve a complex problem, from understanding how the people interact with others and what is the process that they follow.
The collection of data about different approach will be conducted through the teamwork observation to understand relationships and behaviour, an online survey to detect data about idea generation and one-to-one interviews to collect experience and approach.
The comparison of quantitative and qualitative data will enable to identify behaviours and parameters, starting from data encoding related to the design features and the creative process phases.
The aim is to make visual the connections between information sets and to structure information to formulate the model. It will be experienced in a specific field to test the collaboration between multiple professional competencies.

Keywords: collaborative process, visual tool, multidisciplinary team, interaction, design model

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BACKGROUND / APPROACH

co-design approach + multidisciplinarity → collaborative process

The research starts with the analysis of the main methodologies and the case studies selection of tools and toolkit that help the project development during co-design for the generation of new ideas and product as closer to users.



co-design/participatory design

«Co-creation is based on collaboration between stakeholders and users in the design process, in contrast to standard market research».



design thinking

"Design thinking is a human-centered approach to innovation that draws from the designer's toolkit to integrate the needs of people, the possibilities of technology, and the requirements for business success."

problems + collaboration → new ideas



THE DESIGN KIT TRAVEL PACK by IDEO

visual language



DESIGN THINKING FOR EDUCATORS

team + tools → co-create



PHILIPS, DECISIONS TOOLKIT by STUDIO UNMP

interaction



TOOLKIT | DEVELOPING A MUSEUM by STUDIO UNMP

DEFINITION / COLLECT DATA

creative process + different disciplines and competencies → collect data

Starting from the observation of team with various competencies, the following steps to collect data are the definition of an online survey and one-to-one interviews with academics and professionals to detect data about team-work routine behaviours, languages, phases and tools during the project development.

HOW

observation
Observation of creative and interdisciplinary teams provides gathering data by conducting a form of visual research about behaviours and interactions.

online survey
Detect quantitative data about team-work experience behaviours, languages, phases, tools during the project development in the various disciplines.
The questions are in four parts; the general information, teamwork experience, process and approach, and needs and benefits.

one-to-one-interviews
Based on open-ended and predetermined questions about the topic of the interviews and the issues (motivations, attitudes, experience, behaviour or feelings)

WHO

students
- S.o.P.D. - School of Product Design University of Canterbury - Christchurch New Zealand
- Summer Startup Programme UCE - UC Centre for Entrepreneurship University of Canterbury - Christchurch New Zealand

academia
- medicine
- business
- design
- engineering
- chemistry

professionals
- designer
- chemist
- technical staff

enterprise

TOPIC

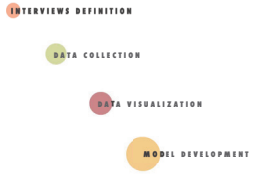
relations
experiences
behaviors
motivation
languages
interactions

idea-generation
approach
process
phases
tools
prototype

outcomes
benefits
impact
troubles

DATA ANALYSIS

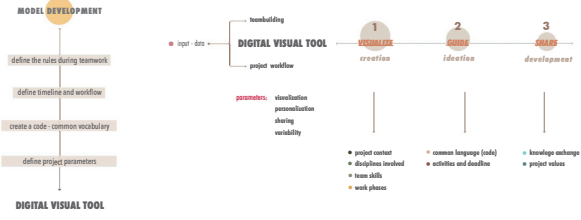
1. data segmentation
2. data categorization
3. comparison of data
4. description of the results



DEVELOPMENT / RESULTS

experience data collection + data analysis parameters definition → visual model development

Data decoding helps parameters definition that will be used to define the design model with a system of instructions and tool that helps the multidisciplinary team for dealing with complex problem-solving. It will promote idea generation with a holistic perspective on the problem and potential solutions. The research includes an applicative and experimental part of the model, with the definition of a digital tool that helps the interaction between technical, economic, humanistic and creative/design skills in a specific area.
In future developments is expected to define a database of good practices with information relating to team-building, to know how the disciplines get involved in a specific project context to understand conflicts and ways of interacting in creative teams.



SAPIENZA UNIVERSITÀ DI ROMA

cumulus creative thinking

Education in social design by means of artistic photography

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DE SIGN CULT URE(OF) REVOLUTION
CRITICAL THINKING DISRUPTION CHANGE

ABSTRACT:

This ongoing research work addresses the importance of inclusive education in Social Design by means of artistic photography as a main tool. Following a theoretical path that justifies these good practices, we propose an action-research model through analysis and reflection on several educational interventions in Social Design at our school, which involve design, intervention and the subsequent evaluation of a creative process, which uses artistic photography workshops in a participatory way, at a p2p level and through face-to-face contact among students and the vulnerable groups. From 2017 to date, we have worked with intellectually disabled, people suffering from mental health problems and immigrant mothers.
This work aims to be a little contribution to the UN 2030 Agenda for Sustainable Development. Specifically, to its goal number 4.7, about the need of improving Education Quality.
We believe this work suits in this Track "Culture (of) Revolution" because it fosters students to think critically and to be aware of their capability of playing a part in the achievement of social change.

RESEARCH OBJECTIVES:

1. The main objective of this research is to demonstrate that these inclusive educational practices in Social Design by means of photography, produce a change of attitude in design students.

2. Specifically, show that they become aware they have the tools to contribute to social-change achievement.



METHODOLOGY AND TOOLS

THEORETICAL FRAMEWORK

Double conceptual definition

Social Design
(Papanek, 1971)

1. Research & learning practice in Social Design (Margolin, 2012) Action-Research.

2. Social Design for Social Innovation (Manzini, 1992): participatory and p2p.

3. Socio-educational challenge: face-to-face contact (Margolin, 2012).

Photography

4. Photography, a particular tool. (Benjamin, 1936).

5. Documental Photography (Freund, 1974) VS Artistic Photography.

6. Research based on Photography as a document (PHOTOVOICE) or Photography as a work of art (By analogy, our challenge).



EMPIRICAL FRAMEWORK

It is based on a qualitative methodology called PHOTOVOICE (Wang y Burris, 1997) PHOTOVOICE used in Anthropology research: everybody in the vulnerable group takes pictures to document their everyday life and needs.

What is new? By analogy, they take ....artistic pictures!

RESEARCH PROCESS

Design
- Both research & practice
- P2p, participatory, face-to-face

Intervention
- Student training
- Photography workshop
- Collaborative creative development
- Exhibition

Evaluation
- Collecting data: focus groups, semi-structured interviews.
- Sample: 7 students, 7 participants from the vulnerable group, 1 teacher and 2 facilitators (aprox.).
- Analysing qualitative data: MAXQDA 2020, software.
- Categories from: subjective learning, integration and satisfaction indicators.

THANKS TO

Escuela Superior de Diseño de Aragón (ESDA) management team.
Marta Pastor, Graphic Design.
Marta Gil-Lacruz, University of Zaragoza.
Ana Gil-Lacruz, University of Zaragoza.

EXPECTED RESULT

EUREKA, IT WORKS!

In Design teaching, inclusive educational practices based on these three features: p2p, participatory and face-to-face, make students be aware of their own capability to generate social change.

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Enabling Collaborative Turns: A Conversation-Based Approach for Design Workgroups

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DE SIGN CULT URE(OF) THINKING
THEORY HISTORY CRITICS

ABSTRACT Against the backdrop of rising complexity in design problems, driven by rapid technological change, the work of the designer is evolving. By engaging in collaboration beyond their established practices, designers can understand these complex challenges from different disciplinary perspectives and produce innovative, purposeful, and coherent solutions. A design workgroup may comprise members unfamiliar with each other and who may have different disciplinary approaches. Even when a workgroup already has a cooperative working relationship, its members may still have unspoken assumptions and differing expectations of their collaboration. As such, this research serves to articulate how a design workgroup may begin each collaborative project with a shared and clarified understanding of what collaboration means and to agree on what collaborative actions are expected of each member. This research proposes an expanded definition of collaboration in design which discerns the features of collaboration and its associated behaviors. Within a disciplinary-based partnership framework, these features outline the extent of collaboration in different forms of partnership. The conversation is identified as the key to collaboration in design and forms the core of 'Collaborative Turns' that facilitate collaborative actions. To enable 'Collaborative Turns', a prototype of a conversation-based activity was developed to present a guided approach for a workgroup to have exploratory and divergent conversations. Initial responses suggest there is potential value to designing such conversations for a workgroup, to gain a better understanding of collaborative actions and to recognize the manner of engaging in a collaborative conversation.

RESEARCH OBJECTIVE 1 How collaboration in design is perceived, defined, and distinguished from other forms of group work

- 1a. How do designers perceive and distinguish collaboration and cooperation?
- 1b. How is collaboration defined in disciplinary-based partnership and participatory-based co-creation?
- 1c. What are the features of collaboration in design?

RESEARCH OBJECTIVE 2 Conversation as a way of enabling shared understanding of collaborative actions in design

- 2a. What are the essential conversations that designers and different disciplinary practitioners need to have?
- 2b. How might these conversations be conducted or designed?

METHODOLOGY

- In-depth interviews
- Non-participant observations
- Literature review
- Prototyping
- Focus group

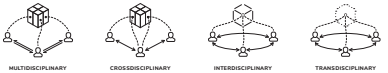
OUTPUT

- Features of collaboration
- The extent of collaboration in disciplinary-based partnership
- Concept of 'Collaborative Turns'
- Conversation Activity

Expanded definition

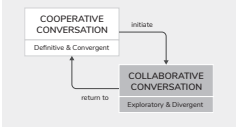
Collaboration in design is a progression of collaborative actions that designers and other disciplinary practitioners are **jointly accountable** for. They **work interdependently** to jointly define a novel problem and evaluate solutions through **the integration of knowledge, skills ,and perspectives**. It involves establishing a **cooperative relationship** among **differentiated roles**, yet **enabling divergent perspectives** and seeking opportunities in the divergence to integrate and develop ideas.

Extent of collaboration in disciplinary-based partnership [1]



TYPE OF DISCIPLINARY-BASED PARTNERSHIP	MULTIDISCIPLINARY	CROSSDISCIPLINARY	INTERDISCIPLINARY	TRANSDISCIPLINARY
State of plan/problem	Established plan	Specific problem	Ill-defined problem	Unknown problem
Aim of partnership	Assemble solutions from identified disciplines to realize an established plan	Actively evaluate solutions with identified disciplines to solve specific problems	**Define the novel problems and** evaluate solutions with different disciplines. Enhance knowledge of associated disciplines	Define novel exploration scope with different disciplines to investigate questions. Invent new knowledge, concept, or method that can transpose to associated disciplines or originate a new practice
FEATURES OF COLLABORATION				
Joint accountability	Only individual accountability to solutions produced for established plan	*Joint accountability only to solutions produced for specified problems*	*Joint accountability to definition and solution for novel problem*	*Joint accountability to novel exploration scope and outcomes*
Expertise integration	Not necessary	To jointly evaluate solutions	To jointly define novel problems and evaluate solutions	To jointly define novel exploration scope and evaluate approaches
Enabled divergence	Not necessary	Necessary	Necessary	Necessary
Task interdependency	Mostly independent	Specific	Comprehensive	Comprehensive
Role differentiation	Necessary	Necessary	Necessary	Necessary
Cooperative relationship	Necessary	Necessary	Necessary	Necessary
OVERALL COLLABORATION	**Least likely**	**Limited to specific parts of the project**	**Most likely**	**Most likely**

Concept of Collaborative Turns [2]



Collaborative Turns are cycles of cooperative and collaborative conversations to enable collaborative actions.

1. **Start with cooperative conversation**
   To establish a closely aligned understanding of a topic.
2. **Turn towards collaborative conversation**
   To encourage variance in understanding, to enable divergent perspectives, and to encounter and negotiate differences.
3. **Return to a cooperative conversation**
   To converge a new shared understanding to produce an agreed action.

Conversation activity prototype [3]



1. Activity guide; 2. Activity sheets; 3. Tokens; 4. Conversation cards; 5. Response mats



Detail of conversation cards



Test of conversation activity prototype

Initial responses to activity prototype

"[The activity] is interesting because I think it really does facilitate [the] conversations. And [points out] each other's opinions."

- Participant 1

"I think this [activity] actually gives [the conversations] some structure that you can kind of tally and keep track of. It can get a bit, because of structure, ... a bit stressful. Like, am I doing it right? Am I putting the token right? But I [quite like] the questions and how the features are structured. The positions or the Response Moves help [remind me] of things that I did not say. And then I might bring it up because it's there."

- Participant 2

"[Some people] may find, oh why must we do these? But ... in order to achieve communication, it has to be done. ... Be it how you think, it would be helpful. ... It's not that common that people will do that ... on their own. So I think certain sessions [have] to be implemented. So that's where I see this activity will be helpful."

- Participant 3

This poster presents the first three stages of this research project. Discussion of the final stage can be found in the attendant thesis (available upon request to the author).

1. The subregions of partnerships are informed by Dykes, Rodgers and Smyth's disciplinary framework. [Dykes, T. H., Rodgers, P. A., & Smyth, M. (2009). Towards a new disciplinary framework for contemporary creative design practice. CoDesign, 5(2), 99–116. https://doi.org/10.1080/15710880902910417]
2. The conceptual model takes reference from Ramalan Glanville's concept of 'normal' and 'design' conversations. [Glanville, R. (2013). A (Cybernetic) Musing: Design and Cybernetics. VIRUS, 3. http://www.nomads.usp.br/virus/virus03/Archive/Virus.php?item=2&lang=en]
3. The design of the activity is informed by William Isaacs' practices of Dialogic Leadership. [Isaacs, W. (2008). Dialogue: The art of thinking together.]

Experimenting new joints for more sustainable and easier to assemble furniture.

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DE SIGN CULT URE(OF) MAKING
PROCESS MANUFACTURING POST-INDUSTRY

INNESTO

READY-TO-ASSEMBLE



Ready-to-assemble furniture is a type of furniture that needs to be assembled by customers, who do not necessarily have manual skills. Today, this field is mainly composed of products that require tools and accessories for assembly. Often, the necessary tools are absent from the kit for sale, or the ones provided are difficult to use. In this context, the research presents a design experimentation on joints that exploit the elasticity of wood to avoid the use of accessories and tools.

Research objectives

The research aimed to experiment a new type of joint with the following characteristics:

- no need for accessories, glue or tools for assembly;
- very easy to assemble;
- realizable with CNC milling machines.

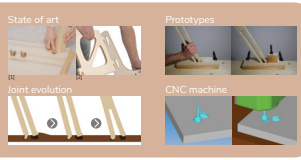
Methodology and tools

The research involved different methodologies and tools, including:

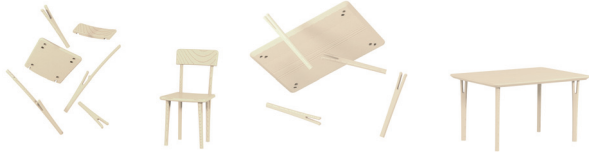
- study and analysis of the field of furniture;
- prototypes production and testing;
- use of specific software.

Research process

Research on the existing solutions has been carried out according to different parameters. After which various proposals have been made and tested. The chosen system has been evolved considering the performance of the joint, the ease of assembly and the requirements of CNC milling machines.



Results



The products designed with this joint system are composed of a small number of pieces and are characterized by a remarkable ease of assembly-disassembly. In fact, the various pieces require simple operations to be joined together. For similar reasons, the new system also benefits the manufacturing companies, which make, obtain, and stock fewer components. Finally, designing ready-to-assemble furniture entirely of wood also benefits the environmental impact of the products.



[1] https://www.ikea.com/us/en/p/lisabo-table-ash-veneer-70294339/ [2] https://www.kickstarter.com/projects/quarkdaw/gypsy-modular-reconfiguarable-furniture/description

SAPIENZA UNIVERSITÀ DI ROMA
cumulus creative finishing

Exploring the potential uses of ocean plastic and public engagement activities for raising awareness

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DE SIGN CULT URE(OF) REVOLUTION
CRITICAL THINKING DISRUPTION CHANGE

Abstract

Ocean plastic started to attract attention from many levels of society. Scholars have done geographical and quantitative research, but the research on the exploration of either ocean plastic as an accessible material or public perception towards ocean plastic has not been thoroughly examined. This practice-based research will explore to what extent this gap will be addressed by conducting a series of actions related to design and public engagement.
This research is multidisciplinary – it uses theories and literature to explore ocean plastic as a global issue but also uses science to examine the qualities and properties of ocean plastic as well as sociological enquiry to raise awareness.
By reviewing the literature to understand the need for addressing ocean plastic challenge, the researcher finds complex meaning in ecological, economic and political agendas of ocean plastic. The study investigated the design potential of ocean plastic by applying conventional and digital methods in the polymer laboratory and design workshop. The laboratory experimentation with recycling ocean plastic includes mainly Polyethylene (PE), Polypropylene (PP), Polyethylene Terephthalate (PET) and Polystyrene (PS), collected on the beaches in Scotland. The context of ocean plastic is reframed through working with people with various backgrounds to raise the public awareness of ocean plastic and encourage the public to take actions to recycle ocean plastic in the future. The participants were shown the prototypes/ results from the experiments at the same time interacted with them. These objects are deployed as tokens with the potential to represent the experience of involving into protecting the marine environment. The researcher kept in touch with some participants to track their behaviours towards ocean plastic after the workshop and analysed the extent to which their perception of ocean plastic had changed. In this way, the researcher can make materials which encapsulate the sense of experience, memory, care, awareness and dissemination for the public.

Research objectives

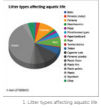
- To explore the gap between existing research about ocean plastic and the potential aesthetic uses.
- To engage the public and raise awareness about ocean plastic. People from different backgrounds (such as design students, tourists etc.) will be taking part in some ocean plastic related activities and will be in touch with the researcher to report their attitude/ behaviours change towards (ocean) plastic after the events. It aims to gain opinions from people in different industries shape public actions to solve ocean plastic problems.

Methodology and tools

Literature review – to research ocean plastic in ecological, economic and political agendas.
Design workshop and polymer laboratory experimentation – to explore the potential aesthetic uses of ocean plastic.
Focus group – to engage the public to be (more) aware of ocean plastic situation, and take action to reduce it.
Participants follow-up – to examine to what extent the participants' perceptions are changed after the activities.

Expected/obtained results

There will be potential uses of ocean plastic in different fields. Currently, the obtained result shows that ocean plastic can be used in the tourism industry - souvenirs and tourist experience, and 3D printing (See pictures below). Jewellery will also be a potential use. The public engagement activities are also designed to gain more design ideas (potential uses) from people from different backgrounds. Moreover, public perceptions about ocean plastic are expected to have some change after participating in the activities, for example, their attitudes towards using plastic product and behaviours of recycling (ocean) plastic are being researched. Second- and third-year design students were the first group who took part in the event, and left constructive opinions. One of the students started using ocean plastic in his design after his participation. This project does not only recycle ocean plastic in various ways but also has a positive impact on the public awareness and will potentially reduce the amount of plastic that is already in and entering the marine environment.



1. Litter types affecting aquatic life


2. Plastic ropes entangled a seal


3.Plastic found in a dead sea bird body

Abundance

- 80% of ocean waste originates from land.
- Each year, at least 8 million tonnes of plastics leak into the ocean.
- There were over 150 million tonnes of plastics in the ocean in 2015.
(Jambeck et al, 2015; OceanConservancy, 2015)

Marine impacts

Entanglement or entrapment (see Image 2), ingestion (see Image 3), habitat destruction, transport and bioaccumulation of contaminants (Pettipas, Bernier and Walker, 2016)

Field trip in Scotland - the Isle of Harris

- A huge amount of plastic waste was found on the beaches – nets, ropes, containers, bottles, etc.
- Some plastic pieces are subsiding.
- Most of the waste was washed up from the sea.
- Some pieces can be identified where they were from, but most of them can not.
- Some pieces are complete and recognisable, but many are fragmented.
- They all have rough surfaces after being in the marine environment for a long time.




Field trips in the Isle of Harris, Scotland


Ocean plastic's rough surfaces

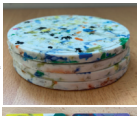

Numbered and examined the samples

Experimentation

- Collected samples on the beaches
- Numbered the samples and examined the plastic types in the polymer laboratory
- Compressed, laser-cut and 3D printed the ocean plastic
- Conducted worshops with the public


100% PET (ocean plastic) filament


Left:100% PP (ocean plastic) filament
Right: 50% PP mixed with 50% PLA



Left:100% PP (ocean plastic) filament
Right: 50% PP mixed with 50% PLA


Left:100% PE (ocean plastic) filament
Right: 50% PE mixed with 50% PLA


Potential use - Lighting


Personalised "Initial keychains"


Coasters


3D printed cookie cutter - from different recycled ocean plastic


3D printed cats - from different recycled ocean plastic


Potential use - Children 3D puzzles


Potential use - Jewellery

I think it would appeal to people who visit seaside towns to have their souvenirs made from ocean plastics as it protects the ocean of the place they visited

There needs to be a major change in how we use plastic and what effect it has on society life. We need to use alternatives to plastic in our designs

I loved the idea of making the ocean plastic into tourist gifts. I feel like sticking with basic tourist gifts like keychains or magnets would work really well as long it's been marketed/ loods as recycled ocean plastic. I definitely would buy!

For my post projects I have researched about the use of plastic in general but not ocean one. Definately I will keep your research and the research methods you used in mind for future projects I love how you researched and experienced the topic

As a design student, does this presentation have any impact on you about ocean plastic?



Feedback from the participants (N=158)
Data collected via Mentimeter.com



3D printing ocean plastic filament, still need more experiments

Conclusion

"Plastic recycling refers to a method that can regain the original plastic material. However, there are still more sophisticated methods available for the treatment and management of waste plastic" (Fink, 2018, p.xi). The methods employed in this project, especially 3D printing, to some extent, have positive impacts on many fields, such as tourism, polymer science, public engagement and waste management. Ocean plastic as a material has the characteristics of large quantity, wide variety and rich colours. Today, the ubiquity of plastic waste offers potentially attractive business opportunities for further development (Hunt and Charter, 2016). If there is a steady flow of plastic waste, there is a significant opportunity to use local ecological innovation and 3D printing technology to turn waste materials into valuable products(Hunt and Charter, 2016). However, 3D printing ocean plastic technology is still at an early developing stage due to the features of ocean plastic itself, such as contaminants causing blockages, warping and degradation. Therefore, more experiments are needed to develop 3D printing ocean plastic.

Pictures
1. https://theconversation.com/microplastics-graph
2. https://visual.ly/community/Global%20Issues/pollution/ocean-plastic-problem
3. https://uk.news.yahoo.com/dead-whale-stomach-contains-shocking-amount-ocean-rubbish-tmx- nqs-204851280.html

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Feed: design for Eating Disorders prevention in pre-adolescent age.

DE SIGN CULT URE(OF) LIFE NATURE BIOLOGY HUMAN

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Abstract & Objective

IN ITALY **95%** OF THE 3 MILLION PEOPLE WITH EATING DISORDERS ARE AGED BETWEEN 11 & 25 YEARS

In the contemporary era, in which the hedonistic diet has been brutally replaced by the practice of nutritionism (Pollan, 2007), eating disorders are a serious threat to the new generation. However, still only 4 out of 100 primary prevention programs is effectively improving the position of young people in relation to the risk factors (Della Grave, 2013).

Taking in consideration the picture of the incidence of eating disorders among the adolescents, this work has the purpose of investigating, by adopting an interdisciplinary approach, the existing systems of prevention and early diagnosis of ED and obesity, in order to analyze their effectiveness and development possibilities. The use of design methodologies allows therefore to systematize the data collected and to put forward a future proposal for school prevention services, in which the well-being of the teenager and his healthy awareness of food and body appearance can be seen as the result of the cooperation of different professional figures.
The research ranges from pedagogy to clinical psychology, from the sciences of nutrition to the sociology of food, with a strategic focus on the phenomenon of gamification, which acts as a glue between the message transmitted by each individual discipline and the Generation Z's user.

The goal of this research is to design an integrated service for the scholar prevention of Eating Disorders in pradolescent age.

Research Process

1. **SCENARIO DEFINITION**
   #foodculture: desk research about sociological aspects of eating trends through history;
2. **LITERATURE REVIEW**
   #eatingdisorders & **#prevention**: research and cataloguing of existing programs, scientific research and critical literature;
3. **LEARNING ACTIVITIES**
   #networking: field research powered by direct collaboration with clinical psychologists, neuropsychiatrics and nutritionists.
   Body Boundaries Test (Fabrizio, 2014) thorough research;
4. **USER EXPERIENCE**
   #surveys & **#analisys**: target characteristics and needs definition using the tools of field research and UX analisys;
5. **SYSTEM & INTERACTION**
   #designprocess: product and UI definition through gamification strategies for user involvement (Viola, 2017);
6. **PILOT PROJECT**
   #output: field testing of experimental program & prototyping; collection and observation of short- and long-term results

Methodology & Tools

BODY BOUNDARIES & PROPRIOCEPTION

The body is a representation of mental representation (Ruggieri, Fabrizio, 1994). Therefore, the analysis of the body image of an individual can explain and predict some disorders that are difficult to understand.
The reference to the methodologies of body boundaries testing has allowed the project to integrate nutritional education with the experience of proprioception.
The greater the distortion of reality, the greater the risk we will have of the patient suffering from an eating disorder.

GAMIFICATION

Gamification is a design method used to generate involvement through a mechanical and a graphic component of videogame origin. The ultimate goal of applying gamification processes to everyday activities is to increase engagement. The involvement generated by gamification is articulated on three levels: attraction, interaction and experience.
Taking up game-like dynamic dynamics, businesses and institutions try to gain the attention of customers, employees and sympathizers through a mechanism that provides for rewards and a tight and captivating dynamic.

Results

FEED: PREVENTION IS CHILD'S PLAY

Feed is a service that offers the possibility of developing one's own conscience regarding the modalities of self-esteem and self-control in the food and social sphere.
Feed it's aimed at middle schools for the integrated universal prevention of eating disorders. The objective of the program is to make the recognized values of each analyzed scientific field converge to a fresh, user-friendly, language: the gaming.
Challenging their abilities to achieve daily goals, children will gradually gain awareness of the principles of proper nutrition and the benefits of a positive relationship with body shape changes.





in the development of the project the design not only plays a strategic role. At first, the UI style hybridizes a flat language with 3D effects, to create a visual identity that straddles the taste of children and trendy videogames among teenagers; bright colors and variable weight fonts adapt well to the use of the game in video.
Lastly, the product, customizable and viral, meets user needs and overcomes the stigmatization towards EDs; a digital interface breaks down the social barriers between professionals and users, facilitating the opening and freedom of the actions carried out.



SERVICE KEYPOINTS



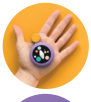
Tailor made service

Program goals fit each user thanks to a first registration survey available in-app.
In particular, to adapt the distribution of the various daily macronutrient portions, it will be asked if they practice and how often a sport activity and if they follow a restrictive food lifestyle, such as veganism or a gluten free diet.



Body Boundaries test & updating

The user avatar is an abstract self-representation, built by passing a redesigned, playful and interactive Body Boundaries Test.
The shape can be updated in colors and shape whenever the users want, according to the small changes he feels during the program duration.



Playful interaction

Join the program means play. Through gamification, users feel involved: through the app and the device they can feed their avatar, fill their diary, gain points and achieve new levels by exploring new functions.
The scoring system starts from a complex data crossover, brought to its maximum simplification.



Extra contents for extra fun

Through the app user is able to access notifications and extra content uploaded by expert doctors and pedagogists, which can be unlocked by completing the daily goals.
In particular, they includes a food diary and a subsection dedicated to sending doubts or feedback from the user directly to the team of expert coaches.



Evidence collection

The final reward is a real puppet of the beloved avatar: collect it with the class improve the appreciation of singles diversity. Moreover the sense of responsibility and the involvement shown during the playing period will have laid the foundations to build a strong sense of responsibility towards nutrition and diversity.

Conclusions & Future Objectives

This project aims to highlight the possibility of an implementation of the EDs prevention by hybridating different methodologies and knowledge.
During the last two years, the development of many service components was possible thanks to the collaboration with professionals from the sectors involved.
Of course, to test the effectiveness and the feasibility of those scientific results, a pilot program will have to be verified as soon as the emergency situation due to Covid-19 will allow it to be submitted to partner schools.

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SAPIENZA UNIVERSITÀ DI ROMA

cumulus creative thinking

Festival Living Labs: Involving the Festival Community in Sustainable Experimentation.

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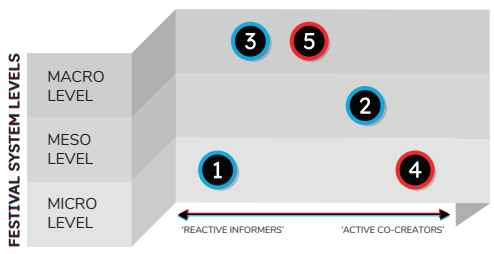

Figure 1: Plotted examples on system levels on a festival scale (y-axis) and festival community involvement (x-axis).



Example 1: Micro-level design: 'Happy' trashcans that reactively involve the festival community in waste sorting at Northside festival.



Example 2: Meso-level design: local start-ups are actively involved at Northside festival for co-creative redesign of the waste infrastructure, collecting coffee grounds to recycle for new products.



Example 3: Macro-level design: More or less 250 'trash heroes' are reactively involved at Northside festival to sort out the waste. Language is used to build a positive identity around waste sorting.



Example 4: Micro-level design: Festival volunteers at Welcome to the Village festival are actively co-creating design elements to create awareness about the potential value of human waste for compost.



Example 5: Macro-level design: Festival visitors are reactively involved to respond to and interact with new concepts of circularity.

Introduction: How can the festival community be involved in experimentation for sustainable design?

For a radical transformational change for sustainability, design requires an integrated approach, whereas designers have to contextualize their design from product and service level (micro) to integration in the socio-technical infrastructures (meso) towards the societal landscape (macro) (Ceschin & Gaziulusoy, 2016; Joore & Brezet, 2015; Schot & Geels, 2008). Since design functions socially and its features relate to the social and psychological world of human, both technical and human-centered aspects are important in design development (Yaneva, 2009). For this reason, many contemporary design paradigms advocate a user-centered and participatory approach (Dell'Era & Landoni, 2014). To accelerate design for transformational change, sustainability transition approaches emphasize the importance of purposive experimentation, often in the context of protected spaces (Von Wirth, Fuenfschilling, Frantzeskaki & Coenen, 2019; Schot & Geels, 2008). An approach that can facilitate this space for experimentation providing a real-life community with social, cultural and technical infrastructures to integrate design is that of festival living labs (Jensen, Rasmussen, Marlow & Amdrup, 2018; Dijkstra, Tiekstra, Boonstra, De Werk & Joore, 2020). Festivals are considered as meeting places of modern culture serving as temporary cities with a social and cultural role to strengthen communities, express social identities and worldviews (Bennett, Taylor & Woodward, 2014; Marling & Kiib, 2011; Larsson, 2009; Usyal, Gahan & Martin, 1993; Falassi, 1987). Most festivals are rebuilt every time they are hosted, and these iterations enable interventions to its infrastructures in relation to the festival community. Combining an integrated and human-centered approach, we investigated how the festival community can be involved in experimentation for sustainable design at festival living labs.

Methodology, tools & research process: community involvement and a multi-level perspective

To operationalize the integrated approach a multi-level perspective is used, resulting in the following system levels on a festival scale ***[figure 1]***:

- Micro-level: products and services.
- Meso-level: economic, technical, cultural and/or social infrastructures, e.g. considering waste management, food consumption.
- Macro-level: intangible concepts such as culture and community shared values.

To evaluate festival community involvement the dimension of Dell'Era and Landoni (2014) is applied to the festival context. The scale ranges are:

- 'Reactive informers': festival community members respond to design developments and are asked questions and/or are observed.
- 'Active co-creators': festival community members become involved in the design development as partners.

So far, we have conducted two case studies of festivals using participatory observations and semi-structured interviews: Northside festival in Denmark and Welcome to the Village festival in the Netherlands. Northside collaborates with WorldPerfect, a sustainable consulting agency that uses design to accelerate sustainable change. Welcome to the Village festival offers a program, called DORP living lab where amongst others, designers can develop and test sustainable practices. Both festivals are involved in the Interreg North Sea Region Inno-Quarter project whereas festivals are approached as living labs (Innoquarter, 2020).

Case study 1: Northside festival. Reactive and co-creative involvement to design a positive culture around waste

WorldPerfect's purposive experimentation at Northside festival is to change the system around waste management towards a circular approach. They use an integrated approach, involving the festival community as well as 'reactive informers' as 'active co-creators'. On a micro-level WorldPerfect developed 'happy' trashcans for five different types of waste, that light up in the dark and that communicate the recycling process in order to involve the audience to contribute to waste sorting ***[example 1]***. After the festival, a survey is spread out amongst the visitors to evaluate the effect of WorldPerfect's sustainability interventions.

On a meso-level WorldPerfect uses the iterations of the festival to redesign the waste management infrastructure, resulting in newly added fractions for waste sorting every year: 12 different fractions in 2019. During the festival WorldPerfect actively involves festival visitors and partners by organizing tours and workshops, so new collaborations and ideas evolve. Cork and coffee grounds are two examples of newly co-created waste sorting at the festival ***[example 2]***. Also, volunteers reactively participate by collecting and sorting out the waste streams. At a macro-level WorldPerfect reactively involves volunteers by using language and identity building as a way to reframe the cultural connotation with waste. For example, the words 'resources' is used instead of the less attractive word 'waste'. The volunteers sorting out the waste streams, are called 'trash heroes' in order to build a positive identity around waste sorting and recycling ***[example 3]***.

Case study 2: Welcome to the Village festival. Reactive and co-creative involvement for circular design solutions

At Welcome to the Village festival visitors can choose to participate as volunteers in a program called DORP living lab. In this program the volunteers are involved as 'active co-creators' in the development and testing of circular design projects. One example project is that of social designer Fides Lapidaire. Her purposive experimentation is about closing the food cycle by introducing dry toilets that help convert human waste matter into compost to grow vegetables.

On a micro-level Fides involved volunteers to further develop her product at the festival: a food truck that communicates and explains the recycling process to create awareness and to change the perspective about the value of human waste ***[example 4]***. The festival audience is involved as 'reactive informers' on a macro-level, giving the opportunity to interact and respond to the designs by participating in little surveys and interviews ***[example 5]***. Also, Welcome to the Village involves the audience by organizing tours around the different projects. Since the implementation of the projects is reserved to a defined area and the designs are not fully integrated within the festival infrastructures, we didn't observe community involvement on a meso-level.

Conclusion: Festivals Living Labs as a promising approach for designers

As *figure 1* shows, both festival living labs combine active and reactive approaches to involve the festival community in purposive experimentation for sustainable design. At Northside, design elements for waste management are fully integrated throughout the festival and the festival community is reactively involved on all levels. On a smaller scale the community participates as 'active co-creators' to co-design the infrastructure. At Welcome to the Village the festival community involvement in experimentation is reserved to a specific area. This approach might hinder a fully integrated approach of the design elements throughout the festival (especially on meso-level design) but might reinforce the involvement of the festival community as 'active co-creators'. Reflecting on festivals as a space for experimentation they indeed can offer the ability to involve the community on all system levels. By contextualizing design and involving the community, festival living labs can offer a space for designers to experiment in an integrated way and they create a potential for sustainable design practices to diffuse more widely. We see festival living labs as a promising approach for more designers to use.

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Grey matter - Matière grise. When the ‘thé dansant’ is no longer an option. Imagining an inclusive and intergenerational urban future, placing seniors as productive actors of the civic life.

Associates: Jerome Picard, Elida Mosquera, Benoist Desfonds, Matthieu Boustany.
Contributor Peeraya Suphasidh
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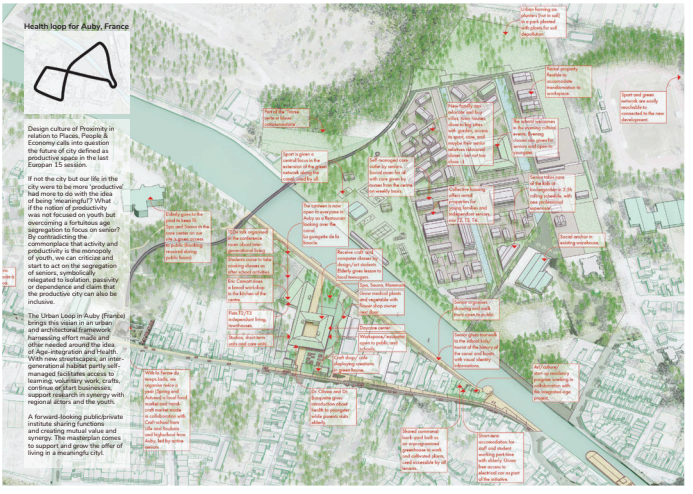
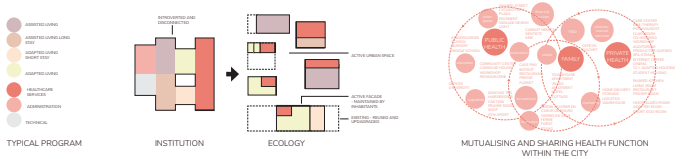
DE SIGN CULT URE(OF) PROXIMITY PLACES PEOPLE ECONOMY



HOW TO REIMAGINE THE ECOLOGY OF HEALTH AS A NEW PRODUCTIVE CIVIC LANDSCAPE FOR OUR CITY ?



HOW CAN THE ARCHITECTURE OF HEALTH MANIFEST IN THE BUILT ENVIRONMENT AT DIFFERENT SCALE?



HOW CAN A NEW INCLUSIVE AND SHARED VISION OF LIVING TOGETHER GIVE A NEW MEANING TO GROW OLDER TOMORROW?



SAPIENZA UNIVERSITÀ DI ROMA cumulus creative learning

Guided by Voices from the Fields: A case study on earth, plants and fashion design

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DE SIGN CULT URE (OF) LIFE
NATURE BIOLOGY HUMAN



When creating, fashion designers are inspired by a myriad of elements that cross their paths: cultures, colors, forms, processes, etc. While encounters with elements from human culture are highly prolific, discussions on cultural appropriation frequently arise. Looking at the case of the Ethno Course, this study asks about alternative paths of inspiration and how can a closer engagement with non-human entities affect fashion design practice?

Keywords: Estonian crafts, natural dyes, fashion design, fashion design education, cultural appropriation, creativity

In the Ethno Course, part of the Fashion program at the Estonian Academy of Arts–running since the 1940s (Ojaave and Puppart 2019), students are invited to be inspired by and appropriate of the dynamics of the Estonian fields and forests. These dynamics include practices of cultivating and harvesting and observing how place, weather, and time influence their designs.



During the course of a semester, students experience working in three environments: the fields, an Estonian craft archive (Reinholm 2013), and the design studio. In this way, they not only engage in growing and harvesting plants but also in gathering community recipes and stories, to build their own. While losing control of the reactions between textiles and plant dyes (Klemola 1986), students become aware of what the fields can tell. For example, how the age and geographical location of a plant may impact the final color when used for dyes. The eventual outcomes are plural, including woven textiles, surfaces, haberdasheries, and clothing that explore the plurality and liveliness of the natural dyes, displaying the non-static aspect of the pieces.

From participating students' reports and final outcomes, we conclude that drawing inspiration from experiences with and through non-human matters, such as plants, grounds, and climate, effects a shift from an aesthetic of seriality (Steiner 1999) to an aesthetic where uniqueness and affects are highlighted (cf. Valle-Noronha 2019). From the relations between seasons and places to the ways, time affects materials listening to the field's voices may offer fashion and textile designers new paths for creativity.





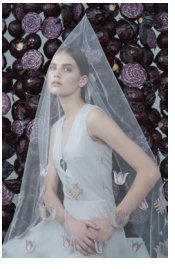

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Image Credits (from top to bottom)
In the woods (Piret Puppart), Dying samples (Piret Puppart), Weaving together (Nele Kurvits), Woven Dress by Nele Kurvits (Photo: Virge Viertek, Veil and Dress by Kreet Kärner (Photographer: Virge Viertek)

Notes to the reader
This case study has been investigated from the perspective of sustainability and cultural heritage and presented at the Fashion Colloquia Jaipur. This contribution explores a new perspective to the work.

SAPIENZA UNIVERSITÀ DI ROMA
cumulus

Heirloom: a device for the survival of the fittest memories

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DE SIGN CULT URE(OF) ARTIFICIAL DIGITAL TECHNOLOGY ROBOTIC

Abstract

The project investigates the idea of **design without designer**, by submitting design to the rules of biological evolution.
In *The selfish gene*, an essay by Richard Dawkins, evolution is analyzed from the point of view of the singular gene, fundamental unit of evolution, that does all it can to survive, replicating through to the offsprings. Genes that have a reproductive advantage, thrive. On the contrary, they end up disappearing. The author extends these concepts in a broader sense to ideas, fundamental entities of culture, replicators just like DNA: the memes. We possess part of the genome of our ancestors within our genome, although we do not know who these were and what their thoughts were. Based on these concepts, I designed a device that would allow the transmission from generation to generation of something immaterial: values, memories, that would survive the individuals themselves.

Research Objectives

Investigating the concept of design without designer, through a project that submits design to the rules of biology;

The project

Heirloom is a device for the survival of memories in the form of voice messages.

The idea is that our memories are passed on to our offsprings just as our genetic material is passed on and that, as happens with biological evolution thanks to natural selection, only the best memories survive over time.

Heirloom is passed from hand to hand, from generation to generation. For each step, new memories are recorded by each user, and memories of the ancestors are listened to, and a score is progressively assigned to every record according to the average listening time. Memories that have been heard less end up disappearing to leave space in the memory to the most heard memories. When two users form a couple, the two devices meet, and a single collective memory is generated consisting of the best memories of each of the two families.

The device is recharged by means of a key placed on the side of the box in which the device is contained, and while it is turned, as if it were a carillon, a music automatically generated by the system is reproduced based on the overall mood of the collective memory of the family to which it belongs.



Methodology and Tools

DESK RESEARCH

CRITICAL DESIGN APPROACH

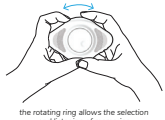
Research Process

1 GROUNDWORK
establishing foundation of research through secondary data sources.

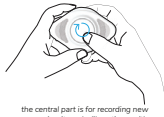
2 DEFINITION
definition of the scope, objectives and possible methodologies.

3 IDEATION
creative process to arrive at a possible solution.

4 PROTOTYPING
creation of various models in plastic material and a digital prototype for the features test.



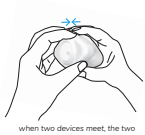
the rotating ring allows the selection and listening of memories



the central part is for recording new memories, it works like a timer with a duration of 30''



to take care of the memory of the ancestors, periodically rotate the key to avoid permanent deletion



when two devices meet, the two memories will merge into a new one

SAPIENZA UNIVERSITÀ DI ROMA

cumulus creative hubbing

HYBRID TOWN,
Stories in Maps: from China to Milan

DE SIGN CULT URE(OF) PROXIMITY PLACES PEOPLE ECONOMY

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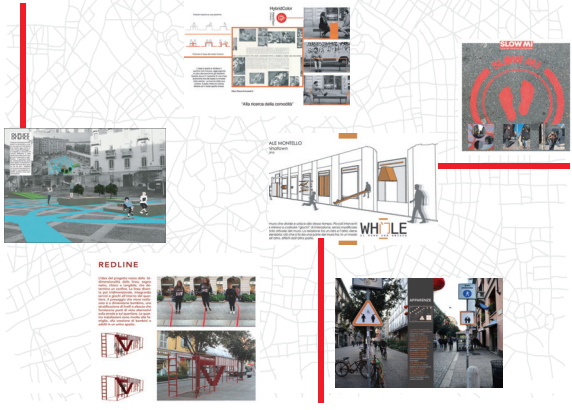

Hybrid Town is a project born as a curricular academic activity of NABA in the 2019/20 winter term. The idea started among faculty members trying to involve and integrate the growing number of Chinese students that attend to our Academy, combined with the observation of the gentrification phenomenon of Milan's Chinatown neighbourhood (via Paolo Sarpi).

Paolo Sarpi area has been from the early 1900s a close Chinese community, full of commercial import-export companies and shops that were mainly oriented to the local Chinese residents. Things started to change when an urban intervention on 2010-11 (which followed a high wave of protests by local residents for the too many import-export businesses in the area) made most of the block pedestrian-only, making it very difficult for trucks and vans to reach their destinations and thus inducing a transformation in the commercial activities, which started to become more and more street-customer-oriented. This gave way to a gentrification process as the area drew the attention of many non-Chinese entrepreneurs, who decided to open cafes, bars and shops in the new pedestrian area, and, subsequently, of real-estate speculators who see in the newly refurbished area an occasion for increasing the value and the rent of their properties.

The underlying questions of this project are: can the arts help residents of a changing neighbourhood maintain their identity? What is this identity? How can Milan's Chinatown be described to who does not know it? What are its needs? How can art contribute to the integration of cultures? How can urban interventions that foster multicultural integration be conceived and designed from different perspectives and through contamination across different disciplines? Can NABA, as a cultural and multi-disciplinary institution encourage good practices of integration?

Eleven classes, meaning more than 300 students and 20 professors from different backgrounds and disciplines, were asked to work on these questions. Many teams were formed, and students started exploring the neighbourhood through their own cultural and artistic lenses.

What we would like to present is the result of one of those teams, which is particularly interdisciplinary: the faculty members are one architect, one designer and one sound artist who asked students to explore the area through its sound features and, from the results of such exploration, to devise urban design solutions which would help the cultures that are living together in that very particular neighbourhood understand each other and thus successfully integrate.



SAPIENZA UNIVERSITÀ DI ROMA
cumulus creative looking

Identities and sustainable futures

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ABSTRACT:

The social impact of the artistic discipline of Design is an intrinsic part of the DNA of End-of-degree Projects at ESDAP Catalunya in which different methodologies are developed to put users and their communities at the heart of reflection and analysis with a view to identifying, proposing and evaluating different tangible solutions for individuals and for society. It embraces a range of processes in which the designer is actively involved with the community and acts as a mediator playing the role of activist. "Designing together" is not simply an empowerment strategy. It also means opening up spaces to specific groups that represent the seed of a sustainable future. Since its recent creation, ESDAP Catalunya has been firmly committed to social innovation and promotes and encourages a model of design that primarily focuses on users (people) and their contemporary context. Generating knowledge and broadening the base of critical thinking is one of the educational challenges that continue to nourish our students' projects.

This poster seeks to convey a cross-cutting vision of our institution's responsibility and commitment to the management of conflicts associated with gender, multiplicity and diversity. It also strives to show how design is a useful tool for social transformation through a series of tutor-supervised proposals aimed at prompting not only an ethical stance, but also open investigation that encourages new languages of action and creates new relations through direct intervention in people's lives. The re-activation of processes that stimulate minority communities to give them a voice, participatory initiatives and raising awareness are the lines that steer our work.

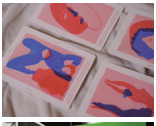




Human-Centred Research – qualitative research methods are used to build empathy with various stakeholders to discover issues and insights.

Designers are now expected to tackle increasingly intricate and diverse problems that **involve economic, social, cultural, political** and **technological issues**.

If designers desire to have an impact on present-day complex societal problems in a meaningful and effective way, it is imperative that they **operate in interdisciplinary teams**, to collaborate and coordinate with experts from different fields (Davis, 2012)









End-of-degree Projects:
The collective dimensions are demonstrated in the common body of knowledge built from the sharing and feedback of ideas throughout research progression.



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Interaction studies applied to Robotic Surgery

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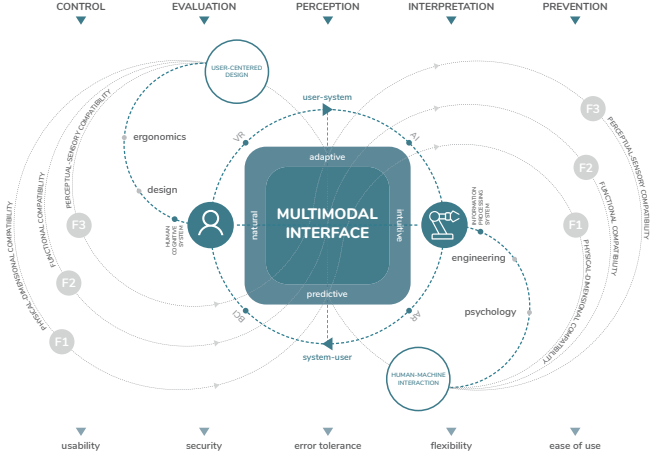
DE SIGN CULT URE(OF) ARTIFICIAL DIGITAL TECHNOLOGY ROBOTIC





ABSTRACT

Social complexity is characterized by the introduction of digital and artificial innovations – which bring new incentives and benefits to contemporary society every day – and it requires the creation of new disciplinary synergies able to govern and optimize performances and opportunities offered by technologies.
It becomes essential to change the culture of design, in an era of "dematerialisation" (Marras & Macacci, 2014) where the discipline of design must necessarily invert its interest from the binomial form-function to the modes and capacities of interaction that affect any technological artifact. Therefore, technology, supported by complementary skills, can expand the user's skills, facilitating complex operations and being of help and support for specific tasks.
The project aims to reflect on how technology can support humans instead of drastically reducing their role, disregarding their sensitivity and intelligence and overcoming the opposition between human and machine to identify an imaginary coexistence hinged on original forms of interaction in the field of robotic surgery.
The aim is to reformulate the modes of language that are interposed between humans and robots, facilitating and synthesizing information to support new interactive forms of communication that can improve the interactions interposed between both during control activities, from physical-dimensional to functional compatibility up to the perceptual-cognitive and emotional sphere.
Through surgeon monitoring and controlling and the integration of new visualization technologies, the new generations of robots will be able to perform increasingly less invasive, complex and high-precision operations, bringing new value to therapeutic and surgical science.

KEYWORDS:
Interactive Control; Robotic Systems; Artificial Perceptions; Interaction Design; Robotic Surgery.

OUTPUT

Configuration of multimodal interfaces to ensure new visualization and control modes through:
- ergonomics and increased skills in human-machine interaction;
- prevention and safety in surgical procedures;
- usability and adaptability of interactive systems;
- flexibility and error tolerance in robotic control.

RESEARCH PROCESS

One of the great challenges of robotic surgery is to design efficient and ergonomic human-machine interaction systems that improve the surgeon and robot skills. (Boyraz et al., 2019)
In the contemporary scenario, the field dedicated to medical imaging techniques that allow the surgeon to have a three-dimensional interactive relationship – visual and tactile – with simulated parts of the patient's body, is constantly developing. (Maldonado, 2005) Research is currently underway to implement collaborative human-robot systems in surgical environments that are able to reduce the surgeon's workload through task automation – benefiting surgeons and patients – by facilitating operative processes and reducing operating times. (Rivas-Blanco et al., 2019)
Following this direction, the research presents part of the preliminary studies for the definition of a model of human-robot interaction in surgical environments, which is able to improve the language and perceptual dynamics that interpose themselves during communication.
Optimizing and reducing the probability of error through the evaluation of the perceptual-cognitive factors that influence interaction and the analysis of the requirements that determine human reliability.
Starting from Norman's (1988) suggestion that the user interacts with the system through a bidirectional exchange of messages – user-system and system-user – and through discordant modes of communication and intention, it was possible to identify requirements related to ergonomic risks, safety in the operator environment, reliability of control systems and visibility, management and visualization of information flows.
In fact, with the adoption of methods of analysis and design, new modes of visualization, control, prevention and safety have been configured.
Through the identification of advanced technological tools it will be able to provide the operator with real-time information on the status of the operating process, to facilitate data acquisition and to improve safety levels.

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Intervention of Indian Textile Craft in Design Pedagogy for Social innovation and Economic Growth.

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DE SIGN CULT URE(OF) RESILIENCE
SOCIAL INNOVATION CIRCULAR ECONOMY SUSTAINABILITY

Need Gap:

Does Design Pedagogy Support Craft Project to become Entrepreneurial Ventures?



Research Objectives

A. To integrate learning outcomes of final design project with Indian heritage craft and serving to artisan community to break the social equilibrium

B. To facilitate students to study the chosen craft and innovate design ideas as per the trend, market gap, client, design development, explorations to skillfully execute for a product and to encourage students to choose Indian craft that is dying

C. To collaborate learning with artisans leading to new entrepreneurship opportunities for young designers and source of livelihood to artisans in the circular economy

Research Process:





Novel Entrepreneurship Models

Research Tools & Methodology:

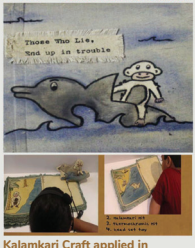
Indian Crafts can be introduced into the curriculum as a natural process of learning by simplifying the process for students to study and understand the importance of artisanal work and co relate their realization with current Scenario hence creating new product and Business models for future.





Research Outcomes:

TDFI 2013-17 Student Work :Lisha Malhotra



Kalamkari Craft applied in interactive storybook for children
Some Schools introduced these books in Schools

TDFI 2013-17 Student Work : Kriti Gundhi



Crochet- Amigrumi Craft to create interesting toys and products for kids.The Project formulated as Business Venture:Meri Gullack contributing to Socio-Economic Growth

TDFI 2013-17 Student Work : Chitrandaga Goyal



Achada - Waste of Traditional Block printing of Saganer fabric used for a product solution for home decor.Converted in a business venture contributing to socio-economic growth.

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Italia 3.0
An educational strategy to enhance food as Food Cultural Heritage

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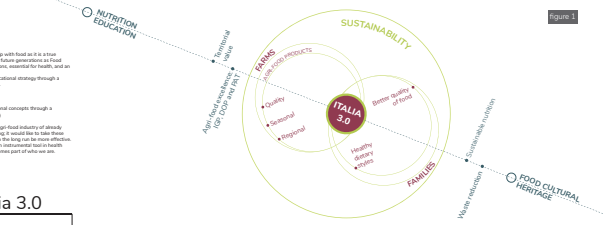
DE SIGN CULT URE(OF) REVOLUTION
CRITICAL THINKING DISRUPTION CHANGE

figure 1



INTRODUCTION

It is time for us to rethink our relationship with food as it is a true wealth that should be transferred to all future generations as Food Cultural Heritage. Food is rich in traditions, essential for health, and an important social tool.
Italia 3.0 begins with an innovative educational strategy through a series of studies from 20 Italian regions.

What is Italia 3.0 based on?
-Regionality and quality.
-Redefinition of educational and nutritional concepts through a sustainable food system path. **(figure 1)**

Italia 3.0 does not want to change the agri-food industry of already existing excellences, but wants to bring the quality of the food supply systems to another level which would in the long run be more effective. Italia 3.0 focuses on nutrition, as both an instrumental tool in health and also as a portal into culture. It becomes part of who we are.

Behind Italia 3.0

Legend



figure 2

THEORETICAL FRAMEWORK

Traditional cuisines are passed down from generation to generation; these foods reflect pride for their ethnicity. "Specific food cultures have emerged in various parts of the world over many years which can be linked to the exploitation of specific territorial crops" (Montanari, 2006). Food is an important part of culture and operates as an expression of cultural identity starting from a small community to the entire country. Our food memory banks are in danger and should not be deleted because it would have a negative effect on our ability to taste and remember the treasure that these raw materials can offer.

METHOD

20 Italian regions with all the agri-food products in each area were studied. The products were then divided into species and categorized using the European **IGP/DOP** and the Italian **PAT** certifications.
Our first analysis was to determine how the raw materials were processed by the final consumer in each of the Italian regions.
16 food processing tasks were analyzed (the first few were raw and unprocessed). Each is represented with a specific icon and color code. **figure 2** is the created legend used as a guide for graphing the analyzed data.

Each region was given a specific processing task according to the specific IGP, DOP and PAT foods.
For example: apple processing task-washing, cutting with a knife, grating, removing the stalk, removing the core.
This type of analysis was continued in each region for all the elements examined and is summarized in **figure 3**.
These were the first steps that helped set up the whole outline for Italia 3.0.
This systemic design project approach can be used in any country. This is what makes this project unique.

Example: Lazio Region

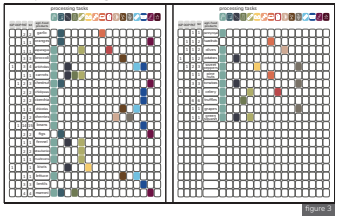


figure 3

FROM CONCEPT TO PROTOTYPE

The first phase of this study was graphically rendered to have an immediate understanding of the Italian agri-food panorama in the 20 different regions. Thanks to the creation of the modules that were suited to create the visual legends, the transition from clutters to the whole picture of Italia 3.0 was made possible. This allowed us to highlight the differences in the food and culinary methods, no longer through geopolitical lines, but rather exploiting the quantity and quality of the products that characterize these regions.
Figure 4 depicts the IGP, DOP and PAT certifications, each corresponding to three different forms; size and color are based on the quantity of species of the same food found in each region.
The numbers found below each form represents the quantities of the same species of the particular food for each of the certifications; they are categorized starting from the smallest to the largest according to the number of products found for each certification. For example: IGP max. 4, DOP max. 3, PAT max. 36.
This mapping is the basis for the rewriting for each territorial matrix. It portrays the essence of a territory with a view to the Culture/ Revolution **(figure 5)**.

Italia 3.0 Prototype

Legend

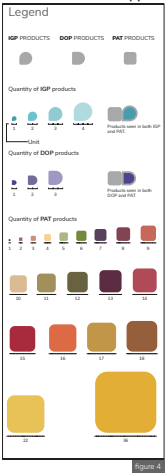


figure 4

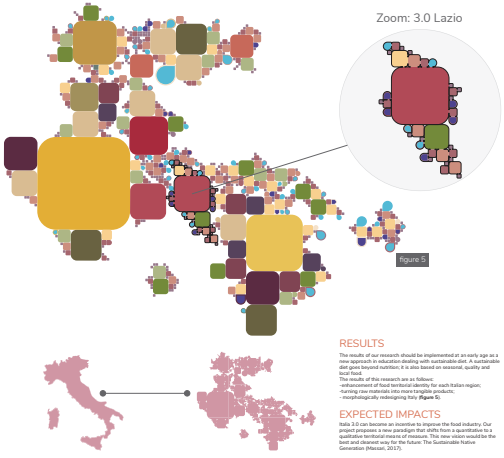


figure 5

RESULTS

The results of our research should be implemented at an early age as a new approach in education dealing with sustainable diet. A sustainable diet goes beyond nutrition; it is also based on seasonal, quality and local food.
The results of this research are as follows:
-enhancement of food territorial identity for each Italian region;
-turning raw materials into more tangible products;
-morphologically redesigning Italy **(figure 5)**.

EXPECTED IMPACTS

Italia 3.0 can become an incentive to improve the food industry. Our project proposes a new paradigm that shifts from a quantitative to a qualitative-territorial means of measure. This new vision would be the best and cleanest way for the future: The Sustainable Native Generation (Mezzan, 2017).

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Kairos: How Digital Culture Heritage can improve creativity through Systemic Design

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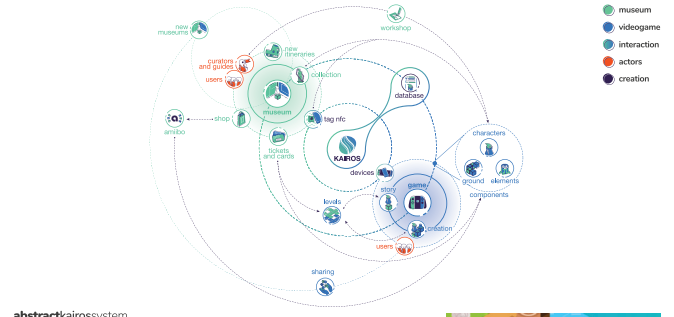
DE SIGN CULT URE(OF) MULTIPLICITY GENDER PLURALISM DIVERSITY



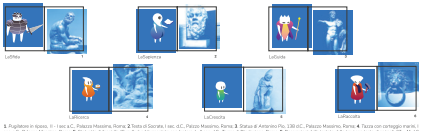
abstractkairossystem

Kairos system intends to **increase creativity** using a Systemic Design and a collaborative approach based on a complexity strategy to public engagement. We consider the **museum as a living game network and a research lab**, while **the game works as a process activator** that stimulates the implementation of active and participative learning by the **fruition of cultural heritage**. We want to support the students' participation in the entire learning path, encouraging the development of personal soft skills to face future challenges independently.
The choice of the museum is fundamental for the project because, according to the International Council of Museum (2019) **"museums are democratizing, inclusive and polyphonic spaces** for critical dialogue about the pasts and the futures. Acknowledging and addressing the conflicts and challenges of the present, they hold artifacts and specimens in trust for society, safeguard diverse memories for future generations and guarantee equal rights and equal access to heritage for all people."
Since the **human mind is an active receptacle** that needs practice and the interaction to learn (Huizinga, 2009), we chose **digital games** because **interaction is their main characteristic**.

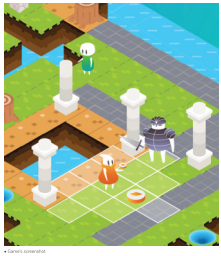


archetypes

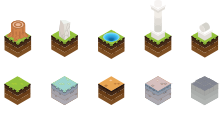
The entire system's dynamic is enriched by the **characters of the game**. At the beginning of middle childhood, we start to learn and practice with a **wide range of symbols** (Gardner, 2009), therefore the characters are inspired by **psychological and narrative archetypes**, different and gender-less. **Anyone can find a character and empathize with it**; in addition, **every museum can create its own characters**, even during a workshop with visitors, representing particular subjects.
Western society is based on stories and poems that talk about wars, fugitives landing in new worlds, hospitality, and composition.
For this reason, in Kairos there are themes like travel and discovery that make the system itself a metaphor of them.



1. Pugilatore in riposo, II – I sec a.C., Palazzo Massimo, Roma; 2 Testa di Socrate, I sec. d.C., Palazzo Massimo, Roma; 3. Statua di Antonino Pio, 138 d.C., Palazzo Massimo, Roma; 4 Tazza con corteggio marino, I sec. d.C., Palazzo Massimo, Roma; 5. Statuetta di Fanciullo (Lucullo) addormentato con lanterna, I – II sec. d.C., Terme di Diocleziano, Roma; 6. Decorazione delle testate delle teche con teste di animali, III – A.C., Palazzo Massimo, Roma



• Kairos's screenshot



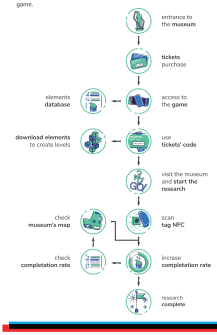
• Elements to creat levels and obstacles

methodologicalapproachandresults

Kairos pillars are based on **qualitative research** conducted through **interviews with museum curators and industry experts,** participating in events, conferences, and a wide case studies research. Every time we discovered and gained new infos we confronted experts to confirm our suppositions and ideas. the contextualization and interpretation of the data identified some recurring themes, with the purpose to **find the opportunity and the space to generate new narratives and experiences**. All the actors and data were analyzed to put in systems maps, creating new links and reclaiming new positions and roles.
This research allows having a format and a base of elements of which each museum can develop its multiple contents, different both aesthetically and functionally, to strengthen its cultural heritage.
The game encourages visitors to explore different museums by **enhancing the diversity of our cultural heritage.**
During the last two years Kairos has been **used as a tool** for the Systems Theory and Analysis course, held b Professor Veneranda Carrino in ISIA Roma Design during a three–years research about "Water and Culture Heritage".
Thanks to this collective approach students are now implementing and designing new functions, characters, and levels shaped on the museum Baths of Diocletian's needs.
The ultimate purpose of the project is to be able to embrace any museum inside the game, **showing the museum's peculiarity and adding a new experience to the traditional one.**

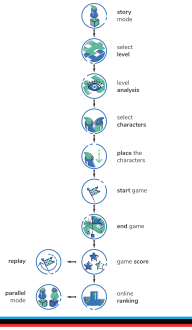
flowchartmuseum

Kairos is divided into two phases: the first one takes place in museums where users can find characters and elements that will be used in the game.



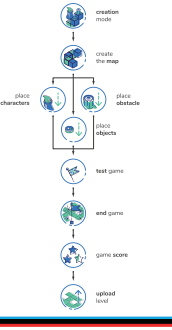
flowchartstory

In the second phase users can use charcters to solve the levels and create stories.



flowchartcreation

In the creation mode users can build up levels using the elements fand shere them online.



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Kinetic calendar for tracking physical and emotional stress in women

DE SIGN CULT URE(OF) LIFE
NATURE BIOLOGY HUMAN

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Abstract

In some cultures or working environments, a strong emotional display is perceived as a sign of weakness or a lack of self control. Many women believe that they should seem or be "cold and strong" even more than their male pairs, in order to not be dismissed in several contexts.
The main problem with this, is that all humans have the need to express feelings; and in a huge majority, women's brains are specifically wired to express their feelings more than most men due to biological reasons. Trying to ignore this facts plays a role in getting many people inside a stress-depression spiral, causing the expression of this emotions even through physical symptoms.
The objects we are surrounded by are to some extend, a reflection of our personality and our experiences. Helping users recognize some emotional patterns by forming recognizible images
and place them inside the user´s personal environment to mimic the functions of a "mirror"; not to perceive any physical features, but to capture in some way their emotional journey during a cycle, in order to analyze the relation between stress and discomfort, with the hormonal cycle as well as some monthly events, that could in a long term affect her physical state.
The data collected by the users might not only serve as a visual feedback but also it can help physicians detecting patterns or relations for some common mental-related affections, such as the Psychosomatic Disorder. The aim of this work is helping to develop deeper self-understanding in the users, regarding the possible connection between their emotions and their hormonal cycle; by having visual ffedback and sensorial reference inside our living space.





Objectives

-Measure the base level stress of the user by using the HRV (Heart Rate Variability) parameters with a weareable device.
-Offer an easy way to register the number of emotional peaks or/and symptoms around the day.
-Design a calendar-like display where the emotional inputs can be related to hormonal phases of the menstrual cycle, and the physical stress parameters.
-Help useres register this data to make available for further statistical or medical purposes.
-Encourage the user to develop a sense of emotional self-awareness, by the observationa and acceptance not only of physical sensations, but also of their emotional reactions.

The process and tools



Tracking emotions is one of the fastest growing ways to help quantify our mental health. That's why some technology companies, have worked over the last few years to create a solution that best helps us identify and understand our emotions. Thats why a weareable devise is proposed to measure the physical stress by the Heart Rate Variability, complementing this input with a mobile app to include the subjective perception of the user.
This emotional data can then be correlated and then reflected on the visual display to help unpack the instances and circumstances that lead to distressing situations, or also, the happiest moments. Detecting how emotionally volatile the user might be in certain situations can be a huge help in improving her mental health. For example, insights from emotion tracking could help a medical professional provide advice and support on how these feelings can be coped with in everyday activities.







*Mock-up of the interphase of the application

Expectations

The development of design projects focused in emotional health is a contribute to a more empathetic social environment and to a bigger awareness to the fundamental role of stress and the effect it can have in our bodily functions, resulting either in physical symptoms, or to long term anxiety or depression due to ignored emotional hints.
The attempts to translate this hints in to an object or visual feedback, can lead us to a more assertive approach to regulate some emotional or stress issues.
Understanding the strong relation between the emotions and the body, connected mainly through the highway formed by perception - thoughts - brain and hormones, can lead to the creation of a variety of tools to explore the unseen ecosystem that we hold within our bodies. This paths could be as unique as a fingerprint, or show patters according to cultural, geographical or biological conditions, as well as gatherig accurate data for users to share with a health professional if needed.

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Knitted expressions. Movement as material in Textile Design

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DE SIGN CULT URE(OF) LANGUAGES AESTHETICS EXPRESSION VISUAL

Abstract

The study focuses on exploring and manipulating materiality in knitting technique. Material is not only a substance but an experience that can be visual or tactile. The emphasis is on movement and how textile materiality effects and restricts it. Various techniques from basic to advance level have been learned and combined on silver reed knitting machine to create stimulating textural samples. Elastic materials like lyca both black, white, nude along with rubber and wool yarns have been explored keeping in mind the conceptual framework. The technique is not taken just as a surface but more of creating structures with strength and greater stretch ability investigating aesthetic expression. This study helps to explore material and its structural properties. It would assist to evolve and consider the ways in which bodies and textiles interact with each other. The combination of techniques in samples resulted in dramatic forms specially when taken off the machine. All samples explore materiality combining various knit structures which creates interesting results both tactile and visual.

Keywords

Materiality, movement, interaction

Research Objectives

- Explore movement and how materiality effects and restricts knitted textile
- Reconsider the relation of body and its motion.
- Understand and realize preconceptions in creative development.
- Investigate new materials in knitting

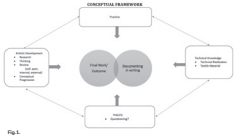

Fig.1.

Research Process

Various researchers have used movement as a design element. Vaughan (1997) have explored movement in performance as an expression. Similarly, Peterson & Nielsen (2002) applied motion to graphic interface. Physical movement as a design element involve challenges because of the limitation of material, shape and size. (Nam, lee & Park, 2007). This aim is to search for the right choice of materials and structures in construction of knitted fabric which creates the challenge to explore the aesthetic expression.

According to Dewey, it is not possible to describe aesthetic experience in words as there is no prescribed definition of this thought (Shusterman,2000). However, according to pragmatists various principles characterizes the aesthetic expression. Noticeably, it has been argued that the human body dimension is an active part of aesthetic experience (Ross & Wensveen,2010).

Chen works creates possibilities to read and explore body movement as an expression. His work focuses on creating sculptures which are body containers using shredded magazine papers. She reflects on finding relation between clothes and media exploring visual language as an art form for the viewer. The worn tube-like Knitted structures in unconventional material by living body questions the existence in different contexts.

In addition, Adam practice explores knitting technique in relation to body movement. She deeply looks into the Martha Graham practice who is a known choreographer/dancer and have always considered choice of fabric, texture and its weight for the performance. Adam works innovatively combines knitting techniques, variation of ribs with plain knits creating textural form. Her project 'Landscape of the body' investigates body movement, using body as an object that each individual can relate to. This also gives an understanding about how body is perceived by each individual amongst others.

The technique helps to develop rapid forms and surfaces as material doesn't require any pretreatment for making of form in knitting structures. This becomes the significant feature during the design process using the technique and evolving the expression of form.
(Landahl, K.,2015)



Fig. 2.



Fig. 3.

Methodology and tools

The initial samples on the machine were more about understanding carriage functions, setting up the machine and changing needles. The technique on single bed machine i.e. shaping (increasing and decreasing stitches) and partial knitting samples were interesting to use as shape-changing method. The experiments provide wider understanding of surfaces and change in shape of knitted fabrics exploring possibilities to be draped on the body. The samples were developed using Lycra (black + white) Dtex 78/78, 40 needles.

The sample in the figure 4 is placed on the mannequin. It has a hole made through partial knitting technique which gives possibilities to explore the transformation of a surface on body. Similarly, in figure 5 the increase or decrease in the stitches while making of the sample gives various potentials to achieve different shapes and form. This is further investigated while draping it on mannequin.

The selection of the following samples is based on a comparative study. All samples are made using same pattern/design developed on computer but choice of material, technique and machine set up makes them look different, achieving stimulating visual expressions. The choice of stretch fiber, yarn provides elasticity for the samples which responds well to body movement and later return to its original shape and size.



Fig. 4.



Fig. 5.

Sample 1

Design: Pattern 2
TUCK STITCH (SINGLE BED)
Tension 5
Needles:60
Material:Lycra black Dtex 78/78

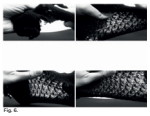

Fig. 6.

The visual expression of the knitted sample seems plain because of the use of material. The material Lycra squeezes when taken off the machine. The yarn holds the loops together and the fabric becomes less open. The interaction with the fabric later shows the pattern enhancing design.

Sample 2

Design: Pattern 2
Fair ISLE (SINGLE BED)
Tension 10
Needles:80
Material:Lycra black Dtex 78/78
+ Bomull/acrylic NM. 34/2 + Nude lycra



Fig. 7.

In this sample the design of the pattern made on computer was prominent visually. The tactility and relief on the surface because of the combination in yarn made it look aesthetically appealing. The sample has a bit of controlled stretch ability because of the blend of Bomull yarn with nude lycra. The use of nude lycra added a little of shimmer in the overall effect which enhanced with the stretching of sample.

Sample 3

Design: Pattern 2
TUCK + RIB (DOUBLE BED)
Tension 10
Needles: 120
Material: Bomull/acrylic NM. 34/2 + Nude lycra



Fig. 8.

This sample is made using both needle beds. The combination of using two techniques tuck and rib in one sample explore potential movement and change in shape because of the curl in knitted fabric. The combination of rib with plain knits planned till the middle of the sample and continued in the opposite direction half way creates textural form. This give possibilities to further combine these techniques to observe movement in the knitted sample.

Sample 4

Design: Pattern 2
TUCK + RIB (DOUBLE BED)
Tension 10
Needles: 120
Material: Lycra black Dtex 78/78



Fig. 9.



Fig. 10.

This sample is developed based on the same technique as above. There has been a change in selection of material and making of sample. It starts with a tuck stitch later continuing with plain knit, further transferring the loops to start with the rib. The rib is planned in a way that it increases diagonally later combined with plain knit. The making is planned to achieve texture giving shape to the sample. The use of the material and technique adds 3- dimensionality to the sample when taken off the machine.

Expected/obtained results

The experiments and exploration of material in knitting on silver reed machine gave endless possibilities to proceed further. The process helps to translate thoughts into creative solution which can be further developed on industrial knitting machines.

The process investigated material properties and knitted fabric techniques. The use of material in relation to explore elasticity and change of pattern through movement was observed while sampling. The combination of yarns helped to explore stretch ability of the sample. The combination of techniques in samples resulted in dramatic forms specially when taken off the machine. All samples explore materiality combining various knit structures which creates interesting results both tactile and visual.

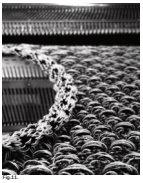

Fig.11.

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cumulus creative linking

Love Leftovers - Useful fictions and what if we could put our memories on sale?

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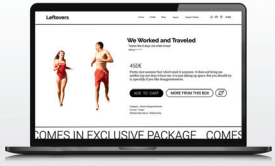
DE SIGN CULT URE(OF) REVOLUTION
CRITICAL THINKING DISRUPTION CHANGE

What if we could trade our memories?

abstract

Opening up a space for discussion, Love Leftovers project investigates how people form their own opinion about the kind of future they desire (Dunne, A. & Raby, F. 2013). The project explores through a speculative approach, the value we give to our memories, interweaving fiction and language of the consumeristic world. During the Research, memories are considered as consumable objects that are collected and accumulated. Treating them as data, the project investigates the empirical space in which all this sentimental information ends up after losing their "personal" value and questions: Is it possible to recycle it? Could the "memory" be shared, sold, or replaced - so, we can put it on market?
To gain necessary information for designing the platform available for trade of the memories, one of the tools applied during the Research was questionnaire. The Research gained from 225 respondents that associated specific sensations of a particular memory, possibly describing them in physical terms such as size, format, taste, and condition. Through a series of questionnaires, the project highlights how our memories are perceived as subjective, both real and unreal, as they could be experienced in the real time life routine but, at the same time, could be imagined as well (Oatley, K. 2011). With this regard, design acts as a mediator, in which the outcome of the Research is presented as a fictional online market where every memory becomes an item available for purchase with the aim to unsettle the present rather than predict the future (Stephen R. L. Clark, 2011).



Title: Love Leftovers **Designer:** Teodora Ivkov **Relator:** prof. Lorenzo Imbesi
MSc of Product and Service Design, Sapienza University of Rome

"Distinction between actual and fictional world"

Sainsbury, R. M. 2009.

research objectives, methodologies and process

This project explores the notion of nostalgia and memories, love-leftovers that remain after the end of the relationship. The process of the Research started with a question: What if we could export the memory from our mind into a black imaginary box and lock it away?
Following the traces of the abandoned sentimental objects, the analysis during the project came to conclusion that at some point, each of these items (photographs, letters, personal things) will end up at the flea market as commodity, losing their sentimental value and gaining material one, in order to be sold and consumed again. The Research argues that if it is possible to re-sell things of sentimental worth, it is possible to trade our remeberings, as well. Considering flea markets as places for recycling memories, the project started exploring ways of exporting them within their sentimental value.
In order to create a fictional space for trade of memories and explore the initial idea, one of the tools conducted during the process was the questionnaire. Within this questionnaire, respondents were asked to define their memories as specifically as possible, describing the taste, format, size, and price of the memory they would give away.







Since the project is of a speculative nature, the aim of the study is to unsettle the present (Stephen R. L. Clark, 2011) and open up space for debate in order to question the consumeristic culture and challenge the way technologies affect our private lives (Dunne, A. & Raby, F. 2013) by designing a parallel space of speculation that uses hypothetical or fictional products. (Vaihinger, H. 1911)

What value do we give to our memories?

obtained results

As a by-product, one of the results of the research was the communication itself within this questionnaire, between researcher and the respondents. 225 responses describing particular memory of someone were exported into a virtual space, representing specific memories ready to be sold, exhcanged or locked in the black box.





Translating memories into consumable objects

obtained results

The main outcome of the research is expressed as the virtual market in the form of a website imitating existing online stores, where every memory becomes a consumable object available for purchase. The idea of the final visual representation of the memory within the system was based on the statement that photograph is a thin slice of space as well as time (Sontag, S. 1977.) This tiny objects, so-called memories or love-leftovers, are visually described as slices - fragments cut out from our imagination, imitating the act of cutting a detail or a person from the photo.



The research is still on-going with a focus on exploring the gap between virtual and material world and the sentimental value we give to objects that surround us. It's aim is not to provide the solution in form of the Memory Market, but to question the idea of a memory as an object and what might happen if we could be able to trade them.

SCAN NOW
If You want to finalize
the purchase

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cumulus creative hubs

Mass media imaginary as a symbol. How image is revealing the crises of our time through cinematic design.

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DESIGN CULTURE(OF) LANGUAGES AESTHETICS EXPRESSION VISUAL

Abstract

If our era is the era of image, then, our way of studying the context we live in, necessarily involves analyzing the visual universe we inhabit.

The images we create and consume can tell us as much of our political, affective and even spiritual situation as any other field of social studies. Maybe even in a more honest way.

Image is now an analysis measure and **visual semiotics a necessary line of research.** In this sense, the visual fields of new media, advertising, fashion and design become reasons for study, not only about aesthetics, but **about society itself.**

The cinema, specifically, perhaps for its amazing technical progress, reveals in its recent films shared symbolic images of what could define our societies today. Icons such as natural references, physical quality or some updated idea of the spiritual dimension and its apparent disappearance.

María Acaso writes that it's a common minsconception to assume that images are innocent and neutral. Also investigators as Martínez Luna, Cousins or W. J. T. Mitchel claim the depth of images and its ability to challenge contemporary audiences. **A depth that, nowadays, we should all learn to read consciously.**

Methodology

Production design is one of the most unknown areas in visuals. However, it is also one of the most decisive sectors for the study of contemporary image.

This research is based on a review of recent audiovisual content from the perspective of the **visual aesthetics**. Costumes, props, artifacts, locations, architectures and many other visual elements that, in their quality of objects, denote a large amount of **symbolic information**, often revealed subtly to the viewer.

Because of its imaginary and prospective quality, we focus on fiction, terror and science fiction productions.

Objectives

This research focuses on three main objectives:

1. Claim **the role of visual semiotics** as one of the most important disciplines of our time.

2. Value the role of **new media and leisure areas as generators of content** and contemporary and even prospective knowledge.

3. Assume the **image as a unit of analysis** from which to educate in current contexts as well as from which to learn to generate new perspectives.

These points could help us **change the way we understand and use visual culture**

Research process

So far, from this investigation three repeated images have been detected throughout the contemporary audiovisual.

The first one is **the insistence on natural references**, necessarily related to the climate crisis, which is the most decisive crisis of our time beyond ecological area, as Bruno Latour writes.

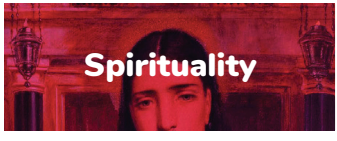
The second one is **the vindication of the physical**, through objects, skin and other elements that suggest what Josep María Esquirol calls a well-understood *materialism*. It recalls the importance of what is familiar and close, such as land, tradition and those that we surround.

And the third one is **the image associated with religious elements**, which refer to an intimate spirituality for a globalized world that Todorov, quoting Benjamin Constant, refer to as *religious sentiment*.

These three references, repeated in the fictional audiovisual stories, speak of the three crises of our time, which refer to the **climate crisis, the isolation arising from a new virtual framework and the spiritual lack that plagues much of capitalist societies**.







Expected results

Although this is a purely theoretical investigation, the provisional conclusions are regularly presented in conferences and articles. The result is a general statement by the public that contemporary audiovisual actually seems to pose a very specific aesthetic trend, which calls for states of reflection around the critical time we live. As a final result, this research is expected to propose a **specific cinematographic aesthetic trend** derived from those crises that define us, but which seem to be better explained by the visual.

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cumulus creative thinking

Neighborhood Cowork (Cowork del Barrio): Co-creating agents for social change

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DE SIGN CULT URE(OF) RESILIENCE
SOCIAL INNOVATION CIRCULAR ECONOMY SUSTAINABILITY

Abstract

This project is a space for intersectoral collaboration, where Crea Potential, AC (NGO), Metropolitan Autonomous University (a public institution of higher education) and a group of young people from Azcapotzalco´s c Mexico´s City, converge to use design and Social Innovation to develop community projects to imagine and build a better future.

A group of students of industrial design carry out processes of co-creation and co-design with the youth of vulnerable communities in order to establish a dialogue that allows not only to generate projects that seek to trigger processes of community development but also to train agents for social change (at the University and at the community). The model under which we are working has been generated not only from literature but from the expertise acquired in the field.

Problem Statement

The crisis of the current economic model forces us to rethink the path of an industry-oriented discipline in our country (Mexico), since there is not properly a product development based industry because of the globalization process. In this context, we also need to find new ways to teach how design can contribute to relief social en economic crisis.

Social Innovation can build solutions to improve our local conditions, but this may be specially difficult in Mexico City because social tissue is broken in many communities (due to the context of violence, poverty and marginalization). In order to get a long term change, we need to get child and young people into action so they can build better conditions for themselves, and their communities. But in our previous field experience, we find out that young people are excluded most of the time from community processes, because they don't see themselves as valuable contributors to their communities.

Research question

How can design change its role and contribute to social innovation processes in a country where citizen participation is displaced by violence, poverty and marginalization ?

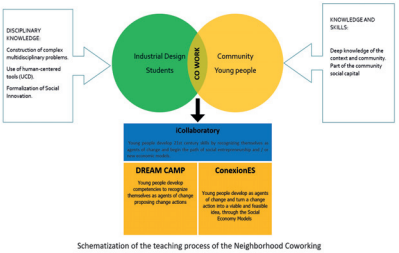
Neighborhood Cowork is a design education model that proposes to Co-create agents for social change

Our research group works under the premise that meaningful knowledge is co-constructed by theorizing practice and practice should bring theoretical concepts to the field. Under this framework, we have taken design for social innovation as our frame to work on field with local communities. Recognizing that specific teaching tools are required, which allow students to co-create with communities and rethink previously learned development models.

The Neighborhood CoWork is conceptualized as a meeting point within the University and the different stakeholders capable to trigger community development processes "from the inside". The Co Work model is centered in common education and co-creation processes among design students from the University and young people from the neighborhoods, who will get thetools they need to assume themselves as agents for social change in their communities: young people in vulnerable situations become social leaders of positive changes with a clear mission and vision.

Inequity is the result of the existence of millions of young people in vulnerable conditions who do not have access to resources such as quality education, specialized training, technology, tools for developing their skills, etc. that allow them to recognize and strengthen their entrepreneurial potential to devise and execute projects that allow them to improve their living conditions and those of the communities where they live.

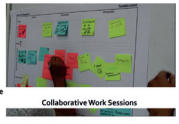
Methodology

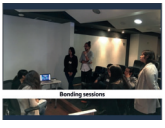


Schematization of the teaching process of the Neighborhood Coworking


Co- Creation Sessions


Common tools for students and youth groups from the community


Collaborative Work Sessions


Bonding sessions

Conclusions:

We promote social empowerment as a catalyst of social innovation that lead to the improvement of the community, so design can participate with own disciplinary knowledge. Until now two groups have developed Service Product Systems for community development, but we need to work in unattended issues:

1. It is necessary to adopt common criteria to be able to get academic objectives as well as project evaluation indicators, common between the two groups (students and youth groups). Therefore, it was adopted as PERSONAL, SOCIAL and LEARNING skills and competencies.

2. So far it has been essential to seek alliances with other groups outside from academia, for example consultants and NGO´s, which allows adopting techniques and strategies that come directly from professional work in the field.

3. The challenge of Co Work del Barrio is to achieve a sustainable project that becomes a meeting point for dialogue between knowledge: those of the community and those of the university, which implies management-level challenges: academic and methodological.

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cumulus creative bridging

Pen Your Thoughts: A Visual Design Language Study on Student's Learning Progression

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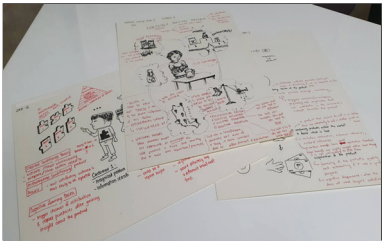
DE SIGN CULT URE(OF) LANGUAGES AESTHETICS EXPRESSION VISUAL

ABSTRACT

The Language of Students in the Art & Design Field is inevitably VISUAL in form; and equally this concept draw a parallel relationship with skill-based laboratory design courses. Conversely, majority of professional lecture design courses uses a traditional teacher-centered approach in imparting basic design concepts and theories to student. Hence, there have been relatively high challenges for design facilitator to evaluate the intended learning outcomes of the course topic using a congruent visual design language activity.

Pen Your Thoughts (PYT) visually accelerates Personal Meaning Mapping (PMM), a variation concept mapping technique in data gathering developed by John Falk (Lelliot,2009). Similarly, PMM and PYT works in a two-layer process, before & after the Teaching & Learning Activities (TLAs) experience (Reeves,2013). This being given, it is probable that design facilitator's evaluation or own appraisal to student's Assessment Tasks (ATs) are strengthened by means of student's critical thinking and recognition of gained insights after the course TLAs. Fundamentally, PYT is an interactive streamlined visual representation of the learning experience after a course discussion. This study examined how "Pen Your Thoughts" has been used as an effective formative assessment to determine student's learning progression. It aims to extend a higher level of understanding and reinforce autonomous COGNITION.



METHODOLOGY

The study utilizes Personal Meaning Mapping (PMM) technique where the data gathering instrument is divided in two (2) vital parts:

The first part is the "MEANING STAGE" - where the personal assessment and pre-testing begins. At this point, students will pen down their thoughts about the given topic in a sheet of white paper using BLACK ink pen/marker before the facilitator begins the topic of discussion in class. The Illustration done in Black Ink represents the neutral juncture in the student's learning process, thus validates the Meaning Stage illustrating the student's current knowledge about a subject matter.

Subsequently, the "LEARNING STAGE" or post-testing period takes in place after the class lecture discussion. In principle, the Learning Stage will let the students alter their original sheet of paper by adding more visual elements using RED ink pen/marker translating the deeper analysis of the topic discussed in class that occurred not present in the sheet during the Meaning Stage.

The process begins with a Qualitative approach with the PMM responses, forming the basis for the Quantitative PYT Predictor Variables. The initial sample were a class sophomore students taking up Advertising Practice 2 & 3 (Adprac 2&3), both Professional Lecture Design Courses in the College of Fine Arts and Design, University of Santo Tomas.

PROBLEM & HYPOTHESIS

Specifically, this study investigated how *'PEN YOUR THOUGHTS'* can be an effective formative assessment for Professional Lecture Design Courses in the College of Fine Arts and Design, University of Santo Tomas.

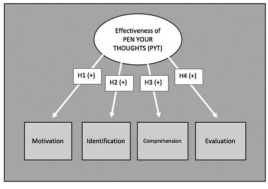


Figure 1: Research Paradigm

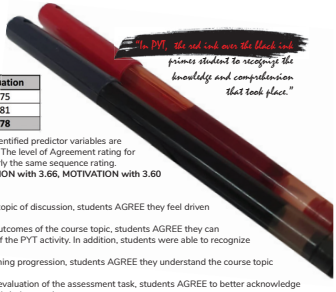
Figure 1 illustrates the Research Paradigm, where analysis of PYT Effectiveness is the predominant objective of the study. Binning of the Four (4) conceptual hypotheses with the PYT Predictor Variables are interpreted as follows:

(H1)Effectiveness of PYT activity drives motivation to design students to learn the topic of discussion.
(H2) Effectiveness of PYT aid design facilitators in attaining the intended learning outcomes of the course topic.
(H3) Effectiveness of PYT influences recognition & comprehension of student's learning progression
(H4) Effectiveness of PYT reinforces the student's acceptance of design facilitator's evaluation of the assessment task.

RESULTS & DISCUSSION

Table 1: PYT Predictor Variables

	Motivation	Identification	Comprehension	Evaluation
Adprac 2 course	3.61	3.31	3.63	3.75
Adprac 3 course	3.58	3.42	3.70	3.81
WM	**3.60**	**3.37**	**3.66**	**3.78**



Measures of the central tendency in this study are presented in the Table 1, where all identified predictor variables are considered imperative factors probing PYT effectiveness when applied to both courses. The level of Agreement rating for each variable differ between & within groups, but both sample groups translated similarly the same sequence rating.
Overall, EVALUATION obtained the highest WM of 3.78, followed by COMPREHENSION with 3.66, MOTIVATION with 3.60 and lastly IDENTIFICATION with 3.37.

For H1 - Effectiveness of PYT activity drives motivation to design students to learn the topic of discussion, students AGREE they feel driven to learn about the topic of discussion knowing the assessment task is VISUAL in form.
For H2 - Effectiveness of PYT aid design facilitators in attaining the intended learning outcomes of the course topic, students AGREE they can validate to have LESS knowledge about the course topic during the MEANING STAGE of the PYT activity. In addition, students were able to recognize the gained insights from the course topic after seeing the LEARNING STAGE output.
For H3 - Effectiveness of PYT influences recognition & comprehension of student's learning progression, students AGREE they understand the course topic during the LEARNING STAGE of the PYT Activity.
For H4 -Effectiveness of PYT reinforces the student's acceptance of design facilitator's evaluation of the assessment task, students AGREE to better acknowledge the evaluation of the design facilitator in the given Assessment Task when PYT Activity is being used.

CONCLUSION & DIRECTION FOR FUTURE RESEARCH

Generally, study findings revealed that since significant differences in user response do exist within and between groups, the data acquired from both sample groups are indeed conclusive as they have presented different values leading & determining PYT effectiveness.

This initial study identified an effective tool that will address the intended learning outcomes of professional lecture design courses in the College of Fine Arts and Design, University of Santo Tomas. Reciprocally, subjective evaluation of design facilitators will be REINFORCED by student's own understanding of the course discussion when PYT is used. **Hence, Pen your thoughts (PYT) will be an innovative visual design language activity that utilizes Personal Meaning Mapping (PMM) technique in recognizing design student's learning progression.**

Moreover, the NEXT STAGE of this study will be developed by analyzing other intended learning outcomes delivered in different modality such as blended learning, enriched virtual mode of instruction or in a co-teaching environment. Apart from conducting these traditional class lectures (online/offline) to determine PYT effectiveness, the researcher will later on consider using other Learning Resources such as Secondary Data. Further, the researcher may also examine Bloom's Taxonomy correlation with PYT as avenue or direction for future research.

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Real-time snow information for tourists - Utilizing AI for tourism - Case Snowman

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DE SIGN CULT URE(OF) ARTIFICIAL DIGITAL TECHNOLOGY ROBOTIC

How can AI add value in accessing information about snow?

This research looked at the possibility AI could bring to Arctic tourism through testing two hypotheses- namely that information about winter and snow are valuable to tourists, and that AI could provide improved access to this information. Our objective was to utilize AI to offer customized snow activity experiences for tourists based on the value local context brings (Bang et al, 2012). Our research is innovative by uniting Computer Science and Tourism. It explores an alternative to existing (mass) snow tourism in Finnish Lapland. The AI connects to local databases in Finnish Lapland, such as maps, weather forecasts, and local services in the area, to extract available information on snow conditions and activities in it, in real-time. Local information translated by AI is made accessible to foreign customers. Thus we aim to provide our target group with a nuanced local snow activity experience.

The research strategy is constructive design research (Koskinen et al, 2012). The data collection approach included a mixed complex method (Saunders, 2012): field notes (process notes), testing Siri and Google Assistant (Go, Sundar, 2019) in working groups, photo documentation, and debriefing. The timeframe of our research was a 10-day cross-sectional study (Saunders, 2012). Qualitative content analysis was the method used to understand and sort the data (Hsieh & Shannon, 2005)



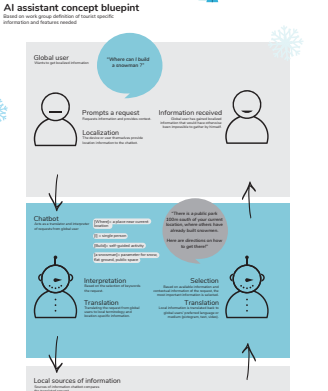
The research cycle was divided into 7 steps:

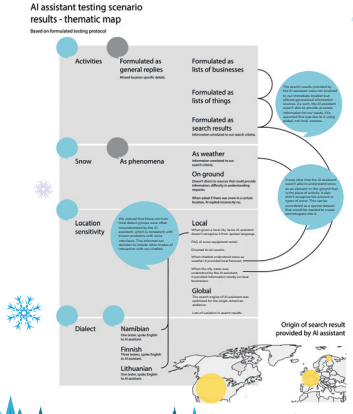
1. Hypothesis
2. Research design
3. AI (specifically Siri, Google Assistant) self-testing in two working groups
4. Analysis
5. Findings
6. Concept development
7. Planning the prototype of the Snowman app

Outcomes: A service concept blueprint on how to utilize chatbot as a tourist information service. It can be utilized to define service requirements and local databases.

Limitations: We aim to develop the prototype for the cross-border users/locations in the Arctic region, currently we have been referring to the location Rovaniemi, Finland. Future research could use Alexa, Samsung S-Voice, and other AI, assistants.







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Recycling, refusing plastic use and choosing biodegradable materials for new products

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DESIGN CULTURE(OF) RESILIENCE
SOCIAL INNOVATION CIRCULAR ECONOMY SUSTAINABILITY

REFUSE plastic
SAY YES TO biodegradable materials

Abstract | Objective | Methodology and tools | Research process | Expected/Obtain results

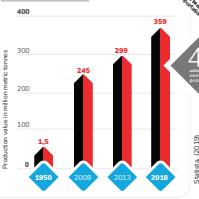
social innovation examples... | Newest

ABSTRACT

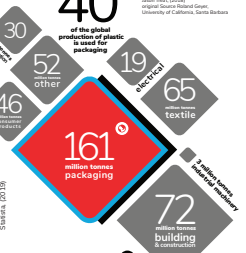
Plastic due to its properties like density, hardness, tensile strength, durability is one of the most used materials on a global scale. The use of polymer materials is vast. Plastic products are so deep-rooted into our routine that they become invisible. The way we use it and how we discard it becomes almost an automated process. Increasing awareness is the way to have a more active social attitude towards refusing plastic use. The recycling process is a constant variation across countries due to their development. In developed countries, recycled plastic reaches about 30%. **In this poster, we first discuss the key benefits and challenges of recycling plastic. Then showcase a few products, while underlining the new ways of designing with biodegradable materials replacing traditional plastic.**

See more on OBJECTIVE →

Production of plastics worldwide from 1950 to 2018



Statista, (2019)



OBJECTIVE

The objectives of this investigation are to display the impact of recycled plastic and the paradigm change that will lead to further research on biodegradable materials for general everyday use:

1. Recycle plastic is creating a plastic loop that does not solve the environmental pollution with plastic.
2. Identifying bioplastic or biomaterials key benefits and challenges
3. Changing methodology, in the way we think when designing
4. Social innovation, circular economy increase awareness and attention to society's ecological issues

METHODOLOGY AND TOOLS

This survey took under consideration fourteen articles, thirteen validated my initial assumption, and one was excluded because of a lack of relevance to the main topic. The used database is Google, Research Gate, Dezeen.com, Medium.com. The articles selected are dated 2016, 2017, 2018, and 2019. Also, to showcase new materials into products, there were blogs, user comments, and reviews taken under consideration.

See more on RESEARCH PROCESS →



Michael Braungart and **William McDonough** in their book The Upcycle, 2013

"Human beings don't have a pollution problem; they have a design problem."

RESEARCH PROCESS

Management of plastic worldwide

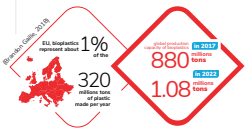
Polymer consumption gets higher as we get richer. The plastic waste management of middle-growing countries failed to keep up with the production possibilities thus, the level is on the rise, and it drops again when considering more developed countries.
Higher-income states have good awareness, a better strategy when it comes to sustainability, environmental issues, and local regulations. (Hannah Ritchie and Max Roser, 2018)

Recycling plastic requires a well-managed infrastructure that contains everything from sorting the different types of polymer to be reused by production companies to taxes and constant investments in the processing technology.

RESEARCH PROCESS

Recycled resin can be used in a wide variety of applications and meets around 10% of global demand. (Woldemar d'Ambrières, 2019)
The challenge of recycling plastic is that it requires control of every factor at every life stage of the product: design, life-end management, ways in which recycled products are being utilized. Also, a big concern is the CO2 gas emission when melting the polymer. Some types of plastic materials are not recycled because of their small quantities. Moreover, the recycled polymer resin is harder to use because of its odor and color. Even if the price of recycled plastic is lower and the upgrading of processing technology will lead to a better quality of this material we will still see a strong need for an alternative to the plastic creation-recycling industry because ultimately the plastic loop continues.

Consumers and citizens can make their contribution to tackling this type of pollution by better sorting plastic waste and changing behavior. How? Removing unnecessary plastic from daily routine and considering buying products that are made of reusable or bio-degradable materials.



One legal initiative that empowers this behavior is the 2019 EU ban against single-use plastic cutlery, cotton buds, straws, bags, glasses by 2021 for all member countries.



Products showcase social innovation

Eliminating negative environmental impact can be done through well though design. Sustainability is linked with design. The life stages of a product have to be taken under consideration from the beginning of the development project. An upcycle mindset is reassessing waste and transforming it into something valuable. (Charlotte Wegener, Marie Aakjær, 2016) Social innovation is required to tackle social and environmental problems of the current day and age creatively. Ezio Manzini, in his book Design, "Design, When Everybody Designs" shares the idea of building a sustainable lifestyle with a focus on cosmopolitan localism. When social innovation becomes the driving factor citizens are working in smaller local groups sharing innovative ideas and building a slow, reuse culture. It is how the consciousness of a recycling mindset is surpassed.

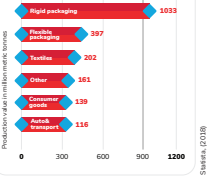
Here are some examples that portray a system of thinking and production setup guided by concepts like sustainability, reuse, social innovation, and circular economy.

The first one introduces a **new material, an algae-starch mix that can replace polymer production.** It is known that an alga consumes carbon dioxide from nature. The design and research project by professionals Eric Klarenbeek and Maartje Dros for research foundation Atelier Luma presented this material that can safely replace plastic for package food. (Marcus Fairs, 2018)

Moreover, the Slovak University of Technology published in 2018 the results of six-year research that presented a new material called **Nuatan**. It is made from two biopolymers: Polylactic Acid (PLA) extracted from corn starch and Polyhydroxybutyrate (PHB) obtained from corn starch metabolized by microorganisms. The production process remains the same as for traditional polymer: it can be 3D printed or injection molded and blow-formed. Its properties are again to be taken into consideration: its life span is up to 15 years and it can withstand temperatures of over 100 degrees Celsius. Nuatan can be utilized for single-use products to replace plastic straws, cutlery, cups, glasses, or other products such as frame glasses. (Marcus Fairs, 2018)
The end life for this biodegradable material evolves into compost at temperatures over 60 degrees Celsius in a microbial environment or an industrial composter. The environmental benefits are pollution control and climate change.

Marina Tex is another material used as an alternative for petrochemical raw materials, made from fish scales and skin. This waste is usually discarded into landfills or incinerated. As in previous cases, this biodegradable material can have multiple applications. The notable difference from the other two examples is that the end of life cycle those not require a separate collection infrastructure. It is low energy to produce and environmentally friendly since it is waste-based. (Rima Sabina Aouf, 2019) The author of this new material find is University of Sussex graduate Lucy Huges, proving once again the social involvement trend. Her discovery offers a solution to a global problem while focusing on involving the local fish industry. The economic and social benefits of these kinds of initiatives are clear, however the high manufacturing prices of these materials compared to plastics and rigid regulations are slowing down their expansion. Further innovation and rethinking of the life cycle are required.

Production capacity of bioplastics worldwide in 2016, by market segment (in 1,000 metric tons)



Statista, (2018)

EXPECTED/ OBTAINED RESULTS

The analysis of the resources mentioned before supporting my initial view about the future of sustainable products and putting into practice the type of project thinking focused on reuse waste, on the use of resources different from polymers. Social awareness through any type of media helps citizens and designers commit to a better way of understanding the impact of the products that we buy day by day.

The study area showed that although a hundred years old the bioplastic industry is far from the production levels of traditional plastic, and a lot of them are used for expensive products such as frame glasses where raw material prices don't make much difference.

Statistics approximate that in ten years, biomaterials will equal the growth of the crude oil-based plastic. That will ultimately lead to a competitive product price-wise with similar properties as traditional polymer.
However, the effort of changing the polymer industry involves a collective effort on a global scale that can lead to the scenario of sustainable cities, neighborhoods, communities.

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Shifting Mindsets, Bridging Generations

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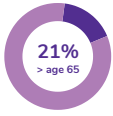
DE SIGN CULT URE (OF) PROXIMITY PLACES PEOPLE ECONOMY

Within the next decade, Singapore will transition from an aged society to a super-aged society.

Amid this radical demographic shift, the changing of the traditional family structure has made the ever-widening generational divide seem more apparent than ever. This disconnection contributes greatly to the reduction of intergenerational contact, threatening intergenerational solidarity. This is profoundly harmful to society as it gives rise to ageism and the formation of negative stereotypes, thus contributing to the negative narratives of old age.



By 2025, more than 21% of the population will be aged 65 and above (UN).



This research explored employing intergenerational design in creating interventions to enhance and trigger **intergenerational interactions**. The intergenerational audience would engage in experiences that involve the **sharing of narratives and memories** with **experiential learning** and **cooperative play** supporting the process. The design process resulted in *Rippling Conversations*, an intergenerational game that facilitates co-creation of marbling artworks through narrative-sharing.

Research Objectives

1. To explore how intergenerational design can be employed to enhance and trigger social interactions between generations.
2. To influence the younger generations to embrace intergenerational relationships and encourage them to be the agents of change in society.

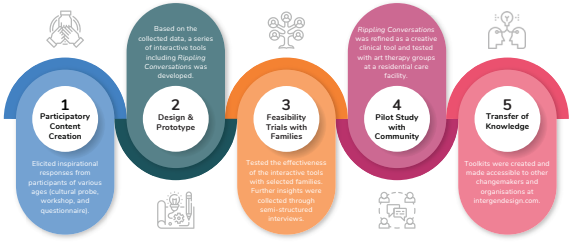
Methodology and Tools

Mixed methods were used for data collection at various stages of the research. Some of the methods chosen were as follows:



Research Process

The foundation of knowledge of this research was established with primary data (questionnaires, observations, interviews, etc.) and secondary data (action plans, case studies, news articles, etc.). The key stages that outline the main developments in this 16-months study are as follows:



Results

Documented reactions and interactions revealed that the process was effective in inducing nostalgic memories, building a shared language, developing empathy, and fostering greater understanding.

Narrative-sharing was successful in engaging both the narrator and the listener in **nostalgic reflection**

Experiential learning helped to develop **empathy**

Cooperative play helped to build a **shared language**

Fostered greater **understanding** between participants

Conclusion

1. The combination of the sharing of narratives and memories, experiential learning and cooperative play could be used as a **generalised methodology** to guide and support current and future intergenerational practices.
2. **Toolkits** in the form of **open source templates** and **step-by-step guides** are made accessible online to other changemakers and organisations, extending the potential impact of the research through transferability and scalability.

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TellMi Ecosystem: an example of Design Process applied to didactic methodology.

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DE SIGN CULT URE(OF) RESILIENCE
SOCIAL INNOVATION CIRCULAR ECONOMY SUSTAINABILITY

ABSTRACT

TellMi is a student project developed during a Service Design Workshop led by Michele Aquila, Kim Mingo, and Laura Polazzi. The proposed project and design output is a direct and clear result of the pedagogical and didactic methodology. Through a series of theoretical lectures and correlated practical activities, the workshop provided the students with an expanded perspective on related design areas and a guiding framework that delineated the key steps and introduced the tools that would allow the design of new systems.
The pedagogical context is defined by a transdisciplinary approach and reflects the multicultural composition of the work teams. We recognized the importance of creating a framework that is open to and can accommodate the differences within heterogeneous teams and takes advantage of the strengths and potential offered by varied backgrounds and cultures (Figure 1).

This Service Design workshop was in collaboration with the DP Città Resilient of the City of Milan, directed by Piero Pelizzaro, within the Sharing Cities of Horizon 2020 and 100 Resilient Cities Programme pioneered by the Rockefeller Foundation. The workshop involved the Municipality of Milan intending to create a service design solution that would foster inclusive decision-making and empowerment of stakeholders in an integrated process of understanding and planning a better city. Students were asked to design the possible interfaces for a dashboard that would be able to provide city planners with an extensive real-time understanding of the city dynamics. The workshop was conducted following the Double Diamond Process (Design Council, 2004) main phases: discover, define, develop and deliver.

The result was TellMi, an app-based service that would allow the involvement of the citizens in a process of improving the city. The service would allow a direct role and voice within the community that would be supported by a feedback loop with the municipality.
The intent and hope are that a system of communication between the two would enable the government to work better in an open and inclusive process.

Figure 1
The teamwork



TELLMI

Research objectives

The project aimed to design innovative ways for the city administration to listen to and collaborate with citizens at a community level and extract important data in the process. The research stage led to the finding that communities come together when there is a common problem for them to solve. Based on this, the team explored the scope of enabling a direct communication channel between the municipality and the people of Milan.

Methodology and tools / design process

The project was conducted following the Double Diamond Design Process, a design process developed through in-house research at the Design Council in 2004.
The process is divided into four distinct phases, discover, define, develop and deliver. It maps the divergent and convergent stages of the design process, showing the different modes of thinking that designers use.
During the discovery phase, students explored existing communities to understand the dynamics that facilitate their creation (Figure 2). The workgroups identified several important elements that bring people together, an interest in creating projects together, or the need for solutions for specific problems. They proceeded to focus the investigation on the type of issues that these people face when creating communities in the identified situations.
They recognized two main barriers, the apathy of other citizens and the difficulty of collaborating with the municipality when in need of their support.

Figure 2
Discover phase: Exploring communities, personas and benchmark outcomes



The diversified professional and cultural background of each team member made a difference in this phase. The students connected the skills acquired in the past studies and work experiences (for example, the prior work experience as a psychologist), with the new tools to analyze the user experience to extract valuable insights.
The multiculturality of the team was fundamental during the research phase. With the increased immigration of recent years, the composition of the citizens of the city of Milan is varied in terms of culture, country of origin, language, and customs. This creates further hurdles in the communication modes between the citizens and the municipality but also between different communities themselves. The international, multicultural composition of the workgroups through structured brainstorming exercises identified different cultural and pragmatic difficulties.
A component of ethnographic research was built into the process through primary research, by interviews and participant observation, as well as with comparative digital ethnographic findings (as specific community platforms and social media channels). In addition, each student collected qualitative case studies as best practices to propose solutions to the different problems. This became fundamental in informing and supporting the user-centered design solution.

The second phase, the defining phase, was focused on establishing a clear goal for their project. Starting from the insights, the students defined the objective of supporting the collaboration between citizens and the Municipality of Milan in a better way, helping them to work together and solve different kinds of issues.

The third phase was focused on the development of a solution that responds to that objective. The research insight led the student to design a project able to empower citizens to communicate community and city issues directly to the Comune di Milano. The proposed solution: TellMi. The first issue was to identify the ecosystem (Figure 3).

The TellMi Ecosystem consists of three main players:
- citizens
- municipality of Milan
- fieldworkers

The citizen is provided with a mobile application to report issues directly to the municipality. When other citizens view and validate the reported issue, it gains popularity and becomes a priority for the municipality to resolve. The municipality can access a dashboard that collects all these reports in real-time. The dashboard becomes an important instrument to monitor the productivity of their departments, respond to the interests of the citizens, and make informed decisions to allocate resources if necessary.

The fieldworkers working with the municipality are also provided with an application that would help them navigate to the exact location of the problem and which would identify their tasks, and more importantly, to update citizens and the municipality about the progress of the works. The fieldworkers' updates relative to the status of the project or intervention are vital as a communication tool with the citizens.
This involves them and motivates them to continue contributing to the improvement of the city and thereby continue using the service (Figure 4).

During the last phase, delivery, the students created a prototype of the app-based service. The tools implemented in this phase included scenarios, storytelling tools, prototypes, and graphic presentations.

Figure 3
TellMi Ecosystem: a service that connects citizens, the municipality of Milan and fieldworkers in a closed feedback loop.



Figure 4
Main interfaces for the three typologies of users.



Conclusions

The project presents excellent potential since it creates a direct communication avenue between the citizens and the municipality. It creates a channel where people can communicate their problems and see a response. At the same time, it provides valuable information to the municipality.
In this project, we see the importance of the multidisciplinary method in the development of a project. The student team was composed of five Service and Interaction designers with diverse professional backgrounds; psychology, product design, graphic design, and digital communication.
During the design process, each student had a specific role and they applied their skills and specific knowledge to achieve the project objectives.
The project presents a strategic approach with a focus on user needs. It starts from the understanding of the problems of the actors involved and then generates a solution that connects them, thus creating value for all. All touchpoints needed to support this ecosystem were developed in detail, considering the supporting technologies and devices as well as the experience for all of the users-citizens, fieldworkers, and the municipality employees themselves.

The collaboration with the DP Città Resilienti continued within the 100 Resilient Cities program and challenged our students with new issues around the topics of environmental sustainability, natural-based solutions, and platforms for the promotion of green roofs in the city of Milan.

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Time Well Spent

Facilitating mindful and meaningful screen use through a 'Design for Humansic Living' methodology

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DE SIGN CULT URE(OF) LIFE NATURE BIOLOGY HUMAN

Abstract

The Internet and technology have evolved rapidly in recent years, and digital technology has become integral to the modern civilisation. Rapid growth and modernisation result in people experiencing burnout and craving for work-life balance. As a way of escaping reality, daily drudgery and boredom, people tend to rely on digital screens for fast entertainment and instant gratification, which gradually leads to excessive recreational screen use (ERSU).

Research has shown that ERSU disrupts health and well-being (Cigna) – people are not clocking enough sleep and find it harder to fit in physical activity. Not only does it lead to an increased risk of mental and physical health problems, it also lowers mental performance and affects productivity levels. Human interactions have also become minimal as people spend more time on phones than they do with each other, causing a lack of social connectedness.

This project looks at harmonising human intrinsic needs in the context of minimising ERSU: (1) Taking care of core needs – functioning, health, (2) Fulfiling emotional needs – pleasure, connection, and (3) Achieving personal significance needs – meaningfulness, capabilities, self-actualisation. The project explores integrating different design approaches to encourage mindfulness and sensitivity while fulfilling user's emotional needs. Interventions will serve as antidotes, encouraging users to take care of their core needs while finding meaning in the purpose of screen-time activities.



1 concern: excessive recreational screen use (ERSU)

ERSU is impacting the state of individual and societal flourishing, a lack of mindful screen use may be restraining human potential and growth.

2 purpose of project

Ease ERSU and enable more meaningful activities for user to function well/better for self-actualisation / flourishing.

3 project objective

Explore less intrusive and motivating approaches to facilitate mindful recreational screen use positively. Approaches should help users to ease ERSU meaningfully or in meaningful ways that are useful for their wellness/well-being.

4 design strategy

To better motivate an user, each design intervention aims to address, harmonise and enhance the following Humansic (human+intrinsic) needs :

- Emotional needs (Pleasure)
- Core needs (Health)
- Personal Significance Needs (Capabilities)

These interventions are termed as Humansic Design. Human-first is the core value of Humansic Design. It considers human sensitivities and human capabilities at the forefront.

5 hypothesis

Humansic Design can facilitate the process of user minimising ERSU meaningfully.

Humansic Design can encourage mindfulness and sensitivity while fulfilling user's emotional needs.

Humansic Design Interventions can serve as antidotes, encouraging users to take care of their core needs while finding meaning in the purpose of screen-time activities.

6 humansic design DNA

Comprises of 7 themes/approaches: (a) Design for Human Sensitivities & Capabilities (Humane Tech), (b) Design for Pleasure (Jordan), (c) Design for Subsistence, (d) Design for Meaningfulness, (e) Design for Reinforcement (The Transtheoretical Model), (f) Design Sensibilities, (g) Collaborative Design.



7 premises to develop, test and evaluate humansic design approaches

- Social
- In-bed

From questionnaire with 1, 252 respondents carried out with support from Active SG, 'in bed' was revealed as the 2nd most common place where people use their mobile devices during recreational time. Social support was identified as the top motivator.

8 humansic design interventions are considered successful when,

1. User demonstrates willingness to change and take action after the design interaction/experience.
2. Positive & meaningful results have been established from user's actions influenced by the design. Results are:
   - A willingness to maintain positive habits. This can be measured qualitatively.
   - Positive/Meaningful improvements. This can be measured quantitatively (sleep/nutrition/physical wellness) and qualitatively (social connection/mental well-being).
   - Efforts and actions to sustain healthy change. This can be measured qualitatively.

9 interventions for different user stages

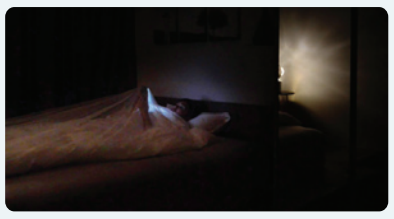
Humansic interventions were designed to help users at different stages develop mindful screen habits meaningfully and more positively for a healthier digital/life balance.

- **Screen-reliant user:** Interactive card game evokes digital mindfulness and enables social bonding through various types of play: Physital play, kinesthetic play, creative play, cooperative play and educative play.
- **Adjusting user:** Therapeutic sleep system facilitates the mood for sleeping, minimises ERSU during bed-time and enables user to have a good night's sleep.
- **Mindful user:** Open-source tutorials were created to inspire more users to utilise their recreational time for more meaningful purposes. Users can transform existing items into wellness products or adopt them as craft therapy against ERSU.

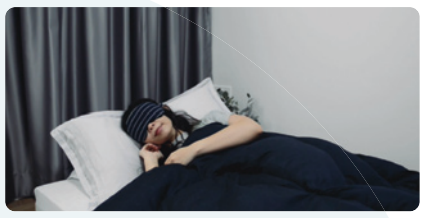
10 results



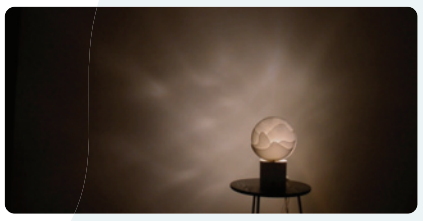
80.8% of card game participants found the game fun and liked how the various play possibilities fostered social bonding and new knowledge. 88.4% became more digitally mindful from a follow-up survey.



100% of participants from in-bed experiment have adopted more mindful screen habits since intervention testing and shared that they felt better emotionally and mentally after minimising ERSU.



55% 5 out of 9 mindful users took initiative in wellness craft-making. Participants shared the making process was therapeutic and wore their sleep masks to bed to improve or maintain sleep hygiene.



100% of participants from extended in-bed experiment showed positive findings for mindful and meaningful screen use.

From qualitative data: Participants' ERSU were minimised by half or more during intervention testing compared to screen time collected for baseline data. Participants also felt they had better sleep quality and higher energy levels.

From quantitative data: Participants' sleep latency (time taken to fall asleep) and sleep quality have improved from baseline. On average, participants fell asleep 3.5 times faster during intervention testing*.

In-bed therapy experiment minimised participants habitual use of excessive screen time and also helped to improve their core needs (wellness through better sleep).

*n=3; Average control data from aggregated nights: 11 | *p<0.05*
Scientific data were carried out with Dr Richard Swinbourne and Sport Singapore.

11 discussion

Results suggest that Humansic Design was effective in facilitating mindful recreational screen use positively in a meaningful way.

Findings from each intervention revealed that participants' emotional (pleasure) needs were fufilled and their core needs were taken care of (wellness/well-being enhanced through social interactions/better sleep). Improvements are meaningful and may better enable their personal significance needs (capabilities), allowing for self-actualisation / flourishing.

12 limitations

The sample size for most of the tests were limited as time and resources did not permit for a larger sample size. Although the nature of this study does not enable its findings to be deemed as conclusive, the pilot tests demonstrated positive findings that are worthwhile to run further studies.

Future research with a greater number of subjects and a longitudinal study may value-add to these pilot studies.

13 conclusion

It is possible to minimise ERSU with Humansic Design. Humansic Design interventions resulted in users developing positive screen habits along with meaningful (wellness/well-being) improvements. Thus, future research on Humansic Design with a greater number of participants could be explored.

This research project can add to the current body of knowledge on minimising ERSU both positively and meaningfully. Insights from this project may also inform designers and researchers to consider points of suitable application for projects relating to minimising ERSU and digital/life well-being.

With the digital community at risk of domination by screen addiction fuelled by distractive technology, this project may serve as a case study on the importance of designing with human sensitivities, vulnerabilities, capabilities and intrinsic needs in mind. Healthier minds and bodies can be cultivated when a design enhances meaningfulness and uniquely human capabilities.

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Trans/Feminist Critical Making – Design as Open-Source Opposition

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DE SIGN CULT URE(OF) MULTIPLICITY GENDER PLURALISM DIVERSITY

INCLUSIVE DEMOCRATISATION

A prospective path to strengthening social self-determination is currently emerging through critical hacker- and maker communities, in which people participate directly in the development of new technical artefacts through democratised production possibilities such as open-source software and hardware. But under what conditions can this democratic potential unfold, and democracy for who?



TRANS/FEMINIST HACKING

Trans/feminist hackspaces around the globe are currently forming, debating the value-sets and codes of conduct necessary for creating access and empowering female and non-binary individuals and collectives in tech. Through doing so, they are enabling environments based on collectivity and multiplicity, ensuring safe spaces for heterogeneous identities and taboo issues (Wuschitz 2014; Sollfrank 2019).



CRITICAL MAKER LAB

The Critical Maker Lab was established within a cross university setting – as a transdisciplinary terrain that attempts to exceed the boundaries of theory and practice, academia and activism, science and civil society. Here, critical theorists and critical practitioners (hackers, makers and designers) meet to debate the politics of technology and to prototype alternative visions for an inclusive digital society.

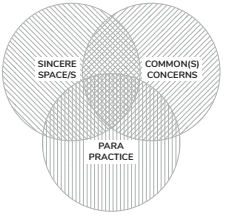


TRANS/FEMINIST HACKSPACES

INCLUSIVE CULTURES AS SAFE-SPACES

HACKING WITHIN CODES OF CONDUCTS

HACKING RESTRICTIVE GENDER SCRIPTS



DIY / DIT APPROACHES

COLLECTIVITY + MULTIPLICITY

TACKLING TABOO ISSUES

OPEN-SOURCE QUEER TECHNOLOGY

SPATIAL ASSEMBLAGES



Setting up different workshops and forming safer spaces with a diverse group of people.

UN/RE/DESIGN



Drawing on open source – understanding through resituated making.

COMPOSING COMMONS

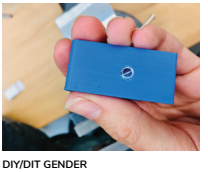


Formulating concerns – speculating on radical self-learning and self-sovereign bodies.



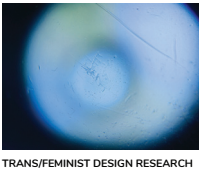
HACKING BODY POLITICS

Experimenting with trans/feminist approaches to using and reappropriating open soft- and hardware to envision alternative possibilities of health technologies, the topic of ovulation and the menstrual cycle was explored as a techno-political territory. As the 'female body' is essentialized and capitalized on through a new market of intimate data (period-tracking, fertility-tracking) (Lupton 2014, 2016) – how might a feminist approach to technology look, shifting parameters, for instance, from self-tracking to self-learning.



DIY/DIT GENDER

A series of hands-on participatory workshops used Do-It-Yourself and Do-It-Together approaches as a strategy to liberate participants from knowledge hierarchies and production dynamics of the current market. From making one's own personalised menstrual cup using a DIY injection moulding technique based on 3D printed moulds, to track hormone changes by designing DIY microscopes that make visible changing patterns in saliva – collective speculations on self-observation for autonomous self-knowledge and self-care were articulated and debated.



TRANS/FEMINIST DESIGN RESEARCH

Trans/feminist practices emerging in critical maker and hacker communities reify the values of a commons-based multiplicity as it intersects with employing free/open technologies. Including these principles into practice based design research emerges a space in which taboo issues can be raised, and critical speculations can be collectively materialized into a heterodox design practice. In such a workshop setting, a design culture emerges in which not only technical artefacts, but also individual identities can take issue with restrictive gender scripts and performances.

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Visual Exploration Method to Engage Art History with Practice-based Mindset in Design Education

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DE SIGN CULT URE(OF) LANGUAGES AESTHETICS EXPRESSION VISUAL

Overview

Over the years, education fields in most Asia have been dominated by science, politics, and economy, while art and design are only considered as extracurricular activities up to high school education level. Therefore, students who choose design major as their higher degree of education, mostly are more enthusiastic with practical subjects instead of theoretical ones. This situation has become very challenging for educators who teach the design theory subject, like art history module. Students, especially the first year ones, consider this kind of subject as dull and boring since it usually requires them to do lots of reading and writing.

Case Study : Western Art Review

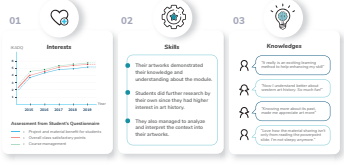
In order to solve this problem, researcher decided to apply creative method by doing experiment in the art history class, especially for students' assignment. By doing the 'Western Art Review' as case study, researcher gave students various visual exploration, projects instead of applying essay or multiple choices test as assignments. Researcher also revised the usual grading proportion standard for the module. However, students still learned about art history chronologically in the classroom. They also did research and group discussion to be able to acquire theoretical knowledge accordingly. Afterwards, students were expected to observe and analyze different media, so that they could demonstrate and present their primary findings through visual exploration (form, colors, and composition) in order to produce their final project outcomes.



The main objective of this experiment is to reconstruct students' general mindset about how to perceive theoretical knowledge and integrate it into practice-based mindset in design. They need to understand that art history, as the fundamental knowledge, is really important if they want to create better design outcomes. That learning art history is not about reading, memorizing and writing textual content, but more into understanding the context of the art itself and also how to integrate the knowledge into design practice.

Therefore, researcher showcased some artwork samples from three visual exploration projects in the 'Western Art Review' case study for this research. In those projects, students are required to analyze visual media i.e. film posters and magazine covers before they managed to recreate and modify them into new artworks that were inspired by famous art styles from art history and civilization timeline, such as Egyptian, Greek, Christian, or Modern art.

Through this research process, researcher managed to obtain satisfactory outcomes from students, both practically and theoretically. After applying this methodology for the last five years, researcher can prove that there is significant improvement in the art history classroom based on the students' interests, skills, and knowledges.





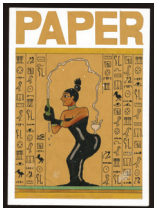
Conclusion

Researcher tried to apply a 'student-centered approach' that relate more to their psychological manner, since researcher realize that once students love the modules, they will be able to produce remarkable outcomes with right understanding and limitless creativity.

Therefore, this experimental project will be able to improve students' self-efficacy and confidence in mastering both theoretical and practical knowledge. This project can also become a case study sample on how to integrate practice-based modules, such as Illustration and Color Theory, with art history module.













Western Art Review - Interdisciplinary Design Practice scheme

Acknowledgment

Researcher wish to thank all students from Bina Nusantara University who were involved and shared their insights for this research for the last five years.

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